



**NEHRU INSTITUTE OF ENGINEERING AND TECHNOLOGY**  
Nehru Gardens, Thirumalayampalayam, Coimbatore-641 105  
ISO 14001: 2004 Certified, Recognized by UGC with 2(f) & 12(B)  
Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai  
Accredited by NAAC, NBA Accredited UG courses: AERO, CSE, MECH



**Extended Profile 1.1 Number of Courses offered by the Institution across all Programmes during the last five years**

**Curriculum and Syllabus of all courses offered by the Institutions across all programmes.  
(Anna University Regulation 2013 & Regulation 2017)**



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Academic Year 2020-21

Curriculum and syllabus for regulations 2017

S.NO	NAME OF THE PROGRAMME	Year			
		I year	II year	III year	IV Year
1	BE - AERONAUTICAL ENGINEERING	R-2017	R-2017	R-2017	R-2017
2	B.TECH-ARTIFICIAL INTELLIGENCE AND DATA SCIENCE	R-2017	R-2017	R-2017	R-2017
3	BE - COMPUTER SCIENCE AND ENGINEERING	R-2017	R-2017	R-2017	R-2017
4	B.TECH - COMPUTER SCIENCE AND BUSINESS SYSTEM	R-2017	R-2017	R-2017	R-2017
5	BE - ELECTRONICS AND COMMUNICATION ENGINEERING	R-2017	R-2017	R-2017	R-2017
6	BE - ELECTRICAL AND ELECTRONICS ENGINEERING	R-2017	R-2017	R-2017	R-2017
7	BE - MECHATRONICS ENGINEERING	R-2017	R-2017	R-2017	R-2017
8	BE - MECHANICAL ENGINEERING	R-2017	R-2017	R-2017	R-2017
9	MBA - MASTER OF BUSINESS ADMINISTRATION	R-2017	R-2017	R-2017	R-2017
10	M.E - AERONAUTICAL ENGINEERING	R-2017	R-2017	R-2017	R-2017
11	M.E - COMMUNICATION SYSTEMS	R-2017	R-2017	R-2017	R-2017

*R. Dey*  
IQAC

*P. Mani*  
Principal



Dr. P. MANIARASAN  
Principal  
Nehru Institute of Engg. & Technology  
T.M.Palayam, Coimbatore - 641 105

## OUR VISION

Our Vision is to mould the youngsters to acquire sound knowledge in technical and scientific fields to face the future challenges by continuous upgradation of all resources and processes for the benefit of humanity as envisaged by our great leader Pandit Jawaharlal Nehru.

## OUR MISSION

- To build a strong centre of learning and research in engineering and technology.
- To facilitate the youth to learn and imbibe discipline, culture and spirituality.
- To produce quality engineers, dedicated scientists and leaders.
- To encourage entrepreneurship.
- To face the challenging needs of the global industries.

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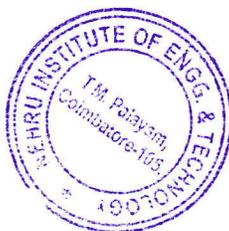
## Academic Year 2019-20

### Curriculum and syllabus for regulations 2013 and regulations 2017

S.NO	NAME OF THE PROGRAMME	Year			
		I year	II year	III year	IV Year
1	BE - AERONAUTICAL ENGINEERING	R-2017	R-2017	R-2017	R-2013
2	BE - COMPUTER SCIENCE AND ENGINEERING	R-2017	R-2017	R-2017	R-2013
3	BE - ELECTRONICS AND COMMUNICATION ENGINEERING	R-2017	R-2017	R-2017	R-2013
4	BE - ELECTRICAL AND ELECTRONICS ENGINEERING	R-2017	R-2017	R-2017	R-2013
5	BE - MECHATRONICS ENGINEERING	R-2017	R-2017	R-2017	R-2013
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9	M.E - COMMUNICATION SYSTEMS	R-2017	R-2017	R-2017	R-2013

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Academic Year 2018-19

Curriculum and syllabus for regulations 2013 and regulations 2017

S.NO	NAME OF THE PROGRAMME	Year			
		I year	II year	III year	IV year
1	BE - AERONAUTICAL ENGINEERING	R-2017	R-2017	R-2013	R-2013
2	BE - COMPUTER SCIENCE AND ENGINEERING	R-2017	R-2017	R-2013	R-2013
3	BE - ELECTRONICS AND COMMUNICATION ENGINEERING	R-2017	R-2017	R-2013	R-2013
4	BE - ELECTRICAL AND ELECTRONICS ENGINEERING	R-2017	R-2017	R-2013	R-2013
5	BE - MECHATRONICS ENGINEERING	R-2017	R-2017	R-2013	R-2013
6	BE - MECHANICAL ENGINEERING	R-2017	R-2017	R-2013	R-2013
7	MBA - MASTER OF BUSINESS ADMINISTRATION	R-2017	R-2017	R-2013	R-2013
8	M.E - AERONAUTICAL ENGINEERING	R-2017	R-2017	R-2013	R-2013
9	M.E - COMMUNICATION SYSTEMS	R-2017	R-2017	R-2013	R-2013
10	ME. – EMBEDDED SYSTEM TECHNOLOGIES	R-2017	R-2017	R-2013	R-2013
11	MCA – MASTER OF COMPUTER APPLICATIONS	R-2017	R-2017	R-2013	R-2013

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## Academic Year 2017-18

### Curriculum and syllabus for regulations 2013 and regulations 2017

S.NO	NAME OF THE PROGRAMME	Year			
		I year	II year	III year	IV year
1	BE - AERONAUTICAL ENGINEERING	R-2017	R-2013	R-2013	R-2013
2	BE - COMPUTER SCIENCE AND ENGINEERING	R-2017	R-2013	R-2013	R-2013
3	BE - ELECTRONICS AND COMMUNICATION ENGINEERING	R-2017	R-2013	R-2013	R-2013
4	BE - ELECTRICAL AND ELECTRONICS ENGINEERING	R-2017	R-2013	R-2013	R-2013
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Academic Year 2016-17

Curriculum and syllabus for regulations 2013

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		I year	II year	III year	IV year
1	BE - AERONAUTICAL ENGINEERING	R-2013	R-2013	R-2013	R-2013
2	BE - COMPUTER SCIENCE AND ENGINEERING	R-2013	R-2013	R-2013	R-2013
3	BE - ELECTRONICS AND COMMUNICATION ENGINEERING	R-2013	R-2013	R-2013	R-2013
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P. [Signature]  
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# **Regulation 2013**

## ANNA UNIVERSITY, CHENNAI

### REGULATIONS 2013

(Common to all B.E. / B.Tech. Degree (8 Semesters) Full – Time Programmes of Affiliated Institutions)

#### CREDIT SYSTEM

#### AFFILIATED COLLEGES

#### DEGREE OF BACHELOR OF ENGINEERING / BACHELOR OF TECHNOLOGY

This Regulations is applicable to the students admitted to B.E./B.Tech. Programmes at all Engineering Colleges affiliated to Anna University, Chennai (other than Autonomous Colleges) and to all the University Colleges of Engineering of Anna University, Chennai from the academic year 2013-2014.

#### 1. PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires:

- I) **“Programme”** means Degree Programme, that is B.E./B.Tech. Degree Programme.
- II) **“Discipline”** means specialization or branch of B.E./B.Tech. Degree Programme, like Civil Engineering, Textile Technology, etc.
- III) **“Course”** means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, etc.
- IV) **“Director, Academic Courses”** means the authority of the University who is responsible for all academic activities of the Academic Programmes for implementation of relevant rules of this Regulations pertaining to the Academic Programmes.
- V) **“Chairman”** means the Head of the Faculty.
- VI) **“Head of the Institution”** means the Principal of the College.
- VII) **“Head of the Department”** means head of the Department concerned.
- VIII) **“Controller of Examinations”** means the authority of the University who is responsible for all activities of the University Examinations.
- IX) **“University”** means ANNA UNIVERSITY, CHENNAI.

#### 2. ADMISSION

- 2.1 Candidates seeking admission to the first semester of the eight semester B.E. / B.Tech. Degree Programme:

Should have passed the Higher Secondary Examinations of (10+2) Curriculum (Academic Stream) prescribed by the Government of Tamil Nadu with Mathematics, Physics and Chemistry as three of the four subjects of study under Part-III or any examination of any other University or authority accepted by the Syndicate of Anna University as equivalent thereto.

**(OR)**

Should have passed the Higher Secondary Examination of Vocational stream (Vocational groups in Engineering / Technology) as prescribed by the Government of Tamil Nadu.

## 2.2 **Lateral entry admission**

- (i) The candidates who possess the Diploma in Engineering / Technology awarded by the State Board of Technical Education, Tamilnadu or its equivalent are eligible to apply for Lateral entry admission to the third semester of B.E. / B.Tech. in the branch corresponding to the branch of study.

**(OR)**

- (ii) The candidates who possess the Degree in Science (B.Sc.,) (10+2+3 stream) with Mathematics as a subject at the B.Sc. Level are eligible to apply for Lateral entry admission to the third semester of B.E. / B.Tech.

Such candidates shall undergo two additional Engineering subject(s) in the third and fourth semesters as prescribed by the University.

## 3. **PROGRAMMES OFFERED**

B.E. / B.Tech. Programmes under the Faculty of Civil Engineering, Faculty of Mechanical Engineering, Faculty of Electrical Engineering, Faculty of Information and Communication Engineering and Faculty of Technology.

## 4. **STRUCTURE OF PROGRAMMES**

- 4.1 Every Programme will have curricula with syllabi consisting of theory and practical courses such as:

- (i) General core courses comprising Mathematics, Basic sciences, Engineering sciences, Humanities and Management.
- (ii) Core courses of Engineering/Technology.
- (iii) Elective courses for specialization in related fields.
- (iv) Workshop Practice, Computer Practice, Engineering Graphics, Laboratory work, Industrial Training, Seminar presentation, Project work, Educational tours, Camps etc.
- (v) NCC / NSS / NSO / YRC activities for character development

There shall be a certain minimum number of core courses and sufficient number of elective courses that can be opted by the students. The blend of different courses shall be so designed that the student, at the end of the programme, would have been trained not only in his / her relevant professional field but also would have developed as a socially conscious human being.

- 4.2 Each course is normally assigned a certain number of credits with 1 credit per lecture period per week, 1 credit per tutorial period per week, 1 credit for 2 periods of laboratory or practical or seminar or project work per week (2 credits for 3 or 4 periods of practical).
- 4.3 Each semester curriculum shall normally have a blend of lecture courses not exceeding 7 and practical courses not exceeding 4. However, the total number of courses per semester shall not exceed 10.
- 4.4 For the award of the degree, a student has to earn certain minimum total number of credits specified in the curriculum of the relevant branch of study.
- 4.5 **The medium of instruction is English for all courses, examinations, seminar presentations and project / thesis / dissertation reports except for the programmes offered in Tamil Medium.**

## 5. DURATION OF THE PROGRAMME

- 5.1 A student is ordinarily expected to complete the B.E. / B.Tech. Programme in 8 semesters (four academic years) but in any case not more than 14 Semesters for HSC (or equivalent) candidates and not more than 12 semesters for Lateral Entry Candidates.
- 5.2 Each semester shall normally consist of 90 working days or 450 periods of 50 minutes each. The Head of the Institution shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course being taught.
- 5.3 The Head of the Institution may conduct additional classes for improvement, special coaching, conduct of model test etc., over and above the specified periods. But for the purpose of calculation of attendance requirement for writing the end semester examinations (as per clause 6) by the students, following method shall be used.

$$\text{Percentage of Attendance} = \frac{\text{Total no. of periods attended in all the courses per semester}}{(\text{No. of periods / week as prescribed in the curriculum}) \times 15 \text{ taken together for all courses of the semester}} \times 100$$

The University Examination will ordinarily follow immediately after the last working day of the semester as per the academic schedule prescribed from time to time.

- 5.4 The total period for completion of the programme reckoned from the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5.1 irrespective of the period of break of study (vide clause 18.4) in order that he/she may be eligible for the award of the degree (vide clause 15).

## 6. ATTENDANCE REQUIREMENTS FOR COMPLETION OF THE SEMESTER

- 6.1 A Candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester.  
Ideally every student is expected to attend all classes and secure 100% attendance. However, in order to give provision for certain unavoidable reasons such as Medical / participation in sports, the student is expected to attend atleast 75% of the classes.  
Therefore, he/she shall **secure not less than 75%** (after rounding off to the nearest integer) of overall attendance as calculated as per clause 5.3.
- 6.2 However, a candidate who secures overall attendance between 65% and 74% in the current semester due to medical reasons (prolonged hospitalization / accident / specific illness) / Participation in Sports events may be permitted to appear for the current semester examinations subject to the condition that the candidate shall submit the medical certificate / sports participation certificate attested by the Head of the Institution. The same shall be forwarded to the Controller of Examinations for record purposes.
- 6.3 Candidates who **secure less than 65% overall attendance and candidates who do not satisfy the clause 6.1 and 6.2** shall not be permitted to write the University examination at the end of the semester and not permitted to move to the next semester. They are required to repeat the incomplete semester in the next academic year, as per the norms prescribed.

## 7. CLASS ADVISOR

There shall be a class advisor for each class. The class advisor will be one among the (course-instructors) of the class. He / She will be appointed by the HoD of the department concerned. The class advisor is the ex-officio member and the Convener of the class committee. The responsibilities for the class advisor shall be:

- To act as the channel of communication between the HoD and the students of the respective class.
- To collect and maintain various statistical details of students.
- To help the chairperson of the class committee in planning and conduct of the class committee meetings.
- To monitor the academic performance of the students including attendance and to inform the class committee.
- To attend to the students' welfare activities like awards, medals, scholarships and industrial visits.

## 8. CLASS COMMITTEE

8.1. Every class shall have a class committee consisting of teachers of the class concerned, student representatives and a chairperson who is not teaching the class. It is like the 'Quality Circle' (more commonly used in industries) with the overall goal of improving the teaching-learning process. The functions of the class committee include

- Solving problems experienced by students in the class room and in the laboratories.
- **Clarifying the regulations of the degree programme and the details of rules therein particularly (clause 5 and 6) which should be displayed on college Notice-Board.**
- Informing the student representatives, the academic schedule including the dates of assessments and the syllabus coverage for each assessment.
- Informing the student representatives the details of Regulations regarding weightage used for each assessment. In the case of practical courses (laboratory / drawing / project work / seminar etc.) the breakup of marks for each experiment / exercise / module of work, should be clearly discussed in the class committee meeting and informed to the students.
- Analyzing the performance of the students of the class after each test and finding the ways and means of solving problems, if any.
- Identifying the weak students, if any, and requesting the teachers concerned to provide some additional help or guidance or coaching to such weak students.

8.2 The class committee for a class under a particular branch is normally constituted by the Head of the Department. However, if the students of different branches are mixed in a class (like the first semester which is generally common to all branches), the class committee is to be constituted by the Head of the Institution.

8.3 The class committee shall be constituted within the first week of each semester.

8.4 At least 4 student representatives (usually 2 boys and 2 girls) shall be included in the class committee.

8.5 The Chairperson of the class committee may invite the Class adviser(s) and the Head of the Department to the class committee meeting.

8.6 The Head of the Institution may participate in any class committee of the institution.

8.7 The chairperson is required to prepare the minutes of every meeting, submit the same to Head of the Institution within two days of the meeting and arrange to circulate it among the students and teachers concerned. If there are some points in the minutes requiring action by the management, the same shall be brought to the notice of the Management by the Head of the Institution.

- 8.8 The first meeting of the class committee shall be held within one week from the date of commencement of the semester, in order to inform the students about the nature and weightage of assessments within the framework of the Regulations. Two or three subsequent meetings may be held in a semester at suitable intervals. **The Class Committee Chairman shall put on the Notice Board the cumulative attendance particulars of each student at the end of every such meeting to enable the students to know their attendance details to satisfy the clause 6 of this Regulation.** During these meetings the student members representing the entire class, shall meaningfully interact and express the opinions and suggestions of the other students of the class in order to improve the effectiveness of the teaching-learning process.

## 9. COURSE COMMITTEE FOR COMMON COURSES

Each common theory course offered to more than one discipline or group, shall have a "Course Committee" comprising all the teachers teaching the common course with one of them nominated as Course Coordinator. The nomination of the Course Coordinator shall be made by the Head of the Department / Head of the Institution depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The 'Course committee' shall meet in order to arrive at a common scheme of evaluation for the test and shall ensure a uniform evaluation of the tests. Wherever feasible, the course committee may also prepare a common question paper for the internal assessment test(s).

## 10. SYSTEM OF EXAMINATION

- 10.1 Performance in each course of study shall be evaluated based on (i) continuous internal assessment throughout the semester and (ii) University examination at the end of the semester.
- 10.2 Each course, both theory and practical (including project work & viva voce Examinations) shall be evaluated for a maximum of 100 marks.
- For all theory and practical courses including project work, the continuous internal assessment will carry **20 marks** while the End - Semester University examination will carry **80 marks**.
- 10.3 Industrial training and seminar shall carry 100 marks and shall be evaluated through internal assessment only.
- 10.4 The University examination (theory and practical) of 3 hours duration shall ordinarily be conducted between October and December during the odd semesters and between April and June during the even semesters.
- 10.5 The University examination for project work shall consist of evaluation of the final report submitted by the student or students of the project group (of not exceeding 4 students) by an external examiner and an internal examiner, followed by a viva-voce examination conducted separately for each student by a committee consisting of the external examiner, the supervisor of the project group and an internal examiner.
- 10.6 For the University examination in both theory and practical courses including project work the internal and external examiners shall be appointed by the Controller of Examinations.

## 11. PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

For all theory and practical courses (including project work) the continuous assessment shall be for a maximum of 20 marks. The above continuous assessment shall be awarded as per the procedure given below:

### 11.1(a) Theory Courses

Three tests each carrying 100 marks shall be conducted during the semester by the Department / College concerned. The total marks obtained in all tests put together out of 300, shall be proportionately reduced for 20 marks and rounded to the nearest integer (This also implies equal weightage to all the three tests).

**(b) Practical Courses:**

The maximum marks for Internal Assessment shall be 20 in case of practical courses. Every practical exercise / experiment shall be evaluated based on conduct of experiment / exercise and records maintained. There shall be at least one test. The criteria for arriving at the Internal Assessment marks of 20 is as follows: 75 marks shall be awarded for successful completion of all the prescribed experiments done in the Laboratory and 25 marks for the test. The total mark shall be reduced to 20 and rounded to the nearest integer.

**(c) Theory Courses with Laboratory Component:**

If there is a theory course with Laboratory component, there shall be three tests: the first two tests (each 100 marks) will be from theory portions and the third test (maximum mark 100) will be for laboratory component. The sum of marks of first two tests shall be reduced to 60 marks and the third test mark shall be reduced to 40 marks. The sum of these 100 marks may then be arrived at for 20 and rounded to the nearest integer.

**11.2(a)** The seminar / Case study is to be considered as purely INTERNAL (with 100% internal marks only). Every student is expected to present a minimum of 2 seminars per semester before the evaluation committee and for each seminar, marks can be equally apportioned. The three member committee appointed by Head of the Institution will evaluate the seminar and at the end of the semester the marks can be consolidated and taken as the final mark. The evaluation shall be based on the seminar paper (40%), presentation (40%) and response to the questions asked during presentation (20%).

(b) The Industrial / Practical Training, Summer Project, Internship shall carry 100 marks and shall be evaluated through internal assessment only. At the end of Industrial / Practical training / internship / Summer Project, the candidate shall submit a certificate from the organization where he / she has undergone training and a brief report. The evaluation will be made based on this report and a Viva-Voce Examination, conducted internally by a three member Departmental Committee constituted by the Head of the Institution. The certificates (issued by the organization) submitted by the students shall be attached to the mark list sent by the Head of the Institution to the Controller of Examinations.

**11.3 Project Work:**

Project work may be allotted to a single student or to a group of students not exceeding 4 per group.

The Head of the Institutions shall constitute a review committee for project work for each branch of study. There shall be three reviews during the semester by the review committee. The student shall make presentation on the progress made by him / her before the committee. The total marks obtained in the three reviews shall be **reduced for 20 marks** and rounded to the nearest integer (as per the scheme given in 11.3.1).

**11.3.1** The project report shall carry a maximum 30 marks. The project report shall be submitted as per the approved guidelines as given by Director, Academic Courses. Same mark shall be awarded to every student within the project group for the project report. The viva-voce examination shall carry 50 marks. Marks are awarded to each student of the project group based on the individual performance in the viva-voce examination.

Review I	Review II	Review III	End semester Examinations				
			Thesis Submission (30)		Viva-Voce (50)		
			Internal	External	Internal	External	Supervisor
5	7.5	7.5	15	15	15	20	15

**11.3.2** If a candidate fails to submit the project report on or before the specified deadline, he/she is deemed to have failed in the Project Work and shall re-enroll for the same in a subsequent semester.

**11.4** Internal marks approved by the Head of the Institution shall be displayed by the respective HODs within 5 days from the last working day.

**11.5 Attendance Record**

Every teacher is required to maintain an 'ATTENDANCE AND ASSESSMENT RECORD' which consists of attendance marked in each lecture or practical or project work class, the test marks and the record of class work (topic covered), separately for each course. This should be submitted to the Head of the department periodically (at least three times in a semester) for checking the syllabus coverage and the records of test marks and attendance. The Head of the department will put his signature and date after due verification. At the end of the semester, the record should be verified by the Head of the Institution who will keep this document in safe custody (for five years). The University or any inspection team appointed by the University may verify the records of attendance and assessment of both current and previous semesters.

**12. REQUIREMENTS FOR APPEARING FOR UNIVERSITY EXAMINATIONS**

A candidate shall normally be permitted to appear for the University Examinations of the current semester if he/she has satisfied the semester completion requirements (subject to Clause 6) and has registered for examination in all courses of the semester. Registration is mandatory for current semester examinations as well as arrear examinations, failing which the candidate will not be permitted to move to the higher semester.

A candidate who has already appeared for any subject in a semester and passed the examination is not entitled to reappear in the same subject for improvement of grades.

**13. PASSING REQUIREMENTS**

**13.1** A candidate who secures not less than 50% of total marks prescribed for the course [Internal Assessment + End semester University Examinations] with a minimum of 45% of the marks prescribed for the end-semester University Examination, shall be declared to have passed the course and acquired the relevant number of credits. This is applicable for both theory and practical courses (including project work).

**13.2** If a candidate fails to secure a pass in a particular course, it is mandatory that he/she shall register and reappear for the examination in that course during the subsequent semester when examination is conducted in that course; he/she should continue to register and reappear for the examinations in the failed subjects till he / she secures a pass.

**13.3** The internal assessment marks obtained by the candidate in the first appearance shall be retained and considered valid for all subsequent attempts till the candidate secure a pass. However, from the third attempt onwards if a candidate fails to obtain pass marks (IA + End Semester Examination) as per clause 13.1, then the candidate shall be declared to have passed the examination if he/she secure a minimum of 50% marks prescribed for the university end semester examinations alone.

**14. AWARD OF LETTER GRADES**

**14.1.1** All assessments of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the candidate in each subject as detailed below:

Letter grade	Grade Points	Marks Range
S	10	91 – 100
A	9	81 – 90
B	8	71 – 80
C	7	61 – 70
D	6	57 – 60
E	5	50 – 56
U	0	< 50
W	0	(or 50 but not satisfying clause 13.1)

A student is deemed to have passed and acquired the corresponding credits in a particular course if he/she obtains any one of the following grades: “S”, “A”, “B”, “C”, “D”, “E”.

‘SA’ denotes shortage of attendance (as per clause 6.3) and hence prevention from writing the end semester examination. ‘SA’ will appear only in the result sheet.

“U” denotes **Reappearance** (RA) is required for the examination in the course. “W” denotes **withdrawal** from the exam for the particular course. (The grades U and W will figure both in Marks Sheet as well as in Result Sheet)

### Grade sheet

After results are declared, Grade Sheets will be issued to each student which will contain the following details:

- The college in which the candidate has studied
- The list of courses enrolled during the semester and the grade scored.
- The Grade Point Average (GPA) for the semester and
- The Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

GPA for a semester is the ratio of the sum of the products of the number of credits for courses acquired and the corresponding points to the sum of the number of credits for the courses acquired in the semester.

CGPA will be calculated in a similar manner, considering all the courses registered from first semester. “U”, and “W” grades will be excluded for calculating GPA and CGPA.

$$\text{GPA / CGPA} = \frac{\sum_{i=1}^n C_i \text{ GP}_i}{\sum_{i=1}^n C_i}$$

where  $C_i$  is the number of Credits assigned to the course

$\text{GP}_i$  is the point corresponding to the grade obtained for each course

$n$  is number of all courses successfully cleared during the particular semester in the case of GPA and during all the semesters in the case of CGPA

## 15. ELIGIBILITY FOR THE AWARD OF THE DEGREE

### 15.1 A student shall be declared to be eligible for the award of the Degree if he/she has

- Successfully gained the required number of total credits as specified in the Curriculum corresponding to his/her Programme within the stipulated time.

- No disciplinary action is pending against him/her.
- The award of the degree must be approved by the Syndicate.
- Successfully completed any additional courses prescribed by the Director, Academic Courses, whenever any candidate is readmitted under Regulations other than R – 2013 (clause 18.2).

## **16. CLASSIFICATION OF THE DEGREE AWARDED**

### **16.1 FIRST CLASS WITH DISTINCTION**

A candidate who satisfies the following conditions shall be declared to have passed the examination in First class with Distinction.

- Should have passed the End semester examination in all the courses of all the eight semesters (six semesters in the case of lateral entry) in his/her First Appearance within four years (three years in the case of lateral entry). Withdrawal from examination (vide Clause 17) will not be considered as an appearance. One year authorized break of study (if availed of) is permitted in addition to four years (three years in the case of lateral entry) for award of First class with Distinction.
- Should have secured a CGPA of not less than 8.50.

### **16.2 FIRST CLASS**

A candidate who satisfies the following conditions shall be declared to have passed the examination in First class.

- Should have passed the End semester examination in all the courses of all the eight semesters (six semesters in the case of lateral entry) within five years (four years in the case of lateral entry). One year authorized break of study (if availed of) or prevention from writing the End Semester examination due to lack of attendance (if applicable) is included in the duration of five years (four years in the case of lateral entry) for award of First class.
- Should have secured a CGPA of not less than 6.50.

### **16.3 SECOND CLASS**

All other candidates (not covered in clauses 16.1 and 16.2) who qualify for the award of the degree (vide Clause 15) shall be declared to have passed the examination in **Second Class**.

**16.4** A candidate who is absent in semester examination in a course / project work after having registered for the same shall be considered to have appeared in that examination for the purpose of classification. (subject to clause 17 and 18)

### **16.5 Photocopy / Revaluation**

A candidate can apply for photocopy of his/her semester examination answer paper in a theory course, within 2 weeks from the declaration of results, on payment of a prescribed fee through proper application to the Controller of Examinations through the Head of Institutions. The answer script is to be valued and justified by a faculty member, who handled the subject and recommend for revaluation with breakup of marks for each question. Based on the recommendation, the candidate can register for the revaluation through proper application to the Controller of Examinations. The Controller of Examinations will arrange for the revaluation and the results will be intimated to the candidate concerned through the Head of the Institutions. Revaluation is not permitted for practical courses and for project work.

A candidate can apply for revaluation of answer scripts for not exceeding 5 subjects at a time.

## **16.6 Review**

Candidates not satisfied with Revaluation can apply for Review of his/ her examination answer paper in a theory course, within the prescribed date on payment of a prescribed fee through proper application to Controller of Examination through the Head of the Institution.

Candidates applying for Revaluation only are eligible to apply for Review.

## **17. PROVISION FOR WITHDRAWAL FROM END-SEMESTER EXAMINATION**

- 17.1 A candidate, may for valid reasons and on prior application, be granted permission to withdraw from appearing for the examination of any one course or consecutive examinations of more than one course in a semester examination.
- 17.2 Such withdrawal shall be permitted **only once during the entire period** of study of the degree programme.
- 17.3 Withdrawal application is valid only if it is made within 10 days prior to the commencement of the examination in that course or courses and recommended by the Head of the Institution and approved by the Controller of Examinations.
- 17.3.1 Notwithstanding the requirement of mandatory TEN days notice, applications for withdrawal for special cases under extraordinary conditions will be considered on the merit of the case.
- 17.4 Withdrawal shall not be construed as an appearance for the eligibility of a candidate for First Class with Distinction.
- 17.5 Withdrawal from the End Semester Examination is **NOT** applicable to arrears subjects of previous semesters.
- 17.6 The candidate shall reappear for the withdrawn courses during the examination conducted in the subsequent semester.
- 17.7 Withdrawal shall not be permitted in the final semester examinations.

## **18. PROVISION FOR AUTHORISED BREAK OF STUDY**

- 18.1 Break of Study shall be granted only once for valid reasons for a maximum of one year during the entire period of study of the degree programme. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for break of study. If a candidate intends to temporarily discontinue the programme in the middle of the semester for valid reasons, and to rejoin the programme in a subsequent year, permission may be granted based on the merits of the case provided he / she applies to the Director, Student Affairs in advance, but not later than the last date for registering for the end semester examination of the semester in question, through the Head of the Institution stating the reasons therefore and the probable date of rejoining the programme.
- 18.2 The candidates permitted to rejoin the programme after break of study / prevention due to lack of attendance, shall be governed by the Curriculum and Regulations in force at the time of rejoining. The students rejoining in new Regulations shall apply to the Director, Academic Courses in the prescribed format through Head of the Institution at the beginning of the readmitted semester itself for prescribing additional courses, if any, from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.
- 18.3 The authorized break of study will not be counted towards the duration specified for passing all the courses for the purpose of classification (vide Clause 16.1).
- 18.4 The total period for completion of the Programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5.1 irrespective of the period of break of study in order that he/she may be eligible for the award of the degree.

18.5 If any student is prevented for want of required attendance, the period of prevention shall not be considered as authorized 'Break of Study' (Clause 18.1)

## 19. INDUSTRIAL VISIT

Every student is required to undergo one Industrial visit for every theory course offered, starting from the third semester of the Programme. Every teacher shall take the students at least for one industrial visit in a semester.

## 20. PERSONALITY AND CHARACTER DEVELOPMENT

All students shall enroll, on admission, in any one of the personality and character development programmes (the NCC / NSS / NSO / YRC) and undergo training for about 80 hours and attend a camp of about seven days. The training shall include classes on hygiene and health awareness and also training in first-aid.

**National Cadet Corps (NCC)** will have about 20 parades.

**National Service Scheme (NSS)** will have social service activities in and around the College / Institution.

**National Sports Organization (NSO)** will have sports, Games, Drills and Physical exercises.

**Youth Red Cross (YRC)** will have activities related to social services in and around college / institutions.

While the training activities will normally be during weekends, the camp will normally be during vacation period.

Every student shall put in a minimum of 75% attendance in the training and attend the camp compulsorily. The training and camp shall be completed during the first year of the programme. However, for valid reasons, the Head of the Institution may permit a student to complete this requirement in the second year.

## 21. DISCIPLINE

21.1 Every student is required to observe disciplined and decorous behavior both inside and outside the college and not to indulge in any activity which will tend to bring down the prestige of the University / College. The Head of Institution shall constitute a disciplinary committee consisting of Head of Institution, Two Heads of Department of which one should be from the faculty of the student, to enquire into acts of indiscipline and notify the University about the disciplinary action recommended for approval. In case of any serious disciplinary action which leads to suspension or dismissal, then a committee shall be constituted including one representative from Anna University, Chennai. In this regard, the member will be nominated by the University on getting information from the Head of the Institution.

21.2 If a student indulges in malpractice in any of the University / internal examination he / she shall be liable for punitive action as prescribed by the University from time to time.

## 22. REVISION OF REGULATIONS, CURRICULUM AND SYLLABI

The University may from time to time revise, amend or change the Regulations, Curriculum, Syllabus and scheme of examinations through the Academic Council with the approval of Syndicate.

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**ANNA UNIVERSITY, CHENNAI**  
**AFFILIATED INSTITUTIONS**  
**R - 2013**  
**B.E. AERONAUTICAL ENGINEERING**  
**I – VIII SEMESTERS CURRICULUM AND SYLLABUS**

**SEMESTER I**

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	HS6151	<u>Technical English – I</u>	3	1	0	4
2.	MA6151	<u>Mathematics – I</u>	3	1	0	4
3.	PH6151	<u>Engineering Physics – I</u>	3	0	0	3
4.	CY6151	<u>Engineering Chemistry – I</u>	3	0	0	3
5.	GE6151	<u>Computer Programming</u>	3	0	0	3
6.	GE6152	<u>Engineering Graphics</u>	2	0	3	4
<b>PRACTICALS</b>						
7.	GE6161	<u>Computer Practices Laboratory</u>	0	0	3	2
8.	GE6162	<u>Engineering Practices Laboratory</u>	0	0	3	2
9.	GE6163	<u>Physics and Chemistry Laboratory - I</u>	0	0	2	1
<b>TOTAL</b>			<b>17</b>	<b>2</b>	<b>11</b>	<b>26</b>

**SEMESTER II**

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	HS6251	<u>Technical English – II</u>	3	1	0	4
2.	MA6251	<u>Mathematics – II</u>	3	1	0	4
3.	PH6251	<u>Engineering Physics – II</u>	3	0	0	3
4.	CY6251	<u>Engineering Chemistry – II</u>	3	0	0	3
5.	GE6252	<u>Basic Electrical and Electronics Engineering</u>	4	0	0	4
6.	GE6253	<u>Engineering Mechanics</u>	3	1	0	4
<b>PRACTICALS</b>						
7.	GE6261	<u>Computer Aided Drafting and Modeling Laboratory</u>	0	1	2	2
8.	GE6262	<u>Physics and Chemistry Laboratory - II</u>	0	0	2	1
<b>TOTAL</b>			<b>19</b>	<b>4</b>	<b>4</b>	<b>25</b>

### SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MA6351	<u>Transforms and Partial Differential Equations</u>	3	1	0	4
2.	ME6352	<u>Manufacturing Technology</u>	3	0	0	3
3.	AE6301	<u>Aero Engineering Thermodynamics</u>	3	0	0	3
4.	CE6451	<u>Fluid Mechanics and Machinery</u>	3	0	0	3
5.	CE6452	<u>Solid Mechanics</u>	3	0	0	3
6.	AE6302	<u>Elements of Aeronautics</u>	3	0	0	3
<b>PRACTICAL</b>						
7.	CE6315	<u>Strength of Materials Laboratory</u>	0	0	3	2
8.	CE6461	<u>Fluid Mechanics and Machinery Laboratory</u>	0	0	3	2
9.	AE6311	<u>Thermodynamics Laboratory</u>	0	0	3	2
10.	AE6312	<u>CAM and Manufacturing Laboratory</u>	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>1</b>	<b>12</b>	<b>27</b>

### SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MA6459	<u>Numerical Methods</u>	3	1	0	4
2.	AE6401	<u>Aerodynamics - I</u>	3	0	0	3
3.	AE6402	<u>Aircraft Systems and Instruments</u>	3	0	0	3
4.	AT6302	<u>Mechanics of Machines</u>	3	1	0	4
5.	AE6403	<u>Aircraft Structures - I</u>	3	1	0	4
6.	AE6404	<u>Propulsion - I</u>	3	0	0	3
<b>PRACTICAL</b>						
7.	AE6411	<u>Aircraft Structures Laboratory - I</u>	0	0	3	2
8.	AE6412	<u>Aerodynamics Laboratory</u>	0	0	3	2
9.	AE6413	<u>CAD and Aircraft Component Drawing</u>	0	0	4	2
<b>TOTAL</b>			<b>18</b>	<b>3</b>	<b>10</b>	<b>27</b>

### SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	AE6501	<u>Flight Dynamics</u>	3	1	0	4
2.	AE6502	<u>Aircraft Structures - II</u>	3	1	0	4
3.	AE6503	<u>Aerodynamics - II</u>	3	1	0	4
4.	AE6504	<u>Propulsion - II</u>	3	0	0	3
5.	AE6505	<u>Control Engineering</u>	3	0	0	3
6.	GE6351	<u>Environmental Science and Engineering</u>	3	0	0	3
<b>PRACTICAL</b>						
7.	AE6511	<u>Aircraft Structures Laboratory - II</u>	0	0	3	2
8.	AE6512	<u>Propulsion Laboratory</u>	0	0	3	2
9.	GE6674	<u>Communication and Soft Skills- Laboratory Based</u>	0	0	4	2
<b>TOTAL</b>			<b>18</b>	<b>3</b>	<b>10</b>	<b>27</b>

**SEMESTER VI**

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MG6851	<u>Principles of Management</u>	3	0	0	3
2.	AE6601	<u>Finite Element Methods</u>	3	1	0	4
3.	AE6602	<u>Vibrations and Elements of Aeroelasticity</u>	3	0	0	3
4.	AE6603	<u>Composite Materials and Structures</u>	3	0	0	3
5.	AE6604	<u>Aircraft Materials and Processes</u>	3	0	0	3
6.		Elective – I	3	0	0	3
<b>PRACTICAL</b>						
7.	AE6611	<u>Aero Engine and Airframe Laboratory</u>	0	0	3	2
8.	AE6612	<u>Aircraft Design Project - I</u>	0	0	3	2
9.	AE6613	<u>Computer Aided Simulation Laboratory</u>	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>1</b>	<b>9</b>	<b>25</b>

**SEMESTER VII**

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	GE6757	<u>Total Quality Management</u>	3	0	0	3
2.	AE6701	<u>Avionics</u>	3	0	0	3
3.	ME6014	<u>Computational Fluid Dynamics</u>	3	0	0	3
4.	AE6702	<u>Experimental Stress Analysis</u>	3	0	0	3
5.		Elective – II	3	0	0	3
6.		Elective – III	3	0	0	3
<b>PRACTICAL</b>						
7.	AE6711	<u>Aircraft Design Project - II</u>	0	0	3	2
8.	AE6712	<u>Aircraft Systems Laboratory</u>	0	0	3	2
9.	AE6713	<u>Flight Integration Systems and Control Laboratory</u>	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>0</b>	<b>9</b>	<b>24</b>

**SEMESTER VIII**

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	AE6801	<u>Wind Tunnel Techniques</u>	3	0	0	3
2.		Elective – IV	3	0	0	3
<b>PRACTICAL</b>						
3.	AE6811	<u>Project Work</u>	0	0	12	6
<b>TOTAL</b>			<b>6</b>	<b>0</b>	<b>12</b>	<b>12</b>

**TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 193**

## ELECTIVES FOR M.E. AERONAUTICAL ENGINEERING

### SEMESTER VI ELECTIVE – I

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	AE6001	<u>Theory of Elasticity</u>	3	0	0	3
2.	AE6002	<u>Aircraft General Engineering and Maintenance Practices</u>	3	0	0	3
3.	AE6003	<u>Space Mechanics</u>	3	0	0	3
4.	AE6004	<u>Heat Transfer</u>	3	0	0	3
5.	GE6084	Human Rights	3	0	0	3

### SEMESTER VII ELECTIVES– II

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	AE6005	<u>Helicopter Theory</u>	3	0	0	3
2.	AE6006	<u>Theory of Plates and Shells</u>	3	0	0	3
3.	AE6007	<u>Fatigue and Fracture</u>	3	0	0	3
4.	AE6008	<u>UAV Systems</u>	3	0	0	3
5.	GE6083	Disaster Management	3	0	0	3

### ELECTIVES – III

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	AE6009	<u>Industrial Aerodynamics</u>	3	0	0	3
2.	AE6010	<u>Airframe Maintenance and Repair</u>	3	0	0	3
3.	AE6011	<u>Aero Engine Maintenance and Repair</u>	3	0	0	3
4.	AE6012	<u>Air Traffic Control and Planning</u>	3	0	0	3

### SEMESTER VIII ELECTIVES – IV

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	AE6013	<u>Hypersonic Aerodynamics</u>	3	0	0	3
2.	AE6014	<u>Experimental Aerodynamics</u>	3	0	0	3
3.	AE6015	<u>Rockets and Missiles</u>	3	0	0	3
4.	AE6016	<u>Structural Dynamics</u>	3	0	0	3

**OBJECTIVES:**

- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.

**UNIT I****9+3**

Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one's place, important festivals etc. – Introducing oneself, one's family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one's leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words - Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

**UNIT II****9+3**

Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking and answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Process descriptions (general/specific) - Definitions - Recommendations – Instructions; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association (connotation); E-materials - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

**UNIT III****9+3**

Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading - Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause and effect / compare and contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

**UNIT IV****9+3**

Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations and acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.

## UNIT V

9+3

Listening - Listening to different accents, Listening to Speeches/Presentations, Listening to broadcast and telecast from Radio and TV; Speaking - Giving impromptu talks, Making presentations on given topics; Reading - Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email; Writing - Creative writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items (fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar and Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents - Interpreting posters.

**TOTAL (L:45+T:15): 60 PERIODS**

### OUTCOMES:

Learners should be able to

- speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- read different genres of texts adopting various reading strategies.
- listen/view and comprehend different spoken discourses/excerpts in different accents

### TEXTBOOKS:

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

### REFERENCES:

1. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice. Oxford University Press, New Delhi. 2011.
2. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi. 2006.
3. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005
4. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi. 2001.
5. Viswamohan, Aysha. English for Technical Communication. Tata McGraw-Hill, New Delhi. 2008.

### EXTENSIVE Reading (Not for Examination)

1. Kalam, Abdul. Wings of Fire. Universities Press, Hyderabad. 1999.

### WEBSITES:

1. <http://www.usingenglish.com>
2. <http://www.uefap.com>

### TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like self introduction, peer introduction, group poster making, grammar and vocabulary games, etc.
- Discussions
- Role play activities
- Short presentations
- Listening and viewing activities with follow up activities like discussion, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc.

## EVALUATION PATTERN:

### Internal assessment: 20%

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Reviews
- Creative writing
- Poster making, etc.

All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual speaking activities, Pair work activities like role play, Interview, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded from simple to complex, from direct to inferential
- ✓ Writing assessment: Writing paragraphs, essays etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content.

### End Semester Examination: 80%

MA6151

MATHEMATICS – I

L T P C  
3 1 0 4

### OBJECTIVES:

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

### UNIT I MATRICES

9+3

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

### UNIT II SEQUENCES AND SERIES

9+3

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test, Integral test and D'Alembert's ratio test – Alternating series – Leibnitz's test – Series of positive and negative terms – Absolute and conditional convergence.

**UNIT III APPLICATIONS OF DIFFERENTIAL CALCULUS 9+3**  
Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals.

**UNIT IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES 9+3**  
Limits and Continuity – Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor’s series for functions of two variables – Maxima and minima of functions of two variables – Lagrange’s method of undetermined multipliers.

**UNIT V MULTIPLE INTEGRALS 9+3**  
Double integrals in cartesian and polar coordinates – Change of order of integration – Area enclosed by plane curves – Change of variables in double integrals – Area of a curved surface - Triple integrals – Volume of Solids.

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES:**

- This course equips students to have basic knowledge and understanding in one fields of materials, integral and differential calculus.

**TEXT BOOKS:**

1. Bali N. P and Manish Goyal, “A Text book of Engineering Mathematics”, Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
2. Grewal. B.S, “Higher Engineering Mathematics”, 41<sup>st</sup> Edition, Khanna Publications, Delhi, 2011.

**REFERENCES:**

1. Dass, H.K., and Er. Rajnish Verma, “Higher Engineering Mathematics”, S. Chand Private Ltd., 2011.
2. Glyn James, “Advanced Modern Engineering Mathematics”, 3<sup>rd</sup> Edition, Pearson Education, 2012.
3. Peter V. O’Neil, “Advanced Engineering Mathematics”, 7th Edition, Cengage learning, 2012.
4. Ramana B.V, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., “Engineering Mathematics”, Volume I, Second Edition, PEARSON Publishing, 2011.

**PH6151 ENGINEERING PHYSICS – I L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

**UNIT I CRYSTAL PHYSICS 9**  
Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment) - Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)



**OBJECTIVES:**

- To make the students conversant with basics of polymer chemistry.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- To acquaint the students with the basics of nano materials, their properties and applications.

**UNIT I POLYMER CHEMISTRY****9**

Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: T<sub>g</sub>, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Preparation, properties and uses of Nylon 6,6, and Epoxy resin.

**UNIT II CHEMICAL THERMODYNAMICS****9**

Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions (problems); Criteria of spontaneity; Gibbs-Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore(problems).

**UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY****9**

Photochemistry: Laws of photochemistry - Grotthuss-Draper law, Stark-Einstein law and Lambert-Beer Law. Quantum efficiency – determination- Photo processes - Internal Conversion, Inter-system crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitization. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram only).

**UNIT IV PHASE RULE AND ALLOYS****9**

Phase rule: Introduction, definition of terms with examples, One Component System- water system - Reduced phase rule - Two Component Systems- classification – lead-silver system, zinc-magnesium system. Alloys: Introduction- Definition- Properties of alloys- Significance of alloying, Functions and effect of alloying elements- Ferrous alloys- Nichrome and Stainless steel – heat treatment of steel; Non-ferrous alloys – brass and bronze.

**UNIT V NANO CHEMISTRY****9**

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: nano cluster, nano rod, nanotube(CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrode position, chemical vapour deposition, laser ablation; Properties and applications

**TOTAL :45 PERIODS****OUTCOMES:**

- The knowledge gained on polymer chemistry, thermodynamics. spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these subjects for further learning.

**TEXT BOOKS:**

1. Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010
2. Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009

**REFERENCES:**

1. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.
3. Gowariker V.R. , Viswanathan N.V. and JayadevSreedhar, "Polymer Science", New Age International P (Ltd.), Chennai, 2006.
4. Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.

**GE6151****COMPUTER PROGRAMMING****L T P C  
3 0 0 3****OBJECTIVES:****The students should be made to:**

- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

**UNIT I INTRODUCTION****8**

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

**UNIT II C PROGRAMMING BASICS****10**

Problem formulation – Problem Solving - Introduction to 'C' programming –fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

**UNIT III ARRAYS AND STRINGS****9**

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

**UNIT IV FUNCTIONS AND POINTERS****9**

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

## UNIT V STRUCTURES AND UNIONS

9

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

**TOTAL: 45 PERIODS**

### OUTCOMES:

**At the end of the course, the student should be able to:**

- Design C Programs for problems.
- Write and execute C programs for simple applications.

### TEXTBOOKS:

1. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009
3. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.

### REFERENCES:

1. Byron S Gottfried, "Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.
2. Dromey R.G., "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007.
3. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006.

**GE6152**

**ENGINEERING GRAPHICS**

**L T P C**  
**2 0 3 4**

### OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

### CONCEPTS AND CONVENTIONS (Not for Examination)

**1**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

### UNIT I PLANE CURVES AND FREE HAND SKETCHING

**5+9**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

### UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES

**5+9**

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

**UNIT III PROJECTION OF SOLIDS****5+9**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

**UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES****5+9**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

**UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS****6+9**

Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

**COMPUTER AIDED DRAFTING (Demonstration Only)****3**

Introduction to drafting packages and demonstration of their use.

**TOTAL: 75 PERIODS****OUTCOMES:**

On Completion of the course the student will be able to

- perform free hand sketching of basic geometrical constructions and multiple views of objects.
- do orthographic projection of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- prepare isometric and perspective sections of simple solids.
- demonstrate computer aided drafting.

**TEXT BOOK:**

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50<sup>th</sup> Edition, 2010.

**REFERENCES:**

1. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
2. Luzzader, Warren.J. and Duff, John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2<sup>nd</sup> Edition, 2009.
4. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.
5. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

**Publication of Bureau of Indian Standards:**

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

**Special points applicable to University Examinations on Engineering Graphics:**

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

**GE6161**

**COMPUTER PRACTICES LABORATORY**

**L T P C**  
**0 0 3 2**

**OBJECTIVES:**

**The student should be made to:**

- Be familiar with the use of Office software.
- Be exposed to presentation and visualization tools.
- Be exposed to problem solving techniques and flow charts.
- Be familiar with programming in C.
- Learn to use Arrays, strings, functions, structures and unions.

**LIST OF EXPERIMENTS:**

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions – Includes Parameter Passing
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.
- Develop recursive programs.

**LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:**

Standalone desktops with C compiler      30 Nos.

(or)

Server with C compiler supporting 30 terminals or more.

**OBJECTIVES:**

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

**GROUP A (CIVIL & MECHANICAL)****I CIVIL ENGINEERING PRACTICE****9****Buildings:**

- (a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

**Plumbing Works:**

- (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.  
 (b) Study of pipe connections requirements for pumps and turbines.  
 (c) Preparation of plumbing line sketches for water supply and sewage works.  
 (d) Hands-on-exercise:  
     Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.  
 (e) Demonstration of plumbing requirements of high-rise buildings.

**Carpentry using Power Tools only:**

- (a) Study of the joints in roofs, doors, windows and furniture.  
 (b) Hands-on-exercise:  
     Wood work, joints by sawing, planing and cutting.

**II MECHANICAL ENGINEERING PRACTICE****13****Welding:**

- (a) Preparation of arc welding of butt joints, lap joints and tee joints.  
 (b) Gas welding practice

**Basic Machining:**

- (a) Simple Turning and Taper turning  
 (b) Drilling Practice

**Sheet Metal Work:**

- (a) Forming & Bending:  
 (b) Model making – Trays, funnels, etc.  
 (c) Different type of joints.

**Machine assembly practice:**

- (a) Study of centrifugal pump  
 (b) Study of air conditioner

**Demonstration on:**

- (a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.  
 (b) Foundry operations like mould preparation for gear and step cone pulley.  
 (c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

## GROUP B (ELECTRICAL & ELECTRONICS)

- III ELECTRICAL ENGINEERING PRACTICE** **10**
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
  2. Fluorescent lamp wiring.
  3. Stair case wiring
  4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
  5. Measurement of energy using single phase energy meter.
  6. Measurement of resistance to earth of an electrical equipment.
- IV ELECTRONICS ENGINEERING PRACTICE** **13**
1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
  2. Study of logic gates AND, OR, EOR and NOT.
  3. Generation of Clock Signal.
  4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
  5. Measurement of ripple factor of HWR and FWR.

**TOTAL: 45 PERIODS**

### OUTCOMES:

- ability to fabricate carpentry components and pipe connections including plumbing works.
- ability to use welding equipments to join the structures.
- ability to fabricate electrical and electronics circuits.

### REFERENCES:

1. Jeyachandran K., Natarajan S. & Balasubramanian S., “A Primer on Engineering Practices Laboratory”, Anuradha Publications, 2007.
2. Jeyapooan T., Saravanapandian M. & Pranitha S., “Engineering Practices Lab Manual”, Vikas PUBLISHING House Pvt.Ltd, 2006.
3. Bawa H.S., “Workshop Practice”, Tata McGraw – Hill Publishing Company Limited, 2007.
4. Rajendra Prasad A. & Sarma P.M.M.S., “Workshop Practice”, Sree Sai Publication, 2002.
5. Kannaiah P. & Narayana K.L., “Manual on Workshop Practice”, Scitech Publications, 1999.

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

#### CIVIL

- |   |          |
|---|----------|
| 1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. | 15 Sets. |
| 2. Carpentry vice (fitted to work bench)  | 15 Nos.  |
| 3. Standard woodworking tools   | 15 Sets. |
| 4. Models of industrial trusses, door joints, furniture joints  | 5 each   |
| 5. Power Tools: (a) Rotary Hammer   | 2 Nos    |
| (b) Demolition Hammer   | 2 Nos    |
| (c) Circular Saw  | 2 Nos    |
| (d) Planer  | 2 Nos    |
| (e) Hand Drilling Machine   | 2 Nos    |
| (f) Jigsaw  | 2 Nos    |

## MECHANICAL

1. Arc welding transformer with cables and holders	5 Nos.
2. Welding booth with exhaust facility	5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos.
5. Centre lathe	2 Nos.
6. Hearth furnace, anvil and smithy tools	2 Sets.
7. Moulding table, foundry tools	2 Sets.
8. Power Tool: Angle Grinder	2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner	One each.

## ELECTRICAL

1. Assorted electrical components for house wiring	15 Sets
2. Electrical measuring instruments	10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each	
4. Megger (250V/500V)	1 No.
5. Power Tools: (a) Range Finder	2 Nos
(b) Digital Live-wire detector	2 Nos

## ELECTRONICS

1. Soldering guns	10 Nos.
2. Assorted electronic components for making circuits	50 Nos.
3. Small PCBs	10 Nos.
4. Multimeters	10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply	

**GE6163**

**PHYSICS AND CHEMISTRY LABORATORY – I**

**L T P C**  
**0 0 2 1**

### PHYSICS LABORATORY – I

#### OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

#### LIST OF EXPERIMENTS

(Any FIVE Experiments)

- (a) Determination of Wavelength, and particle size using Laser  
(b) Determination of acceptance angle in an optical fiber.
- Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
- Determination of wavelength of mercury spectrum – spectrometer grating
- Determination of thermal conductivity of a bad conductor – Lee's Disc method.
- Determination of Young's modulus by Non uniform bending method
- Determination of specific resistance of a given coil of wire – Carey Foster's Bridge

**OUTCOMES:**

- The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Diode laser, lycopodium powder, glass plate, optical fiber.
2. Ultrasonic interferometer
3. Spectrometer, mercury lamp, grating
4. Lee's Disc experimental set up
5. Traveling microscope, meter scale, knife edge, weights
6. Carey foster's bridge set up  
(vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

**CHEMISTRY LABORATORY- I****OBJECTIVES:**

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by vacometry.

**LIST OF EXPERIMENTS**

(Any FIVE Experiments)

- 1 Determination of DO content of water sample by Winkler's method.
- 2 Determination of chloride content of water sample by argentometric method.
- 3 Determination of strength of given hydrochloric acid using pH meter.
- 4 Determination of strength of acids in a mixture using conductivity meter.
- 5 Estimation of iron content of the water sample using spectrophotometer.  
(1,10- phenanthroline / thiocyanate method).
- 6 Determination of molecular weight of polyvinylalcohol using Ostwald viscometer.
- 7 Conductometric titration of strong acid vs strong base.

**TOTAL: 30 PERIODS**

**OUTCOMES:**

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

**REFERENCES:**

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York 2001.
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry", LBS Singapore 1994.
3. Jeffery G.H., Bassett J., Mendham J. and Denny vogel's R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Iodine flask	-	30 Nos
2. pH meter	-	5 Nos
3. Conductivity meter	-	5 Nos
4. Spectrophotometer	-	5 Nos
5. Ostwald Viscometer	-	10 Nos

**Common Apparatus : Pipette, Burette, conical flask, porcelain tile, dropper (each 30 Nos.)**

**OBJECTIVES:**

- To make learners acquire listening and speaking skills in both formal and informal contexts.
- To help them develop their reading skills by familiarizing them with different types of reading strategies.
- To equip them with writing skills needed for academic as well as workplace contexts.
- To make them acquire language skills at their own pace by using e-materials and language lab components.

**UNIT I****9+3**

Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on topics like weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; Writing - Effective use of SMS for sending short notes and messages - Using 'emojicons' as symbols in email messages; Grammar - Regular and irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. 'can') - Homophones (e.g. 'some', 'sum'); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

**UNIT II****9+3**

Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercises on Grammar and vocabulary, Extensive reading activity (reading stories / novels), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students' dialogues.

**UNIT III****9+3**

Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret, etc.); Reading - Speed reading – reading passages with time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading articles from journals - Format for journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. 'rock', 'train', 'ring'); E-materials - Interactive exercise on Grammar and vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU and RIE materials – Attending a meeting and writing minutes.

**UNIT IV****9+3**

Listening - Listening to a telephone conversation, Viewing model interviews (face-to-face, telephonic and video conferencing); Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary - Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on

Grammar and Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

## **UNIT V**

**9+3**

Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading; Writing – Checklist - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; E-materials - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises; Language Lab - Different models of group discussion.

**TOTAL (L:45+T:15): 60 PERIODS**

### **OUTCOMES:**

Learners should be able to

- Speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies.
- Write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
- Read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
- Listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

### **TEXTBOOKS:**

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

### **REFERENCES:**

1. Anderson, Paul V. Technical Communication: A Reader-Centered Approach. Cengage. New Delhi. 2008
2. Muralikrishna, & Sunita Mishra. Communication Skills for Engineers. Pearson, New Delhi. 2011
3. Riordan, Daniel. G. Technical Communication. Cengage Learning, New Delhi. 2005
4. Sharma, Sangeetha & Binod Mishra. Communication Skills for Engineers and Scientists. PHI Learning, New Delhi. 2009
5. Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA. 2007

### **EXTENSIVE Reading (Not for Examination)**

1. Khera, Shiv. You can Win. Macmillan, Delhi. 1998.

### **Websites**

1. <http://www.englishclub.com>
2. <http://owl.english.purdue.edu>

## TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like individual writing and presentations, group discussions, interviews, reporting, etc
- Long presentations using visual aids
- Listening and viewing activities with follow up activities like discussions, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc
- Projects like group reports, mock interviews etc using a combination of two or more of the language skills

## EVALUATION PATTERN:

### Internal assessment: 20%

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Report
- Creative writing, etc.

All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual presentations, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded following Bloom's taxonomy
- ✓ Writing assessment: Writing essays, CVs, reports etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content graded following Bloom's taxonomy.

### End Semester Examination: 80%

MA6251

MATHEMATICS – II

L T P C  
3 1 0 4

### OBJECTIVES:

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

### UNIT I VECTOR CALCULUS

9+3

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.



**OBJECTIVES:**

- To enrich the understanding of various types of materials and their applications in engineering and technology.

**UNIT I CONDUCTING MATERIALS****9**

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

**UNIT II SEMICONDUCTING MATERIALS****9**

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

**UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS****9**

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications

Superconductivity: properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High  $T_c$  superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

**UNIT IV DIELECTRIC MATERIALS****9**

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Clausius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

**UNIT V ADVANCED ENGINEERING MATERIALS****9**

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications

**TOTAL: 45 PERIODS****OUTCOMES:**

- The students will have the knowledge on physics of materials and that knowledge will be used by them in different engineering and technology applications.

**TEXT BOOKS:**

- Arumugam M., Materials Science. Anuradha publishers, 2010
- Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009

**REFERENCES:**

- Palanisamy P.K. Materials Science. SCITECH Publishers, 2011
- Senthilkumar G. Engineering Physics II. VRB Publishers, 2011
- Mani P. Engineering Physics II. Dhanam Publications, 2011
- Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009

**OBJECTIVES:**

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- Principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.

**UNIT I WATER TECHNOLOGY****9**

Introduction to boiler feed water-requirements-formation of deposits in steam boilers and heat exchangers- disadvantages (wastage of fuels, decrease in efficiency, boiler explosion) prevention of scale formation -softening of hard water -external treatment zeolite and demineralization - internal treatment- boiler compounds (phosphate, calgon, carbonate, colloidal) - caustic embrittlement -boiler corrosion-priming and foaming- desalination of brackish water –reverse osmosis.

**UNIT II ELECTROCHEMISTRY AND CORROSION****9**

Electrochemical cell - redox reaction, electrode potential- origin of electrode potential- oxidation potential- reduction potential, measurement and applications - electrochemical series and its significance - Nernst equation (derivation and problems). Corrosion- causes- factors- types- chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Paints- constituents and function. Electroplating of Copper and electroless plating of nickel.

**UNIT III ENERGY SOURCES****9**

Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion- differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells:Types of batteries- alkaline battery- lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H<sub>2</sub> -O<sub>2</sub> fuel cell- applications.

**UNIT IV ENGINEERING MATERIALS****9**

Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties – refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Portland cement- manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement–properties and uses. Glass - manufacture, types, properties and uses.

**UNIT V FUELS AND COMBUSTION****9**

Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- coal-analysis of coal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) - petroleum- manufacture of synthetic petrol (Bergius process)- knocking-octane number - diesel oil- cetane number - natural gas- compressed natural gas(CNG)- liquefied petroleum gases(LPG)- producer gas- water gas. Power alcohol and bio diesel. Combustion of fuels: introduction- theoretical calculation of calorific value- calculation of stoichiometry of fuel and air ratio- ignition temperature- explosive range - flue gas analysis (ORSAT Method).

**TOTAL: 45 PERIODS**



**UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING****12**

Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations.

Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

**TOTAL: 60 PERIODS****OUTCOMES:**

- ability to identify the electrical components explain the characteristics of electrical machines.
- ability to identify electronics components and use of them to design circuits.

**TEXT BOOKS:**

1. Mittle N., “Basic Electrical Engineering”, Tata McGraw Hill Edition, New Delhi, 1990.
2. Sedha R.S., “Applied Electronics”, S. Chand & Co., 2006.

**REFERENCES:**

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical, Electronics and Computer Engineering”, Tata McGraw Hill, Second Edition, 2006.
2. Nagsarkar T K and Sukhija M S, “Basics of Electrical Engineering”, Oxford press 2005.
3. Mehta V K, “Principles of Electronics”, S.Chand & Company Ltd, 1994.
4. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill, 2002.
5. Premkumar N, “Basic Electrical Engineering”, Anuradha Publishers, 2003.

**GE6253****ENGINEERING MECHANICS****L T P C  
3 1 0 4****OBJECTIVES:**

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

**UNIT I BASICS AND STATICS OF PARTICLES****12**

Introduction – Units and Dimensions – Laws of Mechanics – Lami’s theorem, Parallelogram and triangular Law of forces — Vectorial representation of forces – Vector operations of forces -additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

**UNIT II EQUILIBRIUM OF RIGID BODIES****12**

Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon’s theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

**UNIT III PROPERTIES OF SURFACES AND SOLIDS****12**

Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula – Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem –Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

**UNIT IV DYNAMICS OF PARTICLES****12**

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton's laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

**UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS****12**

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

**TOTAL : 60 PERIODS****OUTCOMES:**

- ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
- ability to analyse the forces in any structures.
- ability to solve rigid body subjected to dynamic forces.

**TEXT BOOKS:**

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8<sup>th</sup> Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

**REFERENCES:**

1. Hibbeler, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11<sup>th</sup> Edition, Pearson Education 2010.
2. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4<sup>th</sup> Edition, Pearson Education 2006.
3. Meriam J.L. and Kraige L.G., " Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", Third Edition, John Wiley & Sons,1993.
4. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3<sup>rd</sup> Edition, Vikas Publishing House Pvt. Ltd., 2005.
5. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 1998.
6. Kumar, K.L., "Engineering Mechanics", 3<sup>rd</sup> Revised Edition, Tata McGraw-Hill Publishing company, New Delhi 2008.

**GE6261 COMPUTER AIDED DRAFTING AND MODELING LABORATORY****L T P C  
0 1 2 2****OBJECTIVES:**

- To develop skill to use software to create 2D and 3D models.

**LIST OF EXERCISES USING SOFTWARE CAPABLE OF DRAFTING AND MODELING**

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).

6. Drawing of a plan of residential building ( Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- ability to use the software packers for drafting and modeling
- ability to create 2D and 3D models of Engineering Components

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

Sl.No	Description of Equipment	Quantity
1.	Pentium IV computer or better hardware, with suitable graphics facility	30 No.
2.	Licensed software for Drafting and Modeling.	30 Licenses
3.	Laser Printer or Plotter to print / plot drawings	2 No.

**GE6262**

**PHYSICS AND CHEMISTRY LABORATORY – II**

**L T P C**  
**0 0 2 1**

**PHYSICS LABORATORY – II**

**OBJECTIVES:**

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

**LIST OF EXPERIMENTS**

**(Any FIVE Experiments)**

1. Determination of Young's modulus by uniform bending method
2. Determination of band gap of a semiconductor
3. Determination of Coefficient of viscosity of a liquid –Poiseuille's method
4. Determination of Dispersive power of a prism - Spectrometer
5. Determination of thickness of a thin wire – Air wedge method
6. Determination of Rigidity modulus – Torsion pendulum

**OUTCOMES:**

- The students will have the ability to test materials by using their knowledge of applied physics principles in optics and properties of matter.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Traveling microscope, meter scale, Knife edge, weights
2. Band gap experimental set up
3. Burette, Capillary tube, rubber tube, stop clock, beaker and weighing balance
4. spectrometer, prism, sodium vapour lamp.
5. Air-wedge experimental set up.
6. Torsion pendulum set up.  
(vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

## CHEMISTRY LABORATORY - II

### OBJECTIVES:

- To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

### LIST OF EXPERIMENTS

#### (Any FIVE Experiments)

- 1 Determination of alkalinity in water sample
- 2 Determination of total, temporary & permanent hardness of water by EDTA method
- 3 Estimation of copper content of the given solution by EDTA method
- 4 Estimation of iron content of the given solution using potentiometer
- 5 Estimation of sodium present in water using flame photometer
- 6 Corrosion experiment – weight loss method
- 7 Conductometric precipitation titration using  $\text{BaCl}_2$  and  $\text{Na}_2\text{SO}_4$
- 8 Determination of CaO in Cement.

**TOTAL: 30 PERIODS**

### OUTCOMES:

- The students will be conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis.

### REFERENCES:

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York, 2001.
  2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry, LBS Singapore ,1994.
  3. Jeffery G.H, Bassett J., Mendham J. and Denny R.C., "Vogel's Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
  4. Kolthoff I.M. and Sandell E.B. et al. Quantitative chemical analysis, McMillan, Madras 1980
- **Laboratory classes on alternate weeks for Physics and Chemistry.**

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

- |                       |   |       |
|-----------------------|---|-------|
| 1. Potentiometer      | - | 5 Nos |
| 2. Flame photo meter  | - | 5 Nos |
| 3. Weighing Balance   | - | 5 Nos |
| 4. Conductivity meter | - | 5 Nos |

**Common Apparatus : Pipette, Burette, conical flask, percelain tile, dropper (30 Nos each)**

**OBJECTIVES**

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

**UNIT I PARTIAL DIFFERENTIAL EQUATIONS****9 + 3**

Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order partial differential equations - Lagrange's linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

**UNIT II FOURIER SERIES****9 + 3**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

**UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS****9 + 3**

Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

**UNIT IV FOURIER TRANSFORMS****9 + 3**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

**UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS****9 + 3**

Z- transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES**

- The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

**TEXT BOOKS**

1. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal. B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.
3. Narayanan.S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.

**REFERENCES**

1. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7<sup>th</sup> Edition, Laxmi Publications Pvt Ltd , 2007.
2. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company Limited, NewDelhi, 2008.

3. Glyn James, "Advanced Modern Engineering Mathematics", 3<sup>rd</sup> Edition, Pearson Education, 2007.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8<sup>th</sup> Edition, Wiley India, 2007.
5. Ray Wylie. C and Barrett.L.C, "Advanced Engineering Mathematics" Tata Mc Graw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.
6. Datta.K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.

**ME6352**

**MANUFACTURING TECHNOLOGY**

**L T P C**  
**3 0 0 3**

**OBJECTIVES**

- The automobile components such as piston, connecting rod, crankshaft, engine block, front axle, frame, body etc., are manufactured by various types of production processes involving casting, welding, machining, metal forming, power metallurgy etc. Hence B.E. Automobile Engineering students must study this course Production Technology.

**UNIT I CASTING**

**8**

Casting types, procedure to make sand mould, types of core making, moulding tools, machine moulding, special moulding processes – CO<sub>2</sub> moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

**UNIT II WELDING**

**8**

Classification of welding processes. Principles of Oxy-acetylene gas welding. A.C metal arc welding, resistance welding, submerged arc welding, tungsten inert gas welding, metal inert gas welding, plasma arc welding, thermit welding, electron beam welding, laser beam welding, defects in welding, soldering and brazing.

**UNIT III MACHINING**

**13**

General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines. General principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining and Laser beam machining.

**UNIT IV FORMING AND SHAPING OF PLASTICS**

**7**

Types of plastics - Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of - Injection moulding – Plunger and screw machines – Blow moulding – Rotational moulding – Film blowing – Extrusion - Typical industrial applications – Thermoforming – Processing of Thermosets – Working principles and typical applications - Compression moulding – Transfer moulding – Bonding of Thermoplastics – Fusion and solvent methods – Induction and Ultrasonic methods

**UNIT V METAL FORMING AND POWDER METALLURGY**

**9**

Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing and Spinning, Powder metallurgy – Principal steps involved advantages, disadvantages and limitations of powder metallurgy.

**TOTAL: 45 PERIODS**

## OUTCOMES:

- The Students can able to use different manufacturing process and use this in industry for component production

## TEXT BOOKS

1. Hajra Choudhury, "Elements of Workshop Technology", Vol. I and II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2005.
2. Nagendra Parashar B.S. and Mittal R.K., "Elements of Manufacturing Processes", Prentice-Hall of India Private Limited, 2007.

## REFERENCES

1. Serope Kalpajian, Steven R.Schmid, "Manufacturing Processes for Engineering Materials", Fourth Edition, Pearson Education, Inc. 2007.
2. Jain. R.K. and S.C. Gupta, "Production Technology", Khanna Publishers. 16<sup>th</sup> Edition,2001.
3. "H.M.T. Production Technology – Handbook", Tata McGraw-Hill, 2000.
4. Roy. A. Linberg, "Process and Materials of Manufacture", PHI, 2000.
5. Adithan. M and Gupta. A.B., "Manufacturing Technology", New Age, 2006.

**AE6301**

**AERO ENGINEERING THERMODYNAMICS**

**L T P C**  
**3 0 0 3**

## OBJECTIVES:

- To achieve an understanding of principles of thermodynamics and to be able to use it in accounting for the bulk behavior of the simple physical systems.
- To provide in-depth study of thermodynamic principles, thermodynamics of state, basic thermodynamic relations, Properties of pure substances
- To enlighten the basic concepts of heat transfer and propulsion cycles.

### **UNIT I BASIC CONCEPT AND FIRST LAW**

**9**

Concept of continuum, macroscopic approach, thermodynamic systems – closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics- concept of temperature and heat, internal energy, specific heat capacities, enthalpy - concept of ideal and real gases. First law of thermodynamics - applications to closed and open systems - steady flow processes with reference to various thermal equipments.

### **UNIT II SECOND LAW AND ENTROPY**

**9**

Second law of thermodynamics – kelvin planck and clausius statements of second law. Reversibility and irreversibility - carnot theorem. carnot cycle, reversed carnot cycle, efficiency, COP - thermodynamic temperature scale - clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy.

### **UNIT III THERMODYNAMIC AVAILABILITY AND AIR STANDARD CYCLES**

**9**

Basics – energy in non-flow processes: expressions for the energy of a closed system – equivalence between mechanical energy forms and exergy – flow of energy associated with heat flow – exergy consumption and entropy generation - exergy in steady flow processes: expressions for exergy in steady flow processes – exergy dissipation and entropy generation - otto, diesel, dual and brayton cycles - air standard efficiency - mean effective pressure.



**UNIT III      DIMENSIONAL ANALYSIS****9**

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

**UNIT IV      PUMPS****10**

Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps –classification.

**UNIT V      TURBINES****10**

Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students can able to apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Can critically analyse the performance of pumps and turbines.

**TEXT BOOK:**

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2004.

**REFERENCES:**

1. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2004
3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", 2011.
4. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011

**CE6452****SOLID MECHANICS****L T P C  
3 0 0 3****OBJECTIVES:**

- To introduce various behavior of structural components under various loading conditions.

**UNIT I      INTRODUCTION****8**

Definition of stress, strain and their relations – relations between material constants – axial loading - statically determinate and indeterminate problems in tension & compression – plane truss analysis – method of joints – method of sections – 3-D trusses – thermal stresses – impact loading.

**UNIT II      STRESSES IN BEAMS****10**

Shear force & bending moment diagrams: bending and shear stress variation in beams of symmetric sections, a typical spar section: beams of uniform strength - beams of two materials.

**UNIT III      DEFLECTION OF BEAMS****10**

Double integration method – macaulay's method – moment area method – conjugate beam method – principle of superposition – maxwell's reciprocal theorem.

**UNIT IV TORSION – SPRINGS – COLUMNS 10**  
Torsion of solid and hollow circular shafts – shear stress variation – open and closed-coiled helical springs – stresses in helical springs – classification of columns – euler buckling – columns with different end conditions.

**UNIT V BIAxIAL STRESSES 7**  
Stresses in thin-walled pressure vessels – combined loading of circular shaft with bending, torsion and axial loadings – Mohr’s circle and its construction – determination of principal stresses.

**TOTAL: 45 PERIODS**

**OUTCOMES**

- Solve the problems related to the structural components under various loading conditions.

**TEXT BOOKS:**

1. William Nash, "Strength of Materials", Tata McGraw Hill, 2004
2. Timoshenko and Young "Strength of Materials" Vol. I & II

**REFERENCES:**

1. Dym,C.L., and Shames,I.H., ‘Solid Mechanics’, McGraw Hill, Kogakusha, Tokyo, 1973.
2. Stephen Timoshenko, ‘Strength of Materials’, Vol I & II, CBS Publishers and Distributors, Third Edition.
3. Timoshenko,S. and Young, D.H., ‘Elements of Strength of Materials’, T.Van Nostrand Co. Inc., Princeton, N.J., 1977.

**AE6302 ELEMENTS OF AERONAUTICS L T P C  
3 0 0 3**

**OBJECTIVES:**

- To introduce the concepts of flying, International standard atmosphere, structural aspects of airplanes, brief description of systems, instruments and power plants used in airplanes.

**UNIT I HISTORY OF FLIGHT 8**  
Balloon flight – ornithopters - early airplanes by wright brothers, biplanes and monoplanes, developments in aerodynamics, materials, structures and propulsion over the years.

**UNIT II BASICS OF FLIGHT MECHANICS 9**  
Physical properties and structure of the atmosphere, temperature, pressure and altitude relationships, newton’s law of motions applied to aeronautics - evolution of lift, drag and moment. aerofoils, mach number, maneuvers.

**UNIT III AIRCRAFT CONFIGURATIONS 10**  
Different types of flight vehicles, classifications. components of an airplane and their functions. conventional control, powered control, basic instruments for flying - typical systems for control actuation.

**UNIT IV AIRPLANE STRUCTURES AND MATERIALS 9**  
General types of construction, monocoque, semi-monocoque and geodesic constructions, typical wing and fuselage structure. metallic and non-metallic materials, use of aluminium alloy, titanium, stainless steel and composite materials. stresses and strains – hooke’s law – stress - strain diagrams - elastic constants.

**UNIT V POWER PLANTS****9**

Basic ideas about piston, turboprop and jet engines - use of propeller and jets for thrust production - comparative merits, principles of operation of rocket, types of rockets and typical applications, exploration into space.

**TOTAL: 45 PERIODS****OUTCOMES**

- Identify the component of Flight
- Identify suitable materials for Aircraft structure
- Perform basic calculation on Mechanics using Newton law for lift, drag and moment.

**TEXT BOOKS:**

1. Anderson, J.D., "Introduction to Flight", McGraw-Hill, 1995.
2. Stephen. A. Brandt, "Introduction to Aeronautics: A design perspective" American Institute of Aeronautics & Astronautics, 1997

**REFERENCES:**

1. Kermode, A.C., "Mechanics of Flight", Himalayan Book, 1997

**CE6315****STRENGTH OF MATERIALS LABORATORY****L T P C**  
**0 0 3 2****OBJECTIVES**

To supplement the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads. This would enable the student to have a clear understanding of the design for strength and stiffness

**LIST OF EXPERIMENTS**

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
  - (i) Unhardened specimen
  - (ii) Quenched Specimen and
  - (iii) Quenched and tempered specimen.
11. Microscopic Examination of
  - (i) Hardened samples and
  - (ii) Hardened and tempered samples.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Ability to perform different destructive testing
- Ability to characteristic materials

### LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity	1
2	Torsion Testing Machine (60 NM Capacity)	1
3	Impact Testing Machine (300 J Capacity)	1
4	Brinell Hardness Testing Machine	1
5	Rockwell Hardness Testing Machine	1
6	Spring Testing Machine for tensile and compressive loads (2500 N)	1
7	Metallurgical Microscopes	3
8	Muffle Furnace (800 C)	1

**CE6461**

**FLUID MECHANICS AND MACHINERY LABORATORY**

**L T P C**

**0 0 3 2**

**OBJECTIVES:**

Upon Completion of this subject, the students can able to have hands on experience in flow measurements using different devices and also perform calculation related to losses in pipes and also perform characteristic study of pumps, turbines etc.,

**LIST OF EXPERIMENTS**

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Ability to use the measurement equipments for flow measurement
- Ability to do performance trust on different fluid machinery

### LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

S. No.	NAME OF THE EQUIPMENT	Qty.
1	Orifice meter setup	1
2	Venturi meter setup	1
3	Rotameter setup	1
4	Pipe Flow analysis setup	1
5	Centrifugal pump/submergible pump setup	1
6	Reciprocating pump setup	1

7	Gear pump setup	1
8	Pelton wheel setup	1
9	Francis turbine setup	1
10	Kaplan turbine setup	1

AE6311

**THERMODYNAMICS LABORATORY**

**L T P C**  
**0 0 3 2**

**OBJECTIVES**

- To enhance the basic knowledge in applied thermodynamics

**LIST OF EXPERIMENTS**

1. Performance test on a 4-stroke engine
2. Valve timing of a 4 – stroke engine and port timing of a 2 stroke engine
3. Determination of effectiveness of a parallel flow heat exchanger
4. Determination of effectiveness of a counter flow heat exchanger
5. Determination of heating value of a fuel
6. Determination of specific heat of solid
7. Determination of thermal conductivity of solid.
8. Determination of thermal resistance of a composite wall.
9. COP test on a vapour compression refrigeration test rig
10. COP test on a vapour compression air-conditioning test rig

**TOTAL: 45 PERIODS**

**OUTCOMES**

- Ability to perform test on diesel/petrol engine
- Ability to explain the characteristics of the diesel/Petrol engine
- Ability to determine the properties of the fuels.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

Sl.No	Details of Equipments	Qty Req.	Experiment No.
1.	4 stroke twin cylinder diesel engine	1	1
2.	Cut section model of 4 stroke diesel engine and cut section model of 2 stroke petrol engine	1	2
3.	Parallel and counter flow heat exchanger test rig	1	3,4
4.	Bomb Calorimeter	1	5
5.	Vapour compression refrigeration test rig	1	9
6.	Vapour compression air-conditioning test rig	1	10
7.	Conductive heat transfer set up	1	7
8.	Composite wall	1	8

**OBJECTIVES**

- To teach and train the students in the lab about the design and drafting of aero components

**LIST OF EXPERIMENTS**

- Design and modeling of rectangular plate with hole.
- Design and modeling of spar components.
- Design and modeling of aerofoil sections.
- Design and modeling of cut section for wings.
- Design and modeling of machine component.
- Design and modeling of bulk head.
- Design and analysis of a truss.
- Design and analysis of beam distributed load.
- Facing and Turning (Taper, Step) operations in CNC.
- Drilling operations in CNC.

**TOTAL: 45 PERIODS****OUTCOMES**

Ability to design and model difficult aero component and perform structural analysis using available software packages

**LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS**

Sl.No.	Name of the Equipment	Quantity	Experiment No.
1	Computer nodes	30	1 to 8
2	Modeling Packages	30 licenses	1 to 6
3	FEA&CAM SOFTWARE	30 licenses	7 & 8
4	UPS	1	1 to 8
5.	CNC Machine	1	9,10
5	Printer	2	All

**OBJECTIVES**

- This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology

**UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS****10+3**

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method - Eigenvalues of a matrix by Power method.

**UNIT II INTERPOLATION AND APPROXIMATION****8+3**

Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

**UNIT III      NUMERICAL DIFFERENTIATION AND INTEGRATION      9+3**  
Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

**UNIT IV      INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS      9+3**  
Single Step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods - Milne's and Adams-Bashforth predictor corrector methods for solving first order equations.

**UNIT V      BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS      9+3**  
Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES**

- The students will have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

**TEXT BOOKS**

1. Grewal. B.S., and Grewal. J.S., " Numerical methods in Engineering and Science", Khanna Publishers, New Delhi, 9<sup>th</sup> Edition, 2007.
2. Gerald. C. F., and Wheatley. P. O., " Applied Numerical Analysis", Pearson Education, Asia, New Delhi, 6<sup>th</sup> Edition, 2006.

**REFERENCES**

1. Chapra. S.C., and Canale.R.P., "Numerical Methods for Engineers, 5<sup>th</sup> Edition, Tata McGraw - Hill, New Delhi, 2007.
2. Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi, 2007.
3. Sankara Rao. K., "Numerical methods for Scientists and Engineers", 3<sup>rd</sup> Edition, Prentice Hall of India Private Ltd., New Delhi, 2007.

**AE6401**

**AERODYNAMICS - I**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To introduce the concepts of mass, momentum and energy conservation relating to aerodynamics.
- To make the student understand the concept of vorticity, irrotationality, theory of airfoils and wing sections.
- To introduce the basics of viscous flow.

<b>UNIT I</b>	<b>INTRODUCTION TO LOW SPEED FLOW</b>	<b>9</b>
Euler equation, incompressible bernoulli's equation. circulation and vorticity, green's lemma and stoke's theorem, barotropic flow, kelvin's theorem, streamline, stream function, irrotational flow, potential function, equipotential lines, elementary flows and their combinations.		
<b>UNIT II</b>	<b>TWO DIMENSIONAL INVISCID INCOMPRESSIBLE FLOW</b>	<b>9</b>
Ideal Flow over a circular cylinder, D'Alembert's paradox, magnus effect, Kutta joukowski's theorem, starting vortex, kutta condition, real flow over smooth and rough cylinder.		
<b>UNIT III</b>	<b>AIRFOIL THEORY</b>	<b>9</b>
Cauchy-riemann relations, complex potential, methodology of conformal transformation, kutta-joukowski transformation and its applications, thin airfoil theory and its applications.		
<b>UNIT IV</b>	<b>SUBSONIC WING THEORY</b>	<b>9</b>
Vortex filament, biot and savart law, bound vortex and trailing vortex, horse shoe vortex, lifting line theory and its limitations.		
<b>UNIT V</b>	<b>INTRODUCTION TO BOUNDARY LAYER THEORY</b>	<b>9</b>
Boundary layer and boundary layer thickness, displacement thickness, momentum thickness, energy thickness, shape parameter, boundary layer equations for a steady, two dimensional incompressible flow, boundary layer growth over a flat plate, critical reynolds number, blasius solution, basics of turbulent flow.		

**TOTAL: 45 PERIODS**

**OUTCOMES**

- An ability to apply airfoil theory to predict air foil perform
- A knowledge of incompressible flow
- An explosive to Boundary layer theory

**TEXT BOOKS:**

1. Houghton, E.L., and Caruthers, N.B., "Aerodynamics for Engineering students", Edward Arnold Publishers Ltd., London, 1989.
2. Anderson, J.D., "Fundamentals of Aerodynamics", McGraw Hill Book Co., 1999

**REFERENCES:**

1. Milne Thomson, L.H., "Theoretical Aerodynamics", Macmillan, 1985
2. John J Bertin., "Aerodynamics for Engineers", Pearson Education Inc, 2002
3. Clancey, L J., " Aerodynamics", Pitman, 1986
4. Kuethe, A.M and Chow, C.Y, "Foundations of Aerodynamics", Fifth Edition, John Wiley & Sons, 2000.

<b>AE6402</b>	<b>AIRCRAFT SYSTEMS AND INSTRUMENTS</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

**OBJECTIVES:**

- To impart knowledge of the hydraulic and pneumatic systems components and types of instruments and its operation including navigational instruments to the students

<b>UNIT I</b>	<b>AIRCRAFT SYSTEMS</b>	<b>8</b>
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Hydraulic systems – Study of typical workable systems – components – hydraulic systems controllers – modes of operation – pneumatic systems – working principles – typical pneumatic power system –

brake system – components, landing gear systems – classification – shock absorbers – retractive mechanism.

**UNIT II AIRPLANE CONTROL SYSTEMS 12**

Conventional Systems – power assisted and fully powered flight controls – power actuated systems – engine control systems – push pull rod system – operating principles – modern control systems – digital fly by wire systems – auto pilot system, active control technology

**UNIT III ENGINE SYSTEMS 8**

Fuel systems – piston and jet engines – components - multi-engine fuel systems, lubricating systems - piston and jet engines – starting and ignition systems – piston and jet engines

**UNIT IV AIRCONDITIONING AND PRESSURIZING SYSTEM 8**

Basic air cycle systems – vapour cycle systems, boot-strap air cycle system – evaporative vapour cycle systems – evaporation air cycle systems – oxygen systems – fire protection systems, deicing and anti icing system.

**UNIT V AIRCRAFT INSTRUMENTS 9**

Flight instruments and navigation instruments – accelerometers, air speed indicators – mach meters – altimeters - gyroscopic instruments– principles and operation – study of various types of engine instruments – tachometers – temperature gauges – pressure gauge – operation and principles.

**TOTAL: 45 PERIODS**

**OUTCOMES**

- Know the operation of airplane control system, Engine system, Air conditioning and pressing system.
- Know the operation of air data Instruments system

**TEXT BOOKS:**

1. Mekinley, J.L. and R.D. Bent, "Aircraft Power Plants", McGraw Hill 1993.
2. Pallet, E.H.J, "Aircraft Instruments & Principles", Pitman & Co 1993.

**REFERENCES:**

1. Treager, S., "Gas Turbine Technology", McGraw Hill 1997.
2. Mckinley, J.L. and Bent R.D. "Aircraft Maintenance & Repair", McGraw Hill,1993.
3. Handbooks of Airframe and Power plant Mechanics, US dept. of Transportation, Federal, Aviation Administration, The English Book Store, New Delhi, 1995

**AT6302**

**MECHANICS OF MACHINES**

**L T P C  
3 1 0 4**

**OBJECTIVES:**

- To understand the principles in the formation of mechanisms and their kinematics.
- To understand the effect of friction in different machine elements.
- To analyse the forces and toques acting on simple mechanical systems
- To understand the importance of balancing and vibration.

**UNIT I KINEMATIC OF MECHANICS 10**

Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain – kinematics analysis in simple mechanisms – velocity and acceleration polygons – Analytical methods – computer approach – cams – classifications – displacement diagrams - layout of plate cam profiles – derivatives of followers motion – circular arc and tangent cams.



**UNIT II ENERGY METHODS** **10**  
Strain Energy in axial, bending, torsion and shear loadings. Castigliano's theorems and their applications. Energy theorems – dummy load & unit load methods – energy methods applied to statically determinate and indeterminate beams, frames, rings & trusses.

**UNIT III COLUMNS** **10**  
Euler's column curve – inelastic buckling – effect of initial curvature – the Southwell plot – columns with eccentricity – use of energy methods – theory of beam columns – beam columns with different end conditions – stresses in beam columns.

**UNIT IV FAILURE THEORIES** **9**  
Ductile and brittle materials – maximum principal stress theory - maximum principal strain theory - maximum shear stress theory - distortion energy theory – octahedral shear stress theory.

**UNIT V INDUCED STRESSES** **7**  
Thermal stresses – impact loading – Fatigue – Creep - Stress Relaxation

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES**

- Ability to perform linear static analysis of determinate and indeterminate aircraft structural components
- Ability to design the component using different theories of failure

**TEXT BOOKS:**

1. Timoshenko and Gere, "Mechanics of Materials", Tata McGraw Hill, 1993.
2. Megson T M G, "Aircraft Structures for Engineering students" Elsevier Science and Technology, 2007
3. Peery and Azar, "Aircraft Structures"

**REFERENCES:**

1. Donaldson, B.K., "Analysis of Aircraft Structures - An Introduction", McGraw Hill, 1993.
2. Bruhn E F, "Analysis and Design of Flight Vehicle Structures", Tri-State Off-set Company, USA, 1985
3. Peery, D.J. and Azar,J.J., "Aircraft Structures", 2<sup>nd</sup> Edition, McGraw – Hill, N.Y, 1999.

**AE6404**

**PROPULSION - I**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To introduce basic concepts and salient features of engine components of jet propelled engines which are operated in atmosphere to students. This course is also aimed at making students familiarize with advanced jet propulsion methods like hypersonic propulsion.

**UNIT I FUNDAMENTALS OF AIR BREATHING ENGINES** **8**

Operating principles of piston engines – thermal efficiency calculations – classification of piston engines - illustration of working of gas turbine engine – the thrust equation – factors affecting thrust – effect of pressure, velocity and temperature changes of air entering compressor – methods of thrust augmentation – characteristics of turboprop, turbofan and turbojet – performance characteristics.

**UNIT II            INLETS, NOZZLES AND COMBUSTION CHAMBERS FOR JET ENGINES            10**

Internal flow and Stall in subsonic inlets – relation between minimum area ratio and external deceleration ratio – diffuser performance – supersonic inlets – starting problem on supersonic inlets – shock swallowing by area variation – real flow in nozzles and nozzle efficiency – losses in nozzles – equilibrium flow and frozen flow in nozzles- two phase flow in nozzles – ejector and variable area nozzles - interaction of nozzle flow with adjacent surfaces – thrust reversal- classification of combustion chambers – combustion chamber performance – effect of operating variables on performance – flame stabilization

**UNIT III            COMPRESSORS FOR JET ENGINES            9**

Principle of operation of centrifugal compressor and axial flow compressor– Work done and pressure rise – velocity diagrams – degree of reaction – free vortex and constant reaction designs of axial flow compressor – performance characteristics of centrifugal and axial flow compressors– stage efficiency calculations - cascade testing

**UNIT IV            TURBINES FOR JET ENGINES            9**

Principle of operation of axial flow turbines– limitations of radial flow turbines- Work done and pressure rise – Velocity diagrams – degree of reaction – free vortex and constant nozzle angle designs – performance characteristics of axial flow turbine– turbine blade cooling methods – stage efficiency calculations – basic blade profile design considerations – matching of compressor and turbine

**UNIT V            RAMJET PROPULSION            9**

Operating principle of ramjet engine – various components of ramjet engines and their efficiencies – Combustion in ramjet engine – critical, subcritical and supercritical modes of operation -ramjet engine and its performance characteristics – sample ramjet design calculations – flame stability problems in ramjet combustors –integral ram rockets.

**TOTAL: 45 PERIODS**

**OUTCOMES**

- Ability to identify the engine components of jet propelled engines
- Know the details of advanced Jet propulsion and hypersonic propulsion

**TEXT BOOKS:**

1. Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Addison – Wesley Longman INC, 1999.
2. James Award, "Aerospace Propulsion System"

**REFERENCES:**

1. Cohen, H. Rogers, G.F.C. and Saravana muttoo, H.I.H. "Gas Turbine Theory", Longman, 1989.
2. Oates, G.C., "Aero thermodynamics of Aircraft Engine Components", AIAA Education Series, New York, 1985.
3. Rolls Royce, "Jet Engine", 5<sup>th</sup> Edition, Rolls Royce Technical Publications, 2005.
4. Mathur, M.L. and Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", Standard Publishers & Distributors, Delhi, 1999.

**OBJECTIVES**

- To study the properties of materials used in Aircraft structure.
- To study the failure of different component under different loading condition

**LIST OF EXPERIMENTS**

1. Determination of young's modulus for metallic materials
2. Determination of flexural strength of metallic materials.
3. Deflection of a simply-supported beam
4. Deflection of a cantilever beam.
5. Verification of superposition theorem
6. Verification of maxwell's reciprocal theorem
7. Influence line study on beams
8. Buckling load estimation of slender eccentric columns
9. Construction of south well plot
10. Study of non-destructive testing procedures
11. Determination of flexural rigidity of composite beams
12. Shear failure of bolted and riveted Joints
13. Calibration of proving ring and spring
14. Truss and frame analysis.

(Only 10 experiments will be conducted)

**TOTAL: 45 PERIODS**

**OUTCOMES**

- Ability to perform non-destructive testing to predict the properties of metabolic materials used in aircraft application

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

Sl. No.	Name of the Equipment	Quantity	Experiment No.
1	100 kN Universal Testing Machine	1	1,2,11,12
2	Beams with weight hangers and dial gauges	6	3,4,5,6,7
3	Truss model and frame model	2	14
4	Column set up with dial gauges	2	8,9

**OBJECTIVES**

- To predict different aerodynamic propulsion used in aero application

**LIST OF EXPERIMENTS**

1. Application of Bernoulli's Equation – venturimeter and orifice meter.
2. Frictional loss in laminar flow through pipes.
3. Frictional loss in turbulent flow through pipes.
4. Calibration of a subsonic Wind tunnel.
5. Determination of lift for the given airfoil section.

6. Pressure distribution over a smooth circular cylinder.
7. Pressure distribution over a rough circular cylinder.
8. Pressure distribution over a symmetric aerofoil.
9. Pressure distribution over a cambered aerofoil.
10. Flow visualization studies in subsonic flows.

**TOTAL: 45 PERIODS**

### OUTCOMES

- Ability to use the fundamental dynamic principle in aircraft application.

#### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl. No.	Name of the Equipment	Quantity	Experiment No.
1	Venturimeter	1	1
2	Orificemeter	1	1
3	Pipe friction apparatus	1	2,3
4	Subsonic Wind tunnel	1	4,5,6,7,8,9,10
5	Models(aerofoil, rough and smooth cylinder , flat plate)	2	5,6,7,8,9

**AE6413**

**CAD AND AIRCRAFT COMPONENT DRAWING**

**L T P C**  
**0 0 4 2**

### OBJECTIVES

- To introduce the concept of design of basic structural components and to draft both manually and using modelling package.

### LIST OF EXERCISES

1. Design and drafting of riveted joints
2. Design and drafting of welded joints.
3. Design and drafting control components cam
4. Design and drafting control components bell crank
5. Design and drafting control components gear
6. Design and drafting control components push-pull rod
7. Three view diagram of a typical aircraft
8. Layout of typical wing structure.
9. Layout of typical fuselage structure.
10. Layout of control system

**TOTAL : 60 PERIODS**

### OUTCOMES

- Ability to design and draw different joints and components using manual drafting method.

#### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl.No	Equipments	Quantity	Experiments No.
1	Drawing Boards, Drafting machines	30	1, 5

**OBJECTIVES**

- To study the performance of airplanes under various operating conditions and the static and dynamic response of aircraft for both voluntary and involuntary changes in flight conditions

**UNIT I CRUISING FLIGHT PERFORMANCE 9**

Forces and moments acting on a flight vehicle - Equation of motion of a rigid flight vehicle - Different types of drag –estimation of parasite drag co-efficient by proper area method- Drag polar of vehicles from low speed to high speeds - Variation of thrust, power with velocity and altitudes for air breathing engines . Performance of airplane in level flight - Power available and power required curves. Maximum speed in level flight - Conditions for minimum drag and power required

**UNIT II MANOEUVERING FLIGHT PERFORMANCE 10**

Range and endurance - Climbing and gliding flight (Maximum rate of climb and steepest angle of climb, minimum rate of sink and shallowest angle of glide) -Turning performance (Turning rate turn radius). Bank angle and load factor – limitations on turn - V-n diagram and load factor.

**UNIT III STATIC LONGITUDINAL STABILITY 10**

Degree of freedom of rigid bodies in space - Static and dynamic stability - Purpose of controls in airplanes -Inherently stable and marginal stable airplanes – Static, Longitudinal stability - Stick fixed stability - Basic equilibrium equation - Stability criterion - Effects of fuselage and nacelle - Influence of CG location - Power effects - Stick fixed neutral point - Stick free stability-Hinge moment coefficient - Stick free neutral points-Symmetric maneuvers - Stick force gradients - Stick \_ force per 'g' - Aerodynamic balancing.

**UNIT IV LATERAL AND DIRECTIONAL STABILITY 8**

Dihedral effect - Lateral control - Coupling between rolling and yawing moments - Adverse yaw effects - Aileron reversal - Static directional stability - Weather cocking effect - Rudder requirements - One engine inoperative condition - Rudder lock.

**UNIT V DYNAMIC STABILITY 8**

Introduction to dynamic longitudinal stability: - Modes of stability, effect of freeing the stick - Brief description of lateral and directional. dynamic stability - Spiral, divergence, Dutch roll, auto rotation and spin.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES**

- Ability to analyse the performance of aircraft under various Flight conditions such as take off, cruise, landing, climbing, gliding, turning and other maneuvers.

**TEXT BOOK**

- Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son., Inc, NY, 1988.
- Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 2004.
- Mc Cornick. W., "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, NY, 1979.

**REFERENCES**

- Etkin, B., "Dynamics of Flight Stability and Control", Edn. 2, John Wiley, NY, 1982.
- Babister, A.W., "Aircraft Dynamic Stability and Response", Pergamon Press, Oxford, 1980.
- Dommasch, D.O., Sherby, S.S., and Connolly, T.F., "Aeroplane Aero dynamics", Third Edition, Issac Pitman, London, 1981.
- Mc Cornick B. W, "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, NY, 1995.

**OBJECTIVES:**

- To provide the students various methods for analysis of aircraft wings and fuselage.
- To provide the the behavior of major aircraft structural components.

**UNIT I UNSYMMETRICAL BENDING****9**

Bending of symmetric beams subject to skew loads - bending stresses in beams of unsymmetrical sections – generalized 'k' method, neutral axis method, principal axis method.

**UNIT II SHEAR FLOW IN OPEN SECTIONS****9**

Thin walled beams – concept of shear flow – the shear centre and its determination – shear flow distribution in symmetrical and unsymmetrical thin-walled sections – structural idealization – shear flow variation in idealized sections.

**UNIT III SHEAR FLOW IN CLOSED SECTIONS****9**

Bredt - Batho theory – single-cell and multi-cell tubes subject to torsion – shear flow distribution in thin-walled single & multi-cell structures subject to combined bending torsion – with walls effective and ineffective in bending – shear centre of closed sections.

**UNIT IV BUCKLING OF PLATES****8**

Bending of thin plates – rectangular sheets under compression - local buckling stress of thin walled sections – crippling strength estimation – thin-walled column strength – load carrying capacity of sheet stiffener panels – effective width.

**UNIT V STRESS ANALYSIS OF WING AND FUSELAGE****10**

Loads on an aircraft – the V-n diagram – shear force and bending moment distribution over the aircraft wing and fuselage – shear flow in thin-webbed beams with parallel and non-parallel flanges – complete tension field beams – semi-tension field beam theory.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES**

- Ability to analyse the aircraft wings and fuselage
- Ability to demonstrate the behavior of major aircraft structural components.

**TEXT BOOKS:**

1. Megson T M G , "Aircraft Structures for Engineering Students", Elsevier Ltd, 2007
2. Peery, D.J., and Azar, J.J., "Aircraft Structures", 2<sup>nd</sup> edition, McGraw – Hill, N.Y., 1999
3. Bruhn. E.H., "Analysis and Design of Flight Vehicles Structures", Tri-state off-set Company, USA, 1985.

**REFERENCES:**

1. Rivello, R.M., "Theory and Analysis of Flight Structures", McGraw Hill, 1993.
2. Howard D Curtis, "Fundamentals of Aircraft Structural Analysis", WCB-McGraw Hill, 1997

**OBJECTIVES:**

- To introduce the concepts of compressibility,
- To make the student understand the theory behind the formation of shocks and expansion fans in Supersonic flows.
- To introduce the methodology of measurements in Supersonic flows.

**UNIT I FUNDAMENTAL ASPECTS OF COMPRESSIBLE FLOW 9**

Compressibility, continuity, momentum and energy equations for steady one dimensional flow, compressible bernoulli's equation, area – mach number – velocity relation, mach cone, mach angle, one dimensional isentropic flow through variable area duct, critical conditions, characteristic mach number, area-mach number relation, maximum discharge velocity – operating characteristics of nozzles- introduction to hypersonic flows

**UNIT II SHOCK AND EXPANSION WAVES 10**

Normal shock relations, Prandtl's relation, Hugoniot equation, Rayleigh Supersonic Pitot tube equation, Moving normal shock waves, Oblique shocks,  $\theta - \delta - M$  relation, Shock Polar, Reflection of oblique shocks, left running and right running waves, Interaction of oblique shock waves, slip line, shock-boundary layer interaction – transonic lambda shock – compression corner effect – incident shock interaction - Rayleigh flow, Fanno flow, Expansion waves, Prandtl-Meyer expansion, Maximum turning angle, Simple and non-simple regions.

**UNIT III TWO DIMENSIONAL COMPRESSIBLE FLOW 9**

Potential equation for 2-dimensional compressible flow, Linearisation of potential equation, perturbation potential, Linearised Pressure Coefficient, Linearised subsonic flow, Prandtl-Glauert rule, Linearised supersonic flow, Method of characteristics.

**UNIT IV HIGH SPEED FLOW OVER AIRFOILS, WINGS AND AIRPLANE CONFIGURATION 9**

Critical Mach number, Drag divergence Mach number, Shock Stall, Supercritical Airfoil Sections, Transonic area rule, Swept wing, Airfoils for supersonic flows, Lift, drag, Pitching moment and Centre of pressure for supersonic profiles, Shock-expansion theory, wave drag, supersonic wings, Design considerations for supersonic aircraft- aerodynamic heating.

**UNIT V EXPERIMENTAL TECHNIQUES FOR HIGH SPEED FLOWS 8**

Wind tunnels for transonic, Supersonic and hypersonic flows, shock tube, Gun tunnels-peculiar problems in the operation of hypersonic tunnels - Supersonic flow visualization methods

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES**

- Understanding characteristics of fluid flows
- Knowledge gained in shock phenomenon and fluid waves.
- understanding fluid flow characteristics over wings airfoils and airplanes.
- Usage of wind tunnels for evaluating flow behaviours.

**TEXT BOOKS:**

1. Anderson, J. D, "Modern Compressible Flow", McGraw-Hill & Co., 2002.
2. Rathakrishnan., E, "Gas Dynamics", Prentice Hall of India, 2004.

**REFERENCES:**

1. Shapiro, A. H., "Dynamics and Thermodynamics of Compressible Fluid Flow", Ronald Press, 1982.
2. Zucrow, M. J. and Anderson, J. D., "Elements of Gas Dynamics", McGraw- Hill & Co., 1989.
3. Oosthuizen, P.H., & Carscallen, W.E., "Compressible Fluid Flow", McGraw- Hill & Co., 1997



**REFERENCES:**

1. James Award, "Aerospace Propulsion System"
2. Hieter and Pratt, "Hypersonic Air Breathing Propulsion"

**AE6505****CONTROL ENGINEERING****L T P C****3 0 0 3****OBJECTIVES:**

- To introduce the mathematical modeling of systems, open loop and closed loop systems and analyses in time domain and frequency domain.
- To impart the knowledge on the concept of stability and various methods to analyze stability in both time and frequency domain.
- To introduce sampled data control system.

**UNIT I INTRODUCTION****9**

Historical review, Simple pneumatic, hydraulic and thermal systems, Series and parallel system, Analogies, mechanical and electrical components, Development of flight control systems.

**UNIT II OPEN AND CLOSED LOOP SYSTEMS****9**

Feedback control systems – Control system components - Block diagram representation of control systems, Reduction of block diagrams, Signal flow graphs, Output to input ratios.

**UNIT III CHARACTERISTIC EQUATION AND FUNCTIONS****9**

Laplace transformation, Response of systems to different inputs viz., Step impulse, pulse, parabolic and sinusoidal inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuit.

**UNIT IV CONCEPT OF STABILITY****9**

Necessary and sufficient conditions, Routh-Hurwitz criteria of stability, Root locus and Bode techniques, Concept and construction, frequency response.

**UNIT V SAMPLED DATA SYSTEMS****9**

Z-Transforms Introduction to digital control system, Digital Controllers and Digital PID controllers

**TOTAL: 45 PERIODS****OUTCOMES:**

- Ability to apply mathematical knowledge to model the systems and analyse the frequency domain
- Ability to check the stability of the both time and frequency domain

**TEXT BOOKS:**

1. OGATO, Modern Control Engineering, Prentice-Hall of India Pvt. Ltd., New Delhi, 1998.
2. Azzo, J.J.D. and C.H. Houpis Feed back control system analysis and synthesis, McGraw-Hill international 3rs Edition, 1998.

**REFERENCES:**

1. Kuo, B.C. "Automatic control systems", Prentice-Hall of India Pvt. Ltd., New Delhi, 1998.
2. Houpis, C.H. and Lamont, G.B. "Digital control Systems", McGraw Hill Book co., New York, U.S.A. 1995.
3. Naresh K Sinha, "Control Systems", New Age International Publishers, New Delhi, 1998.

**OBJECTIVES**

To the study of nature and the facts about environment.

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY****12**

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds  
Field study of simple ecosystems – pond, river, hill slopes, etc.

**UNIT II ENVIRONMENTAL POLLUTION****10**

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry- Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO<sub>2</sub>, NO<sub>x</sub>, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies –  
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

**UNIT III NATURAL RESOURCES****10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources

for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins –Biochemical degradation of pollutants, Bioconversion of pollutants.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

#### **UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides.

Public awareness.

#### **UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

**TOTAL : 45 PERIODS**

#### **OUTCOMES:**

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

#### **TEXT BOOKS :**

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.

#### **REFERENCES :**

1. Trivedi. R.K., 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

**OBJECTIVES:**

- To enable the students understand the behavior of aircraft structural components under different loading conditions.
- To provide the Principle involved in photo elasticity and its applications in stress analysis for composite laminates.

**LIST OF EXPERIMENTS**

1. Unsymmetrical Bending of a Cantilever Beam
2. Combined bending and Torsion of a Hollow Circular Tube
3. Material Fringe Constant of a Photo elastic Models
4. Shear Centre of a Channel Section
5. Free Vibration of a Cantilever Beam
6. Forced Vibration of a cantilever Beam
7. Fabrication of a Composite Laminate.
8. Determination of Elastic constants for a Composite Tensile Specimen.
9. Determination of Elastic constants for a Composite Flexural Specimen.
10. Tension field beam
11. Moire techniques

(Only 10 experiments will be conducted)

**TOTAL: 45 PERIODS**

**OUTCOMES**

- Ability to perform Bending, Torsion, Shear, Vibration test on metallic, composite specimen

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

Sl.No.	Name of the Equipment	Quantity	Experiment No.
1	Photo elasticity set up	1	3
2	100 kN Universal Testing Machine	1	8,9
3	Vibration set up with accesories	1	5,6
4	Wagner beam	1	10
5	Unsymmetrical bending set up	1	1
6	Set up for combined bending and torsion	1	2

**OBJECTIVES:**

- To familiarize students and to expose them practically to various aircraft piston and gas turbine engines
- To give practical exposure to various testing methods of variable area ducts, propellants, jet engine components and rockets
- To practically determine the flow behavior of jets

**LIST OF EXPERIMENTS**

1. Study of aircraft piston and gas turbine engines
2. Velocity profiles of free jets.
3. Velocity profiles of wall jets.
4. Wall pressure measurements of a subsonic ramjet duct.

5. Flame stabilization studies using conical flame holders.
6. Cascade testing of compressor blades
7. Velocity and pressure measurements in co-axial jets
8. Flow visualization of secondary injection in a supersonic cross flow
9. Wall pressure distribution in subsonic diffusers.
10. Wall Pressure measurements in supersonic nozzles

**TOTAL: 45 PERIODS**

### OUTCOMES

- Ability to understand details of piston and gas turbine engine
- Ability to perform various testing on ducts, propellants, jet engine components

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl.No.	Name of the Equipment	Quantity	Experiment No.
1	Goblin engine	1	1
2	Inline engine	1	1
3	Radial/ V- type engine	1	1
4	Jet facility with compressor and storage tank	1	2,3,7,8,10
5	Multitube manometer	2	2,3,4,7,9
6	Wind tunnel	1	6
7	0-5 bar pressure transducer with pressure indicator (or) DSA pressure scanner	8 1	7,10
8	Schlieren/ Shadowgraph set up	1	8
9	Ramjet facility	1	4
10	Conical flame holder	1	5
11	Compressor blade set	1	6

### GE6674 COMMUNICATION AND SOFT SKILLS- LABORATORY BASED

**L T P C**  
**0 0 4 2**

#### OBJECTIVES:

To enable learners to,

- Develop their communicative competence in English with specific reference to speaking and listening
- Enhance their ability to communicate effectively in interviews.
- Strengthen their prospects of success in competitive examinations.

#### UNIT I LISTENING AND SPEAKING SKILLS

**12**

Conversational skills (formal and informal)- group discussion- making effective presentations using computers, listening/watching interviews conversations, documentaries. Listening to lectures, discussions from TV/ Radio/ Podcast.

#### UNIT II READING AND WRITING SKILLS

**12**

Reading different genres of texts ranging from newspapers to creative writing. Writing job applications- cover letter- resume- emails- letters- memos- reports. Writing abstracts- summaries- interpreting visual texts.

**UNIT III ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS AND PLACEMENTS**

**12**

International English Language Testing System (IELTS) - Test of English as a Foreign Language (TOEFL) - Civil Service(Language related)- Verbal Ability.

**UNIT IV INTERVIEW SKILLS**

**12**

Different types of Interview format- answering questions- offering information- mock interviews-body language( paralinguistic features)- articulation of sounds- intonation.

**UNIT V SOFT SKILLS**

**12**

**Motivation- emotional intelligence**-Multiple intelligences- emotional intelligence- managing changes-time management-stress management-leadership straits-team work- career planning - intercultural communication- creative and critical thinking

**TOTAL: 60 PERIODS**

**Teaching Methods:**

1. To be totally learner-centric with minimum teacher intervention as the course revolves around practice.
2. Suitable audio/video samples from Podcast/YouTube to be used for illustrative purposes.
3. Portfolio approach for writing to be followed. Learners are to be encouraged to blog, tweet, text and email employing appropriate language.
4. GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.
5. Learners are to be assigned to read/write/listen/view materials outside the classroom as well for gaining proficiency and better participation in the class.

**Lab Infrastructure:**

S. No.	Description of Equipment (minimum configuration)	Qty Required
1	<b>Server</b>	1 No.
	• PIV System	
	• 1 GB RAM / 40 GB HDD	
	• OS: Win 2000 server	
	• Audio card with headphones	
2	<b>Client Systems</b>	60 Nos.
	• PIII or above	
	• 256 or 512 MB RAM / 40 GB HDD	
	• OS: Win 2000	
	• Audio card with headphones	
• JRE 1.3		
3	Handicam	1 No.
4	Television 46"	1 No.
5	Collar mike	1 No.
6	Cordless mike	1 No.
7	Audio Mixer	1 No.
8	DVD recorder/player	1 No.
9	LCD Projector with MP3/CD/DVD provision for Audio/video facility	1 No.

## **Evaluation:**

### **Internal: 20 marks**

Record maintenance: Students should write a report on a regular basis on the activities conducted, focusing on the details such as the description of the activity, ideas emerged, learning outcomes and so on. At the end of the semester records can be evaluated out of 20 marks.

### **External: 80 marks**

Online Test	- 35 marks
Interview	- 15 marks
Presentation	- 15 marks
Group Discussion	- 15 marks

### **Note on Internal and External Evaluation:**

1. Interview – mock interview can be conducted on one-on-one basis.
2. Speaking – example for role play:
  - a. Marketing engineer convincing a customer to buy his product.
  - b. Telephonic conversation- fixing an official appointment / placing an order / enquiring and so on.
3. Presentation – should be extempore on simple topics.
4. Discussion – topics of different kinds; general topics, and case studies.

## **OUTCOMES:**

### **At the end of the course, learners should be able to**

- Take international examination such as IELTS and TOEFL
- Make presentations and Participate in Group Discussions.
- Successfully answer questions in interviews.

## **REFERENCES:**

1. **Business English Certificate Materials**, Cambridge University Press.
2. **Graded Examinations in Spoken English and Spoken English for Work** downloadable materials from Trinity College, London.
3. **International English Language Testing System** Practice Tests, Cambridge University Press.
4. Interactive Multimedia Programs on **Managing Time and Stress**.
5. **Personality Development** (CD-ROM), Times Multimedia, Mumbai.
6. Robert M Sherfield and et al. “**Developing Soft Skills**” 4th edition, New Delhi: Pearson Education, 2009.

## **Web Sources:**

<http://www.slideshare.net/rohitjsh/presentation-on-group-discussion>

[http://www.washington.edu/doi/TeamN/present\\_tips.html](http://www.washington.edu/doi/TeamN/present_tips.html)

<http://www.oxforddictionaries.com/words/writing-job-applications>

<http://www.kent.ac.uk/careers/cv/coveringletters.htm>

[http://www.mindtools.com/pages/article/newCDV\\_34.htm](http://www.mindtools.com/pages/article/newCDV_34.htm)

**OBJECTIVES:**

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization .

**UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9**

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

**UNIT II PLANNING 9**

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

**UNIT III ORGANISING 9**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

**UNIT IV DIRECTING 9**

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

**UNIT V CONTROLLING 9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

**TOTAL: 45 PERIODS****OUTCOME :**

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have some basic knowledge on international aspect of management

**TEXTBOOKS:**

- Stephen P. Robbins & Mary Coulter, "Management", 10<sup>th</sup> Edition, Prentice Hall (India) Pvt. Ltd., 2009.
- JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6<sup>th</sup> Edition, Pearson Education, 2004.

**REFERENCES:**

- Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" 7<sup>th</sup> Edition, Pearson Education, 2011.
- Robert Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008.
- Harold Koontz & Heinz Weihrich "Essentials of management" Tata Mc Graw Hill, 1998.
- Tripathy PC & Reddy PN, "Principles of Management", Tata McGraw Hill, 1999.

**OBJECTIVES:**

- To give exposure various methods of solution and in particular the finite element method. Gives exposure to the formulation and the procedure of the finite element method and its application to varieties of problems.

**UNIT I INTRODUCTION****8**

Review of various approximate methods – variational approach and weighted residual approach- application to structural mechanics problems. finite difference methods- governing equation and convergence criteria of finite element method.

**UNIT II DISCRETE ELEMENTS****10**

Bar elements, uniform section, mechanical and thermal loading, varying section, 2D and 3D truss element. Beam element - problems for various loadings and boundary conditions – 2D and 3D Frame elements - longitudinal and lateral vibration. Use of local and natural coordinates.

**UNIT III CONTINUUM ELEMENTS****8**

Plane stress, plane strain and axisymmetric problems. Derivation of element matrices for constant and linear strain triangular elements and axisymmetric element.

**UNIT IV ISOPARAMETRIC ELEMENTS****9**

Definitions, Shape function for 4, 8 and 9 nodal quadrilateral elements, stiffness matrix and consistent load vector, evaluation of element matrices using numerical integration.

**UNIT V FIELD PROBLEM AND METHODS OF SOLUTIONS****10**

Heat transfer problems, steady state fin problems, derivation of element matrices for two dimensional problems, torsion problems. bandwidth- elimination method and method of factorization for solving simultaneous algebraic equations – Features of software packages, sources of error.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOME**

- Upon completion of this course, the Students can able to understand different mathematical Techniques used in FEM analysis and use of them in Structural and thermal problem

**TEXT BOOKS:**

- Tirupathi.R. Chandrapatha and Ashok D. Belegundu, "Introduction to Finite Elements in Engineering", Printice Hall India, Third Edition, 2003.
- Rao. S.S., "Finite Element Methods in Engineering," Butterworth and Heinemann, 2001
- Reddy J.N., "An Introduction to Finite Element Method", McGraw Hill, 2000.

**REFERENCES:**

- Krishnamurthy, C.S., "Finite Element Analysis", Tata McGraw Hill, 2000.
- Bathe, K.J. and Wilson, E.L., "Numerical Methods in Finite Elements Analysis", Prentice Hall of India, 1985.
- Robert D Cook, David S Malkus, Michael E Plesha, "Concepts and Applications of Finite Element Analysis", 4<sup>th</sup> edition, John Wiley and Sons, Inc., 2003.
- Larry J Segerlind, "Applied Finite Element Analysis", Second Edition, John Wiley and Sons, Inc. 1984.

**OBJECTIVES:**

- To study the effect of time dependent forces on mechanical systems and to get the natural characteristics of system with more degree of freedom systems.
- To study the aeroelastic effects of aircraft wing.

**UNIT I SINGLE DEGREE OF FREEDOM SYSTEMS 10**

Introduction to simple harmonic motion, D'Alembert's principle, free vibrations – damped vibrations – forced vibrations, with and without damping – support excitation – transmissibility - vibration measuring instruments.

**UNIT II MULTI DEGREES OF FREEDOM SYSTEMS 10**

Two degrees of freedom systems - static and dynamic couplings - vibration absorber- principal coordinates - principal modes and orthogonal conditions - eigen value problems - hamilton's principle - lagrangean equations and application.

**UNIT III CONTINUOUS SYSTEMS 8**

Vibration of elastic bodies - vibration of strings – longitudinal, lateral and torsional vibrations

**UNIT IV APPROXIMATE METHODS 9**

Approximate methods - rayleigh's method - dunkerlay's method – rayleigh-ritz method, matrix iteration method.

**UNIT V ELEMENTS OF AEROELASTICITY 8**

Vibration due to coupling of bending and torsion - aeroelastic problems - collars triangle - wing divergence - aileron control reversal – flutter – buffeting. – elements of servo elasticity

**TOTAL: 45 PERIODS****OUTCOMES**

- Gaining understanding of single and multi degree vibrating systems
- Ability to use numerical techniques for vibration problems
- Knowledge acquired in aero elasticity and fluttering

**TEXT BOOKS:**

1. Leonard Meirovitch, "Elements of Vibration Analysis". McGraw Hill International Edition, 2007
2. Grover. G.K., "Mechanical Vibrations", 7<sup>th</sup> Edition, Nem Chand Brothers, Roorkee, India, 2003
3. Thomson W T, 'Theory of Vibration with Application' - CBS Publishers, 1990.

**REFERENCES:**

1. William Weaver, Stephen P. Timoshenko, Donovan H. Yound, Donovan H. Young. 'Vibration Problems in Engineering' – John Wiley and Sons, New York, 2001
2. Bisplinghoff R.L., Ashely H and Hogman R.L., "Aeroelasticity", Addison Wesley Publication, New York, 1983.
3. William W Seto, "Mechanical Vibrations" – McGraw Hill, Schaum Series.
4. TSE. F.S., Morse, I.F., Hinkle, R.T., "Mechanical Vibrations" – Prentice Hall, New York, 1984.
5. Den Hartog, "Mechanical Vibrations" Crastre Press, 2008.

**OBJECTIVES:**

- To make the student understand the analysis of composite laminates under different loading conditions and different environmental conditions.

**UNIT I MICROMECHANICS****10**

Introduction - advantages and application of composite materials – types of reinforcements and matrices - micro mechanics – mechanics of materials approach, elasticity approach- bounding techniques – fiber volume ratio – mass fraction – density of composites. effect of voids in composites.

**UNIT II MACROMECHANICS****10**

Generalized Hooke's Law - elastic constants for anisotropic, orthotropic and isotropic materials - macro mechanics – stress-strain relations with respect to natural axis, arbitrary axis – determination of in plane strengths of a lamina - experimental characterization of lamina. failure theories of a lamina. hygrothermal effects on lamina.

**UNIT III LAMINATED PLATE THEORY****10**

Governing differential equation for a laminate. stress – strain relations for a laminate. different types of laminates. in plane and flexural constants of a laminate. hygrothermal stresses and strains in a laminate. failure analysis of a laminate. impact resistance and interlaminar stresses. netting analysis

**UNIT IV FABRICATION PROCESS AND REPAIR METHODS****8**

Various open and closed mould processes, manufacture of fibers, importance of repair and different types of repair techniques in composites – autoclave and non-autoclave methods.

**UNIT V SANDWICH CONSTRUCTIONS****7**

Basic design concepts of sandwich construction - materials used for sandwich construction - failure modes of sandwich panels - bending stress and shear flow in composite beams.

**TOTAL: 45 PERIODS****OUTCOMES**

- Understanding the mechanics of composite materials
- Ability to analyse the laminated composites for various loading cases
- Knowledge gained in manufacture of composites

**TEXT BOOKS:**

- Dam Ishai., "Mechanics of Composite Materials,"
- Autar K Kaw, 'Mechanics of Composite Materials', CRC Press, 1997.
- Madhuji Mukhopadhyay, Mechanics of Composite Materials and Structures, University Press, 2004

**REFERENCES:**

- Agarwal, B.D., and Broutman, L.J., "Analysis and Performance of Fibre Composites," John Wiley and sons. Inc., New York, 1995.
- Lubin, G., "Handbook on Advanced Plastics and Fibre Glass", Von Nostrand Reinhold Co., New York, 1989.
- Calcote, L R. "The Analysis of laminated Composite Structures", Von – Nostrand Reinhold Company, New York 1998.
- Allen Baker, "Composite Materials for Aircraft Structures", AIAA Series, II Edition, 1999.

**OBJECTIVES**

- To study the types of mechanical behaviour of materials for aircraft applications

**UNIT I ELEMENTS OF AEROSPACE MATERIALS 9**

Structure of solid materials – Atomic structure of materials – crystal structure – miller indices – density – packing factor – space lattices – x-ray diffraction – imperfection in crystals – physical metallurgy - general requirements of materials for aerospace applications

**UNIT II MECHANICAL BEHAVIOUR OF MATERIALS 9**

Linear and non linear elastic properties – Yielding, strain hardening, fracture, Bauehinger's effect – Notch effect testing and flaw detection of materials and components – creep and fatigue - comparative study of metals, ceramics plastics and composites.

**UNIT III CORROSION & HEAT TREATMENT OF METALS AND ALLOYS 10**

Types of corrosion – effect of corrosion on mechanical properties – stress corrosion cracking – corrosion resistance materials used for space vehicles heat treatment of carbon steels – aluminium alloys, magnesium alloys and titanium alloys – effect of alloying treatment, heat resistance alloys – tool and die steels, magnetic alloys,

**UNIT IV CERAMICS AND COMPOSITES 9**

Introduction – powder metallurgy - modern ceramic materials – cermets - cutting tools – glass ceramic –production of semi fabricated forms - plastics and rubber – carbon/carbon composites, fabrication processes involved in metal matrix composites - shape memory alloys – applications in aerospace vehicle design, open and close mould processes.

**UNIT V HIGH TEMPERATURE MATERIALS CHARACTERIZATION 8**

Classification, production and characteristics – methods and testing – determination of mechanical and thermal properties of materials at elevated temperatures – application of these materials in thermal protection systems of aerospace vehicles – super alloys – high temperature material characterization.

**TOTAL: 45 PERIODS****OUTCOMES**

- Role of corrosion and heat treatment processes of aircraft materials
- Knowledge in usage of composite materials in aircraft component design.
- Exposure to high temperature materials for space applications

**TEXT BOOK**

- Titterton.G., "Aircraft Materials and Processes", V Edition, Pitman Publishing Co., 1995.

**REFERENCES**

- Martin, J.W., "Engineering Materials, Their properties and Applications", Wykedham Publications (London) Ltd., 1987.
- Van Vlack.L.H., "Materials Science for Engineers", Addison Wesley, 1985.
- Raghavan.V., "Materials Science and Engineering", Prentice Hall of India, New Delhi, 1993.

**OBJECTIVES**

- To introduce the knowledge of the maintenance and repair procedures followed for overhaul of aero engines.

**LIST OF EXPERIMENTS**

- Dismantling and reassembling of an aircraft piston engine.
- Study of Camshaft operation, firing order and magneto, valve timing
- Study of lubrication and cooling system
- Study of auxiliary systems, pumps and carburetor
- Aircraft wood gluing-single & double scarf joints
- Welded single & double V-joints.
- Fabric & Riveted Patch repairs
- Tube bending and flaring
- Sheet metal forming
- Preparation of glass epoxy of composite laminates and specimens.

**TOTAL: 45 PERIODS****OUTCOMES**

- Ability to maintain and repair the aero engines.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

Sl. No	Equipments	Qty
1	Aircraft Piston engines	1
2	Set of basic tools for dismantling and assembly	1 set
3	NDT equipment	1 set
4	Micrometers, depth gauges, vernier calipers	2 sets
5	Valve timing disc	1
6	Shear cutter pedestal type	1
7	Drilling Machine	1
8	Bench Vices	1
9	Radius Bend bars	1
10	Pipe Flaring Tools	1
11	Welding machine	1
12	Glass fibre, epoxy resin	1
13	Strain gauges and strain indicator	1

**OBJECTIVES:**

- To make the student work in groups and understand the Concepts involved in Aerodynamic design, Performance analysis and stability aspects of different types of airplanes
- Comparative studies of different types of airplanes and their specifications and performance details with reference to the design work under taken.
  - Preliminary weight estimation, Selection of design parameters, power plant selection, aerofoil selection, fixing the geometry of Wing, tail, control surfaces Landing gear selection.

3. Preparation of layout drawing, construction of balance and three view diagrams of the airplane under consideration.
4. Drag estimation, Performance calculations, Stability analysis and V-n diagram.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Upon completion of the Aircraft Design Project I students will be in a position to design aircraft and demonstrate the performance of the design.

**AE6613**

**COMPUTER AIDED SIMULATION LABORATORY**

**L T P C**  
**0 0 3 2**

**OBJECTIVES:**

- To make the students familiarize with computational fluid dynamics and structural analysis software tools. By employing these tools for Aerospace applications students will have an opportunity to expose themselves to simulation software.

**LIST OF EXPERIMENTS**

1. Simulation of flow through a Converging-diverging nozzle.
2. Simulation of flow through an axial flow compressor blade passage.
3. Simulation of supersonic flow over a wing of biconvex cross section
4. Hot flow simulation through an axial flow turbine blade passage.
5. Simulation of flow through subsonic and supersonic diffusers.
6. Structural analysis of a tapered wing
7. Structural analysis of a fuselage structure
8. Analysis of a composite laminate structure
9. Structural analysis of a landing gear
10. Thermo structural analysis of a composite laminate structure

**TOTAL : 45 PERIODS**

**OUTCOMES**

- Use of different simulation and analysis software to simulate flow behavior and perform structural analysis

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

SI.No	Equipments	Qty
1	Internal server (or) Work station	1
2	Computers	30
3	Modelling packages (i) CATIA (ii) ANSYS (iii) Pro E (iv) NASTRAN	30 licenses
4	UPS	1
5	Printer	1

**OBJECTIVES :**

- To facilitate the understanding of Quality Management principles and process.

**UNIT I INTRODUCTION****9**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

**UNIT II TQM PRINCIPLES****9**

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

**UNIT III TQM TOOLS AND TECHNIQUES I****9**

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

**UNIT IV TQM TOOLS AND TECHNIQUES II****9**

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

**UNIT V QUALITY SYSTEMS****9**

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors..

**TOTAL: 45 PERIODS****OUTCOMES:**

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

**TEXTBOOK:**

1. Dale H. Besterfield, et al., "Total quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2006).

**REFERENCES:**

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8<sup>th</sup> Edition, First Indian Edition, Cengage Learning, 2012.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

**OBJECTIVES:**

- To introduce the basic of avionics and its need for civil and military aircrafts
- To impart knowledge about the avionic architecture and various avionics data buses
- To gain more knowledge on various avionics subsystems

**UNIT I INTRODUCTION TO AVIONICS****9**

Need for avionics in civil and military aircraft and space systems – integrated avionics and weapon systems – typical avionics subsystems, design, technologies – Introduction to digital computer and memories.

**UNIT II DIGITAL AVIONICS ARCHITECTURE****9**

Avionics system architecture – data buses – MIL-STD-1553B – ARINC – 420 – ARINC – 629.

**UNIT III FLIGHT DECKS AND COCKPITS****9**

Control and display technologies: CRT, LED, LCD, EL and plasma panel – Touch screen – Direct voice input (DVI) – Civil and Military Cockpits: MFDS, HUD, MFK, HOTAS.

**UNIT IV INTRODUCTION TO NAVIGATION SYSTEMS****9**

Radio navigation – ADF, DME, VOR, LORAN, DECCA, OMEGA, ILS, MLS – Inertial Navigation Systems (INS) – Inertial sensors, INS block diagram – Satellite navigation systems – GPS.

**UNIT V AIR DATA SYSTEMS AND AUTO PILOT****9**

Air data quantities – Altitude, Air speed, Vertical speed, Mach Number, Total air temperature, Mach warning, Altitude warning – Auto pilot – Basic principles, Longitudinal and lateral auto pilot.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Ability to built Digital avionics architecture
- Ability to Design Navigation system
- Ability to design and perform analysis on air system

**TEXT BOOKS:**

1. Albert Helfrick.D., "Principles of Avionics", Avionics Communications Inc., 2004
2. Collinson.R.P.G. "Introduction to Avionics", Chapman and Hall, 1996.

**REFERENCES:**

1. Middleton, D.H., Ed., "Avionics systems, Longman Scientific and Technical", Longman Group UK Ltd., England, 1989.
2. Spitzer, C.R. "Digital Avionics Systems", Prentice-Hall, Englewood Cliffs, N.J.,U.S.A. 1993.
3. Spitzer. C.R. "The Avionics Hand Book", CRC Press, 2000
4. Pallet.E.H.J., "Aircraft Instruments and Integrated Systems", Longman Scientific

**OBJECTIVES:**

- To introduce Governing Equations of viscous fluid flows
- To introduce numerical modeling and its role in the field of fluid flow and heat transfer
- To enable the students to understand the various discretization methods, solution procedures and turbulence modeling.
- To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers.

**UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 8**

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behaviour of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

**UNIT II FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION 9**

Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – Finite volume formulation for steady state One, Two and Three -dimensional diffusion problems –Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations – Use of Finite Difference and Finite Volume methods.

**UNIT III FINITE VOLUME METHOD FOR CONVECTION DIFFUSION 10**

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes properties of discretization schemes – Conservativeness, Boundedness, Transportiveness, Hybrid, Power-law, QUICK Schemes.

**UNIT IV FLOW FIELD ANALYSIS 9**

Finite volume methods -Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants – PISO Algorithms.

**UNIT V TURBULENCE MODELS AND MESH GENERATION 9**

Turbulence models, mixing length model, Two equation (k- ) models – High and low Reynolds number models – Structured Grid generation – Unstructured Grid generation – Mesh refinement – Adaptive mesh – Software tools.

**TOTAL: 45 PERIODS****OUTCOMES:**

Upon completion of this course, the students can able

- To create numerical modeling and its role in the field of fluid flow and heat transfer
- To use the various discretization methods, solution procedures and turbulence modeling to solve flow and heat transfer problems.

**TEXT BOOKS:**

1. Versteeg, H.K., and Malalasekera, W., "An Introduction to Computational Fluid Dynamics: The finite volume Method", Pearson Education Ltd.Second Edition – 2007.
2. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw Hill Publishing Company Ltd., 1998.



**TEXT BOOKS:**

1. Dally, J.W., and Riley, W.F., "Experimental Stress Analysis", McGraw Hill Inc., New York 1998.
2. Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G., Pant B., and Ramachandra, K., "Experimental Stress Analysis", Tata McGraw Hill, New Delhi, 1984.
3. Sadhu Singh, "Experimental Stress Analysis", Khanna Publishers, New Delhi, 1996.

**REFERENCES:**

1. Hetenyi, M., "Hand book of Experimental Stress Analysis", John Wiley and Sons Inc., New York, 1972.
2. Pollock A.A., Acoustic Emission in Acoustics and Vibration Progress, Ed. Stephens R.W.B., Chapman and Hall, 1993.
3. Max Mark Frocht, "Photo Elasticity", John Wiley and Sons Inc., New York, 1968
4. Durelli. A.J., "Applied Stress Analysis", Prentice Hall of India Pvt Ltd., New Delhi, 1970
5. Ramesh, K., Digital Photoelasticity, Springer, New York, 2000.

**AE6711****AIRCRAFT DESIGN PROJECT - II****L T P C  
0 0 3 2****OBJECTIVES:**

Each group of students is assigned to continue the structural design part of the airplane. The following are the assignments are to be carried out.

1. Preliminary design of an aircraft wing – Shrenck’s curve, structural load distribution, shear force, bending moment and torque diagrams
2. Detailed design of an aircraft wing – Design of spars and stringers, bending stress and shear flow calculations – buckling analysis of wing panels
3. Preliminary design of an aircraft fuselage – load distribution on an aircraft fuselage
4. Detailed design of an aircraft fuselage – design of bulkheads and longerons – bending stress and shear flow calculations – buckling analysis of fuselage panels
5. Design of control surfaces - balancing and maneuvering loads on the tail plane and aileron, rudder loads
6. Design of wing-root attachment
7. Landing gear design
8. Preparation of a detailed design report with CAD drawings

**TOTAL: 45 PERIODS****OUTCOMES:**

- On completion of Aircraft design project II the students will be in a position to design aircraft wings, fuselage, loading gears etc., and also able to angle the design in terms of structural point of view.

**AE6712****AIRCRAFT SYSTEMS LABORATORY****L T P C  
0 0 3 2****OBJECTIVES**

- To train the students “ON HAND” experience in maintenance of various air frame systems in aircraft and rectification of common snags.

## LIST OF EXPERIMENTS

1. Aircraft "Jacking Up" procedure
2. Aircraft "Levelling" procedure
3. Control System "Rigging check" procedure
4. Aircraft "Symmetry Check" procedure
5. "Flow test" to assess of filter element clogging
6. "Pressure Test" To assess hydraulic External/Internal Leakage
7. "Functional Test" to adjust operating pressure
8. "Pressure Test" procedure on fuel system components
9. "Brake Torque Load Test" on wheel brake units
10. Maintenance and rectification of snags in hydraulic and fuel systems.

**TOTAL: 45 PERIODS**

## OUTCOMES

- Ability to understand to procedure involved in maintenance of various air frame systems

## LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	Items	Quantity	Experiment No.
1.	Serviceable aircraft with all above systems	1	1,2,3,4,5,6,7,8,9,10
2.	Hydraulic Jacks (Screw Jack)	5	1,2,4,8
3.	Trestle adjustable	5	1,2,4,8
4.	Spirit Level	2	8
5.	Levelling Boards	2	8
6.	Cable Tensiometer	1	8
7.	Adjustable Spirit Level	1	8
8.	Plumb Bob	1	8

## AE6713 FLIGHT INTEGRATION SYSTEMS AND CONTROL LABORATORY

**L T P C**  
**0 0 3 2**

## OBJECTIVES:

- This laboratory is to train students, to study about basic digital electronics circuits, various microprocessor applications in Control surface, Displays fault tolerant computers, to study the stability analysis and design using MATLAB.

## LIST OF EXPERIMENTS

1. Addition/Subtraction of 8 bit and 16 bit data for control surface deflection.
2. Sorting of Data in Ascending & Descending order for voting mechanism.
3. Sum of a given series with and without carry for identifying flap data.
4. Greatest in a given series & Multi-byte addition in BCD mode.
5. Addition/Subtraction of binary numbers using adder and Subtractor circuits.
6. Multiplexer & Demultiplexer Circuits
7. Encoder and Decoder circuits.
8. Stability analysis using Root locus, Bode plot techniques.
9. Design of lead, lag and lead –lag compensator for aircraft dynamics.
10. Performance Improvement of Aircraft Dynamics by Pole placement technique.

## Note:

\*\*= If MATLAB software is not available, the mathematical & graphical analysis of the experiment has to be done.

**OUTCOMES:**

- Ability to understand digital electronics circuits.
- Ability to use microprocessor in Flight control
- Ability to perform stability analysis

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S.No	Details of Equipments	Quantity	Experiment Nos.
1.	Microprocessor 8085 Kit	10	1,2,3,4
2.	Adder/Subtractor Binary bits Kit	10	5
3.	Encoder Kit	10	7
4.	Decoder Kit	10	7
5.	Multiplexer Kit	10	6
6.	Demultiplexer Kit	10	6
7.	computers	10	8,9,10
8.	* Regulated power supply	10	5,6,7
9.	MATLAB software	-	8,9,10

\*Is not needed when regulated power supply is in built.

**AE6801**

**WIND TUNNEL TECHNIQUES**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- The students are exposed to various types and techniques of Aerodynamic data generation on aerospace vehicle configurations in the aerospace industry.

**UNIT I PRINCIPLES OF MODEL TESTING**

**6**

Buckingham Theorem – Non dimensional numbers – Scale effect – Geometric Kinematic and Dynamic similarities.

**UNIT II TYPES AND FUNCTIONS OF WIND TUNNELS**

**6**

Classification and types – special problems of testing in subsonic, transonic, supersonic and hypersonic speed regions – Layouts – sizing and design parameters.

**UNIT III CALIBRATION OF WIND TUNNELS**

**9**

Test section speed – Horizontal buoyancy – Flow angularities – Flow uniformity & turbulence measurements – Associated instrumentation – Calibration of subsonic & supersonic tunnels.

**UNIT IV CONVENTIONAL MEASUREMENT TECHNIQUES**

**12**

Force measurements and measuring systems – Multi component internal and external balances – Pressure measurement system - Steady and Unsteady Pressure- single and multiple measurements - Velocity measurements – Intrusive and Non-intrusive methods – Flow visualization techniques- surface flow, oil and tuft - flow field visualization, smoke and other optical and nonintrusive techniques

**UNIT V SPECIAL WIND TUNNEL TECHNIQUES****12**

Intake tests – store carriage and separation tests - Unsteady force and pressure measurements – wind tunnel model design

**TOTAL: 45 PERIODS****OUTCOMES**

- Ability to use various techniques of Aerodynamic data generation.

**TEXT BOOKS:**

1. Rae, W.H. and Pope, A., "Low Speed Wind Tunnel Testing", John Wiley Publication, 1984.
2. NAL-UNI Lecture Series 12:" Experimental Aerodynamics", NAL SP 98 01 April 1998

**REFERENCES:**

1. Pope, A., and Goin, L., "High Speed Wind Tunnel Testing", John Wiley, 1985.
2. Bradshaw "Experimental Fluid Mechanics".
3. Short term course on Flow visualization techniques, NAL , 2009
4. Lecture course on Advanced Flow diagnostic techniques 17-19 September 2008 NAL, Bangalore

**AE6811****PROJECT WORK**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>12</b>	<b>6</b>

**OBJECTIVES:**

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL: 180 PERIODS****OUTCOMES:**

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

**AE6001****THEORY OF ELASTICITY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To make the student understand the elastic behavior of different structural components under various loadings and boundary conditions.

**UNIT I BASIC EQUATIONS OF ELASTICITY****9**

Definition of Stress and Strain: Stress - Strain relationships - Equations of Equilibrium, Compatibility equations, Boundary Conditions, Saint Venant's principle - Principal Stresses, Stress Ellipsoid - Stress invariants.

<b>UNIT II</b>	<b>PLANE STRESS AND PLANE STRAIN PROBLEMS</b>	<b>9</b>
Airy's stress function, Bi-harmonic equations, Polynomial solutions, Simple two dimensional problems in Cartesian coordinates like bending of cantilever and simply supported beams.		
<b>UNIT III</b>	<b>POLAR COORDINATES</b>	<b>9</b>
Equations of equilibrium, Strain - displacement relations, Stress – strain relations, Airy's stress function, Axi – symmetric problems, Introduction to Dunder's table, Curved beam analysis, Lamé's, Kirsch, Michell's and Boussinesque problems – Rotating discs.		
<b>UNIT IV</b>	<b>TORSION</b>	<b>9</b>
Navier's theory, St. Venant's theory, Prandtl's theory on torsion, semi- inverse method and applications to shafts of circular, elliptical, equilateral triangular and rectangular sections. Membrane Analogy.		
<b>UNIT V</b>	<b>INTRODUCTION TO THEORY OF PLATES AND SHELLS</b>	<b>9</b>
Classical plate theory – Assumptions – Governing equations – Boundary conditions – Navier's method of solution for simply supported rectangular plates – Levy's method of solution for rectangular plates under different boundary conditions.		

**TOTAL: 45 PERIODS**

**OUTCOMES**

- Ability to use mathematical knowledge to solve problem related to structural elasticity.

**TEXT BOOKS:**

1. Timoshenko, S., and Goodier, T.N., "Theory of Elasticity", McGraw – Hill Ltd., Tokyo, 1990.
2. Ansel C Ugural and Saul K Fenster, "Advanced Strength and Applied Elasticity", 4<sup>th</sup> Edition, Prentice Hall, New Jersey, 2003.
3. Bhaskar, K., and Varadan, T. K., "Theory of Isotropic/Orthotropic Elasticity", CRC Press USA, 2009.

**REFERENCES:**

1. Wang, C. T., "Applied Elasticity", McGraw – Hill Co., New York, 1993.
2. Sokolnikoff, I. S., "Mathematical Theory of Elasticity", McGraw – Hill, New York, 1978.
3. Volterra & J.H. Caines, "Advanced Strength of Materials", Prentice Hall, New Jersey, 1991
4. Barber, J. R., "Elasticity", Kluwer Academic Publishers, 2004

<b>AE6002</b>	<b>AIRCRAFT GENERAL ENGINEERING AND MAINTENANCE PRACTICES</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

**OBJECTIVES**

- To teach the students about the basic concepts of aircraft general engineering and maintenance practices.

<b>UNIT I</b>	<b>AIRCRAFT GROUND HANDLING AND SUPPORT EQUIPMENT</b>	<b>10</b>
Mooring, jacking, leveling and towing operations – Preparation – Equipment – precautions – Engine starting procedures – Piston engine, turboprops and turbojets – Engine fire extinguishing – Ground power unit.		
<b>UNIT II</b>	<b>GROUND SERVICING OF VARIOUS SUB SYSTEMS</b>	<b>8</b>
Air conditioning and pressurization – Oxygen and oil systems – Ground units and their maintenance.		

**UNIT III MAINTENANCE OF SAFETY** **5**  
Shop safety – Environmental cleanliness – Precautions

**UNIT IV INSPECTION** **10**  
Process – Purpose – Types – Inspection intervals – Techniques – Checklist – Special inspection – Publications, bulletins, various manuals – FAR Air worthiness directives – Type certificate Data sheets – ATA Specifications

**UNIT V AIRCRAFT HARDWARE, MATERIALS, SYSTEM PROCESSES** **12**  
Hand tools – Precision instruments – Special tools and equipments in an airplane maintenance shop – Identification terminology – Specification and correct use of various aircraft hardware (i.e. nuts, bolts, rivets, screws etc) – American and British systems of specifications – Threads, gears, bearings, etc – Drills, tapes and reamers – Identification of all types of fluid line fittings. Materials, metallic and non-metallic Plumbing connectors – Cables – Swaging procedures, tests, Advantages of swaging over splicing.

**TOTAL :45 PERIODS**

**OUTCOMES**

- Knowledge in various ground support system for aircraft operations
- Ability to carryout ground servicing of critical aircraft systems
- Knowledge in specifications standards of aircraft hardware systems.

**TEXT BOOK**

1. Kroes Watkins Delp, "Aircraft Maintenance and Repair", McGraw Hill, New York, 1993

**REFERENCES**

1. A&P Mechanics, "Aircraft Hand Book", F A A Himalayan Book House, New Delhi, 1996
2. A&P Mechanics, " General Hand Book", F A A Himalayan Bok House, New Delhi, 1996

**AE6003** **SPACE MECHANICS** **L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To introduce concepts of satellite injection and satellite perturbations, trajectory computation for interplanetary travel and flight of ballistic missiles based on the fundamental concepts of orbital mechanics.

**UNIT I SPACE ENVIRONMENT** **8**  
Peculiarities of space environment and its description– effect of space environment on materials of spacecraft structure and astronauts- manned space missions – effect on satellite life time

**UNIT II BASIC CONCEPTS AND THE GENERAL N- BODY PROBLEM** **10**  
The solar system – reference frames and coordinate systems – terminology related to the celestial sphere and its associated concepts – Kepler’s laws of planetary motion and proof of the laws – Newton’s universal law of gravitation - the many body problem - Lagrange-Jacobi identity – the circular restricted three body problem – libration points – the general N-body problem – two body problem – relations between position and time.





**UNIT V****9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

**TOTAL : 45 PERIODS****OUTCOME :**

- Engineering students will acquire the basic knowledge of human rights.

**REFERENCES:**

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

**AE6005****HELICOPTER THEORY**

L	T	P	C
3	0	0	3

**OBJECTIVES:**

- To make the student familiarize with the principles involved in helicopters and to study the performance and stability aspects of Helicopter under different operating conditions.

**UNIT I INTRODUCTION****9**

Helicopter as an aircraft, Basic features, Layout, Generation of lift, Main rotor, Gearbox, tail rotor, power plant, considerations on blade, flapping and feathering, Rotor controls and various types of rotor, Blade loading, Effect of solidity, profile drag, compressibility etc., Blade area required, number of Blades, Blade form, Power losses, Rotor efficiency.

**UNIT II AERODYNAMICS OF ROTOR BLADE****9**

Aerofoil characteristics in forward flight, Hovering and Vortex ring state, Blade stall, maximum lift of the helicopter calculation of Induced Power, High speed limitations; parasite drag, power loading, ground effect.

**UNIT III POWER PLANTS AND FLIGHT PERFORMANCE****9**

Piston engines, Gas turbines, Ramjet principle, Comparative performance, Horsepower required, Range and Endurance, Rate of Climb, Best Climbing speed, Ceiling in vertical climb, Autorotation.

**UNIT IV STABILITY AND CONTROL****9**

Physical description of effects of disturbances, Stick fixed Longitudinal and lateral dynamic stability, lateral stability characteristics, control response. Differences between stability and control of airplane and helicopter.

**UNIT V ROTOR VIBRATIONS****9**

Dynamic model of the rotor, Motion of the rigid blades, flapping motion, lagging motion, feathering motion, Properties of vibrating system, phenomenon of vibration, fuselage response, vibration absorbers, Measurement of vibration in flight. Rotor Blade Design: General considerations, Airfoil selection, Blade construction, Materials, Factors affecting weight and cost, Design conditions, Stress analysis.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- To perform the Aerodynamics calculation of Rotor blade
- To perform stability and control characteristics of Helicopter
- To perform and control Rotor vibration

**TEXT BOOKS:**

1. John Fay, "The Helicopter and How It Flies", Himalayan Books 1995
2. Lalit Gupta, "Helicopter Engineering", Himalayan Books New Delhi 1996

**REFERENCES:**

1. Joseph Schafer, "Basic Helicopter Maintenance", Jeppesen 1980
2. R W Prouty, "Helicopter Aerodynamics"

**AE6006**

**THEORY OF PLATES AND SHELLS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES**

- To study the behaviour of the plates and shells with different geometry under various types of loads.

**UNIT I CLASSICAL PLATE THEORY**

**3**

Classical Plate Theory – Assumptions – Differential Equation – Boundary Conditions.

**UNIT II PLATES OF VARIOUS SHADES**

**15**

Navier’s Method of Solution for Simply Supported Rectangular Plates – Leavy’s Method of Solution for Rectangular Plates under Different Boundary Conditions. Governing Equation – Solution for Axi-symmetric loading – Annular Plates – Plates of other shapes.

**UNIT III EIGEN VALUE ANALYSIS**

**8**

Stability and free Vibration Analysis of Rectangular Plates.

**UNIT IV APPROXIMATE METHODS**

**10**

Rayleigh – Ritz, Galerkin Methods– Finite Difference Method – Application to Rectangular Plates for Static, Free Vibration and Stability Analysis.

**UNIT V SHELLS**

**9**

Basic Concepts of Shell Type of Structures – Membrane and Bending Theories for Circular Cylindrical Shells.

**TOTAL : 45 PERIODS**

**OUTCOMES**

- Ability to use different theories to plate and shell
- Perform stability and free vibration calculations
- Use of different methods for stability analysis

**TEXT BOOKS**

1. Timoshenko, S.P. Winowsky. S., and Kreger, “Theory of Plates and Shells”, McGraw-Hill Book Co. 1990.

2. Varadan. T. K. and Bhaskar. K., "Theory of Plates and Shells", 1999, Narosa.

## REFERENCES

1. Flugge, W. "Stresses in Shells", Springer – Verlag, 1985.
2. Timoshenko, S.P. and Gere, J.M., "Theory of Elastic Stability", McGraw-Hill Book Co. 1986

**AE6007**

**FATIGUE AND FRACTURE**

**L T P C**  
**3 0 0 3**

## OBJECTIVES:

- To understand the basic concepts involved in fatigue analysis and to study the importance of fracture mechanics in aerospace applications.

## UNIT I FATIGUE OF STRUCTURES

**7**

S.N. curves - Endurance limits - Effect of mean stress, Goodman, Gerber and Soderberg relations and diagrams - Notches and stress concentrations - Neuber's stress concentration factors - Plastic stress concentration factors - Notched S.N. curves – Fatigue of composite materials.

## UNIT II STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR

**10**

Low cycle and high cycle fatigue - Coffin - Manson's relation - Transition life - cyclic strain hardening and softening - Analysis of load histories - Cycle counting techniques -Cumulative damage - Miner's theory - Other theories.

## UNIT III PHYSICAL ASPECTS OF FATIGUE

**10**

Phase in fatigue life - Crack initiation - Crack growth - Final Fracture - Dislocations - fatigue fracture surfaces.

## UNIT IV FRACTURE MECHANICS

**10**

Strength of cracked bodies - Potential energy and surface energy - Griffith's theory - Irwin - Orwin extension of Griffith's theory to ductile materials - stress analysis of "cracked bodies - Effect of thickness on fracture toughness" - stress intensity factors for typical 'geometries.

## UNIT V FATIGUE DESIGN AND TESTING

**8**

Safe life and Fail-safe design philosophies - Importance of Fracture Mechanics in aerospace structures - Application to composite materials and structures.

**TOTAL: 45 PERIODS**

## OUTCOMES

- Ability to apply mathematical knowledge to define fatigue behaviors
- Ability to perform fatigue design
- Ability to analyse the fracture due to fatigue

## TEXT BOOKS:

1. Prasanth Kumar, "Elements of fracture mechanics", Wheeter publication, 1999.
2. Barrois W, Ripely, E.L., "Fatigue of aircraft structure," Pergamon press. Oxford, 1983.

## REFERENCES:

1. Sih C.G., "Mechanics of fracture." Vol - I, Sijthoff and w Noordhoff International Publishing Co., Netherlands, 1989.
2. Knott, J.F., "Fundamentals of Fracture Mechanics," - Buterworth & Co., Ltd., London, 1983.

3. Kare Hellan ,'Introduction to Fracture Mechanics', McGraw Hill, Singapore,1985

**AE6008**

**UAV SYSTEMS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To make the students to understand the basic concepts of UAV systems design.

**UNIT I INTRODUCTION TO UAV**

**9**

History of UAV –classification – Introduction to Unmanned Aircraft Systems--models and prototypes – System Composition-applications

**UNIT II THE DESIGN OF UAV SYSTEMS**

**9**

Introduction to Design and Selection of the System- Aerodynamics and Airframe Configurations- Characteristics of Aircraft Types- Design Standards and Regulatory Aspects-UK,USA and Europe- Design for Stealth--control surfaces-specifications.

**UNIT III AVIONICS HARDWARE**

**9**

Autopilot – AGL-pressure sensors-servos-accelerometer –gyros-actuators- power supply-processor, integration, installation, configuration, and testing

**UNIT IV COMMUNICATION PAYLOADS AND CONTROLS**

**9**

Payloads-Telemetry-tracking-Aerial photography-controls-PID feedback-radio control frequency range –modems-memory system-simulation-ground test-analysis-trouble shooting

**UNIT V THE DEVELOPMENT OF UAV SYSTEMS**

**9**

Waypoints navigation-ground control software- System Ground Testing- System In-flight Testing- Future Prospects and Challenges-Case Studies – Mini and Micro UAVs.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Ability to design UAV system
- Ability to identify different hardware for UAV

**REFERENCES:**

1. Reg Austin “Unmanned Aircraft Systems UAV design, development and deployment”, Wiley, 2010.
2. Robert C. Nelson, Flight Stability and Automatic Control, McGraw-Hill, Inc, 1998.
3. Kimon P. Valavanis, “Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy”, Springer, 2007
4. Paul G Fahlstrom, Thomas J Gleason, “Introduction to UAV Systems”, UAV Systems, Inc, 1998
5. Dr. Armand J. Chaput, “Design of Unmanned Air Vehicle Systems”, Lockheed Martin Aeronautics Company, 2001

**GE6083**

**DISASTER MANAGEMENT**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)

- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

#### **UNIT I INTRODUCTION TO DISASTERS 9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

#### **UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

#### **UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

#### **UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

#### **UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management.

#### **TEXTBOOK:**

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]

3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

## REFERENCES

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

## DISASTER MANAGEMENT

**L T P C**  
**3 0 0 3**

### OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

### **UNIT I INTRODUCTION TO DISASTERS 9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

### **UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

### **UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenious knowledge, appropriate technology and local resources.

### **UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

### **UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

**TOTAL: 45 PERIODS**

**TEXTBOOK:**

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IAS and Sage Publishers, New Delhi, 2010.

**REFERENCES**

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

**AE6009**

**INDUSTRIAL AERODYNAMICS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To familiarize the learner with non-aeronautical uses of aerodynamics such as road vehicle, building aerodynamics and problems of flow induced vibrations.

**UNIT I            ATMOSPHERE**

**9**

Types of winds, Causes of variation of winds, Atmospheric boundary layer, Effect of terrain on gradient height, Structure of turbulent flows.

**UNIT II            WIND ENERGY COLLECTORS**

**9**

Horizontal axis and vertical axis machines, Power coefficient, Betz coefficient by momentum theory.

**UNIT III            VEHICLE AERODYNAMICS**

**9**

Power requirements and drag coefficients of automobiles, Effects of cut back angle, Aerodynamics of trains and Hovercraft.

**UNIT IV            BUILDING AERODYNAMICS**

**9**

Pressure distribution on low rise buildings, wind forces on buildings. Environmental winds in city blocks, Special problems of tall buildings, Building codes, Building ventilation and architectural aerodynamics.

**UNIT V            FLOW INDUCED VIBRATIONS**

**9**

Effects of Reynolds number on wake formation of bluff shapes, Vortex induced vibrations, Galloping and stall flutter.

**TOTAL: 45 PERIODS**

**OUTCOMES**

- Use of aerodynamics for non- aerodynamics such as vehicle, building.
- Solve the problems and able to analyse vibrations during flow

**TEXT BOOKS:**

1. M.Sovran (Ed), "Aerodynamics and drag mechanisms of bluff bodies and Road vehicles", Plenum press, New York, 1978.
2. Sachs. P., "Winds forces in Engineering", Pergamon Press, 1978.

**REFERENCES:**

1. Blevins. R.D., "Flow Induced Vibrations", Van Nostrand, 1990.
2. Calvent. N.G., "Wind Power Principles", Charles Griffin & Co., London, 1979.

**OBJECTIVES:**

- To make the students to understand the Airframe components and the tools used to maintain the components. Defect investigation, methods to carry out investigation and the detailed maintenance and practice procedures.

**UNIT I MAINTENANCE OF AIRCRAFT STRUCTURAL COMPONENTS 9**

Equipments used in welding shop and their maintenance - Ensuring quality welds - Welding jigs and fixtures - Soldering and brazing – laser welding.

Sheet metal repair and maintenance: Selection of materials; Repair schemes; Fabrication of replacement patches; Tools - power/hand; Repair techniques; Peening - Close tolerance fasteners; Sealing compounds; forming/shaping; Calculation of weight of completed repair; Effect of weight - change on surrounding structure. Sheet metal inspection - N.D.T. Testing. Riveted repair design - Damage investigation - Reverse engineering.

**UNIT II PLASTICS AND COMPOSITES IN AIRCRAFT 9**

Review of types of plastics used in airplanes - Maintenance and repair of plastic components - Repair of cracks, holes etc., various repairs schemes - Scopes.

Cleaning of fibre reinforced plastic (FRP) materials prior to repair; Break test - Repair Schemes; FRP/honeycomb sandwich materials; laminated FRP structural members and skin panels; Tools/equipment; Vacuum-bag process. Special precautions – Autoclaves

**UNIT III AIRCRAFT JACKING, ASSEMBLY AND RIGGING 9**

Airplane jacking and weighing and C.G. Location. Balancing of control surfaces - Inspection maintenance. Helicopter flight controls. Tracking and balancing of main rotor.

**UNIT IV REVIEW OF HYDRAULIC AND PNEUMATIC SYSTEM 12**

Trouble shooting and maintenance practices - Service and inspection - Inspection and maintenance of landing gear systems. - Inspection and maintenance of air-conditioning and pressurization system, water and waste system. Installation and maintenance of Instruments - handling - Testing - Inspection. Inspection and maintenance of auxiliary systems - Rain removal system - Position and warning system - Auxiliary Power Units (APUs).

**UNIT V SAFETY PRACTICES 8**

Hazardous materials storage and handling, Aircraft furnishing practices - Equipments. Trouble shooting. Theory and practices.

**TOTAL: 45 PERIODS****OUTCOMES**

- Ability to identify the airframe components
- Ability to perform defect investigation skill to maintain the airframe

**TEXT BOOKS:**

1. Kroes, Watkins, Delp, "Aircraft Maintenance and Repair", McGraw Hill, New York, 1992.

**REFERENCES:**

1. Larry Reithmeir, "Aircraft Repair Manual", Palamar Books, Marquette, 1992.
2. Brimm D.J. Bogges H.E., "Aircraft Maintenance", Pitman Publishing corp., New York, 1940.
3. Delp. Bent and Mckinely "Aircraft Maintenance Repair", McGraw Hill, New York, 1987.

**OBJECTIVES:**

- To make the students to familiarize with the Aircraft engine maintenance procedure and practice.
- Must have knowledge of basics of Aeronautics and engine components.

**UNIT I PISTON ENGINES****9**

Carburetion and Fuel injection systems for small and large engines - Ignition system components - spark plug detail - Engine operating conditions at various altitudes – Engine power measurements – Classification of engine lubricants and fuels – Induction, Exhaust and cooling system - Maintenance and inspection check to be carried out. Inspection and maintenance and trouble shooting - Inspection of all engine components - Daily and routine checks - Overhaul procedures - Compression testing of cylinders - Special inspection schedules - Engine fuel, control and exhaust systems - Engine mount and super charger - Checks and inspection procedures.

**UNIT II PROPELLERS****9**

Propeller theory - operation, construction assembly and installation - Pitch change mechanism- Propeller axially system- Damage and repair criteria - General Inspection procedures - Checks on constant speed propellers - Pitch setting, Propeller Balancing, Blade cuffs, Governor/Propeller operating conditions – Damage and repair criteria.

**UNIT III JET ENGINES****9**

Types of jet engines – Fundamental principles – Bearings and seals - Inlets - compressors- turbines- exhaust section – classification and types of lubrication and fuels- Materials used - Details of control, starting around running and operating procedures – Inspection and Maintenance- permissible limits of damage and repair criteria of engine components- internal inspection of engines- compressor washing- field balancing of compressor fans- Component maintenance procedures - Systems maintenance procedures - use of instruments for online maintenance - Special inspection procedures- Foreign Object Damage - Blade damage .

**UNIT IV TESTING AND INSPECTION****9**

Symptoms of failure - Fault diagnostics - Case studies of different engine systems - Rectification during testing equipments for overhaul: Tools and equipments requirements for various checks and alignment during overhauling - Tools for inspection - Tools for safety and for visual inspection - Methods and instruments for non destructive testing techniques - Equipment for replacement of parts and their repair. Engine testing: Engine testing procedures and schedule preparation - Online maintenance.

**UNIT V OVERHAULING****9**

Engine Overhaul - Overhaul procedures - Inspections and cleaning of components - Repairs schedules for overhaul - Balancing of Gas turbine components. Trouble Shooting: Procedures for trouble shooting - Condition monitoring of the engine on ground and at altitude - engine health monitoring and corrective methods.

**TOTAL:45 PERIODS****OUTCOMES**

- Apply maintenance procedure to Aircraft Engines
- Identify the engine components and faults
- Apply non destructive testing procedures to identify the defects
- Apply overhauling procedure to new engines

**REFERENCES:**

1. Kroes & Wild, " Aircraft Power plants ", 7th Edition - McGraw Hill, New York, 1994.

2. Turbomeca, " Gas Turbine Engines ", The English Book Store ", New Delhi, 1993.
3. United Technologies Pratt & Whitney, "The Aircraft Gas turbine Engine and its Operation", The English Book Store, New Delhi.

**AE6012**

**AIR TRAFFIC CONTROL AND PLANNING**

**L T P C**  
**3 0 0 3**

**OBJECTIVES**

- To study the procedure of the formation of aerodrome and its design and air traffic control.

**UNIT I BASIC CONCEPTS**

**9**

Objectives of air traffic control systems - Parts of ATC services – Scope and Provision of ATCs – VFR & IFR operations – Classification of ATS air spaces – Various kinds of separation – Altimeter setting procedures – Establishment, designation and identification of units providing ATS – Division of responsibility of control.

**UNIT II AIR TRAFFIC SYSTEMS**

**9**

Area control service, assignment of cruising levels - minimum flight altitude - ATS routes and significant points – RNAV and RNP – Vertical, lateral and longitudinal separations based on time / distance –ATC clearances – Flight plans – position report

**UNIT III FLIGHT INFORMATION SYSTEMS**

**10**

Radar service, Basic radar terminology – Identification procedures using primary / secondary radar – performance checks – use of radar in area and approach control services – assurance control and co-ordination between radar / non radar control – emergencies – Flight information and advisory service – Alerting service – Co-ordination and emergency procedures – Rules of the air.

**UNIT IV AERODROME DATA**

**9**

Aerodrome data - Basic terminology – Aerodrome reference code – Aerodrome reference point – Aerodrome elevation – Aerodrome reference temperature – Instrument runway, physical Characteristics; length of primary / secondary runway – Width of runways – Minimum distance between parallel runways etc. – obstacles restriction.

**UNIT V NAVIGATION AND OTHER SERVICES**

**8**

Visual aids for navigation Wind direction indicator – Landing direction indicator – Location and characteristics of signal area – Markings, general requirements – Various markings – Lights, general requirements – Aerodrome beacon, identification beacon – Simple approach lighting system and various lighting systems – VASI & PAPI - Visual aids for denoting obstacles; object to be marked and lighter – Emergency and other services.

**TOTAL : 45 PERIODS**

**OUTCOMES**

- Understanding the requirement of air traffic control systems and types of air traffic control system.
- Knowledge in flight information systems and rules of air traffic systems.
- Knowledge in direction indicator systems for air navigation.

**TEXT BOOK**

1. AIP (India) Vol. I & II, "The English Book Store", 17-1, Connaught Circus, New Delhi.

## REFERENCES

1. "Aircraft Manual (India) Volume I", latest Edition – The English Book Store, 17-1, Connaught Circus, New Delhi.
2. "PANS – RAC – ICAO DOC 4444", Latest Edition, The English Book Store, 17-1, Connaught Circus, New Delhi.

**AE6013**

**HYPERSONIC AERODYNAMICS**

**L T P C**  
**3 0 0 3**

## OBJECTIVES

- To introduce fundamental concepts and features peculiar to hypersonic flow to students to familiarize them with the aerodynamical aspects of hypersonic vehicles and the general hypersonic flow theory.

### **UNIT I FUNDAMENTALS OF HYPERSONIC AERODYNAMICS**

**9**

Introduction to hypersonic aerodynamics – differences between hypersonic aerodynamics and supersonic aerodynamics - concept of thin shock layers and entropy layers – hypersonic flight paths – hypersonic similarity parameters – shock wave and expansion wave relations of inviscid hypersonic flows.

### **UNIT II SIMPLE SOLUTION METHODS FOR HYPERSONIC INVISCID FLOWS**

**9**

Local surface inclination methods – Newtonian theory – modified Newtonian law – tangent wedge and tangent cone and shock expansion methods – approximate methods - hypersonic small disturbance theory – thin shock layer theory.

### **UNIT III VISCOUS HYPERSONIC FLOW THEORY**

**9**

Boundary layer equations for hypersonic flow – hypersonic boundary layers – self similar and non self similar boundary layers – solution methods for non self similar boundary layers – aerodynamic heating and its adverse effects on airframe.

### **UNIT IV VISCOUS INTERACTIONS IN HYPERSONIC FLOWS**

**9**

Introduction to the concept of viscous interaction in hypersonic flows - Strong and weak viscous interactions - hypersonic viscous interaction similarity parameter – introduction to shock wave boundary layer interactions.

### **UNIT V HIGH TEMPERATURE EFFECTS in HYPERSONIC FLOWS**

**9**

Nature of high temperature flows – chemical effects in air – real and perfect gases – Gibb's free energy and entropy - chemically reacting boundary layers – recombination and dissociation.

**TOTAL: 45 PERIODS**

## OUTCOMES

- Knowledge in basics of hypersonic and supersonic aerodynamics
- Acquiring knowledge in theory of hypersonic flow.
- Understanding of boundary layers of hypersonic flow and viscous interaction
- Role of chemical and temperature effects in hypersonic flow.

## TEXT BOOKS:

1. John D. Anderson. Jr., "Hypersonic and High Temperature Gas Dynamics", Mc.Graw hill Series, New York, 1996.

**REFERENCES:**

1. John D. Anderson. Jr., "Modern Compressible flow with historical Perspective", Mc.Graw Hill Publishing Company, New York, 1996.
2. John T. Bertin, "Hypersonic Aerothermodynamics", published by AIAA Inc., Washington. D.C., 1994.

**AE6014****EXPERIMENTAL AERODYNAMICS****L T P C  
3 0 0 3****OBJECTIVES:**

- To provide details, operating principles and limitations of forces, pressure, velocity and temperature measurements. To describe flow visualization techniques and to highlight in depth discussion of analog methods.

**UNIT I BASIC MEASUREMENTS IN FLUID MECHANICS****7**

Objective of experimental studies – Fluid mechanics measurements – Properties of fluids – Measuring instruments – Performance terms associated with measurement systems – Direct measurements - Analogue methods – Flow visualization –Components of measuring systems – Importance of model studies.

**UNIT II CHARACTERISTICS OF MEASUREMENTS****10**

Characteristic features, operation and performance of low speed, transonic, supersonic and special tunnels - Power losses in a wind tunnel – Instrumentation of wind tunnels – Turbulence- Wind tunnel balance –principles, types and classifications -Balance calibration.

**UNIT III FLOW VISUALIZATION AND ANALOGUE METHODS****9**

Principles of Flow Visualization – Hele-Shaw apparatus - Interferometer – Fringe-Displacement method – Schlieren system – Shadowgraph - Hydraulic analogy – Hydraulic jumps – Electrolytic tank

**UNIT IV PRESSURE, VELOCITY AND TEMPERATURE MEASUREMENTS****9**

Measurement of static and total pressures in low and high speed flows- Pitot-Static tube characteristics - Pressure transducers – principle and operation – Velocity measurements - Hot-wire anemometry – LDV – PIV: Temperature measurements.

**UNIT V SPECIAL FLOWS AND UNCERTAINTY ANALYSIS****10**

Experiments on Taylor-Proudman theorem and Ekman layer – Measurements in boundary layers - Data acquisition and processing – Signal conditioning - Uncertainty analysis – Estimation of measurement errors – External estimate of the error – Internal estimate of the error – Uncertainty calculation - Uses of uncertainty analysis.

**TOTAL: 45 PERIODS****OUTCOMES**

- Knowledge on measurement techniques in aerodynamic flow.
- Acquiring basics of wind tunnel measurement systems
- Specific instruments for flow parameter measurement like pressure, velocity, temperature etc

**TEXT BOOKS:**

1. Rathakrishnan, E., "Instrumentation, Measurements, and Experiments in Fluids," CRC Press – Taylor & Francis, 2007.
2. Robert B Northrop, "Introduction to Instrumentation and Measurements", Second Edition, CRC Press, Taylor & Francis, 2006.

## REFERENCES:

1. Pope, A., and Goin, L., "High Speed Wind Tunnel Testing", John Wiley, 1985.Bradsaw Experimental Fluid Mechanics.
2. NAL-UNI Lecture Series 12: Experimental Aerodynamics, NAL SP 98 01 April 1998
3. Lecture course on "Advanced Flow diagnostic techniques" 17-19 September 2008 NAL, Bangalore

**AE6015**

## **ROCKETS AND MISSILES**

**L T P C**  
**3 0 0 3**

### **OBJECTIVES:**

- To give exposure on important topics like rocket motion, rocket aerodynamics and staging & control of rockets to students to enrich their knowledge in the area of missile flight.

### **UNIT I CLASSIFICATION OF ROCKETS AND MISSILES 9**

Various methods of classification of missiles and rockets – Basic aerodynamic characteristics of surface to surface, surface to air, air to surface and air to air missiles – Examples of various Indian space launch vehicles and missiles – Current status of Indian rocket programme with respect to international scenario

### **UNIT II AERODYNAMICS OF ROCKETS AND MISSILES 10**

Airframe components of rockets and missiles – forces acting on a missile while passing through atmosphere – classification of missiles – slender body aerodynamics – method of describing forces and moments – lift force and lateral moment –lateral aerodynamic damping moment – longitudinal moment – drag estimation – upwash and downwash in missile bodies – rocket dispersion.

### **UNIT III ROCKET MOTION IN FREE SPACE AND GRAVITATIONAL FIELD 10**

One dimensional and two-dimensional rocket motions in free space and homogeneous gravitational fields – description of vertical, inclined and gravity turn trajectories – determination of range and altitude – simple approximations to determine burn out velocity and altitude – estimation of culmination time and altitude.

### **UNIT IV STAGING OF ROCKETS AND MISSILES 8**

Design philosophy behind multistaging of launch vehicles and ballistic missiles – optimization of multistage vehicles – stage separation techniques in atmosphere and in space – stage separation dynamics and lateral separation characteristics –

### **UNIT V CONTROL OF ROCKETS AND MISSILES 8**

Introduction to aerodynamic and jet control methods – various types of aerodynamic control methods for tactical and short range missiles- aerodynamic characteristics - various types of thrust vector control methods including secondary injection thrust vector control for launch vehicles and ballistic missiles – .

**TOTAL: 45 PERIODS**

### **OUTCOMES**

- Knowledge in types of rockets and missiles with respect to Indian & international scenario
- Gaining informations on aerodynamics of rocket and missiles
- Knowledge on stages and remote control of rockets missiles

**TEXT BOOKS:**

1. Cornélisse, J.W., "Rocket Propulsion and Space Dynamics", J.W. Freeman & Co., Ltd, London, 1982
2. Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 5<sup>th</sup> Edition, 1993.

**REFERENCES:**

1. Parker, E.R., "Materials for Missiles and Spacecraft", McGraw Hill Book Co. Inc. 1982.
2. Mathur, M.L., and Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", Standard Publishers and Distributors, Delhi, 1988.

**AE6016****STRUCTURAL DYNAMICS****L T P C  
3 0 0 3****OBJECTIVES:**

- To study the effect of periodic and a periodic forces on mechanical systems with matrix approach and also to get the natural characteristics of large sized problems using approximate methods.

**UNIT I FORCE DEFLECTION PROPERTIES OF STRUCTURES 9**

Constraints and Generalized coordinates – Virtual work and generalized forces – Force – Deflection influence functions – stiffness and flexibility methods.

**UNIT II PRINCIPLES OF DYNAMICS 9**

Free and forced vibrations of systems with finite degrees of freedom – Response to periodic excitation – Impulse Response Function – Convolution Integral

**UNIT III NATURAL MODES OF VIBRATION 9**

Equations of motion for Multi degree of freedom Systems - Solution of Eigen value problems – Normal coordinates and orthogonality Conditions. Modal Analysis.

**UNIT IV ENERGY METHODS 9**

Rayleigh's principle – Rayleigh – Ritz method – Coupled natural modes – Effect of rotary inertia and shear on lateral vibrations of beams – Natural vibrations of plates.

**UNIT V APPROXIMATE METHODS 9**

Approximate methods of evaluating the Eigen frequencies and eigen vectors by reduced, subspace, Lanczos, Power, Matrix condensation and QR methods.

**TOTAL: 45 PERIODS****OUTCOMES**

- Knowing various options of mathematical modeling of structures
- Method of evaluating the response of structures under various dynamically loaded conditions
- Knowledge in natural modes of vibration of structures
- Gaining knowledge in numerical and approximate methods of evaluating natural modes of vibration.

**TEXT BOOKS:**

1. Tse. F.S., Morse. I.E. and Hinkle. H.T., "Mechanical Vibrations: Theory and Applications" , Prentice Hall of India Pvt. Ltd, New Delhi, 2004.
2. Hurty. W.C. and M.F. Rubinstein, "Dynamics of Structures", Prentice Hall of India Pvt. Ltd., New Delhi 1987.

**REFERENCES:**

1. Vierck. R.K., "Vibration Analysis", 2<sup>nd</sup> Edition, Thomas Y. Crowell & Co Harper & Row Publishers, New York, U.S.A. 1989.
2. Timoshenko. S.P., and D.H. Young, "Vibration Problems in Engineering", John Willey & Sons Inc., 1984.
3. Ramamurthi. V., "Mechanical Vibration Practice and Noise Control" Narosa Publishing House Pvt. Ltd, 2008

**ANNA UNIVERSITY, CHENNAI**  
**AFFILIATED INSTITUTIONS**  
**R-2013**  
**B.E. COMPUTER SCIENCE AND ENGINEERING**  
**I TO VIII SEMESTER CURRICULUM AND SYLLABUS**

**SEMESTER I**

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	HS6151	<u>Technical English – I</u>	3	1	0	4
2.	MA6151	<u>Mathematics – I</u>	3	1	0	4
3.	PH6151	<u>Engineering Physics – I</u>	3	0	0	3
4.	CY6151	<u>Engineering Chemistry – I</u>	3	0	0	3
5.	GE6151	<u>Computer Programming</u>	3	0	0	3
6.	GE6152	<u>Engineering Graphics</u>	2	0	3	4
<b>PRACTICALS</b>						
7.	GE6161	<u>Computer Practices Laboratory</u>	0	0	3	2
8.	GE6162	<u>Engineering Practices Laboratory</u>	0	0	3	2
9.	GE6163	<u>Physics and Chemistry Laboratory - I</u>	0	0	2	1
<b>TOTAL</b>			<b>17</b>	<b>2</b>	<b>11</b>	<b>26</b>

**SEMESTER II**

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	HS6251	<u>Technical English – II</u>	3	1	0	4
2.	MA6251	<u>Mathematics – II</u>	3	1	0	4
3.	PH6251	<u>Engineering Physics – II</u>	3	0	0	3
4.	CY6251	<u>Engineering Chemistry – II</u>	3	0	0	3
5.	CS6201	<u>Digital Principles and System Design</u>	3	0	0	3
6.	CS6202	<u>Programming and Data Structures I</u>	3	0	0	3
<b>PRACTICALS</b>						
7.	GE6262	<u>Physics and Chemistry Laboratory - II</u>	0	0	2	1
8.	CS6211	<u>Digital Laboratory</u>	0	0	3	2
9.	CS6212	<u>Programming and Data Structures Laboratory I</u>	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>2</b>	<b>8</b>	<b>25</b>

### SEMESTER III

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MA6351	<u>Transforms and Partial Differential Equations</u>	3	1	0	4
2.	CS6301	<u>Programming and Data Structure II</u>	3	0	0	3
3.	CS6302	<u>Database Management Systems</u>	3	0	0	3
4.	CS6303	<u>Computer Architecture</u>	3	0	0	3
5.	CS6304	<u>Analog and Digital Communication</u>	3	0	0	3
6.	GE6351	<u>Environmental Science and Engineering</u>	3	0	0	3
<b>PRACTICAL</b>						
7.	CS6311	<u>Programming and Data Structure Laboratory II</u>	0	0	3	2
8.	CS6312	<u>Database Management Systems Laboratory</u>	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>1</b>	<b>6</b>	<b>23</b>

### SEMESTER IV

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MA6453	<u>Probability and Queueing Theory</u>	3	1	0	4
2.	CS6551	<u>Computer Networks</u>	3	0	0	3
3.	CS6401	<u>Operating Systems</u>	3	0	0	3
4.	CS6402	<u>Design and Analysis of Algorithms</u>	3	0	0	3
5.	EC6504	<u>Microprocessor and Microcontroller</u>	3	0	0	3
6.	CS6403	<u>Software Engineering</u>	3	0	0	3
<b>PRACTICAL</b>						
7.	CS6411	<u>Networks Laboratory</u>	0	0	3	2
8.	CS6412	<u>Microprocessor and Microcontroller Laboratory</u>	0	0	3	2
9.	CS6413	<u>Operating Systems Laboratory</u>	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>1</b>	<b>9</b>	<b>25</b>

### SEMESTER V

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MA6566	<u>Discrete Mathematics</u>	3	1	0	4
2.	CS6501	<u>Internet Programming</u>	3	1	0	4
3.	CS6502	<u>Object Oriented Analysis and Design</u>	3	0	0	3
4.	CS6503	<u>Theory of Computation</u>	3	0	0	3
5.	CS6504	<u>Computer Graphics</u>	3	0	0	3
<b>PRACTICAL</b>						
6.	CS6511	<u>Case Tools Laboratory</u>	0	0	3	2
7.	CS6512	<u>Internet Programming Laboratory</u>	0	0	3	2
8.	CS6513	<u>Computer Graphics Laboratory</u>	0	0	3	2
<b>TOTAL</b>			<b>15</b>	<b>2</b>	<b>9</b>	<b>23</b>

### SEMESTER VI

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	CS6601	<u>Distributed Systems</u>	3	0	0	3
2.	IT6601	<u>Mobile Computing</u>	3	0	0	3
3.	CS6660	<u>Compiler Design</u>	3	0	0	3
4.	IT6502	<u>Digital Signal Processing</u>	3	1	0	4
5.	CS6659	<u>Artificial Intelligence</u>	3	0	0	3
6.		Elective I	3	0	0	3
<b>PRACTICAL</b>						
7.	CS6611	<u>Mobile Application Development Laboratory</u>	0	0	3	2
8.	CS6612	<u>Compiler Laboratory</u>	0	0	3	2
9.	GE6674	<u>Communication and Soft Skills - Laboratory Based</u>	0	0	4	2
<b>TOTAL</b>			<b>18</b>	<b>1</b>	<b>10</b>	<b>25</b>

### SEMESTER VII

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	CS6701	<u>Cryptography and Network Security</u>	3	0	0	3
2.	CS6702	<u>Graph Theory and Applications</u>	3	0	0	3
3.	CS6703	<u>Grid and Cloud Computing</u>	3	0	0	3
4.	CS6704	<u>Resource Management Techniques</u>	3	0	0	3
5.		Elective II	3	0	0	3
6.		Elective III	3	0	0	3
<b>PRACTICAL</b>						
7.	CS6711	<u>Security Laboratory</u>	0	0	3	2
8.	CS6712	<u>Grid and Cloud Computing Laboratory</u>	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>0</b>	<b>6</b>	<b>22</b>

### SEMESTER VIII

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	CS6801	<u>Multi – Core Architectures and Programming</u>	3	0	0	3
2.		Elective IV	3	0	0	3
3.		Elective V	3	0	0	3
<b>PRACTICAL</b>						
4.	CS6811	<u>Project Work</u>	0	0	12	6
<b>TOTAL</b>			<b>9</b>	<b>0</b>	<b>12</b>	<b>15</b>

**TOTAL NO. OF CREDITS: 184**

### LIST OF ELECTIVES

#### SEMESTER VI – Elective I

S.NO.	CODE NO.	COURSE TITLE	L	T	P	C
1.	CS6001	<u>C# and .Net programming</u>	3	0	0	3
2.	GE6757	<u>Total Quality Management</u>	3	0	0	3
3.	IT6702	<u>Data Warehousing and Data Mining</u>	3	0	0	3
4.	CS6002	<u>Network Analysis and Management</u>	3	0	0	3
5.	IT6004	<u>Software Testing</u>	3	0	0	3
6.	GE6084	Human Rights	3	0	0	3

**SEMESTER VII – Elective II**

S.NO.	CODE NO.	COURSE TITLE	L	T	P	C
7.	CS6003	<u>Ad hoc and Sensor Networks</u>	3	0	0	3
8.	CS6004	<u>Cyber Forensics</u>	3	0	0	3
9.	CS6005	<u>Advanced Database Systems</u>	3	0	0	3
10.	BM6005	<u>Bio Informatics</u>	3	0	0	3
11.	IT6801	<u>Service Oriented Architecture</u>	3	0	0	3

**SEMESTER VII – Elective III**

S.NO	CODE NO.	COURSE TITLE	L	T	P	C
12.	IT6005	<u>Digital Image Processing</u>	3	0	0	3
13.	EC6703	<u>Embedded and Real Time Systems</u>	3	0	0	3
14.	CS6006	<u>Game Programming</u>	3	0	0	3
15.	CS6007	<u>Information Retrieval</u>	3	0	0	3
16.	IT6006	<u>Data Analytics</u>	3	0	0	3

**SEMESTER VIII – Elective IV**

S.NO.	CODE NO.	COURSE TITLE	L	T	P	C
17.	CS6008	<u>Human Computer Interaction</u>	3	0	0	3
18.	CS6009	<u>Nano Computing</u>	3	0	0	3
19.	IT6011	<u>Knowledge Management</u>	3	0	0	3
20.	CS6010	<u>Social Network Analysis</u>	3	0	0	3
21.	CS6013	Foundation Skills in Integrated Product Development	3	0	0	3

**SEMESTER VIII – Elective V**

S.NO.	CODE NO.	COURSE TITLE	L	T	P	C
22.	MG6088	<u>Software Project Management</u>	3	0	0	3
23.	GE6075	<u>Professional Ethics in Engineering</u>	3	0	0	3
24.	CS6011	<u>Natural Language Processing</u>	3	0	0	3
25.	CS6012	<u>Soft Computing</u>	3	0	0	3
26.	GE6083	Disaster Management	3	0	0	3

**OBJECTIVES:**

- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.

**UNIT I****9+3**

Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one's place, important festivals etc. – Introducing oneself, one's family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one's leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words - Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

**UNIT II****9+3**

Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking and answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Process descriptions (general/specific) - Definitions - Recommendations – Instructions; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association (connotation); E-materials - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

**UNIT III****9+3**

Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading - Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause and effect / compare and contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

**UNIT IV****9+3**

Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations and acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.

## UNIT V

9+3

Listening - Listening to different accents, Listening to Speeches/Presentations, Listening to broadcast and telecast from Radio and TV; Speaking - Giving impromptu talks, Making presentations on given topics; Reading - Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email; Writing - Creative writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items (fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar and Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents - Interpreting posters.

**TOTAL (L:45+T:15): 60 PERIODS**

### OUTCOMES:

#### Learners should be able to:

- Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- Read different genres of texts adopting various reading strategies.
- Listen/view and comprehend different spoken discourses/excerpts in different accents.

### TEXTBOOKS:

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012.
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011.

### REFERENCES:

1. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice. Oxford University Press, New Delhi. 2011
2. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi. 2006
3. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005
4. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi. 2001
5. Viswamohan, Aysha. English for Technical Communication. Tata McGraw-Hill, New Delhi. 2008

### EXTENSIVE Reading (Not for Examination)

1. Kalam, Abdul. Wings of Fire. Universities Press, Hyderabad. 1999.

### WEBSITES:

1. <http://www.usingenglish.com>
2. <http://www.uefap.com>

### TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like self introduction, peer introduction, group poster making, grammar and vocabulary games, etc.
- Discussions
- Role play activities
- Short presentations
- Listening and viewing activities with follow up activities like discussion, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc.

## EVALUATION PATTERN:

### Internal assessment: 20%

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Reviews
- Creative writing
- Poster making, etc.

### All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual speaking activities, Pair work activities like role play, Interview, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded from simple to complex, from direct to inferential
- ✓ Writing assessment: Writing paragraphs, essays etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content.

### End Semester Examination: 80%

MA6151

MATHEMATICS – I

L T P C  
3 1 0 4

### OBJECTIVES:

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

### UNIT I MATRICES

9+3

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

### UNIT II SEQUENCES AND SERIES

9+3

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test, Integral test and D’Alembert’s ratio test – Alternating series – Leibnitz’s test – Series of positive and negative terms – Absolute and conditional convergence.

**UNIT III APPLICATIONS OF DIFFERENTIAL CALCULUS 9+3**  
Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals.

**UNIT IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES 9+3**  
Limits and Continuity – Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor’s series for functions of two variables – Maxima and minima of functions of two variables – Lagrange’s method of undetermined multipliers.

**UNIT V MULTIPLE INTEGRALS 9+3**  
Double integrals in cartesian and polar coordinates – Change of order of integration – Area enclosed by plane curves – Change of variables in double integrals – Area of a curved surface - Triple integrals – Volume of Solids.

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES:**

- This course equips students to have basic knowledge and understanding in one fields of materials, integral and differential calculus.

**TEXT BOOKS:**

1. Bali N. P and Manish Goyal, “A Text book of Engineering Mathematics”, Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
2. Grewal. B.S, “Higher Engineering Mathematics”, 41<sup>st</sup> Edition, Khanna Publications, Delhi, 2011.

**REFERENCES:**

1. Dass, H.K., and Er. Rajnish Verma, “Higher Engineering Mathematics”, S. Chand Private Ltd., 2011.
2. Glyn James, “Advanced Modern Engineering Mathematics”, 3<sup>rd</sup> Edition, Pearson Education, 2012.
3. Peter V. O’Neil, “Advanced Engineering Mathematics”, 7th Edition, Cengage learning, (2012).
4. Ramana B.V, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., “Engineering Mathematics”, Volume I, Second Edition, PEARSON Publishing, 2011.

**PH6151 ENGINEERING PHYSICS – I L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

**UNIT I CRYSTAL PHYSICS 9**  
Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment)- Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)



**OBJECTIVES:**

- To make the students conversant with basics of polymer chemistry.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- To acquaint the students with the basics of nano materials, their properties and applications.

**UNIT I POLYMER CHEMISTRY****9**

Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: T<sub>g</sub>, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Preparation, properties and uses of Nylon 6,6, and Epoxy resin.

**UNIT II CHEMICAL THERMODYNAMICS****9**

Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions (problems); Criteria of spontaneity; Gibbs-Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore(problems).

**UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY****9**

Photochemistry: Laws of photochemistry - Grotthuss–Draper law, Stark–Einstein law and Lambert-Beer Law. Quantum efficiency – determination- Photo processes - Internal Conversion, Inter-system crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitization. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram only).

**UNIT IV PHASE RULE AND ALLOYS****9**

Phase rule: Introduction, definition of terms with examples, One Component System- water system - Reduced phase rule - Two Component Systems- classification – lead-silver system, zinc-magnesium system. Alloys: Introduction- Definition- Properties of alloys- Significance of alloying, Functions and effect of alloying elements- Ferrous alloys- Nichrome and Stainless steel – heat treatment of steel; Non-ferrous alloys – brass and bronze.

**UNIT V NANOCHEMISTRY****9**

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. nanoparticles: nano cluster, nano rod, nanotube(CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrodeposition, chemical vapour deposition, laser ablation; Properties and applications

**TOTAL :45 PERIODS**

**OUTCOMES:**

- The knowledge gained on polymer chemistry, thermodynamics. spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these subjects for further learning.

**TEXT BOOKS:**

1. Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010.
2. Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009.

**REFERENCES:**

1. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.
3. Gowariker V.R. , Viswanathan N.V. and Jayadev Sreedhar, "Polymer Science", New Age International P (Ltd.), Chennai, 2006.
4. Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.

**GE6151****COMPUTER PROGRAMMING****L T P C  
3 0 0 3****OBJECTIVES:****The students should be made to:**

- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

**UNIT I INTRODUCTION****8**

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

**UNIT II C PROGRAMMING BASICS****10**

Problem formulation – Problem Solving - Introduction to 'C' programming –fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

**UNIT III ARRAYS AND STRINGS****9**

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

**UNIT IV FUNCTIONS AND POINTERS****9**

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

**UNIT V STRUCTURES AND UNIONS****9**

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

**TOTAL: 45 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design C Programs for problems.
- Write and execute C programs for simple applications

**TEXTBOOKS:**

1. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2. Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, First Edition, Oxford University Press, 2009.
3. Yashavant P. Kanetkar. “Let Us C”, BPB Publications, 2011.

**REFERENCES:**

1. Byron S Gottfried, “Programming with C”, Schaum’s Outlines, Second Edition, Tata McGraw-Hill, 2006.
2. Dromey R.G., “How to Solve it by Computer”, Pearson Education, Fourth Reprint, 2007.
3. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006.

**GE6152****ENGINEERING GRAPHICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>2</b>	<b>0</b>	<b>3</b>	<b>4</b>

**OBJECTIVES:**

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products
- To expose them to existing national standards related to technical drawings.

**CONCEPTS AND CONVENTIONS (Not for Examination)****1**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

**UNIT I PLANE CURVES AND FREE HAND SKETCHING****5+9**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

**UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 5+9**

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

**UNIT III PROJECTION OF SOLIDS 5+9**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

**UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+9**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

**UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+9**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

**COMPUTER AIDED DRAFTING (Demonstration Only) 3**

Introduction to drafting packages and demonstration of their use.

**TOTAL:75 PERIODS**

**OUTCOMES:**

**On Completion of the course the student will be able to:**

- Perform free hand sketching of basic geometrical constructions and multiple views of objects.
- Do orthographic projection of lines and plane surfaces.
- Draw projections and solids and development of surfaces.
- Prepare isometric and perspective sections of simple solids.
- Demonstrate computer aided drafting.

**TEXT BOOK:**

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50<sup>th</sup> Edition, 2010.

**REFERENCES:**

1. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
2. Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2<sup>nd</sup> Edition, 2009.
4. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.
5. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

**Publication of Bureau of Indian Standards:**

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

**Special points applicable to University Examinations on Engineering Graphics:**

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

**GE6161****COMPUTER PRACTICES LABORATORY****L T P C  
0 0 3 2****OBJECTIVES:****The student should be made to:**

- Be familiar with the use of Office software.
- Be exposed to presentation and visualization tools.
- Be exposed to problem solving techniques and flow charts.
- Be familiar with programming in C.
- Learn to use Arrays, strings, functions, structures and unions.

**LIST OF EXPERIMENTS:**

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions – Includes Parameter Passing
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.
- Develop recursive programs.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

Standalone desktops with C compiler 30 Nos.

(or)

Server with C compiler supporting 30 terminals or more.

**OBJECTIVES:**

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

**GROUP A (CIVIL & MECHANICAL)****I CIVIL ENGINEERING PRACTICE****9****Buildings:**

- (a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

**Plumbing Works:**

- (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- (b) Study of pipe connections requirements for pumps and turbines.
- (c) Preparation of plumbing line sketches for water supply and sewage works.
- (d) Hands-on-exercise:  
Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
- (e) Demonstration of plumbing requirements of high-rise buildings.

**Carpentry using Power Tools only:**

- (a) Study of the joints in roofs, doors, windows and furniture.
- (b) Hands-on-exercise:  
Wood work, joints by sawing, planing and cutting.

**II MECHANICAL ENGINEERING PRACTICE****13****Welding:**

- (a) Preparation of arc welding of butt joints, lap joints and tee joints.
- (b) Gas welding practice

**Basic Machining:**

- (a) Simple Turning and Taper turning
- (b) Drilling Practice

**Sheet Metal Work:**

- (a) Forming & Bending:
- (b) Model making – Trays, funnels, etc.
- (c) Different type of joints.

**Machine assembly practice:**

- (a) Study of centrifugal pump
- (b) Study of air conditioner

**Demonstration on:**

- (a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
- (b) Foundry operations like mould preparation for gear and step cone pulley.
- (c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

## GROUP B (ELECTRICAL & ELECTRONICS)

- III ELECTRICAL ENGINEERING PRACTICE** **10**
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
  2. Fluorescent lamp wiring.
  3. Stair case wiring
  4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
  5. Measurement of energy using single phase energy meter.
  6. Measurement of resistance to earth of an electrical equipment.
- IV ELECTRONICS ENGINEERING PRACTICE** **13**
1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
  2. Study of logic gates AND, OR, EOR and NOT.
  3. Generation of Clock Signal.
  4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
  5. Measurement of ripple factor of HWR and FWR.

**TOTAL: 45 PERIODS**

### **OUTCOMES:**

- Ability to fabricate carpentry components and pipe connections including plumbing works.
- Ability to use welding equipments to join the structures.
- Ability to fabricate electrical and electronics circuits.

### **LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

#### **CIVIL**

- |   |          |
|---|----------|
| 1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. | 15 Sets. |
| 2. Carpentry vice (fitted to work bench)  | 15 Nos.  |
| 3. Standard woodworking tools   | 15 Sets. |
| 4. Models of industrial trusses, door joints, furniture joints  | 5 each   |
| 5. Power Tools: (a) Rotary Hammer   | 2 Nos    |
| (b) Demolition Hammer   | 2 Nos    |
| (c) Circular Saw  | 2 Nos    |
| (d) Planer  | 2 Nos    |
| (e) Hand Drilling Machine   | 2 Nos    |
| (f) Jigsaw  | 2 Nos    |

#### **MECHANICAL**

- |   |         |
|---|---------|
| 1. Arc welding transformer with cables and holders                            | 5 Nos.  |
| 2. Welding booth with exhaust facility  | 5 Nos.  |
| 3. Welding accessories like welding shield, chipping hammer, wire brush, etc. | 5 Sets. |
| 4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.    | 2 Nos.  |
| 5. Centre lathe   | 2 Nos.  |

- |   |           |
|---|-----------|
| 6. Hearth furnace, anvil and smithy tools                 | 2 Sets.   |
| 7. Moulding table, foundry tools                          | 2 Sets.   |
| 8. Power Tool: Angle Grinder                              | 2 Nos     |
| 9. Study-purpose items: centrifugal pump, air-conditioner | One each. |

### **ELECTRICAL**

- |   |         |
|---|---------|
| 1. Assorted electrical components for house wiring                  | 15 Sets |
| 2. Electrical measuring instruments                                 | 10 Sets |
| 3. Study purpose items: Iron box, fan and regulator, emergency lamp | 1 each  |
| 4. Megger (250V/500V)   | 1 No.   |
| 5. Power Tools: (a) Range Finder                                    | 2 Nos   |
| (b) Digital Live-wire detector                                      | 2 Nos   |

### **ELECTRONICS**

- |   |         |
|---|---------|
| 1. Soldering guns   | 10 Nos. |
| 2. Assorted electronic components for making circuits                 | 50 Nos. |
| 3. Small PCBs   | 10 Nos. |
| 4. Multimeters  | 10 Nos. |
| 5. Study purpose items: Telephone, FM radio, low-voltage power supply |         |

### **REFERENCES:**

1. Jeyachandran K., Natarajan S. & Balasubramanian S., "A Primer on Engineering Practices Laboratory", Anuradha Publications, (2007).
2. Jeyapooan T., Saravanapandian M. & Pranitha S., "Engineering Practices Lab Manual", Vikas Puplicing House Pvt.Ltd, (2006)
3. Bawa H.S., "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, (2007).
4. Rajendra Prasad A. & Sarma P.M.M.S., "Workshop Practice", Sree Sai Publication, (2002).
5. Kannaiah P. & Narayana K.L., "Manual on Workshop Practice", Scitech Publications, (1999).

**GE6163**

**PHYSICS AND CHEMISTRY LABORATORY – I**

**L T P C**  
**0 0 2 1**

### **PHYSICS LABORATORY – I**

### **OBJECTIVES:**

To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

### **LIST OF EXPERIMENTS**

(Any FIVE Experiments)

- 1 (a) Determination of Wavelength, and particle size using Laser  
(b) Determination of acceptance angle in an optical fiber.
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
3. Determination of wavelength of mercury spectrum – spectrometer grating
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of Young's modulus by Non uniform bending method
6. Determination of specific resistance of a given coil of wire – Carey Foster's Bridge

**OUTCOMES:**

The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Diode laser, lycopodium powder, glass plate, optical fiber.
2. Ultrasonic interferometer
3. Spectrometer, mercury lamp, grating
4. Lee's Disc experimental set up
5. Traveling microscope, meter scale, knife edge, weights
6. Carey foster's bridge set up

(vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

**CHEMISTRY LABORATORY-I****LIST OF EXPERIMENTS**

(Any FIVE Experiments)

**OBJECTIVES:**

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
  - To acquaint the students with the determination of molecular weight of a polymer by vacometry.
1. Determination of DO content of water sample by Winkler's method.
  2. Determination of chloride content of water sample by argentometric method
  3. Determination of strength of given hydrochloric acid using pH meter
  4. Determination of strength of acids in a mixture using conductivity meter
  5. Estimation of iron content of the water sample using spectrophotometer
  6. (1,10- phenanthroline / thiocyanate method)
  7. Determination of molecular weight of polyvinylalcohol using Ostwald viscometer
  8. Conductometric titration of strong acid vs strong base

**TOTAL: 30 PERIODS**

**OUTCOMES:**

The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters

**REFERENCES:**

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New Yor (2001).
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry", LBS Singapore (1994).
3. Jeffery G.H., Bassett J., Mendham J.and Denny vogel's R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Iodine flask	-	30 Nos
2. pH meter	-	5 Nos
3. Conductivity meter	-	5 Nos
4. Spectrophotometer	-	5 Nos
5. Ostwald Viscometer	-	10 Nos

**Common Apparatus : Pipette, Burette, conical flask, porcelain tile, dropper (each 30 Nos.)**

**OBJECTIVES:**

- To make learners acquire listening and speaking skills in both formal and informal contexts.
- To help them develop their reading skills by familiarizing them with different types of reading strategies.
- To equip them with writing skills needed for academic as well as workplace contexts.
- To make them acquire language skills at their own pace by using e-materials and language lab components

**UNIT I****9+3**

Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on topics like weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; Writing - Effective use of SMS for sending short notes and messages - Using 'emojicons' as symbols in email messages; Grammar - Regular and irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. 'can') - Homophones (e.g. 'some', 'sum'); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

**UNIT II****9+3**

Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercises on Grammar and vocabulary, Extensive reading activity (reading stories / novels), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students' dialogues.

**UNIT III****9+3**

Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret, etc.); Reading - Speed reading – reading passages with time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading articles from journals - Format for journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. 'rock', 'train', 'ring'); E-materials - Interactive exercise on Grammar and vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU and RIE materials – Attending a meeting and writing minutes.

**UNIT IV****9+3**

Listening - Listening to a telephone conversation, Viewing model interviews (face-to-face, telephonic and video conferencing); Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary -

Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on Grammar and Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

## **UNIT V**

**9+3**

Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading; Writing – Checklist - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; E-materials - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises; Language Lab - Different models of group discussion.

**TOTAL: 60 PERIODS**

### **OUTCOMES:**

#### **Learners should be able to:**

- Speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies.
- Write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
- Read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
- Listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

### **TEXTBOOKS:**

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

### **REFERENCES:**

1. Anderson, Paul V. Technical Communication: A Reader-Centered Approach. Cengage. New Delhi. 2008
2. Muralikrishna, & Sunita Mishra. Communication Skills for Engineers. Pearson, New Delhi. 2011
3. Riordan, Daniel. G. Technical Communication. Cengage Learning, New Delhi. 2005
4. Sharma, Sangeetha & Binod Mishra. Communication Skills for Engineers and Scientists. PHI Learning, New Delhi. 2009
5. Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA. 2007

### **EXTENSIVE Reading (Not for Examination)**

1. Khera, Shiv. You can Win. Macmillan, Delhi. 1998.

### **Websites**

1. <http://www.englishclub.com>
2. <http://owl.english.purdue.edu>

## TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like individual writing and presentations, group discussions, interviews, reporting, etc
- Long presentations using visual aids
- Listening and viewing activities with follow up activities like discussions, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc
- Projects like group reports, mock interviews etc using a combination of two or more of the language skills

## EVALUATION PATTERN:

### Internal assessment: 20%

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Report
- Creative writing, etc.

All the four skills are to be tested with equal weightage given to each.

- Speaking assessment: Individual presentations, Group discussions
- Reading assessment: Reading passages with comprehension questions graded following Bloom's taxonomy
- Writing assessment: Writing essays, CVs, reports etc. Writing should include grammar and vocabulary.
- Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content graded following Bloom's taxonomy.

### End Semester Examination: 80%

MA6251

MATHEMATICS – II

L T P C  
3 1 0 4

## OBJECTIVES:

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

## UNIT I VECTOR CALCULUS

9+3

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

**UNIT II ORDINARY DIFFERENTIAL EQUATIONS****9+3**

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

**UNIT III LAPLACE TRANSFORM****9+3**

Laplace transform – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Transforms of unit step function and impulse functions – Transform of periodic functions. Inverse Laplace transform -Statement of Convolution theorem – Initial and final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

**UNIT IV ANALYTIC FUNCTIONS****9+3**

Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping:  $w = z+k$ ,  $kz$ ,  $1/z$ ,  $z^2$ ,  $e^z$  and bilinear transformation.

**UNIT V COMPLEX INTEGRATION****9+3**

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor's and Laurent's series expansions – Singular points – Residues – Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

**TOTAL: 60 PERIODS****OUTCOMES:**

The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.

**TEXT BOOKS:**

1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd.,2011.
2. Grewal. B.S, "Higher Engineering Mathematics", 41<sup>st</sup> Edition, Khanna Publications, Delhi, 2011.

**REFERENCES:**

1. Dass, H.K., and Er. Rajnish Verma," Higher Engineering Mathematics", S. Chand Private Ltd., 2011.
2. Glyn James, "Advanced Modern Engineering Mathematics", 3<sup>rd</sup> Edition, Pearson Education, 2012.
3. Peter V. O'Neil," Advanced Engineering Mathematics", 7th Edition, Cengage learning, (2012).
4. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., "Engineering Mathematics" Volume II, Second Edition, PEARSON Publishing 2011.

**OBJECTIVES:**

- To enrich the understanding of various types of materials and their applications in engineering and technology.

**UNIT I CONDUCTING MATERIALS****9**

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

**UNIT II SEMICONDUCTING MATERIALS****9**

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

**UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS****9**

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications Superconductivity : properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High  $T_c$  superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

**UNIT IV DIELECTRIC MATERIALS****9**

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Clausius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

**UNIT V ADVANCED ENGINEERING MATERIALS****9**

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications

**TOTAL: 45 PERIODS****OUTCOMES:**

The students will have the knowledge on physics of materials and that knowledge will be used by them in different engineering and technology applications

**TEXT BOOKS:**

- Arumugam M., Materials Science. Anuradha publishers, 2010
- Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009

**REFERENCES:**

- Palanisamy P.K. Materials Science. SCITECH Publishers, 2011.
- Senthilkumar G. Engineering Physics II. VRB Publishers, 2011.
- Mani P. Engineering Physics II. Dhanam Publications, 2011.
- Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009.

**OBJECTIVES:**

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- Principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.

**UNIT I WATER TECHNOLOGY****9**

Introduction to boiler feed water-requirements-formation of deposits in steam boilers and heat exchangers- disadvantages (wastage of fuels, decrease in efficiency, boiler explosion) prevention of scale formation -softening of hard water -external treatment zeolite and demineralization - internal treatment- boiler compounds (phosphate, calgon, carbonate, colloidal) - caustic embrittlement-boiler corrosion-priming and foaming- desalination of brackish water –reverse osmosis.

**UNIT II ELECTROCHEMISTRY AND CORROSION****9**

Electrochemical cell - redox reaction, electrode potential- origin of electrode potential- oxidation potential- reduction potential, measurement and applications - electrochemical series and its significance - Nernst equation (derivation and problems). Corrosion- causes- factors- types-chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Paints- constituents and function. Electroplating of Copper and electroless plating of nickel.

**UNIT III ENERGY SOURCES****9**

Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion- differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells:Types of batteries- alkaline battery- lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H<sub>2</sub> -O<sub>2</sub> fuel cell- applications.

**UNIT IV ENGINEERING MATERIALS****9**

Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties – refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Portland cement- manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement–properties and uses. Glass - manufacture, types, properties and uses.

**UNIT V FUELS AND COMBUSTION****9**

Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- coal-analysis of coal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) - petroleum- manufacture of synthetic petrol (Bergius process)- knocking- octane number - diesel oil- cetane number - natural gas- compressed natural gas(CNG)- liquefied petroleum gases(LPG)- producer gas- water gas. Power alcohol and bio diesel. Combustion of fuels: introduction- theoretical calculation of calorific value- calculation of stoichiometry of fuel and air ratio- ignition temperature- explosive range - flue gas analysis (ORSAT Method).

**TOTAL: 45 PERIODS**

**OUTCOMES:**

The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

**TEXT BOOKS:**

1. Vairam S, Kalyani P and SubaRamesh., "Engineering Chemistry"., Wiley India PvtLtd., New Delhi., 2011
2. Dara S.S and Umare S.S. "Engineering Chemistry", S. Chand & Company Ltd., New Delhi , 2010

**REFERENCES:**

1. Kannan P. and Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009.
2. AshimaSrivastava and Janhavi N N., "Concepts of Engineering Chemistry", ACME Learning Private Limited., New Delhi., 2010.
3. RenuBapna and Renu Gupta., "Engineering Chemistry", Macmillan India Publisher Ltd., 2010.
4. Pahari A and Chauhan B., "Engineering Chemistry"., Firewall Media., New Delhi., 2010

**CS6201****DIGITAL PRINCIPLES AND SYSTEM DESIGN****L T P C**  
**3 0 0 3****OBJECTIVES:**

The student should be made to:

- Learn the various number systems.
- Learn Boolean Algebra
- Understand the various logic gates.
- Be familiar with various combinational circuits.
- Be familiar with designing synchronous and asynchronous sequential circuits.
- Be exposed to designing using PLD

**UNIT I      BOOLEAN ALGEBRA AND LOGIC GATES****9**

Review of Number Systems – Arithmetic Operations – Binary Codes – Boolean Algebra and Theorems – Boolean Functions – Simplification of Boolean Functions using Karnaugh Map and Tabulation Methods – Logic Gates – NAND and NOR Implementations.

**UNIT II      COMBINATIONAL LOGIC****9**

Combinational Circuits – Analysis and Design Procedures – Circuits for Arithmetic Operations, Code Conversion – Decoders and Encoders – Multiplexers and Demultiplexers – Introduction to HDL – HDL Models of Combinational circuits.

**UNIT III      SYNCHRONOUS SEQUENTIAL LOGIC****9**

Sequential Circuits – Latches and Flip Flops – Analysis and Design Procedures – State Reduction and State Assignment – Shift Registers – Counters – HDL for Sequential Logic Circuits.

**UNIT IV      ASYNCHRONOUS SEQUENTIAL LOGIC****9**

Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-free State Assignment – Hazards.

**UNIT V MEMORY AND PROGRAMMABLE LOGIC****9**

RAM and ROM – Memory Decoding – Error Detection and Correction – Programmable Logic Array – Programmable Array Logic – Sequential Programmable Devices – Application Specific Integrated Circuits.

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of this course, the student will be able to:**

- Perform arithmetic operations in any number system.
- Simplify the Boolean expression using K-Map and Tabulation techniques.
- Use boolean simplification techniques to design a combinational hardware circuit.
- Design and Analysis of a given digital circuit – combinational and sequential.
- Design using PLD.

**TEXT BOOK:**

1. Morris Mano M. and Michael D. Ciletti, “Digital Design”, IV Edition, Pearson Education, 2008.

**REFERENCES:**

1. John F. Wakerly, “Digital Design Principles and Practices”, Fourth Edition, Pearson Education, 2007.
2. Charles H. Roth Jr, “Fundamentals of Logic Design”, Fifth Edition – Jaico Publishing House, Mumbai, 2003.
3. Donald D. Givone, “Digital Principles and Design”, Tata Mcgraw Hill, 2003.
4. Kharate G. K., “Digital Electronics”, Oxford University Press, 2010.

**CS6202****PROGRAMMING AND DATA STRUCTURES I****L T P C  
3 0 0 3****OBJECTIVES:****The student should be made to:**

- Be familiar with the basics of C programming language.
- Be exposed to the concepts of ADTs
- Learn linear data structures – list, stack, and queue.
- Be exposed to sorting, searching, hashing algorithms

**UNIT I C PROGRAMMING FUNDAMENTALS- A REVIEW****9**

Conditional statements – Control statements – Functions – Arrays – Preprocessor - Pointers - Variation in pointer declarations – Function Pointers – Function with Variable number of arguments

**UNIT II C PROGRAMMING ADVANCED FEATURES****9**

Structures and Unions - File handling concepts – File read – write – binary and Stdio - File Manipulations

**UNIT III LINEAR DATA STRUCTURES – LIST****9**

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation — singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation – All operation (Insertion, Deletion, Merge, Traversal)



**OUTCOMES:**

- The students will have the ability to test materials by using their knowledge of applied physics principles in optics and properties of matter.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Traveling microscope, meter scale, Knife edge, weights
2. Band gap experimental set up
3. Burette, Capillary tube, rubber tube, stop clock, beaker and weighing balance
4. spectrometer, prism, sodium vapour lamp.
5. Air-wedge experimental set up.
6. Torsion pendulum set up.  
(vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

**CHEMISTRY LABORATORY -II****OBJECTIVES:**

- To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

**(Any FIVE Experiments)**

1. Determination of alkalinity in water sample
2. Determination of total, temporary & permanent hardness of water by EDTA method
3. Estimation of copper content of the given solution by EDTA method
4. Estimation of iron content of the given solution using potentiometer
5. Estimation of iron content of the given solution using potentiometer
6. Estimation of sodium present in water using flame photometer
7. Corrosion experiment – weight loss method
8. Conductometric precipitation titration using  $\text{BaCl}_2$  and  $\text{Na}_2\text{SO}_4$
9. Determination of CaO in Cement.

**TOTAL: 30 PERIODS****OUTCOMES:**

The students will be conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis.

**REFERENCES:**

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York (2001).
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry, LBS Singapore (1994).
3. Jeffery G.H, Bassett J., Mendham J. and Denny R.C., "Vogel's Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Kolthoff I.M. and Sandell E.B. et al. Quantitative chemical analysis, Mcmillan, Madras 1980

- **Laboratory classes on alternate weeks for Physics and Chemistry.**

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

- |                       |   |       |
|-----------------------|---|-------|
| 1. Potentiometer      | - | 5 Nos |
| 2. Flame photo meter  | - | 5 Nos |
| 3. Weighing Balance   | - | 5 Nos |
| 4. Conductivity meter | - | 5 Nos |

**Common Apparatus : Pipette, Burette, conical flask, porcelain tile, dropper (30 Nos each)**

**OBJECTIVES:**

**The student should be made to:**

- Understand the various logic gates.
- Be familiar with various combinational circuits.
- Understand the various components used in the design of digital computers.
- Be exposed to sequential circuits
- Learn to use HDL

**ST OF EXPERIMENTS:**

1. Verification of Boolean Theorems using basic gates.
2. Design and implementation of combinational circuits using basic gates for arbitrary functions, code converters.
3. Design and implementation of combinational circuits using MSI devices:
  - 4 – bit binary adder / subtractor
  - Parity generator / checker
  - Magnitude Comparator
  - Application using multiplexers
4. Design and implementation of sequential circuits:
  - Shift –registers
  - Synchronous and asynchronous counters
5. Coding combinational / sequential circuits using HDL.
6. Design and implementation of a simple digital system (Mini Project).

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of this course, the student will be able to:**

- Use boolean simplification techniques to design a combinational hardware circuit.
- Design and Implement combinational and sequential circuits.
- Analyze a given digital circuit – combinational and sequential.
- Design the different functional units in a digital computer system.
- Design and Implement a simple digital system.

**LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS****HARDWARE:**

1. Digital trainer kits 30
2. Digital ICs required for the experiments in sufficient numbers 96

**SOFTWARE:**

1. HDL simulator.

**OBJECTIVES:**

The students should be made to:

- Be familiar with c programming
- Be exposed to implementing abstract data types
- Learn to use files
- Learn to implement sorting and searching algorithms.

1. C Programs using Conditional and Control Statements
2. C Programs using Arrays, Strings and Pointers and Functions
3. Representation of records using Structures in C – Creation of Linked List – Manipulation of records in a Linked List
4. File Handling in C – Sequential access – Random Access
5. Operations on a Stack and Queue – infix to postfix – simple expression evaluation using stacks - Linked Stack Implementation – Linked Queue Implementation
6. Implementation of Sorting algorithms
7. Implementation of Linear search and Binary Search.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

At the end of the course, the student should be able to:

- Design and implement C programs for implementing stacks, queues, linked lists.
- Apply good programming design methods for program development.
- Apply the different data structures for implementing solutions to practical problems.
- Develop searching and sorting programs.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

Standalone desktops with C compiler      30 Nos.  
(or)

Server with C compiler supporting 30 terminals or more.

**OBJECTIVES:**

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

**UNIT I      PARTIAL DIFFERENTIAL EQUATIONS**

**9+3**

Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order partial differential equations - Lagrange's linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

**UNIT II      FOURIER SERIES****9+3**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

**UNIT III      APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS****9+3**

Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

**UNIT IV      FOURIER TRANSFORMS****9+3**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

**UNIT V      Z - TRANSFORMS AND DIFFERENCE EQUATIONS****9+3**

Z- transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES:**

- The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

**TEXT BOOKS:**

1. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal. B.S., "Higher Engineering Mathematics", 42<sup>nd</sup> Edition, Khanna Publishers, Delhi, 2012.
3. Narayanan.S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt. Ltd.1998.

**REFERENCES:**

1. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7<sup>th</sup> Edition, Laxmi Publications Pvt Ltd, 2007.
2. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc Graw Hill Publishing Company Limited, NewDelhi, 2008.
3. Glyn James, "Advanced Modern Engineering Mathematics", 3<sup>rd</sup> Edition, Pearson Education, 2007.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8<sup>th</sup> Edition, Wiley India, 2007.
5. Ray Wylie. C and Barrett.L.C, "Advanced Engineering Mathematics" Tata Mc Graw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.
6. Datta.K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.

**OBJECTIVES:****The student should be made to:**

- Be familiar with the C++ concepts of abstraction, encapsulation, constructor, polymorphism, overloading and Inheritance.
- Learn advanced nonlinear data structures.
- Be exposed to graph algorithms
- Learn to apply Tree and Graph structures

**UNIT I OBJECT ORIENTED PROGRAMMING FUNDAMENTALS 9**

C++ Programming features - Data Abstraction - Encapsulation - class - object - constructors - static members – constant members – member functions – pointers – references - Role of this pointer – Storage classes – function as arguments.

**UNIT II OBJECT ORIENTED PROGRAMMING CONCEPTS 9**

String Handling – Copy Constructor - Polymorphism – compile time and run time polymorphisms – function overloading – operators overloading – dynamic memory allocation - Nested classes - Inheritance – virtual functions.

**UNIT III C++ PROGRAMMING ADVANCED FEATURES 9**

Abstract class – Exception handling - Standard libraries - Generic Programming - templates – class template - function template – STL – containers – iterators – function adaptors – allocators - Parameterizing the class - File handling concepts.

**UNIT IV ADVANCED NON-LINEAR DATA STRUCTURES 9**

AVL trees – B-Trees – Red-Black trees – Splay trees - Binomial Heaps – Fibonacci Heaps – Disjoint Sets – Amortized Analysis – accounting method – potential method – aggregate analysis.

**UNIT V GRAPHS 9**

Representation of Graphs – Breadth-first search – Depth-first search – Topological sort – Minimum Spanning Trees – Kruskal and Prim algorithm – Shortest path algorithm – Dijkstra's algorithm – Bellman-Ford algorithm – Floyd - Warshall algorithm.

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Design problem solutions using Object Oriented Techniques.
- Apply the concepts of data abstraction, encapsulation and inheritance for problem solutions.
- Use the control structures of C++ appropriately.
- Critically analyse the various algorithms.
- Apply the different data structures to problem solutions.

**TEXT BOOKS:**

1. Bjarne Stroustrup, "The C++ Programming Language", 3<sup>rd</sup> Edition, Pearson Education, 2007.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 2<sup>nd</sup> Edition, Pearson Education, 2005

**REFERENCES:**

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Second Edition, Mc Graw Hill, 2002.
2. Michael T Goodrich, Roberto Tamassia, David Mount, "Data Structures and Algorithms in C++", 7<sup>th</sup> Edition, Wiley Publishers, 2004.

**OBJECTIVES:**

- To expose the students to the fundamentals of Database Management Systems.
- To make the students understand the relational model.
- To familiarize the students with ER diagrams.
- To expose the students to SQL.
- To make the students to understand the fundamentals of Transaction Processing and Query Processing.
- To familiarize the students with the different types of databases.
- To make the students understand the Security Issues in Databases.

**UNIT I INTRODUCTION TO DBMS****10**

File Systems Organization - Sequential, Pointer, Indexed, Direct - Purpose of Database System- Database System Terminologies-Database characteristics- Data models – Types of data models – Components of DBMS- Relational Algebra. LOGICAL DATABASE DESIGN: Relational DBMS - Codd's Rule - Entity-Relationship model - Extended ER Normalization – Functional Dependencies, Anomaly- 1NF to 5NF- Domain Key Normal Form – Denormalization

**UNIT II SQL & QUERY OPTIMIZATION****8**

SQL Standards - Data types - Database Objects- DDL-DML-DCL-TCL-Embedded SQL-Static Vs Dynamic SQL - QUERY OPTIMIZATION: Query Processing and Optimization - Heuristics and Cost Estimates in Query Optimization.

**UNIT III TRANSACTION PROCESSING AND CONCURRENCY CONTROL****8**

Introduction-Properties of Transaction- Serializability- Concurrency Control – Locking Mechanisms- Two Phase Commit Protocol-Dead lock.

**UNIT IV TRENDS IN DATABASE TECHNOLOGY****10**

Overview of Physical Storage Media – Magnetic Disks – RAID – Tertiary storage – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing - Introduction to Distributed Databases- Client server technology- Multidimensional and Parallel databases- Spatial and multimedia databases- Mobile and web databases- Data Warehouse-Mining- Data marts.

**UNIT V ADVANCED TOPICS****9**

DATABASE SECURITY: Data Classification-Threats and risks – Database access Control – Types of Privileges –Cryptography- Statistical Databases.- Distributed Databases-Architecture-Transaction Processing-Data Warehousing and Mining-Classification-Association rules-Clustering-Information Retrieval- Relevance ranking-Crawling and Indexing the Web- Object Oriented Databases-XML Databases.

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Design Databases for applications.
- Use the Relational model, ER diagrams.
- Apply concurrency control and recovery mechanisms for practical problems.
- Design the Query Processor and Transaction Processor.
- Apply security concepts to databases.

**TEXT BOOK:**

1. Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", Fifth Edition, Pearson Education, 2008.

**REFERENCES:**

1. Abraham Silberschatz, Henry F. Korth and S. Sudharshan, "Database System Concepts", Sixth Edition, Tata Mc Graw Hill, 2011.
2. C.J.Date, A.Kannan and S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
3. Atul Kahate, "Introduction to Database Management Systems", Pearson Education, New Delhi, 2006.
4. Alexis Leon and Mathews Leon, "Database Management Systems", Vikas Publishing House Private Limited, New Delhi, 2003.
5. Raghu Ramakrishnan, "Database Management Systems", Fourth Edition, Tata Mc Graw Hill, 2010.
6. G.K.Gupta, "Database Management Systems", Tata Mc Graw Hill, 2011.
7. Rob Cornell, "Database Systems Design and Implementation", Cengage Learning, 2011.

**CS6303****COMPUTER ARCHITECTURE****L T P C  
3 0 0 3****OBJECTIVES:**

- To make students understand the basic structure and operation of digital computer.
- To understand the hardware-software interface.
- To familiarize the students with arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations.
- To expose the students to the concept of pipelining.
- To familiarize the students with hierarchical memory system including cache memories and virtual memory.
- To expose the students with different ways of communicating with I/O devices and standard I/O interfaces.

**UNIT I OVERVIEW & INSTRUCTIONS****9**

Eight ideas – Components of a computer system – Technology – Performance – Power wall – Uniprocessors to multiprocessors; Instructions – operations and operands – representing instructions – Logical operations – control operations – Addressing and addressing modes.

**UNIT II ARITHMETIC OPERATIONS****7**

ALU - Addition and subtraction – Multiplication – Division – Floating Point operations – Subword parallelism.

**UNIT III PROCESSOR AND CONTROL UNIT****11**

Basic MIPS implementation – Building datapath – Control Implementation scheme – Pipelining – Pipelined datapath and control – Handling Data hazards & Control hazards – Exceptions.

**UNIT IV PARALLELISM****9**

Instruction-level-parallelism – Parallel processing challenges – Flynn's classification – Hardware multithreading – Multicore processors

## UNIT V MEMORY AND I/O SYSTEMS

9

Memory hierarchy - Memory technologies – Cache basics – Measuring and improving cache performance - Virtual memory, TLBs - Input/output system, programmed I/O, DMA and interrupts, I/O processors.

**TOTAL: 45 PERIODS**

### OUTCOMES:

**At the end of the course, the student should be able to:**

- Design arithmetic and logic unit.
- Design and analyse pipelined control units
- Evaluate performance of memory systems.
- Understand parallel processing architectures.

### TEXT BOOK:

1. David A. Patterson and John L. Hennessey, "Computer organization and design", Morgan Kaufman / Elsevier, Fifth edition, 2014.

### REFERENCES:

1. V. Carl Hamacher, Zvonko G. Varanescic and Safat G. Zaky, "Computer Organisation", VI<sup>th</sup> edition, Mc Graw-Hill Inc, 2012.
2. William Stallings "Computer Organization and Architecture" , Seventh Edition , Pearson Education, 2006.
3. Vincent P. Heuring, Harry F. Jordan, "Computer System Architecture", Second Edition, Pearson Education, 2005.
4. Govindarajalu, "Computer Architecture and Organization, Design Principles and Applications", first edition, Tata McGraw Hill, New Delhi, 2005.
5. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata Mc Graw Hill, 1998.
6. <http://nptel.ac.in/>.

CS6304

ANALOG AND DIGITAL COMMUNICATION

L T P C  
3 0 0 3

### OBJECTIVES:

**The student should be made to:**

- Understand analog and digital communication techniques.
- Learn data and pulse communication techniques.
- Be familiarized with source and Error control coding.
- Gain knowledge on multi-user radio communication.

## UNIT I ANALOG COMMUNICATION

9

**Noise:** Source of Noise - External Noise- Internal Noise- Noise Calculation. Introduction to **Communication Systems:** Modulation – Types - Need for Modulation. Theory of Amplitude Modulation - Evolution and Description of SSB Techniques - Theory of Frequency and Phase Modulation – Comparison of various Analog Communication System (AM – FM – PM).

**UNIT II DIGITAL COMMUNICATION 9**

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) Minimum Shift Keying (MSK) –Phase Shift Keying (PSK) – BPSK – QPSK – 8 PSK – 16 PSK - Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).

**UNIT III DATA AND PULSE COMMUNICATION 9**

**Data Communication:** History of Data Communication - Standards Organizations for Data Communication- Data Communication Circuits - Data Communication Codes - Error Detection and Correction Techniques - Data communication Hardware - serial and parallel interfaces.

**Pulse Communication:** Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) - Comparison of various Pulse Communication System (PAM – PTM – PCM).

**UNIT IV SOURCE AND ERROR CONTROL CODING 9**

Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, mutual information, channel capacity, channel coding theorem, Error Control Coding, linear block codes, cyclic codes, convolution codes, viterbi decoding algorithm.

**UNIT V MULTI-USER RADIO COMMUNICATION 9**

Advanced Mobile Phone System (AMPS) - Global System for Mobile Communications (GSM) - Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse - Channel Assignment and Hand - Overview of Multiple Access Schemes - Satellite Communication - Bluetooth.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Apply analog and digital communication techniques.
- Use data and pulse communication techniques.
- Analyze Source and Error control coding.
- Utilize multi-user radio communication.

**TEXT BOOK:**

1. Wayne Tomasi, "Advanced Electronic Communication Systems", 6<sup>th</sup> Edition, Pearson Education, 2009.

**REFERENCES:**

1. Simon Haykin, "Communication Systems", 4<sup>th</sup> Edition, John Wiley & Sons, 2004
2. Rappaport T.S, "Wireless Communications: Principles and Practice", 2<sup>nd</sup> Edition, Pearson Education, 2007
3. H.Taub, D L Schilling and G Saha, "Principles of Communication", 3<sup>rd</sup> Edition, Pearson Education, 2007.
4. B. P.Lathi, "Modern Analog and Digital Communication Systems", 3<sup>rd</sup> Edition, Oxford University Press, 2007.
5. Blake, "Electronic Communication Systems", Thomson Delmar Publications, 2002.
6. Martin S.Roden, "Analog and Digital Communication System", 3<sup>rd</sup> Edition, Prentice Hall of India, 2002.
7. B.Sklar, "Digital Communication Fundamentals and Applications" 2<sup>nd</sup> Edition Pearson Education 2007.

**OBJECTIVES:****To the study of nature and the facts about environment.**

- To find and implement scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY****12**

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds  
Field study of simple ecosystems – pond, river, hill slopes, etc.

**UNIT II ENVIRONMENTAL POLLUTION****10**

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry- Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO<sub>2</sub>, NO<sub>x</sub>, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies – Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

**UNIT III NATURAL RESOURCES****10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources

for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins –Biochemical degradation of pollutants, Bioconversion of pollutants.

Field study of local area to document environmental assets – river/forest/grassland/hill/mountain.

#### **UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT**

**7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides. Public awareness.

#### **UNIT V HUMAN POPULATION AND THE ENVIRONMENT**

**6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environment at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions.
- Development and improvement in standard of living has lead to serious environmental disasters.

#### **TEXT BOOKS:**

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2<sup>nd</sup> Edition, Pearson Education 2004.
2. Benny Joseph, 'Environmental Science and Engineering', Tata Mc Graw-Hill, New Delhi, 2006.

#### **REFERENCES:**

1. R.K. Trivedi, "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standard", Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice Hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press 2005.

**OBJECTIVES:**

**The student should be made to:**

- Be familiarized with good programming design methods, particularly Top- Down design.
- Getting exposure in implementing the different data structures using C++
- Appreciate recursive algorithms.

**LIST OF EXPERIMENTS:****IMPLEMENTATION IN THE FOLLOWING TOPICS:**

1. Constructors & Destructors, Copy Constructor.
2. Friend Function & Friend Class.
3. Inheritance.
4. Polymorphism & Function Overloading.
5. Virtual Functions.
6. Overload Unary & Binary Operators Both as Member Function & Non Member Function.
7. Class Templates & Function Templates.
8. Exception Handling Mechanism.
9. Standard Template Library concept.
10. File Stream classes.
11. Applications of Stack and Queue
12. Binary Search Tree
13. Tree traversal Techniques
14. Minimum Spanning Trees
15. Shortest Path Algorithms

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design and implement C++ programs for manipulating stacks, queues, linked lists, trees, and graphs.
- Apply good programming design methods for program development.
- Apply the different data structures for implementing solutions to practical problems.
- Develop recursive programs using trees and graphs.

**REFERENCE:**

[spoken-tutorial.org](http://spoken-tutorial.org).

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

Standalone desktops with C++ compiler 30 Nos.

(or)

Server with C++ compiler supporting 30 terminals or more.

**OBJECTIVES:**

The student should be made to:

- Learn to create and use a database
- Be familiarized with a query language
- Have hands on experience on DDL Commands
- Have a good understanding of DML Commands and DCL commands
- Familiarize advanced SQL queries.
- Be Exposed to different applications

**LIST OF EXPERIMENTS:**

1. Creation of a database and writing SQL queries to retrieve information from the database.
2. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.
3. Creation of Views, Synonyms, Sequence, Indexes, Save point.
4. Creating an Employee database to set various constraints.
5. Creating relationship between the databases.
6. Study of PL/SQL block.
7. Write a PL/SQL block to satisfy some conditions by accepting input from the user.
8. Write a PL/SQL block that handles all types of exceptions.
9. Creation of Procedures.
10. Creation of database triggers and functions
11. Mini project (Application Development using Oracle/ Mysql )
  - a) Inventory Control System.
  - b) Material Requirement Processing.
  - c) Hospital Management System.
  - d) Railway Reservation System.
  - e) Personal Information System.
  - f) Web Based User Identification System.
  - g) Timetable Management System.
  - h) Hotel Management System

**TOTAL: 45 PERIODS**

**OUTCOMES:**

At the end of the course, the student should be able to:

- Design and implement a database schema for a given problem-domain
- Populate and query a database
- Create and maintain tables using PL/SQL.
- Prepare reports.

**REFERENCE:**

spoken-tutorial.org

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:****HARDWARE:**

Standalone desktops 30 Nos.

(or)

Server supporting 30 terminals or more.

**SOFTWARE:**

Front end: VB/VC ++/JAVA or Equivalent

Back end: Oracle / SQL / MySQL/ PostGress / DB2 or Equivalent

**MA6453****PROBABILITY AND QUEUEING THEORY****L T P C****3 1 0 4****OBJECTIVE:**

To provide the required mathematical support in real life problems and develop probabilistic models which can be used in several areas of science and engineering.

**UNIT I RANDOM VARIABLES****9+3**

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions.

**UNIT II TWO - DIMENSIONAL RANDOM VARIABLES****9+3**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables.

**UNIT III RANDOM PROCESSES****9+3**

Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions.

**UNIT IV QUEUEING MODELS****9+3**

Markovian queues – Birth and Death processes – Single and multiple server queueing models – Little's formula - Queues with finite waiting rooms – Queues with impatient customers: Balking and reneing.

**UNIT V ADVANCED QUEUEING MODELS****9+3**

Finite source models - M/G/1 queue – Pollaczek Khinchin formula - M/D/1 and M/E<sub>K</sub>/1 as special cases – Series queues – Open Jackson networks.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES:**

- The students will have a fundamental knowledge of the probability concepts.
- Acquire skills in analyzing queueing models.
- It also helps to understand and characterize phenomenon which evolve with respect to time in a probabilistic manner.

**TEXT BOOKS:**

1. Ibe. O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 1st Indian Reprint, 2007.
2. Gross. D. and Harris. C.M., "Fundamentals of Queueing Theory", Wiley Student edition, 2004.

**REFERENCES:**

1. Robertazzi, "Computer Networks and Systems: Queueing Theory and performance evaluation", Springer, 3<sup>rd</sup> Edition, 2006.
2. Taha. H.A., "Operations Research", Pearson Education, Asia, 8<sup>th</sup> Edition, 2007.
3. Trivedi.K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", John Wiley and Sons, 2nd Edition, 2002.

4. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2004.
5. Yates. R.D. and Goodman. D. J., "Probability and Stochastic Processes", Wiley India Pvt. Ltd., Bangalore, 2<sup>nd</sup> Edition, 2012.

**CS6551**

**COMPUTER NETWORKS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Understand the division of network functionalities into layers.
- Be familiar with the components required to build different types of networks
- Be exposed to the required functionality at each layer
- Learn the flow control and congestion control algorithms

**UNIT I FUNDAMENTALS & LINK LAYER**

**9**

Building a network – Requirements - Layering and protocols - Internet Architecture – Network software – Performance ; Link layer Services - Framing - Error Detection - Flow control

**UNIT II MEDIA ACCESS & INTERNETWORKING**

**9**

Media access control - Ethernet (802.3) - Wireless LANs – 802.11 – Bluetooth - Switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP, ICMP )

**UNIT III ROUTING**

**9**

Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Multicast – addresses – multicast routing (DVMRP, PIM)

**UNIT IV TRANSPORT LAYER**

**9**

Overview of Transport layer - UDP - Reliable byte stream (TCP) - Connection management - Flow control - Retransmission – TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements

**UNIT V APPLICATION LAYER**

**9**

Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS - SNMP

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Identify the components required to build different types of networks
- Choose the required functionality at each layer for given application
- Identify solution for each functionality at each layer
- Trace the flow of information from one node to another node in the network

**TEXT BOOK:**

1. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers, 2011.

## REFERENCES:

1. James F. Kurose, Keith W. Ross, "Computer Networking - A Top-Down Approach Featuring the Internet", Fifth Edition, Pearson Education, 2009.
2. Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2010.
3. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", Mc Graw Hill Publisher, 2011.
4. Behrouz A. Forouzan, "Data communication and Networking", Fourth Edition, Tata McGraw – Hill, 2011.

**CS6401**

**OPERATING SYSTEMS**

**L T P C**  
**3 0 0 3**

## OBJECTIVES:

**The student should be made to:**

- Study the basic concepts and functions of operating systems.
- Understand the structure and functions of OS.
- Learn about Processes, Threads and Scheduling algorithms.
- Understand the principles of concurrency and Deadlocks.
- Learn various memory management schemes.
- Study I/O management and File systems.
- Learn the basics of Linux system and perform administrative tasks on Linux Servers.

### **UNIT I OPERATING SYSTEMS OVERVIEW**

**9**

Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization- Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

### **UNIT II PROCESS MANAGEMENT**

**9**

Processes-Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication; Threads- Overview, Multicore Programming, Multithreading Models; Windows 7 - Thread and SMP Management. Process Synchronization - Critical Section Problem, Mutex Locks, Semaphores, Monitors; CPU Scheduling and Deadlocks.

### **UNIT III STORAGE MANAGEMENT**

**9**

Main Memory-Contiguous Memory Allocation, Segmentation, Paging, 32 and 64 bit architecture Examples; Virtual Memory- Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

### **UNIT IV I/O SYSTEMS**

**9**

Mass Storage Structure- Overview, Disk Scheduling and Management; File System Storage-File Concepts, Directory and Disk Structure, Sharing and Protection; File System Implementation- File System Structure, Directory Structure, Allocation Methods, Free Space Management, I/O Systems.

### **UNIT V CASE STUDY**

**9**

Linux System- Basic Concepts;System Administration-Requirements for Linux System Administrator, Setting up a LINUX Multifunction Server, Domain Name System, Setting Up Local Network Services; Virtualization- Basic Concepts, Setting Up Xen,VMware on Linux Host and Adding Guest OS.

**TOTAL: 45 PERIODS**

## OUTCOMES:

At the end of the course, the student should be able to:

- Design various Scheduling algorithms.
- Apply the principles of concurrency.
- Design deadlock, prevention and avoidance algorithms.
- Compare and contrast various memory management schemes.
- Design and Implement a prototype file systems.
- Perform administrative tasks on Linux Servers.

## TEXT BOOK:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9<sup>th</sup> Edition, John Wiley and Sons Inc., 2012.

## REFERENCES:

1. William Stallings, "Operating Systems – Internals and Design Principles", 7<sup>th</sup> Edition, Prentice Hall, 2011.
2. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Addison Wesley, 2001.
3. Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education", 1996.
4. D M Dhamdhere, "Operating Systems: A Concept-Based Approach", Second Edition, Tata McGraw-Hill Education, 2007.
5. <http://nptel.ac.in/>.

CS6402

DESIGN AND ANALYSIS OF ALGORITHMS

L T P C  
3 0 0 3

## OBJECTIVES:

The student should be made to:

- Learn the algorithm analysis techniques.
- Become familiar with the different algorithm design techniques.
- Understand the limitations of Algorithm power.

## UNIT I INTRODUCTION

9

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithm Efficiency – Analysis Framework – Asymptotic Notations and its properties – Mathematical analysis for Recursive and Non-recursive algorithms.

## UNIT II BRUTE FORCE AND DIVIDE-AND-CONQUER

9

Brute Force - Closest-Pair and Convex-Hull Problems-Exhaustive Search - Traveling Salesman Problem - Knapsack Problem - Assignment problem.

Divide and conquer methodology – Merge sort – Quick sort – Binary search – Multiplication of Large Integers – Strassen's Matrix Multiplication-Closest-Pair and Convex-Hull Problems.

## UNIT III DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE

9

Computing a Binomial Coefficient – Warshall's and Floyd' algorithm – Optimal Binary Search Trees – Knapsack Problem and Memory functions. Greedy Technique– Prim's algorithm- Kruskal's Algorithm- Dijkstra's Algorithm-Huffman Trees.

**UNIT IV ITERATIVE IMPROVEMENT****9**

The Simplex Method-The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs- The Stable marriage Problem.

**UNIT V COPING WITH THE LIMITATIONS OF ALGORITHM POWER****9**

Limitations of Algorithm Power-Lower-Bound Arguments-Decision Trees-P, NP and NP-Complete Problems--Coping with the Limitations - Backtracking – n-Queens problem – Hamiltonian Circuit Problem – Subset Sum Problem-Branch and Bound – Assignment problem – Knapsack Problem – Traveling Salesman Problem- Approximation Algorithms for NP – Hard Problems – Traveling Salesman problem – Knapsack problem.

**TOTAL: 45 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design algorithms for various computing problems.
- Analyze the time and space complexity of algorithms.
- Critically analyze the different algorithm design techniques for a given problem.
- Modify existing algorithms to improve efficiency.

**TEXT BOOK:**

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.

**REFERENCES:**

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
3. Donald E. Knuth, "The Art of Computer Programming", Volumes 1& 3 Pearson Education, 2009. Steven S. Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2008.
4. <http://nptel.ac.in/>

**EC6504****MICROPROCESSOR AND MICROCONTROLLER****L T P C  
3 0 0 3****OBJECTIVES:**

**The student should be made to:**

- Study the Architecture of 8086 microprocessor.
- Learn the design aspects of I/O and Memory Interfacing circuits.
- Study about communication and bus interfacing.
- Study the Architecture of 8051 microcontroller.

**UNIT I THE 8086 MICROPROCESSOR****9**

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

**UNIT II 8086 SYSTEM BUS STRUCTURE 9**

8086 signals – Basic configurations – System bus timing –System design using 8086 – IO programming – Introduction to Multiprogramming – System Bus Structure - Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.

**UNIT III I/O INTERFACING 9**

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

**UNIT IV MICROCONTROLLER 9**

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

**UNIT V INTERFACING MICROCONTROLLER 9**

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design and implement programs on 8086 microprocessor.
- Design I/O circuits.
- Design Memory Interfacing circuits.
- Design and implement 8051 microcontroller based systems.

**TEXT BOOKS:**

1. Yu-Cheng Liu, Glenn A.Gibson, “Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design”, Second Edition, Prentice Hall of India, 2007.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Second Edition, Pearson Education, 2011

**REFERENCE:**

1. Douglas V.Hall, “Microprocessors and Interfacing, Programming and Hardware:,TMH, 2012

**CS6403**

**SOFTWARE ENGINEERING**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Understand the phases in a software project
- Understand fundamental concepts of requirements engineering and Analysis Modelling.
- Understand the major considerations for enterprise integration and deployment.
- Learn various testing and maintenance measures

<b>UNIT I</b>	<b>SOFTWARE PROCESS AND PROJECT MANAGEMENT</b>	<b>9</b>
Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models – Software Project Management: Estimation – LOC and FP Based Estimation, COCOMO Model – Project Scheduling – Scheduling, Earned Value Analysis - Risk Management.		
<b>UNIT II</b>	<b>REQUIREMENTS ANALYSIS AND SPECIFICATION</b>	<b>9</b>
Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.		
<b>UNIT III</b>	<b>SOFTWARE DESIGN</b>	<b>9</b>
Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design – Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.		
<b>UNIT IV</b>	<b>TESTING AND IMPLEMENTATION</b>	<b>9</b>
Software testing fundamentals-Internal and external views of Testing-white box testing- basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging – Software Implementation Techniques: Coding practices-Refactoring.		
<b>UNIT V</b>	<b>PROJECT MANAGEMENT</b>	<b>9</b>
Estimation – FP Based, LOC Based, Make/Buy Decision, COCOMO II - Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection, RMMM - Scheduling and Tracking –Relationship between people and effort, Task Set & Network, Scheduling, EVA - Process and Project Metrics.		

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to**

- Identify the key activities in managing a software project.
- Compare different process models.
- Concepts of requirements engineering and Analysis Modeling.
- Apply systematic procedure for software design and deployment.
- Compare and contrast the various testing and maintenance.

**TEXT BOOK:**

1. Roger S. Pressman, “Software Engineering – A Practitioner’s Approach”, Seventh Edition, Mc Graw-Hill International Edition, 2010.

**REFERENCES:**

1. Ian Sommerville, “Software Engineering”, 9<sup>th</sup> Edition, Pearson Education Asia, 2011.
2. Rajib Mall, “Fundamentals of Software Engineering”, Third Edition, PHI Learning Private Limited ,2009.
3. Pankaj Jalote, “Software Engineering, A Precise Approach”, Wiley India, 2010.
4. Kelkar S.A., “Software Engineering”, Prentice Hall of India Pvt Ltd, 2007.
5. Stephen R.Schach, “Software Engineering”, Tata McGraw-Hill Publishing Company Limited, 2007.
6. <http://nptel.ac.in/>.

**OBJECTIVES:****The student should be made to:**

- Learn socket programming.
- Be familiar with simulation tools.
- Have hands on experience on various networking protocols.

**LIST OF EXPERIMENTS:**

1. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
2. Study of Socket Programming and Client – Server model
3. Write a code simulating ARP /RARP protocols.
4. Write a code simulating PING and TRACEROUTE commands
5. Create a socket for HTTP for web page upload and download.
6. Write a program to implement RPC (Remote Procedure Call)
7. Implementation of Subnetting .
8. Applications using TCP Sockets like
  - a. Echo client and echo server
  - b. Chat
  - c. File Transfer
9. Applications using TCP and UDP Sockets like
  - d. DNS
  - e. SNMP
  - f. File Transfer
10. Study of Network simulator (NS).and Simulation of Congestion Control Algorithms using NS
11. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer.
  - i. Link State routing
  - ii. Flooding
  - iii. Distance vector

**TOTAL: 45 PERIODS****REFERENCE:**[spoken-tutorial.org](http://spoken-tutorial.org).**OUTCOMES:****At the end of the course, the student should be able to**

- Use simulation tools
- Implement the various protocols.
- Analyse the performance of the protocols in different layers.
- Analyze various routing algorithms

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS****SOFTWARE:**

- C / C++ / Java / Equivalent Compiler 30
- Network simulator like NS2/Glomosim/OPNET/  
Equivalent

**HARDWARE:**

Standalone desktops 30 Nos

**OBJECTIVES:****The student should be made to:**

- Introduce ALP concepts and features
- Write ALP for arithmetic and logical operations in 8086 and 8051
- Differentiate Serial and Parallel Interface
- Interface different I/Os with Microprocessors
- Be familiar with MASM

**LIST OF EXPERIMENTS:****8086 Programs using kits and MASM**

1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. Code conversion, decimal arithmetic and Matrix operations.
4. Floating point operations, string manipulations, sorting and searching
5. Password checking, Print RAM size and system date
6. Counters and Time Delay

**Peripherals and Interfacing Experiments**

7. Traffic light control
8. Stepper motor control
9. Digital clock
10. Key board and Display
11. Printer status
12. Serial interface and Parallel interface
13. A/D and D/A interface and Waveform Generation

**8051 Experiments using kits and MASM**

14. Basic arithmetic and Logical operations
15. Square and Cube program, Find 2's complement of a number
16. Unpacked BCD to ASCII

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Write ALP Programmes for fixed and Floating Point and Arithmetic
- Interface different I/Os with processor
- Generate waveforms using Microprocessors
- Execute Programs in 8051
- Explain the difference between simulator and Emulator

**LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:****HARDWARE:**

8086 development kits	- 30 nos
Interfacing Units	- Each 10 nos
Microcontroller	- 30 nos

**SOFTWARE:**

Intel Desktop Systems with MASM	- 30 nos
8086 Assembler	
8051 Cross Assembler	

**OBJECTIVES:****The student should be made to:**

- Learn shell programming and the use of filters in the UNIX environment.
- Be exposed to programming in C using system calls.
- Learn to use the file system related system calls.
- Be exposed to process creation and inter process communication.
- Be familiar with implementation of CPU Scheduling Algorithms, page replacement algorithms and Deadlock avoidance

**LIST OF EXPERIMENTS:**

1. Basics of UNIX commands.
2. Shell Programming.
3. Implement the following CPU scheduling algorithms
  - a) Round Robin b) SJF c) FCFS d) Priority
4. Implement all file allocation strategies
  - a) Sequential b) Indexed c) Linked
5. Implement Semaphores
6. Implement all File Organization Techniques
  - a) Single level directory b) Two level c) Hierarchical d) DAG
7. Implement Bankers Algorithm for Dead Lock Avoidance
8. Implement an Algorithm for Dead Lock Detection
9. Implement e all page replacement algorithms
  - a) FIFO b) LRU c) LFU
10. Implement Shared memory and IPC
11. Implement Paging Technique of memory management.
12. Implement Threading & Synchronization Applications

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to**

- Implement deadlock avoidance, and Detection Algorithms
- Compare the performance of various CPU Scheduling Algorithm
- Critically analyze the performance of the various page replacement algorithms
- Create processes and implement IPC

**REFERENCE:**[spoken-tutorial.org](http://spoken-tutorial.org)**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

Standalone desktops with C / C++ / Java / Equivalent compiler 30 Nos.

(or)

Server with C / C++ / Java / Equivalent compiler supporting 30 terminals

**OBJECTIVES:**

To extend student's Logical and Mathematical maturity and ability to deal with abstraction and to introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.

**UNIT I LOGIC AND PROOFS****9+3**

Propositional Logic – Propositional equivalences - Predicates and Quantifiers – Nested Quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.

**UNIT II COMBINATORICS****9+3**

Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications.

**UNIT III GRAPHS****9+3**

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

**UNIT IV ALGEBRAIC STRUCTURES****9+3**

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism's – Normal subgroup and cosets – Lagrange's theorem – Definitions and examples of Rings and Fields.

**UNIT V LATTICES AND BOOLEAN ALGEBRA****9+3**

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.

**TOTAL (L: 45+T:15): 60 PERIODS****OUTCOMES:****At the end of the course, students would:**

- Have knowledge of the concepts needed to test the logic of a program.
- Have an understanding in identifying structures on many levels.
- Be aware of a class of functions which transform a finite set into another finite set which relates to input and output functions in computer science.
- Be aware of the counting principles.
- Be exposed to concepts and properties of algebraic structures such as groups, rings and fields.

**TEXT BOOKS:**

1. Kenneth H.Rosen, "Discrete Mathematics and its Applications", 7<sup>th</sup> Edition, Tata Mc Graw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.
2. Tremblay J.P. and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata Mc Graw Hill Pub. Co. Ltd, New Delhi, 30<sup>th</sup> Reprint, 2011.

**REFERENCES:**

1. Ralph.P.Grimaldi., "Discrete and Combinatorial Mathematics: An Applied Introduction", 4<sup>th</sup> Edition, Pearson Education Asia, Delhi, 2007.
2. Thomas Koshy., "Discrete Mathematics with Applications", Elsevier Publications, 2006.
3. Seymour Lipschutz and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata Mc Graw Hill Pub. Co. Ltd., New Delhi, 3<sup>rd</sup> Edition, 2010.

**OBJECTIVES:****The student should be made to:**

- Learn Java Programming.
- Understand different Internet Technologies.
- Be exposed to java specific web services architecture.

**UNIT I JAVA PROGRAMMING****9**

An overview of Java – Data Types – Variables and Arrays – Operators – Control Statements – Classes – Objects – Methods – Inheritance - Packages – Abstract classes – Interfaces and Inner classes – Exception handling - Introduction to Threads – Multithreading – String handling – Streams and I/O – Applets.

**UNIT II WEBSITES BASICS, HTML 5, CSS 3, WEB 2.0****8**

**Web 2.0:** Basics-RIA Rich Internet Applications - Collaborations tools - **Understanding websites and web servers:** Understanding Internet – Difference between websites and web server- Internet technologies Overview –Understanding the difference between internet and intranet; **HTML and CSS:** HTML 5.0 , XHTML, CSS 3.

**UNIT III CLIENT SIDE AND SERVER SIDE PROGRAMMING****11**

**Java Script:** An introduction to JavaScript–JavaScript DOM Model-Date and Objects,-Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript. **Servlets:** Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat Web Server;- **DATABASE CONNECTIVITY:** JDBC perspectives, JDBC program example - **JSP:** Understanding Java Server Pages-JSP Standard Tag Library(JSTL)-Creating HTML forms by embedding JSP code.

**UNIT IV PHP and XML****8**

**An introduction to PHP:** PHP- Using PHP- Variables- Program control- Built-in functions-Connecting to Database – Using Cookies-Regular Expressions; **XML:** Basic XML- Document Type Definition-XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).

**UNIT V INTRODUCTION TO AJAX and WEB SERVICES****9**

**AJAX:** Ajax Client Server Architecture-XML Http Request Object-Call Back Methods; **Web Services:** Introduction- Java web services Basics – Creating, Publishing ,Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application – SOAP.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Implement Java programs.
- Create a basic website using HTML and Cascading Style Sheets.
- Design and implement dynamic web page with validation using JavaScript objects and by applying different event handling mechanisms.
- Design rich client presentation using AJAX.
- Design and implement simple web page in PHP, and to present data in XML format.
- Design and implement server side programs using Servlets and JSP.

**TEXT BOOKS:**

1. Deitel and Deitel and Nieto, "Internet and World Wide Web - How to Program", Prentice Hall, 5<sup>th</sup> Edition, 2011.
2. Herbert Schildt, "Java-The Complete Reference", Eighth Edition, Mc Graw Hill Professional, 2011.

**REFERENCES:**

1. Stephen Wynkoop and John Burke "Running a Perfect Website", QUE, 2<sup>nd</sup> Edition, 1999.
2. Chris Bates, Web Programming – Building Intranet Applications, 3<sup>rd</sup> Edition, Wiley Publications, 2009.
3. Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective", Pearson Education, 2011.
4. Gopalan N.P. and Akilandeswari J., "Web Technology", Prentice Hall of India, 2011.
5. Paul Dietel and Harvey Deitel, "Java How to Program", , 8<sup>th</sup> Edition Prentice Hall of India.
6. Mahesh P. Matha, "Core Java A Comprehensive Study", Prentice Hall of India, 2011.
7. Uttam K.Roy, "Web Technologies", Oxford University Press, 2011.

**CS6502****OBJECT ORIENTED ANALYSIS AND DESIGN****L T P C**  
**3 0 0 3****OBJECTIVES:****The student should be made to:**

- Learn the basics of OO analysis and design skills.
- Learn the UML design diagrams.
- Learn to map design to code.
- Be exposed to the various testing techniques.

**UNIT I UML DIAGRAMS****9**

Introduction to OOAD – Unified Process - UML diagrams – Use Case – Class Diagrams– Interaction Diagrams – State Diagrams – Activity Diagrams – Package, component and Deployment Diagrams.

**UNIT II DESIGN PATTERNS****9**

GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller - Design Patterns – creational - factory method - structural – Bridge – Adapter - behavioral – Strategy – observer.

**UNIT III CASE STUDY****9**

Case study – the Next Gen POS system, Inception -Use case Modeling - Relating Use cases – include, extend and generalization - Elaboration - Domain Models - Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies - Aggregation and Composition.

**UNIT IV APPLYING DESIGN PATTERNS****9**

System sequence diagrams - Relationship between sequence diagrams and use cases Logical architecture and UML package diagram – Logical architecture refinement - UML class diagrams - UML interaction diagrams - Applying GoF design patterns.

**UNIT V CODING AND TESTING****9**

Mapping design to code – Testing: Issues in OO Testing – Class Testing – OO Integration Testing – GUI Testing – OO System Testing.

**TOTAL: 45 PERIODS**

## OUTCOMES:

At the end of the course, the student should be able to:

- Design and implement projects using OO concepts.
- Use the UML analysis and design diagrams.
- Apply appropriate design patterns.
- Create code from design.
- Compare and contrast various testing techniques.

## TEXT BOOK:

1. Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", Third Edition, Pearson Education, 2005.

## REFERENCES:

1. Simon Bennett, Steve Mc Robb and Ray Farmer, "Object Oriented Systems Analysis and Design Using UML", Fourth Edition, Mc-Graw Hill Education, 2010.
2. Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, "Design patterns: Elements of Reusable Object-Oriented Software", Addison-Wesley, 1995.
3. Martin Fowler, "UML Distilled: A Brief Guide to the Standard Object Modeling Language", Third edition, Addison Wesley, 2003.
4. Paul C. Jorgensen, "Software Testing:- A Craftsman's Approach", Third Edition, Auerbach Publications, Taylor and Francis Group, 2008.

CS6503

THEORY OF COMPUTATION

L T P C  
3 0 0 3

## OBJECTIVES:

The student should be made to:

- Understand various Computing models like Finite State Machine, Pushdown Automata, and Turing Machine.
- Be aware of Decidability and Un-decidability of various problems.
- Learn types of grammars.

## UNIT I FINITE AUTOMATA

9

Introduction- Basic Mathematical Notation and techniques- Finite State systems – Basic Definitions – Finite Automaton – DFA & NFA – Finite Automaton with  $\epsilon$ - moves – Regular Languages- Regular Expression – Equivalence of NFA and DFA – Equivalence of NFA's with and without  $\epsilon$ -moves – Equivalence of finite Automaton and regular expressions –Minimization of DFA- - Pumping Lemma for Regular sets – Problems based on Pumping Lemma.

## UNIT II GRAMMARS

9

Grammar Introduction– Types of Grammar - Context Free Grammars and Languages– Derivations and Languages – Ambiguity- Relationship between derivation and derivation trees – Simplification of CFG – Elimination of Useless symbols - Unit productions - Null productions – Greiback Normal form – Chomsky normal form – Problems related to CNF and GNF.

## UNIT III PUSHDOWN AUTOMATA

9

Pushdown Automata- Definitions – Moves – Instantaneous descriptions – Deterministic pushdown automata – Equivalence of Pushdown automata and CFL - pumping lemma for CFL – problems based on pumping Lemma.

**UNIT IV TURING MACHINES 9**

Definitions of Turing machines – Models – Computable languages and functions –Techniques for Turing machine construction – Multi head and Multi tape Turing Machines - The Halting problem – Partial Solvability – Problems about Turing machine- Chomskian hierarchy of languages.

**UNIT V UNSOLVABLE PROBLEMS AND COMPUTABLE FUNCTIONS 9**

Unsolvable Problems and Computable Functions – Primitive recursive functions – Recursive and recursively enumerable languages – Universal Turing machine. MEASURING AND CLASSIFYING COMPLEXITY: Tractable and Intractable problems- Tractable and possibly intractable problems - P and NP completeness - Polynomial time reductions.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design Finite State Machine, Pushdown Automata, and Turing Machine.
- Explain the Decidability or Undecidability of various problems

**TEXT BOOKS:**

1. Hopcroft J.E., Motwani R. and Ullman J.D, “Introduction to Automata Theory, Languages and Computations”, Second Edition, Pearson Education, 2008. (UNIT 1,2,3)
2. John C Martin, “Introduction to Languages and the Theory of Computation”, Third Edition, Tata McGraw Hill Publishing Company, New Delhi, 2007. (UNIT 4,5)

**REFERENCES:**

1. Mishra K L P and Chandrasekaran N, “Theory of Computer Science - Automata, Languages and Computation”, Third Edition, Prentice Hall of India, 2004.
2. Harry R Lewis and Christos H Papadimitriou, “Elements of the Theory of Computation”, Second Edition, Prentice Hall of India, Pearson Education, New Delhi, 2003.
3. Peter Linz, “An Introduction to Formal Language and Automata”, Third Edition, Narosa Publishers, New Delhi, 2002.
4. Kamala Krithivasan and Rama. R, “Introduction to Formal Languages, Automata Theory and Computation”, Pearson Education 2009

**CS6504**

**COMPUTER GRAPHICS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Gain knowledge about graphics hardware devices and software used.
- Understand the two dimensional graphics and their transformations.
- Understand the three dimensional graphics and their transformations.
- Appreciate illumination and color models.
- Be familiar with understand clipping techniques.

**UNIT I INTRODUCTION 9**

Survey of computer graphics, Overview of graphics systems – Video display devices, Raster scan systems, Random scan systems, Graphics monitors and Workstations, Input devices, Hard copy Devices, Graphics Software; Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.

## **UNIT II TWO DIMENSIONAL GRAPHICS**

**9**

Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; window-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.

## **UNIT III THREE DIMENSIONAL GRAPHICS**

**10**

Three dimensional concepts; Three dimensional object representations – Polygon surfaces- Polygon tables- Plane equations - Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces -B-Spline curves and surfaces. TRANSFORMATION AND VIEWING: Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.

## **UNIT IV ILLUMINATION AND COLOUR MODELS**

**7**

Light sources - basic illumination models – halftone patterns and dithering techniques; Properties of light - Standard primaries and chromaticity diagram; Intuitive colour concepts - RGB colour model - YIQ colour model - CMY colour model - HSV colour model - HLS colour model; Colour selection.

## **UNIT V ANIMATIONS & REALISM**

**10**

**ANIMATION GRAPHICS:** Design of Animation sequences – animation function – raster animation – key frame systems – motion specification –morphing – tweening. **COMPUTER GRAPHICS REALISM:** Tiling the plane – Recursively defined curves – Koch curves – C curves – Dragons – space filling curves – fractals – Grammar based models – fractals – turtle graphics – ray tracing.

**TOTAL: 45 PERIODS**

### **OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design two dimensional graphics.
- Apply two dimensional transformations.
- Design three dimensional graphics.
- Apply three dimensional transformations.
- Apply Illumination and color models.
- Apply clipping techniques to graphics.
- Design animation sequences.

### **TEXT BOOKS:**

1. John F. Hughes, Andries Van Dam, Morgan Mc Guire ,David F. Sklar , James D. Foley, Steven K. Feiner and Kurt Akeley ,”Computer Graphics: Principles and Practice”, , 3<sup>rd</sup> Edition, Addison-Wesley Professional,2013. (UNIT I, II, III, IV).
2. Donald Hearn and Pauline Baker M, “Computer Graphics”, Prentice Hall, New Delhi, 2007 (UNIT V).

### **REFERENCES:**

1. Donald Hearn and M. Pauline Baker, Warren Carithers,“Computer Graphics With Open GL”, 4<sup>th</sup> Edition, Pearson Education, 2010.
2. Jeffrey McConnell, “Computer Graphics: Theory into Practice”, Jones and Bartlett Publishers, 2006.
3. Hill F S Jr., "Computer Graphics", Maxwell Macmillan” , 1990.
4. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, Kelvin Sung, and AK Peters, Fundamental of Computer Graphics, CRC Press, 2010.
5. William M. Newman and Robert F.Sproull, “Principles of Interactive Computer Graphics”, Mc Graw Hill 1978.
6. <http://nptel.ac.in/>

**OBJECTIVES:**

**The student should be made to:**

- Learn the basics of OO analysis and design skills.
- Be exposed to the UML design diagrams.
- Learn to map design to code.
- Be familiar with the various testing techniques

**LIST OF EXPERIMENTS:**

**To develop a mini-project by following the 9 exercises listed below.**

1. To develop a problem statement.
2. Identify Use Cases and develop the Use Case model.
3. Identify the conceptual classes and develop a domain model with UML Class diagram.
4. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence diagrams.
5. Draw relevant state charts and activity diagrams.
6. Identify the User Interface, Domain objects, and Technical services. Draw the partial layered, logical architecture diagram with UML package diagram notation.
7. Develop and test the Technical services layer.
8. Develop and test the Domain objects layer.
9. Develop and test the User interface layer.

**SUGGESTED DOMAINS FOR MINI-PROJECT:**

1. Passport automation system.
2. Book bank
3. Exam Registration
4. Stock maintenance system.
5. Online course reservation system
6. E-ticketing
7. Software personnel management system
8. Credit card processing
9. e-book management system
10. Recruitment system
11. Foreign trading system
12. Conference Management System
13. BPO Management System
14. Library Management System
15. Student Information System

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to**

- Design and implement projects using OO concepts.
- Use the UML analysis and design diagrams.
- Apply appropriate design patterns.
- Create code from design.
- Compare and contrast various testing techniques

## LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

### Suggested Software Tools:

Rational Suite (or) Argo UML (or) equivalent, Eclipse IDE and Junit

### Software Tools

30 user License

Rational Suite

Open Source Alternatives: ArgoUML, Visual

Paradigm

Eclipse IDE and JUnit

PCs

30

CS6512

INTERNET PROGRAMMING LABORATORY

L T P C

0 0 3 2

### OBJECTIVES:

The student should be made to:

- Be familiar with Web page design using HTML/XML and style sheets
- Be exposed to creation of user interfaces using Java frames and applets.
- Learn to create dynamic web pages using server side scripting.
- Learn to write Client Server applications.
- Be familiar with the frameworks JSP Strut, Hibernate, Spring
- Be exposed to creating applications with AJAX

### LIST OF EXPERIMENTS:

#### IMPLEMENT THE FOLLOWING:

#### WEBPAGE CONCEPTS

- a) Create a web page with the following using HTML
  - a. To embed a map in a web page
  - b. To fix the hot spots in that map
  - c. Show all the related information when the hot spots are clicked.
- b) Create a web page with the following.
  - a. Cascading style sheets.
  - b. Embedded style sheets.
  - c. Inline style sheets. Use our college information for the web pages.
- c) Create and save an XML document at the server, which contains 10 users Information. Write a Program, which takes user Id as an input and returns the User details by taking the user information from the XML document.

#### SOCKETS & SERVLETS

- a) Write programs in Java using sockets to implement the following:
  - i. HTTP request
  - ii. FTP
  - iii. SMTP
  - iv. POP3
- b) Write a program in Java for creating simple chat application with datagram sockets and datagram packets.
- c) Write programs in Java using Servlets:
  - i. To invoke servlets from HTML forms



**LIST OF EXPERIMENTS:**

**IMPLEMENT THE EXERCISES USING C / OPENGL / JAVA**

1. Implementation of Algorithms for drawing 2D Primitives – Line (DDA, Bresenham) – all slopes  
Circle (Midpoint)
2. 2D Geometric transformations –  
Translation  
Rotation Scaling  
Reflection Shear  
Window-Viewport
3. Composite 2D Transformations
4. Line Clipping
5. 3D Transformations - Translation, Rotation, Scaling.
6. 3D Projections – Parallel, Perspective.
7. Creating 3D Scenes.
8. Image Editing and Manipulation - Basic Operations on image using any image editing software, Creating gif animated images, Image optimization.
9. 2D Animation – To create Interactive animation using any authoring tool.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to**

- Create 3D graphical scenes using open graphics library suits
- Implement image manipulation and enhancement
- Create 2D animations using tools

**REFERENCE:**

[spoken-tutorial.org](http://spoken-tutorial.org)

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

**SOFTWARE**

C, C++, Java, OpenGL

**HARDWARE:**

Standalone desktops - 30 Nos.  
(or)  
Server supporting 30 terminals or more.

**CS6601**

**DISTRIBUTED SYSTEMS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Understand foundations of Distributed Systems.
- Introduce the idea of peer to peer services and file system.
- Understand in detail the system level and support required for distributed system.
- Understand the issues involved in studying process and resource management.

## UNIT I INTRODUCTION

7

Examples of Distributed Systems–Trends in Distributed Systems – Focus on resource sharing – Challenges. **Case study:** World Wide Web.

## UNIT II COMMUNICATION IN DISTRIBUTED SYSTEM

10

System Model – Inter process Communication - the API for internet protocols – External data representation and Multicast communication. **Network virtualization:** Overlay networks. **Case study:** MPI **Remote Method Invocation And Objects:** Remote Invocation – Introduction - Request-reply protocols - Remote procedure call - Remote method invocation. **Case study:** Java RMI - Group communication - Publish-subscribe systems - Message queues - Shared memory approaches - Distributed objects - Case study: Enterprise Java Beans -from objects to components.

## UNIT III PEER TO PEER SERVICES AND FILE SYSTEM

10

Peer-to-peer Systems – Introduction - Napster and its legacy - Peer-to-peer – Middleware - Routing overlays. **Overlay case studies:** Pastry, Tapestry- Distributed File Systems –Introduction - File service architecture – Andrew File system. **File System:** Features-File model -File accessing models - File sharing semantics **Naming:** Identifiers, Addresses, Name Resolution – Name Space Implementation – Name Caches – LDAP.

## UNIT IV SYNCHRONIZATION AND REPLICATION

9

Introduction - Clocks, events and process states - Synchronizing physical clocks- Logical time and logical clocks - Global states – Coordination and Agreement – Introduction - Distributed mutual exclusion – Elections – Transactions and Concurrency Control– Transactions -Nested transactions – Locks – Optimistic concurrency control - Timestamp ordering – Atomic Commit protocols -Distributed deadlocks – Replication – Case study – Coda.

## UNIT V PROCESS & RESOURCE MANAGEMENT

9

**Process Management:** Process Migration: Features, Mechanism - Threads: Models, Issues, Implementation. **Resource Management:** Introduction- Features of Scheduling Algorithms –Task Assignment Approach – Load Balancing Approach – Load Sharing Approach.

**TOTAL: 45 PERIODS**

### OUTCOMES:

**At the end of the course, the student should be able to:**

- Discuss trends in Distributed Systems.
- Apply network virtualization.
- Apply remote method invocation and objects.
- Design process and resource management systems.

### TEXT BOOK:

1. George Coulouris, Jean Dollimore and Tim Kindberg, “Distributed Systems Concepts and Design”, Fifth Edition, Pearson Education, 2012.

### REFERENCES:

1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
2. Tanenbaum A.S., Van Steen M., “Distributed Systems: Principles and Paradigms”, Pearson Education, 2007.
3. Liu M.L., “Distributed Computing, Principles and Applications”, Pearson Education, 2004.
4. Nancy A Lynch, “Distributed Algorithms”, Morgan Kaufman Publishers, USA, 2003.

**OBJECTIVES:****The student should be made to:**

- Understand the basic concepts of mobile computing
- Be familiar with the network protocol stack
- Learn the basics of mobile telecommunication system
- Be exposed to Ad-Hoc networks
- Gain knowledge about different mobile platforms and application development

**UNIT I INTRODUCTION****9**

Mobile Computing – Mobile Computing Vs wireless Networking – Mobile Computing Applications – Characteristics of Mobile computing – Structure of Mobile Computing Application. MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes.

**UNIT II MOBILE INTERNET PROTOCOL AND TRANSPORT LAYER****9**

Overview of Mobile IP – Features of Mobile IP – Key Mechanism in Mobile IP – route Optimization. Overview of TCP/IP – Architecture of TCP/IP- Adaptation of TCP Window – Improvement in TCP Performance.

**UNIT III MOBILE TELECOMMUNICATION SYSTEM****9**

Global System for Mobile Communication (GSM) – General Packet Radio Service (GPRS) – Universal Mobile Telecommunication System (UMTS).

**UNIT IV MOBILE AD-HOC NETWORKS****9**

Ad-Hoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols – Popular Routing Protocols – Vehicular Ad Hoc networks ( VANET) – MANET Vs VANET – Security.

**UNIT V MOBILE PLATFORMS AND APPLICATIONS****9**

Mobile Device Operating Systems – Special Constrains & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – M-Commerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Explain the basics of mobile telecommunication system
- Choose the required functionality at each layer for given application
- Identify solution for each functionality at each layer
- Use simulator tools and design Ad hoc networks
- Develop a mobile application.

**TEXT BOOK:**

1. Prasant Kumar Pattnaik, Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt. Ltd, New Delhi – 2012.

## REFERENCES:

1. Jochen H. Schller, "Mobile Communications", Second Edition, Pearson Education, New Delhi, 2007.
2. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
3. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.
4. William.C.Y.Lee,"Mobile Cellular Telecommunications-Analog and Digital Systems", Second Edition,Tata Mc Graw Hill Edition ,2006.
5. C.K.Toth, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.
6. Android Developers : <http://developer.android.com/index.html>
7. Apple Developer : <https://developer.apple.com/>
8. Windows Phone Dev Center : <http://developer.windowsphone.com>
9. BlackBerry Developer : <http://developer.blackberry.com/>

**CS6660**

**COMPILER DESIGN**

**L T P C**  
**3 0 0 3**

## OBJECTIVES:

**The student should be made to:**

- Learn the design principles of a Compiler.
- Learn the various parsing techniques and different levels of translation
- Learn how to optimize and effectively generate machine codes

### **UNIT I INTRODUCTION TO COMPILERS**

**5**

Translators-Compilation and Interpretation-Language processors -The Phases of Compiler-Errors Encountered in Different Phases-The Grouping of Phases-Compiler Construction Tools - Programming Language basics.

### **UNIT II LEXICAL ANALYSIS**

**9**

Need and Role of Lexical Analyzer-Lexical Errors-Expressing Tokens by Regular Expressions-Converting Regular Expression to DFA- Minimization of DFA-Language for Specifying Lexical Analyzers-LEX-Design of Lexical Analyzer for a sample Language.

### **UNIT III SYNTAX ANALYSIS**

**10**

Need and Role of the Parser-Context Free Grammars -Top Down Parsing -General Strategies-Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0)Item-Construction of SLR Parsing Table -Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC-Design of a syntax Analyzer for a Sample Language .

### **UNIT IV SYNTAX DIRECTED TRANSLATION & RUN TIME ENVIRONMENT**

**12**

Syntax directed Definitions-Construction of Syntax Tree-Bottom-up Evaluation of S-Attribute Definitions- Design of predictive translator - Type Systems-Specification of a simple type checker-Equivalence of Type Expressions-Type Conversions.

**RUN-TIME ENVIRONMENT:** Source Language Issues-Storage Organization-Storage Allocation-Parameter Passing-Symbol Tables-Dynamic Storage Allocation-Storage Allocation in FORTAN.

## UNIT V CODE OPTIMIZATION AND CODE GENERATION

9

Principal Sources of Optimization-DAG- Optimization of Basic Blocks-Global Data Flow Analysis-Efficient Data Flow Algorithms-Issues in Design of a Code Generator - A Simple Code Generator Algorithm.

**TOTAL: 45 PERIODS**

### OUTCOMES:

**At the end of the course, the student should be able to:**

- Design and implement a prototype compiler.
- Apply the various optimization techniques.
- Use the different compiler construction tools.

### TEXTBOOK:

1. Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, "Compilers – Principles, Techniques and Tools", 2<sup>nd</sup> Edition, Pearson Education, 2007.

### REFERENCES:

1. Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence-based Approach", Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
3. Keith D Cooper and Linda Torczon, "Engineering a Compiler", Morgan Kaufmann Publishers Elsevier Science, 2004.
4. Charles N. Fischer, Richard. J. LeBlanc, "Crafting a Compiler with C", Pearson Education, 2008.

IT6502

**DIGITAL SIGNAL PROCESSING**

**L T P C**  
**3 1 0 4**

### OBJECTIVES:

- To introduce discrete Fourier transform and its applications.
- To teach the design of infinite and finite impulse response filters for filtering undesired signals.
- To introduce signal processing concepts in systems having more than one sampling frequency.

## UNIT I SIGNALS AND SYSTEMS

9

Basic elements of DSP – concepts of frequency in Analog and Digital Signals – sampling theorem – Discrete – time signals, systems – Analysis of discrete time LTI systems – Z transform – Convolution – Correlation.

## UNIT II FREQUENCY TRANSFORMATIONS

9

Introduction to DFT – Properties of DFT – Circular Convolution - Filtering methods based on DFT – FFT Algorithms - Decimation – in – time Algorithms, Decimation – in – frequency Algorithms – Use of FFT in Linear Filtering – DCT – Use and Application of DCT.

## UNIT III IIR FILTER DESIGN

9

Structures of IIR – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives – (LPF, HPF, BPF, BRF) filter design using frequency translation.

**UNIT IV FIR FILTER DESIGN****9**

Structures of FIR – Linear phase FIR filter – Fourier Series - Filter design using windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques

**UNIT V FINITE WORD LENGTH EFFECTS IN DIGITAL FILTERS****9**

Binary fixed point and floating point number representations – Comparison - Quantization noise – truncation and rounding – quantization noise power- input quantization error- coefficient quantization error – limit cycle oscillations-dead band- Overflow error-signal scaling.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES:****Upon completion of the course, students will be able to:**

- Perform frequency transforms for the signals.
- Design IIR and FIR filters.
- Finite word length effects in digital filters

**TEXT BOOK:**

1. John G. Proakis and Dimitris G.Manolakis, “Digital Signal Processing – Principles, Algorithms & Applications”, Fourth Edition, Pearson Education, Prentice Hall, 2007.

**REFERENCES:**

1. Emmanuel C.Ifeachor, and Barrie.W.Jervis, “Digital Signal Processing”, Second Edition, Pearson Education, Prentice Hall, 2002.
2. Sanjit K. Mitra, “Digital Signal Processing – A Computer Based Approach”, Third Edition, Tata Mc Graw Hill, 2007.
3. A.V.Oppenheim, R.W. Schafer and J.R. Buck, Discrete-Time Signal Processing, 8<sup>th</sup> Indian Reprint, Pearson, 2004.
4. Andreas Antoniou, “Digital Signal Processing”, Tata McGraw Hill, 2006.

**CS6659****ARTIFICIAL INTELLIGENCE****L T P C  
3 0 0 3****OBJECTIVES:****The student should be made to:**

- Study the concepts of Artificial Intelligence.
- Learn the methods of solving problems using Artificial Intelligence.
- Introduce the concepts of Expert Systems and machine learning.

**UNIT I INTRODUCTION TO AI AND PRODUCTION SYSTEMS****9**

Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics -Specialized production system- Problem solving methods - Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraints satisfaction - Related algorithms, Measure of performance and analysis of search algorithms.

**UNIT II REPRESENTATION OF KNOWLEDGE****9**

Game playing - Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge.

**UNIT III KNOWLEDGE INFERENCE 9**  
Knowledge representation -Production based system, Frame based system. Inference - Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning - Certainty factors, Bayesian Theory-Bayesian Network-Dempster - Shafer theory.

**UNIT IV PLANNING AND MACHINE LEARNING 9**  
Basic plan generation systems - Strips -Advanced plan generation systems – K strips -Strategic explanations -Why, Why not and how explanations. Learning- Machine learning, adaptive Learning.

**UNIT V EXPERT SYSTEMS 9**  
Expert systems - Architecture of expert systems, Roles of expert systems - Knowledge Acquisition – Meta knowledge, Heuristics. Typical expert systems - MYCIN, DART, XOON, Expert systems shells.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Identify problems that are amenable to solution by AI methods.
- Identify appropriate AI methods to solve a given problem.
- Formalise a given problem in the language/framework of different AI methods.
- Implement basic AI algorithms.
- Design and carry out an empirical evaluation of different algorithms on a problem formalisation, and state the conclusions that the evaluation supports.

**TEXT BOOKS:**

1. Kevin Night and Elaine Rich, Nair B., “Artificial Intelligence (SIE)”, Mc Graw Hill- 2008. (Units-I,II,VI & V)
2. Dan W. Patterson, “Introduction to AI and ES”, Pearson Education, 2007. (Unit-III).

**REFERENCES:**

1. Peter Jackson, “Introduction to Expert Systems”, 3<sup>rd</sup> Edition, Pearson Education, 2007.
2. Stuart Russel and Peter Norvig “AI – A Modern Approach”, 2<sup>nd</sup> Edition, Pearson Education 2007.
3. Deepak Khemani “Artificial Intelligence”, Tata Mc Graw Hill Education 2013.
4. <http://nptel.ac.in>

**CS6611 MOBILE APPLICATION DEVELOPMENT LABORATORY L T P C**  
**0 0 3 2**

**OBJECTIVES:**

**The student should be made to:**

- Know the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
- Understand how to work with various mobile application development frameworks.
- Learn the basic and important design concepts and issues of development of mobile applications.
- Understand the capabilities and limitations of mobile devices.

**LIST OF EXPERIMENTS:**

1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.

5. Develop an application that makes use of database.
6. Develop an application that makes use of RSS Feed.
7. Implement an application that implements Multi threading
8. Develop a native application that uses GPS location information.
9. Implement an application that writes data to the SD card.
10. Implement an application that creates an alert upon receiving a message.
11. Write a mobile application that creates alarm clock

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design and Implement various mobile applications using emulators.
- Deploy applications to hand-held devices

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

Standalone desktops with Windows or Android or iOS or Equivalent Mobile Application Development Tools with appropriate emulators and debuggers - 30 Nos.

**CS6612**

**COMPILER LABORATORY**

**L T P C  
0 0 3 2**

**OBJECTIVES:**

**The student should be made to:**

- Be exposed to compiler writing tools.
- Learn to implement the different Phases of compiler
- Be familiar with control flow and data flow analysis
- Learn simple optimization techniques

**LIST OF EXPERIMENTS:**

1. Implementation of Symbol Table
2. Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.)
3. Implementation of Lexical Analyzer using Lex Tool
4. Generate YACC specification for a few syntactic categories.
  - a) Program to recognize a valid arithmetic expression that uses operator +, -, \*, /.
  - b) Program to recognize a valid variable which starts with a letter followed by any number of letters or digits.
  - d) Implementation of Calculator using LEX and YACC
5. Convert the BNF rules into Yacc form and write code to generate Abstract Syntax Tree.
6. Implement type checking
7. Implement control flow analysis and Data flow Analysis
8. Implement any one storage allocation strategies(Heap,Stack,Static)
9. Construction of DAG
10. Implement the back end of the compiler which takes the three address code and produces the 8086 assembly language instructions that can be assembled and run using a 8086 assembler. The target assembly instructions can be simple move, add, sub, jump. Also simple addressing modes are used.
11. Implementation of Simple Code Optimization Techniques (Constant Folding., etc.)

**TOTAL: 45 PERIODS**



**UNIT V SOFT SKILLS****12**

**Motivation- emotional intelligence-**Multiple intelligences- emotional intelligence- managing changes-time management-stress management-leadership straits-team work- career planning - intercultural communication- creative and critical thinking

**TOTAL: 60 PERIODS****Teaching Methods:**

1. To be totally learner-centric with minimum teacher intervention as the course revolves around practice.
2. Suitable audio/video samples from Podcast/YouTube to be used for illustrative purposes.
3. Portfolio approach for writing to be followed. Learners are to be encouraged to blog, tweet, text and email employing appropriate language.
4. GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.
5. Learners are to be assigned to read/write/listen/view materials outside the classroom as well for gaining proficiency and better participation in the class.

**Lab Infrastructure:**

<b>S. No.</b>	<b>Description of Equipment (minimum configuration)</b>	<b>Qty Required</b>
1	<b>Server</b>	1 No.
	• PIV System	
	• 1 GB RAM / 40 GB HDD	
	• OS: Win 2000 server	
	• Audio card with headphones	
2	<b>Client Systems</b>	60 Nos.
	• PIII or above	
	• 256 or 512 MB RAM / 40 GB HDD	
	• OS: Win 2000	
	• Audio card with headphones	
• JRE 1.3		
3	Handicam	1 No.
4	Television 46"	1 No.
5	Collar mike	1 No.
6	Cordless mike	1 No.
7	Audio Mixer	1 No.
8	DVD recorder/player	1 No.
9	LCD Projector with MP3/CD/DVD provision for Audio/video facility	1 No.

## **Evaluation:**

### **Internal: 20 marks**

Record maintenance: Students should write a report on a regular basis on the activities conducted, focusing on the details such as the description of the activity, ideas emerged, learning outcomes and so on. At the end of the semester records can be evaluated out of 20 marks.

### **External: 80 marks**

Online Test	- 35 marks
Interview	- 15 marks
Presentation	- 15 marks
Group Discussion	- 15 marks

### **Note on Internal and External Evaluation:**

1. Interview – mock interview can be conducted on one-on-one basis.
2. Speaking – example for role play:
  - a. Marketing engineer convincing a customer to buy his product.
  - b. Telephonic conversation- fixing an official appointment / placing an order / enquiring and so on.
3. Presentation – should be extempore on simple topics.
4. Discussion – topics of different kinds; general topics, and case studies.

## **OUTCOMES:**

### **At the end of the course, learners should be able to**

- Take international examination such as IELTS and TOEFL
- Make presentations and Participate in Group Discussions.
- Successfully answer questions in interviews.

## **REFERENCES:**

1. **Business English Certificate Materials**, Cambridge University Press.
2. **Graded Examinations in Spoken English and Spoken English for Work** downloadable materials from Trinity College, London.
3. **International English Language Testing System** Practice Tests, Cambridge University Press.
4. Interactive Multimedia Programs on **Managing Time and Stress**.
5. **Personality Development** (CD-ROM), Times Multimedia, Mumbai.
6. Robert M Sherfield and et al. “**Developing Soft Skills**” 4th edition, New Delhi: Pearson Education, 2009.

## **Web Sources:**

<http://www.slideshare.net/rohitjsh/presentation-on-group-discussion>

[http://www.washington.edu/doi/TeamN/present\\_tips.html](http://www.washington.edu/doi/TeamN/present_tips.html)

<http://www.oxforddictionaries.com/words/writing-job-applications>

<http://www.kent.ac.uk/careers/cv/coveringletters.htm>

[http://www.mindtools.com/pages/article/newCDV\\_34.htm](http://www.mindtools.com/pages/article/newCDV_34.htm)

**OBJECTIVES:****The student should be made to:**

- Understand OSI security architecture and classical encryption techniques.
- Acquire fundamental knowledge on the concepts of finite fields and number theory.
- Understand various block cipher and stream cipher models.
- Describe the principles of public key cryptosystems, hash functions and digital signature.

**UNIT I INTRODUCTION & NUMBER THEORY 10**

Services, Mechanisms and attacks-the OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography).FINITE FIELDS AND NUMBER THEORY: Groups, Rings, Fields-Modular arithmetic-Euclid's algorithm-Finite fields- Polynomial Arithmetic –Prime numbers-Fermat's and Euler's theorem-Testing for primality -The Chinese remainder theorem- Discrete logarithms.

**UNIT II BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY 10**

Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. **Public key cryptography:** Principles of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography.

**UNIT III HASH FUNCTIONS AND DIGITAL SIGNATURES 8**

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS – El Gamal – Schnorr.

**UNIT IV SECURITY PRACTICE & SYSTEM SECURITY 8**

Authentication applications – Kerberos – X.509 Authentication services - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security.

**UNIT V E-MAIL, IP & WEB SECURITY 9**

**E-mail Security:** Security Services for E-mail-attacks possible through E-mail - establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. **IPSecurity:** Overview of IPSec - IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). **Web Security:** SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSLAttacks fixed in v3-Exportability-Encoding-Secure Electronic Transaction (SET).

**TOTAL: 45 PERIODS****OUTCOMES:****Upon Completion of the course, the students should be able to:**

- Compare various Cryptographic Techniques
- Design Secure applications
- Inject secure coding in the developed applications

**TEXT BOOKS:**

1. William Stallings, Cryptography and Network Security, 6<sup>th</sup> Edition, Pearson Education, March 2013. (UNIT I,II,III,IV).
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", Prentice Hall of India, 2002. (UNIT V).

**REFERENCES:**

1. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 2007.
2. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.
3. Charles Pfleeger, "Security in Computing", 4<sup>th</sup> Edition, Prentice Hall of India, 2006.
4. Ulysess Black, "Internet Security Protocols", Pearson Education Asia, 2000.
5. Charlie Kaufman and Radia Perlman, Mike Speciner, "Network Security, Second Edition, Private Communication in Public World", PHI 2002.
6. Bruce Schneier and Neils Ferguson, "Practical Cryptography", First Edition, Wiley Dreamtech India Pvt Ltd, 2003.
7. Douglas R Simson "Cryptography – Theory and practice", First Edition, CRC Press, 1995.
8. <http://nptel.ac.in/>.

**CS6702****GRAPH THEORY AND APPLICATIONS****L T P C  
3 0 0 3****OBJECTIVES:****The student should be made to:**

- Be familiar with the most fundamental Graph Theory topics and results.
- Be exposed to the techniques of proofs and analysis.

**UNIT I INTRODUCTION****9**

Graphs – Introduction – Isomorphism – Sub graphs – Walks, Paths, Circuits –Connectedness – Components – Euler graphs – Hamiltonian paths and circuits – Trees – Properties of trees – Distance and centers in tree – Rooted and binary trees.

**UNIT II TREES, CONNECTIVITY & PLANARITY****9**

Spanning trees – Fundamental circuits – Spanning trees in a weighted graph – cut sets – Properties of cut set – All cut sets – Fundamental circuits and cut sets – Connectivity and separability – Network flows – 1-Isomorphism – 2-Isomorphism – Combinational and geometric graphs – Planer graphs – Different representation of a planer graph.

**UNIT III MATRICES, COLOURING AND DIRECTED GRAPH****8**

Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering – Four color problem – Directed graphs – Types of directed graphs – Digraphs and binary relations – Directed paths and connectedness – Euler graphs.

**UNIT IV PERMUTATIONS & COMBINATIONS****9**

Fundamental principles of counting - Permutations and combinations - Binomial theorem - combinations with repetition - Combinatorial numbers - Principle of inclusion and exclusion - Derangements - Arrangements with forbidden positions.

## UNIT V GENERATING FUNCTIONS

10

Generating functions - Partitions of integers - Exponential generating function – Summation operator - Recurrence relations - First order and second order – Non-homogeneous recurrence relations - Method of generating functions.

**TOTAL: 45 PERIODS**

### OUTCOMES:

**Upon Completion of the course, the students should be able to:**

- Write precise and accurate mathematical definitions of objects in graph theory.
- Use mathematical definitions to identify and construct examples and to distinguish examples from non-examples.
- Validate and critically assess a mathematical proof.
- Use a combination of theoretical knowledge and independent mathematical thinking in creative investigation of questions in graph theory.
- Reason from definitions to construct mathematical proofs.

### TEXT BOOKS:

1. Narsingh Deo, "Graph Theory: With Application to Engineering and Computer Science", Prentice Hall of India, 2003.
2. Grimaldi R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", Addison Wesley, 1994.

### REFERENCES:

1. Clark J. and Holton D.A, "A First Look at Graph Theory", Allied Publishers, 1995.
2. Mott J.L., Kandel A. and Baker T.P. "Discrete Mathematics for Computer Scientists and Mathematicians", Prentice Hall of India, 1996.
3. Liu C.L., "Elements of Discrete Mathematics", Mc Graw Hill, 1985.
4. Rosen K.H., "Discrete Mathematics and Its Applications", Mc Graw Hill, 2007.

**CS6703**

**GRID AND CLOUD COMPUTING**

**L T P C  
3 0 0 3**

### OBJECTIVES:

**The student should be made to:**

- Understand how Grid computing helps in solving large scale scientific problems.
- Gain knowledge on the concept of virtualization that is fundamental to cloud computing.
- Learn how to program the grid and the cloud.
- Understand the security issues in the grid and the cloud environment.

## UNIT I INTRODUCTION

9

Evolution of Distributed computing: Scalable computing over the Internet – Technologies for network based systems – clusters of cooperative computers - Grid computing Infrastructures – cloud computing - service oriented architecture – Introduction to Grid Architecture and standards – Elements of Grid – Overview of Grid Architecture.

**UNIT II GRID SERVICES****9**

Introduction to Open Grid Services Architecture (OGSA) – Motivation – Functionality Requirements – Practical & Detailed view of OGSA/OGSI – Data intensive grid service models – OGSA services.

**UNIT III VIRTUALIZATION****9**

Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software - Pros and Cons of cloud computing – Implementation levels of virtualization – virtualization structure – virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management – Virtualization for data center automation.

**UNIT IV PROGRAMMING MODEL****9**

Open source grid middleware packages – Globus Toolkit (GT4) Architecture , Configuration – Usage of Globus – Main components and Programming model - Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job – Design of Hadoop file system, HDFS concepts, command line and java interface, dataflow of File read & File write.

**UNIT V SECURITY****9**

Trust models for Grid security environment – Authentication and Authorization methods – Grid security infrastructure – Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud, Key privacy issues in the cloud.

**TOTAL: 45 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- Apply grid computing techniques to solve large scale scientific problems.
- Apply the concept of virtualization.
- Use the grid and cloud tool kits.
- Apply the security models in the grid and the cloud environment.

**TEXT BOOK:**

1. Kai Hwang, Geoffery C. Fox and Jack J. Dongarra, “Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future of Internet”, First Edition, Morgan Kaufman Publisher, an Imprint of Elsevier, 2012.

**REFERENCES:**

1. Jason Venner, “Pro Hadoop- Build Scalable, Distributed Applications in the Cloud”, A Press, 2009
2. Tom White, “Hadoop The Definitive Guide”, First Edition. O’Reilly, 2009.
3. Bart Jacob (Editor), “Introduction to Grid Computing”, IBM Red Books, Vervante, 2005
4. Ian Foster, Carl Kesselman, “The Grid: Blueprint for a New Computing Infrastructure”, 2<sup>nd</sup> Edition, Morgan Kaufmann.
5. Frederic Magoules and Jie Pan, “Introduction to Grid Computing” CRC Press, 2009.
6. Daniel Minoli, “A Networking Approach to Grid Computing”, John Wiley Publication, 2005.
7. Barry Wilkinson, “Grid Computing: Techniques and Applications”, Chapman and Hall, CRC, Taylor and Francis Group, 2010.

**OBJECTIVES:**

The student should be made to:

- Be familiar with resource management techniques.
- Learn to solve problems in linear programming and Integer programming.
- Be exposed to CPM and PERT.

**UNIT I LINEAR PROGRAMMING****9**

Principal components of decision problem – Modeling phases – LP Formulation and graphic solution – Resource allocation problems – Simplex method – Sensitivity analysis.

**UNIT II DUALITY AND NETWORKS****9**

Definition of dual problem – Primal – Dual relation ships – Dual simplex methods – Post optimality analysis – Transportation and assignment model - Shortest route problem.

**UNIT III INTEGER PROGRAMMING****9**

Cutting plan algorithm – Branch and bound methods, Multistage (Dynamic) programming.

**UNIT IV CLASSICAL OPTIMISATION THEORY:****9**

Unconstrained external problems, Newton – Ralphson method – Equality constraints – Jacobean methods – Lagrangian method – Kuhn – Tucker conditions – Simple problems.

**UNIT V OBJECT SCHEDULING:****9**

Network diagram representation – Critical path method – Time charts and resource leveling – PERT.

**TOTAL: 45 PERIODS****OUTCOMES:**

**Upon Completion of the course, the students should be able to:**

- Solve optimization problems using simplex method.
- Apply integer programming and linear programming to solve real-life applications.
- Use PERT and CPM for problems in project management

**TEXT BOOK:**

1. H.A. Taha, "Operation Research", Prentice Hall of India, 2002.

**REFERENCES:**

1. Paneer Selvam, 'Operations Research', Prentice Hall of India, 2002
2. Anderson 'Quantitative Methods for Business', 8<sup>th</sup> Edition, Thomson Learning, 2002.
3. Winston 'Operation Research', Thomson Learning, 2003.
4. Vohra, 'Quantitative Techniques in Management', Tata Mc Graw Hill, 2002.
5. Anand Sarma, 'Operation Research', Himalaya Publishing House, 2003.

**OBJECTIVES:****The student should be made to:**

- Be exposed to the different cipher techniques
- Learn to implement the algorithms DES, RSA, MD5, SHA-1
- Learn to use network security tools like GnuPG, KF sensor, Net Strumbler

**LIST OF EXPERIMENTS:**

1. Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts:
  - a) Caesar Cipher
  - b) Playfair Cipher
  - c) Hill Cipher
  - d) Vigenere Cipher
  - e) Rail fence – row & Column Transformation
2. Implement the following algorithms
  - a) DES
  - b) RSA Algorithm
  - c) Diffie-Hellman
  - d) MD5
  - e) SHA-1
5. Implement the SIGNATURE SCHEME - Digital Signature Standard
6. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG).
7. Setup a honey pot and monitor the honeypot on network (KF Sensor)
8. Installation of rootkits and study about the variety of options
9. Perform wireless audit on an access point or a router and decrypt WEP and WPA.( Net Stumbler)
10. Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w)

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to**

- Implement the cipher techniques
- Develop the various security algorithms
- Use different open source tools for network security and analysis

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:****SOFTWARE:**

C / C++ / Java or equivalent compiler  
 GnuPG, KF Sensor or Equivalent, Snort, Net Stumbler or Equivalent

**HARDWARE:**

Standalone desktops - 30 Nos.

(or)

Server supporting 30 terminals or more.

**OBJECTIVES:**

The student should be made to:

- Be exposed to tool kits for grid and cloud environment.
- Be familiar with developing web services/Applications in grid framework
- Learn to run virtual machines of different configuration.
- Learn to use Hadoop

**LIST OF EXPERIMENTS:****GRID COMPUTING LAB**

Use Globus Toolkit or equivalent and do the following:

1. Develop a new Web Service for Calculator.
2. Develop new OGSA-compliant Web Service.
3. Using Apache Axis develop a Grid Service.
4. Develop applications using Java or C/C++ Grid APIs
5. Develop secured applications using basic security mechanisms available in Globus Toolkit.
6. Develop a Grid portal, where user can submit a job and get the result. Implement it with and without GRAM concept.

**CLOUD COMPUTING LAB**

Use Eucalyptus or Open Nebula or equivalent to set up the cloud and demonstrate.

1. Find procedure to run the virtual machine of different configuration. Check how many virtual machines can be utilized at particular time.
2. Find procedure to attach virtual block to the virtual machine and check whether it holds the data even after the release of the virtual machine.
3. Install a C compiler in the virtual machine and execute a sample program.
4. Show the virtual machine migration based on the certain condition from one node to the other.
5. Find procedure to install storage controller and interact with it.
6. Find procedure to set up the one node Hadoop cluster.
7. Mount the one node Hadoop cluster using FUSE.
8. Write a program to use the API's of Hadoop to interact with it.
9. Write a wordcount program to demonstrate the use of Map and Reduce tasks

**TOTAL: 45 PERIODS**

**OUTCOMES:**

At the end of the course, the student should be able to

- Use the grid and cloud tool kits.
- Design and implement applications on the Grid.
- Design and Implement applications on the Cloud.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:****SOFTWARE:**

Globus Toolkit or equivalent

Eucalyptus or Open Nebula or equivalent

**HARDWARE**

Standalone desktops

30 Nos

**OBJECTIVES:**

The student should be made to:

- Understand the challenges in parallel and multi-threaded programming.
- Learn about the various parallel programming paradigms, and solutions.

**UNIT I MULTI-CORE PROCESSORS****9**

Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks - Symmetric and Distributed Shared Memory Architectures – Cache coherence - Performance Issues – Parallel program design.

**UNIT II PARALLEL PROGRAM CHALLENGES****9**

Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).

**UNIT III SHARED MEMORY PROGRAMMING WITH OpenMP****9**

OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs - Library functions – Handling Data and Functional Parallelism – Handling Loops - Performance Considerations.

**UNIT IV DISTRIBUTED MEMORY PROGRAMMING WITH MPI****9**

MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation

**UNIT V PARALLEL PROGRAM DEVELOPMENT****9**

Case studies - n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.

**TOTAL: 45 PERIODS****OUTCOMES:**

At the end of the course, the student should be able to:

- Program Parallel Processors.
- Develop programs using OpenMP and MPI.
- Compare and contrast programming for serial processors and programming for parallel processors.

**TEXT BOOKS:**

1. Peter S. Pacheco, “An Introduction to Parallel Programming”, Morgan-Kaufman/Elsevier, 2011.
2. Darryl Gove, “Multicore Application Programming for Windows, Linux, and Oracle Solaris”, Pearson, 2011 (unit 2)

**REFERENCES:**

1. Michael J Quinn, “Parallel programming in C with MPI and OpenMP”, Tata McGraw Hill, 2003.
2. Shameem Akhter and Jason Roberts, “Multi-core Programming”, Intel Press, 2006.

**CS6811**

**PROJECT WORK**

**L T P C**  
**0 0 12 6**

**OBJECTIVES:**

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL: 180 PERIODS**

**OUTCOMES:**

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

**CS6001**

**C# AND .NET PROGRAMMING**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Understand the foundations of CLR execution.
- Learn the technologies of the .NET framework.
- Know the object oriented aspects of C#.
- Be aware of application development in .NET.
- Learn web based applications on .NET (ASP.NET).

**UNIT I INTRODUCTION TO C#**

**9**

Introducing C#, Understanding .NET, overview of C#, Literals, Variables, Data Types, Operators, checked and unchecked operators, Expressions, Branching, Looping, Methods, implicit and explicit casting, Constant, Arrays, Array Class, Array List, String, String Builder, Structure, Enumerations, boxing and unboxing.

**UNIT II OBJECT ORIENTED ASPECTS OF C#**

**9**

Class, Objects, Constructors and its types, inheritance, properties, indexers, index overloading, polymorphism, sealed class and methods, interface, abstract class, abstract and interface, operator overloading, delegates, events, errors and exception, Threading.

**UNIT III APPLICATION DEVELOPMENT ON .NET****9**

Building windows application, Creating our own window forms with events and controls, menu creation, inheriting window forms, SDI and MDI application, Dialog Box (Modal and Modeless), accessing data with ADO.NET, DataSet, typed dataset, Data Adapter, updating database using stored procedures, SQL Server with ADO.NET, handling exceptions, validating controls, windows application configuration.

**UNIT IV WEB BASED APPLICATION DEVELOPMENT ON .NET****9**

Programming web application with web forms, ASP.NET introduction, working with XML and .NET, Creating Virtual Directory and Web Application, session management techniques, web.config, web services, passing datasets, returning datasets from web services, handling transaction, handling exceptions, returning exceptions from SQL Server.

**UNIT V CLR AND .NET FRAMEWORK****9**

Assemblies, Versioning, Attributes, reflection, viewing meta data, type discovery, reflection on type, marshalling, remoting, security in .NET

**TOTAL: 45 PERIODS****OUTCOMES:**

**After completing this course, the student will be able to:**

- List the major elements of the .NET framework
- Explain how C# fits into the .NET platform.
- Analyze the basic structure of a C# application
- Debug, compile, and run a simple application.
- Develop programs using C# on .NET
- Design and develop Web based applications on .NET
- Discuss CLR.

**TEXT BOOKS:**

1. Herbert Schildt, "The Complete Reference: C# 4.0", Tata Mc Graw Hill, 2012.
2. Christian Nagel et al. "Professional C# 2012 with .NET 4.5", Wiley India, 2012.

**REFERENCES:**

1. Andrew Troelsen, "Pro C# 2010 and the .NET 4 Platform, Fifth edition, A Press, 2010.
2. Ian Griffiths, Matthew Adams, Jesse Liberty, "Programming C# 4.0", Sixth Edition, O'Reilly, 2010.

**GE6757****TOTAL QUALITY MANAGEMENT**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To facilitate the understanding of Quality Management principles and process.

**UNIT I INTRODUCTION****9**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

**UNIT II TQM PRINCIPLES 9**  
Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

**UNIT III TQM TOOLS AND TECHNIQUES I 9**  
The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

**UNIT IV TQM TOOLS AND TECHNIQUES II 9**  
Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

**UNIT V QUALITY SYSTEMS 9**  
Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors..

**TOTAL: 45 PERIODS**

**OUTCOMES :**

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

**TEXTBOOK:**

1. Dale H. Besterfield, et al., "Total quality Management", Pearson Education Asia, Third Edition, Indian Reprint 2006.

**REFERENCES:**

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8<sup>th</sup> Edition, First Indian Edition, Cengage Learning, 2012.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

**OBJECTIVES:**

The student should be made to:

- Be familiar with the concepts of data warehouse and data mining,
- Be acquainted with the tools and techniques used for Knowledge Discovery in Databases.

**UNIT I DATA WAREHOUSING****9**

Data warehousing Components –Building a Data warehouse -- Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata.

**UNIT II BUSINESS ANALYSIS****9**

Reporting and Query tools and Applications – Tool Categories – The Need for Applications – Cognos Impromptu – Online Analytical Processing (OLAP) – Need – Multidimensional Data Model – OLAP Guidelines – Multidimensional versus Multirelational OLAP – Categories of Tools – OLAP Tools and the Internet.

**UNIT III DATA MINING****9**

Introduction – Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Data Mining Task Primitives – Integration of a Data Mining System with a Data Warehouse – Issues –Data Preprocessing.

**UNIT IV ASSOCIATION RULE MINING AND CLASSIFICATION****9**

Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining – Classification and Prediction - Basic Concepts - Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction.

**UNIT V CLUSTERING AND TRENDS IN DATA MINING****9**

Cluster Analysis - Types of Data – Categorization of Major Clustering Methods – K-means– Partitioning Methods – Hierarchical Methods - Density-Based Methods –Grid Based Methods – Model-Based Clustering Methods – Clustering High Dimensional Data - Constraint – Based Cluster Analysis – Outlier Analysis – Data Mining Applications.

**TOTAL: 45 PERIODS****OUTCOMES:**

After completing this course, the student will be able to:

- Apply data mining techniques and methods to large data sets.
- Use data mining tools
- Compare and contrast the various classifiers.

**TEXT BOOKS:**

1. Alex Berson and Stephen J.Smith, “Data Warehousing, Data Mining and OLAP”, Tata McGraw – Hill Edition, Thirteenth Reprint 2008.
2. Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2012.

## REFERENCES:

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Person Education, 2007.
2. K.P. Soman, Shyam Diwakar and V. Aja, "Insight into Data Mining Theory and Practice", Eastern Economy Edition, Prentice Hall of India, 2006.
3. G. K. Gupta, "Introduction to Data Mining with Case Studies", Eastern Economy Edition, Prentice Hall of India, 2006.
4. Daniel T.Larose, "Data Mining Methods and Models", Wiley-Interscience, 2006.

**CS6002**

**NETWORK ANALYSIS AND MANAGEMENT**

**L T P C**

**3 0 0 3**

## OBJECTIVES:

**The student should be made to:**

- Learn network devices functions and configurations hub, switch, tap and routers.
- Be familiar with network Security Devices.
- Be exposed to network services.
- Understand and analyze application performance
- Learn to analyze network traffic and protocols
- Be aware of network-troubleshooting concepts.
- Understand network security concepts.

### **UNIT I A SYSTEM APPROACH TO NETWORK DESIGN AND REQUIREMENT ANALYSIS**

**9**

Introduction-Network Service and Service based networks- Systems and services- characterizing the services. Requirement Analysis: Concepts – Background – User Requirements- Application Requirements- Host Requirements-Network Requirements – Requirement Analysis: Guidelines – Requirements gathering and listing- Developing service metrics to measure performance – Characterizing behavior- developing performance threshold – Distinguish between service performance levels. Requirement Analysis: Practice –Template, table and maps –simplifying the requirement analysis process –case study.

### **UNIT II FLOW ANALYSIS: CONCEPTS, GUIDELINES AND PRACTICE**

**9**

Background- Flows- Data sources and sinks- Flow models- Flow boundaries- Flow distributions- Flow specifications- Applying the flow model-Establishing flow boundaries-Applying flow distributions-Combining flow models, boundaries and distributions- Developing flow specifications-prioritizing flow-simplifying flow analysis process –examples of applying flow specs- case study.

### **UNIT III LOGICAL DESIGN: CHOICES, INTERCONNECTION MECHANISMS, NETWORK MANAGEMENT AND SECURITY**

**9**

Background- Establishing design goals- Developing criteria for technology evolution- Making technology choices for design-case study- Shared Medium- Switching and Routing: Comparison and contrast- Switching- Routing-Hybrid Routing/Switching Mechanisms – Applying Interconnection Mechanism to Design – Integrating Network management and security into the Design- Defining Network Management- Designing with manageable resources- Network Management Architecture-Security- Security mechanism- Examples- Network Management and security plans- Case study.

**UNIT IV NETWORK DESIGN: PHYSICAL, ADDRESSING AND ROUTING 9**

Introduction- Evaluating cable plant design options – Network equipment placement- diagramming the physical design- diagramming the worksheet –case study. Introduction to Addressing and routing- establishing routing flow in the design environments- manipulating routing flows- developing addressing strategies- developing a routing strategy- case study.

**UNIT V NETWORK MANAGEMENT AND SNMP PROTOCOL MODEL 9**

Network and System management, Network management system platform; Current SNMP Broadband and TMN management, Network management standards. SNMPV1, SNMPV2 system architecture, SNMPV2, structure of management information. SNMPV2 – MIB – SNMPV2 protocol, SNMPV3-Architecture, Application, MIB, security user based security model, access control RMON.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of this course the students should be able to:**

- Explain the key concepts and algorithms in complex network analysis.
- Apply a range of techniques for characterizing network structure.
- Discuss methodologies for analyzing networks of different fields.
- Demonstrate knowledge of recent research in the area and exhibit technical writing and presentation skills.

**TEXT BOOKS:**

1. James.D.McCabe, “Practical Computer Network Analysis and Design”, 1<sup>st</sup> Edition, Morgan Kaufaman, 1997.
2. Mani Subramanian, “Network Management – Principles & Practice” – 2<sup>nd</sup> Edition Prentice Hall, 2012.

**REFERENCES:**

1. J.Radz,”Fundamentals of Computer Network Analysis and Engineering: Basic Approaches for Solving Problems in the Networked Computing Environment”, Universe, 2005.
2. Mark Newman, “Networks: An Introduction”,Kindle Edition,2010.
3. Laura Chappel and Gerald Combs ,“Wireshark 101: Essential Skills for Network Analysis”,Kindle Edition,2013.
4. William Stallings., “SNMP, SNMP2, SNMP3 and RMON1 and 2”, Pearson Education, 2004.
5. Daw Sudira, “Network Management”, Sonali Publications, 2004.

**IT6004**

**SOFTWARE TESTING**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Expose the criteria for test cases.
- Learn the design of test cases.
- Be familiar with test management and test automation techniques.
- Be exposed to test metrics and measurements.

## **UNIT I INTRODUCTION**

**9**

Testing as an Engineering Activity – Testing as a Process – Testing axioms – Basic definitions – Software Testing Principles – The Tester’s Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design – Defect Examples – Developer/Tester Support of Developing a Defect Repository – Defect Prevention strategies.

## **UNIT II TEST CASE DESIGN**

**9**

Test case Design Strategies – Using Black Bod Approach to Test Case Design – Random Testing – Requirements based testing – Boundary Value Analysis – Equivalence Class Partitioning – State-based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing – Using White Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing – Evaluating Test Adequacy Criteria.

## **UNIT III LEVELS OF TESTING**

**9**

The need for Levers of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination  
System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility testing – Configuration testing – Compatibility testing – Testing the documentation – Website testing.

## **UNIT IV TEST MANAGEMENT**

**9**

People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – The role of three groups in Test Planning and Policy Development – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group.

## **UNIT V TEST AUTOMATION**

**9**

Software test automation – skill needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.

**TOTAL: 45 PERIODS**

### **OUTCOMES:**

**At the end of the course the students will be able to**

- Design test cases suitable for a software development for different domains.
- Identify suitable tests to be carried out.
- Prepare test planning based on the document.
- Document test plans and test cases designed.
- Use of automatic testing tools.
- Develop and validate a test plan.

### **TEXT BOOKS:**

1. Srinivasan Desikan and Gopaldaswamy Ramesh, “Software Testing – Principles and Practices”, Pearson Education, 2006.
2. Ron Patton, “Software Testing”, Second Edition, Sams Publishing, Pearson Education, 2007.

## REFERENCES:

1. Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2003.
2. Edward Kit, "Software Testing in the Real World – Improving the Process", Pearson Education, 1995.
3. Boris Beizer, "Software Testing Techniques" – 2<sup>nd</sup> Edition, Van Nostrand Reinhold, New York, 1990.
4. Aditya P. Mathur, "Foundations of Software Testing \_ Fundamental Algorithms and Techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.

**GE6084**

**HUMAN RIGHTS**

**L T P C**

**3 0 0 3**

## OBJECTIVES :

- To sensitize the Engineering students to various aspects of Human Rights.

### UNIT I

**9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

### UNIT II

**9**

Evolution of the concept of Human Rights Magna carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

### UNIT III

**9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

### UNIT IV

**9**

Human Rights in India – Constitutional Provisions / Guarantees.

### UNIT V

**9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

**TOTAL : 45 PERIODS**

## OUTCOMES:

- Engineering students will acquire the basic knowledge of human rights.

## REFERENCES:

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

**OBJECTIVES:**

**The student should be made to:**

- Understand the design issues in ad hoc and sensor networks.
- Learn the different types of MAC protocols.
- Be familiar with different types of adhoc routing protocols.
- Be expose to the TCP issues in adhoc networks.
- Learn the architecture and protocols of wireless sensor networks.

**UNIT I INTRODUCTION****9**

Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs) :concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.

**UNIT II MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS****9**

Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols- Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11

**UNIT III ROUTING PROTOCOLS AND TRANSPORT LAYER IN AD HOC WIRELESS NETWORKS****9**

Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing (on-demand), hybrid routing- Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.

**UNIT IV WIRELESS SENSOR NETWORKS (WSNS) AND MAC PROTOCOLS****9**

Single node architecture: hardware and software components of a sensor node - WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.

**UNIT V WSN ROUTING, LOCALIZATION & QOS****9**

Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues.

**TOTAL: 45 PERIODS****OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Explain the concepts, network architectures and applications of ad hoc and wireless sensor networks
- Analyze the protocol design issues of ad hoc and sensor networks
- Design routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issues
- Evaluate the QoS related performance measurements of ad hoc and sensor networks

**TEXT BOOK:**

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ", Prentice Hall Professional Technical Reference, 2008.

## REFERENCES:

1. Carlos De Moraes Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2006.
2. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication - 2002.
3. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2005
4. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, and Applications", John Wiley, 2007.
5. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

**CS6004**

**CYBER FORENSICS**

**L T P C**  
**3 0 0 3**

## OBJECTIVES:

**The student should be made to:**

- Learn the security issues network layer and transport layer
- Be exposed to security issues of the application layer
- Learn computer forensics
- Be familiar with forensics tools
- Learn to analyze and validate forensics data

### **UNIT I NETWORK LAYER SECURITY & TRANSPORT LAYER SECURITY 9**

IPSec Protocol - IP Authentication Header - IP ESP - Key Management Protocol for IPSec .  
**Transport layer Security:** SSL protocol, Cryptographic Computations – TLS Protocol.

### **UNIT II E-MAIL SECURITY & FIREWALLS 9**

PGP - S/MIME - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions.

### **UNIT III INTRODUCTION TO COMPUTER FORENSICS 9**

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

### **UNIT IV EVIDENCE COLLECTION AND FORENSICS TOOLS 9**

Processing Crime and Incident Scenes – Working with Windows and DOS Systems. **Current Computer Forensics Tools:** Software/ Hardware Tools.

### **UNIT V ANALYSIS AND VALIDATION 9**

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics

**TOTAL: 45 PERIODS**

## OUTCOMES:

**Upon completion of the course, the student should be able to:**

- Discuss the security issues network layer and transport layer
- Apply security principles in the application layer
- Explain computer forensics
- Use forensics tools
- Analyze and validate forensics data

**TEXT BOOKS:**

1. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.
2. Nelson, Phillips, Einfinger, Steuart, "Computer Forensics and Investigations", Cengage Learning, India Edition, 2008.

**REFERENCES:**

1. John R.Vacca, "Computer Forensics", Cengage Learning, 2005
2. Richard E.Smith, "Internet Cryptography", 3<sup>rd</sup> Edition Pearson Education, 2008.
3. Marjie T.Britz, "Computer Forensics and Cyber Crime": An Introduction", 3<sup>rd</sup> Edition, Prentice Hall, 2013.

**CS6005****ADVANCED DATABASE SYSTEMS****L T P C  
3 0 0 3****OBJECTIVES:****The student should be made to:**

- Learn different types of databases.
- Be exposed to query languages.
- Be familiar with the indexing techniques.

**UNIT I PARALLEL AND DISTRIBUTED DATABASES****9**

Inter and Intra Query Parallelism – Architecture – Query evaluation – Optimization – Distributed Architecture – Storage – Catalog Management – Query Processing - Transactions – Recovery - Large-scale Data Analytics in the Internet Context – Map Reduce Paradigm - run-time system for supporting scalable and fault-tolerant execution - paradigms: Pig Latin and Hive and parallel databases versus Map Reduce.

**UNIT II ACTIVE DATABASES****9**

Syntax and Semantics (Starburst, Oracle, DB2) – Taxonomy – Applications – Integrity Management – Workflow Management – Business Rules – Design Principles – Properties – Rule Modularization – Rule Debugging – IDEA methodology – Open Problems.

**UNIT III TEMPORAL AND OBJECT DATABASES****9**

Overview – Data types – Associating Facts – Temporal Query Language – TSQL2 – Time Ontology – Language Constructs – Architecture – Temporal Support – Object Database and Change Management – Change of Schema – Implementing Database Updates in O2 – Benchmark Database Updates – Performance Evaluation.

**UNIT IV COMPLEX QUERIES AND REASONING****9**

Logic of Query Languages – Relational Calculi – Recursive rules – Syntax and semantics of Data log – Fix point semantics – Implementation Rules and Recursion – Rule rewriting methods – Compilation and Optimization – Recursive Queries in SQL – Open issues.

**UNIT V SPATIAL, TEXT AND MULTIMEDIA DATABASES****9**

Traditional Indexing Methods (Secondary Keys, Spatial Access Methods) – Text Retrieval – Multimedia Indexing – 1D Time Series – 2d Color images – Sub pattern Matching – Open Issues – Uncertainties.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Design different types of databases.
- Use query languages.
- Apply indexing techniques.

**TEXT BOOK:**

1. Raghu Ramakrishnan “Database Management System”, Mc Graw Hill Publications, 2000.

**REFERENCES:**

1. Carlo Zaniolo, Stefano Ceri “Advanced Database Systems”, Morgan Kauffmann Publishers.VLDB Journal, 1997
2. Abraham Silberschatz, Henry F. Korth and S. Sudharshan, “Database System Concepts”, Sixth Edition, Tata McGraw Hill, 2011

**BM6005****BIO INFORMATICS****L T P C  
3 0 0 3****OBJECTIVES:**

**The student should be made to:**

- Exposed to the need for Bioinformatics technologies
- Be familiar with the modeling techniques
- Learn microarray analysis
- Exposed to Pattern Matching and Visualization

**UNIT I INTRODUCTION****9**

Need for Bioinformatics technologies – Overview of Bioinformatics technologies Structural bioinformatics – Data format and processing – Secondary resources and applications – Role of Structural bioinformatics - Biological Data Integration System.

**UNIT II DATAWAREHOUSING AND DATAMINING IN BIOINFORMATICS****9**

Bioinformatics data – Data warehousing architecture – data quality – Biomedical data analysis – DNA data analysis – Protein data analysis – Machine learning – Neural network architecture and applications in bioinformatics.

**UNIT III MODELING FOR BIOINFORMATICS****9**

Hidden Markov modeling for biological data analysis – Sequence identification –Sequence classification – multiple alignment generation – Comparative modeling –Protein modeling – genomic modeling – Probabilistic modeling – Bayesian networks – Boolean networks - Molecular modeling – Computer programs for molecular modeling.

**UNIT IV PATTERN MATCHING AND VISUALIZATION****9**

Gene regulation – motif recognition – motif detection – strategies for motif detection – Visualization – Fractal analysis – DNA walk models – one dimension – two dimension – higher dimension – Game representation of Biological sequences – DNA, Protein, Amino acid sequences.

## **UNIT V MICROARRAY ANALYSIS**

**9**

Microarray technology for genome expression study – image analysis for data extraction – preprocessing – segmentation – gridding – spot extraction – normalization, filtering – cluster analysis – gene network analysis – Compared Evaluation of Scientific Data Management Systems – Cost Matrix – Evaluation model - Benchmark – Tradeoffs.

**TOTAL: 45 PERIODS**

### **OUTCOMES:**

**Upon Completion of the course, □ the students will be able to**

- Develop models for biological data.
- Apply pattern matching techniques to bioinformatics data – protein data genomic data.
- Apply micro array technology for genomic expression study.

### **TEXT BOOK:**

1. Yi-Ping Phoebe Chen (Ed), “BioInformatics Technologies”, First Indian Reprint, Springer Verlag, 2007.

### **REFERENCES:**

1. Bryan Bergeron, “Bio Informatics Computing”, Second Edition, Pearson Education, 2003.
2. Arthur M Lesk, “Introduction to Bioinformatics”, Second Edition, Oxford University Press, 2005

**IT6801**

## **SERVICE ORIENTED ARCHITECTURE**

**L T P C  
3 0 0 3**

### **OBJECTIVES:**

**The student should be made to:**

- Learn XML fundamentals.
- Be exposed to build applications based on XML.
- Understand the key principles behind SOA.
- Be familiar with the web services technology elements for realizing SOA.
- Learn the various web service standards.

## **UNIT I INTRODUCTION TO XML**

**9**

XML document structure – Well formed and valid documents – Namespaces – DTD – XML Schema – X-Files.

## **UNIT II BUILDING XML- BASED APPLICATIONS**

**9**

Parsing XML – using DOM, SAX – XML Transformation and XSL – XSL Formatting – Modeling Databases in XML.

## **UNIT III SERVICE ORIENTED ARCHITECTURE**

**9**

Characteristics of SOA, Comparing SOA with Client-Server and Distributed architectures – Benefits of SOA -- Principles of Service orientation – Service layers.

## **UNIT IV WEB SERVICES**

**9**

Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Message Exchange Patterns – Orchestration – Choreography –WS Transactions.

## UNIT V BUILDING SOA-BASED APPLICATIONS

9

Service Oriented Analysis and Design – Service Modeling – Design standards and guidelines -- Composition – WS-BPEL – WS-Coordination – WS-Policy – WS-Security – SOA support in J2EE

**TOTAL : 45 PERIODS**

### OUTCOMES:

**Upon successful completion of this course, students will be able to:**

- Build applications based on XML.
- Develop web services using technology elements.
- Build SOA-based applications for intra-enterprise and inter-enterprise applications.

### TEXTBOOKS:

1. Ron Schmelzer et al. "XML and Web Services", Pearson Education, 2002.
2. Thomas Erl, "Service Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2005.

### REFERENCES:

1. Frank P.Coyle, "XML, Web Services and the Data Revolution", Pearson Education, 2002
2. Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services", Pearson Education, 2005
3. Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services: An Architect's Guide", Prentice Hall, 2004.
4. James McGovern, Sameer Tyagi, Michael E.Stevens, Sunil Mathew, "Java Web Services Architecture", Morgan Kaufmann Publishers, 2003.

IT6005

**DIGITAL IMAGE PROCESSING**

**L T P C**  
**3 0 0 3**

### OBJECTIVES:

**The student should be made to:**

- Learn digital image fundamentals.
- Be exposed to simple image processing techniques.
- Be familiar with image compression and segmentation techniques.
- Learn to represent image in form of features.

## UNIT I DIGITAL IMAGE FUNDAMENTALS

8

Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - color models.

## UNIT II IMAGE ENHANCEMENT

10

**Spatial Domain:** Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering – **Frequency Domain:** Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.

## UNIT III IMAGE RESTORATION AND SEGMENTATION

9

**Noise models** – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering **Segmentation:** Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation- Morphological processing- erosion and dilation.

**UNIT IV WAVELETS AND IMAGE COMPRESSION****9**

Wavelets – Subband coding - Multiresolution expansions - **Compression:** Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards.

**UNIT V IMAGE REPRESENTATION AND RECOGNITION****9**

Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments – Boundary description – Shape number – Fourier Descriptor, moments- Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

**TOTAL: 45 PERIODS****OUTCOMES:**

**Upon successful completion of this course, students will be able to:**

- Discuss digital image fundamentals.
- Apply image enhancement and restoration techniques.
- Use image compression and segmentation Techniques.
- Represent features of images.

**TEXT BOOK:**

1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2010.

**REFERENCES:**

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata McGraw Hill Pvt. Ltd., 2011.
2. Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.
3. William K Pratt, “Digital Image Processing”, John Willey, 2002.
4. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 2011.
5. <http://eeweb.poly.edu/~onur/lectures/lectures.html>.
6. <http://www.caen.uiowa.edu/~dip/LECTURE/lecture.html>

**EC6703****EMBEDDED AND REAL TIME SYSTEMS****L T P C****3 0 0 3****OBJECTIVES:**

**The student should be made to:**

- Learn the architecture and programming of ARM processor.
- Be familiar with the embedded computing platform design and analysis.
- Be exposed to the basic concepts of real time Operating system.
- Learn the system design techniques and networks for embedded systems

**UNIT I INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS****9**

Complex systems and micro processors– Embedded system design process –Design example: Model train controller- Instruction sets preliminaries - ARM Processor – CPU: programming input and output-supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance- CPU power consumption.

**UNIT II EMBEDDED COMPUTING PLATFORM DESIGN 9**

The CPU Bus-Memory devices and systems–Designing with computing platforms – consumer electronics architecture – platform-level performance analysis - Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.

**UNIT III PROCESSES AND OPERATING SYSTEMS 9**

Introduction – Multiple tasks and multiple processes – Multirate systems- Preemptive real-time operating systems- Priority based scheduling- Interprocess communication mechanisms – Evaluating operating system performance- power optimization strategies for processes – Example Real time operating systems-POSIX-Windows CE.

**UNIT V SYSTEM DESIGN TECHNIQUES AND NETWORKS 9**

Design methodologies- Design flows - Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques- Distributed embedded systems – MPSoCs and shared memory multiprocessors.

**UNIT V CASE STUDY 9**

Data compressor - Alarm Clock - Audio player - Software modem-Digital still camera - Telephone answering machine-Engine control unit – Video accelerator.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Describe the architecture and programming of ARM processor.
- Outline the concepts of embedded systems
- Explain the basic concepts of real time Operating system design.
- Use the system design techniques to develop software for embedded systems
- Differentiate between the general purpose operating system and the real time operating system
- Model real-time applications using embedded-system concepts

**TEXT BOOK:**

1. Marilyn Wolf, “Computers as Components - Principles of Embedded Computing System Design”, Third Edition “Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.

**REFERENCES:**

1. Jonathan W.Valvano, “Embedded Microcomputer Systems Real Time Interfacing”, Third Edition Cengage Learning, 2012.
2. David. E. Simon, “An Embedded Software Primer”, 1st Edition, Fifth Impression, Addison-Wesley Professional, 2007.
3. Raymond J.A. Buhr, Donald L.Bailey, “An Introduction to Real-Time Systems- From Design to Networking with C/C++”, Prentice Hall,1999.
4. C.M. Krishna, Kang G. Shin, “Real-Time Systems”, International Editions, Mc Graw Hill 1997
5. K.V.K.K.Prasad, “Embedded Real-Time Systems: Concepts, Design & Programming”, Dream Tech Press, 2005.
6. Sriram V Iyer, Pankaj Gupta, “Embedded Real Time Systems Programming”, Tata Mc Graw Hill, 2004.

**OBJECTIVES:**

The student should be made to:

- Understand the concepts of Game design and development.
- Learn the processes, mechanics and issues in Game Design.
- Be exposed to the Core architectures of Game Programming.
- Know about Game programming platforms, frame works and engines.
- Learn to develop games.

**UNIT I 3D GRAPHICS FOR GAME PROGRAMMING 9**

3D Transformations, Quaternions, 3D Modeling and Rendering, Ray Tracing, Shader Models, Lighting, Color, Texturing, Camera and Projections, Culling and Clipping, Character Animation, Physics-based Simulation, Scene Graphs.

**UNIT II GAME ENGINE DESIGN 9**

Game engine architecture, Engine support systems, Resources and File systems, Game loop and real-time simulation, Human Interface devices, Collision and rigid body dynamics, Game profiling.

**UNIT III GAME PROGRAMMING 9**

Application layer, Game logic, Game views, managing memory, controlling the main loop, loading and caching game data, User Interface management, Game event management.

**UNIT IV GAMING PLATFORMS AND FRAMEWORKS 9**

2D and 3D Game development using Flash, DirectX, Java, Python, Game engines - DX Studio, Unity.

**UNIT V GAME DEVELOPMENT 9**

Developing 2D and 3D interactive games using DirectX or Python – Isometric and Tile Based Games, Puzzle games, Single Player games, Multi Player games.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon completion of the course, students will be able to

- Discuss the concepts of Game design and development.
- Design the processes, and use mechanics for game development.
- Explain the Core architectures of Game Programming.
- Use Game programming platforms, frame works and engines.
- Create interactive Games.

**TEXT BOOKS:**

1. Mike Mc Shaffrfy and David Graham, "Game Coding Complete", Fourth Edition, Cengage Learning, PTR, 2012.
2. Jason Gregory, "Game Engine Architecture", CRC Press / A K Peters, 2009.
3. David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics" 2<sup>nd</sup> Editions, Morgan Kaufmann, 2006.

**REFERENCES:**

1. Ernest Adams and Andrew Rollings, "Fundamentals of Game Design", 2<sup>nd</sup> Edition Prentice Hall / New Riders, 2009.
2. Eric Lengyel, "Mathematics for 3D Game Programming and Computer Graphics", 3<sup>rd</sup> Edition, Course Technology PTR, 2011.
3. Jesse Schell, The Art of Game Design: A book of lenses, 1<sup>st</sup> Edition, CRC Press, 2008.

**OBJECTIVES:****The Student should be made to:**

- Learn the information retrieval models.
- Be familiar with Web Search Engine.
- Be exposed to Link Analysis.
- Understand Hadoop and Map Reduce.
- Learn document text mining techniques.

**UNIT I INTRODUCTION****9**

Introduction -History of IR- Components of IR - Issues –Open source Search engine Frameworks - The impact of the web on IR - The role of artificial intelligence (AI) in IR – IR Versus Web Search - Components of a Search engine- Characterizing the web.

**UNIT II INFORMATION RETRIEVAL****9**

Boolean and vector-space retrieval models- Term weighting - TF-IDF weighting- cosine similarity – Preprocessing - Inverted indices - efficient processing with sparse vectors – Language Model based IR - Probabilistic IR –Latent Semantic Indexing - Relevance feedback and query expansion.

**UNIT III WEB SEARCH ENGINE – INTRODUCTION AND CRAWLING****9**

Web search overview, web structure, the user, paid placement, search engine optimization/ spam. Web size measurement - search engine optimization/spam – Web Search Architectures - crawling - meta-crawlers- Focused Crawling - web indexes -- Near-duplicate detection - Index Compression - XML retrieval.

**UNIT IV WEB SEARCH – LINK ANALYSIS AND SPECIALIZED SEARCH****9**

Link Analysis –hubs and authorities – Page Rank and HITS algorithms -Searching and Ranking – Relevance Scoring and ranking for Web – Similarity - Hadoop & Map Reduce - Evaluation - Personalized search - Collaborative filtering and content-based recommendation of documents and products – handling “invisible” Web - Snippet generation, Summarization, Question Answering, Cross-Lingual Retrieval.

**UNIT V DOCUMENT TEXT MINING****9**

Information filtering; organization and relevance feedback – Text Mining -Text classification and clustering - Categorization algorithms: naive Bayes; decision trees; and nearest neighbor - Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM).

**TOTAL: 45 PERIODS****OUTCOMES:****Upon completion of the course, students will be able to**

- Apply information retrieval models.
- Design Web Search Engine.
- Use Link Analysis.
- Use Hadoop and Map Reduce.
- Apply document text mining techniques.

## TEXT BOOKS:

1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval , Cambridge University Press, 2008.
2. Ricardo Baeza -Yates and Berthier Ribeiro - Neto, Modern Information Retrieval: The Concepts and Technology behind Search 2<sup>nd</sup> Edition, ACM Press Books 2011.
3. Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, 1<sup>st</sup> Edition Addison Wesley, 2009.
4. Mark Levene, An Introduction to Search Engines and Web Navigation, 2<sup>nd</sup> Edition Wiley, 2010.

## REFERENCES:

1. Stefan Buettcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.
2. Ophir Frieder "Information Retrieval: Algorithms and Heuristics: The Information Retrieval Series ", 2<sup>nd</sup> Edition, Springer, 2004.
3. Manu Konchady, "Building Search Applications: Lucene, Ling Pipe", and First Edition, Gate Mustru Publishing, 2008.

IT6006

DATA ANALYTICS

L T P C  
3 0 0 3

## OBJECTIVES:

The Student should be made to:

- Be exposed to big data
- Learn the different ways of Data Analysis
- Be familiar with data streams
- Learn the mining and clustering
- Be familiar with the visualization

### UNIT I INTRODUCTION TO BIG DATA

8

Introduction to Big Data Platform – Challenges of conventional systems - Web data – Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting - Modern data analytic tools, Stastical concepts: Sampling distributions, resampling, statistical inference, prediction error.

### UNIT II DATA ANALYSIS

12

Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and kernel methods, Analysis of time series: linear systems analysis, nonlinear dynamics - Rule induction - Neural networks: learning and generalization, competitive learning, principal component analysis and neural networks; Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods.

### UNIT III MINING DATA STREAMS

8

Introduction to Streams Concepts – Stream data model and architecture - Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window - Realtime Analytics Platform(RTAP) applications - case studies - real time sentiment analysis, stock market predictions.

**UNIT IV FREQUENT ITEMSETS AND CLUSTERING 9**

Mining Frequent itemsets - Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream – Clustering Techniques – Hierarchical – K- Means – Clustering high dimensional data – CLIQUE and PROCLUS – Frequent pattern based clustering methods – Clustering in non-euclidean space – Clustering for streams and Parallelism.

**UNIT V FRAMEWORKS AND VISUALIZATION 8**

MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed file systems – Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications:

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**The student should be made to:**

- Apply the statistical analysis methods.
- Compare and contrast various soft computing frameworks.
- Design distributed file systems.
- Apply Stream data model.
- Use Visualisation techniques

**TEXT BOOKS:**

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012.

**REFERENCES:**

1. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analytics, John Wiley & sons, 2012.
2. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O’Reilly, 2011.
3. Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Second Edition, Elsevier, Reprinted 2008.

<b>CS6008</b>	<b>HUMAN COMPUTER INTERACTION</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

**OBJECTIVES:**

**The student should be made to:**

- Learn the foundations of Human Computer Interaction.
- Be familiar with the design technologies for individuals and persons with disabilities.
- Be aware of mobile HCI.
- Learn the guidelines for user interface.

**UNIT I FOUNDATIONS OF HCI 9**

The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

**UNIT II DESIGN & SOFTWARE PROCESS 9**

Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

**UNIT III MODELS AND THEORIES 9**

Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.

**UNIT IV MOBILE HCI 9**

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

**UNIT V WEB INTERFACE DESIGN 9**

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

**L: 45, T: 0, TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Design effective dialog for HCI.
- Design effective HCI for individuals and persons with disabilities.
- Assess the importance of user feedback.
- Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
- Develop meaningful user interface.

**TEXT BOOKS:**

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, 3<sup>rd</sup> Edition, Pearson Education, 2004 (UNIT I , II & III).
2. Brian Fling, “Mobile Design and Development”, First Edition , O’Reilly Media Inc., 2009 (UNIT –IV).
3. Bill Scott and Theresa Neil, “Designing Web Interfaces”, First Edition, O’Reilly, 2009.(UNIT-V).

**CS6009 NANO COMPUTING L T P C  
3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Learn nano computing challenges.
- Be familiar with the imperfections.
- Be exposed to reliability evaluation strategies.
- Learn nano scale quantum computing.
- Understand Molecular Computing and Optimal Computing.

**UNIT I NANOCOMPUTING-PROSPECTS AND CHALLENGES 9**

Introduction - History of Computing - Nanocomputing - Quantum Computers – Nanocomputing Technologies - Nano Information Processing - Prospects and Challenges - Physics of Nanocomputing : Digital Signals and Gates - Silicon Nanoelectronics - Carbon Nanotube Electronics - Carbon Nanotube Field-effect Transistors – Nanolithography.

**UNIT II NANOCOMPUTING WITH IMPERFECTIONS 9**  
Introduction - Nanocomputing in the Presence of Defects and Faults - Defect Tolerance - Towards Quadrillion Transistor Logic Systems.

**UNIT III RELIABILITY OF NANOCOMPUTING 9**  
Markov Random Fields - Reliability Evaluation Strategies - NANOLAB - NANOPRISM - Reliable Manufacturing and Behavior from Law of Large Numbers.

**UNIT IV NANOSCALE QUANTUM COMPUTING 9**  
Quantum Computers - Hardware Challenges to Large Quantum Computers - Fabrication, Test, and Architectural Challenges - Quantum-dot Cellular Automata (QCA) - Computing with QCA - QCA Clocking - QCA Design Rules.

**UNIT V QCADESIGNER SOFTWARE AND QCA IMPLEMENTATION 9**  
Basic QCA Circuits using QCA Designer - QCA Implementation - Molecular and Optical Computing: Molecular Computing - Optimal Computing - Ultrafast Pulse Shaping and Tb/sec Data Speeds.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Discuss nano computing challenges.
- Handle the imperfections.
- Apply reliability evaluation strategies.
- Use nano scale quantum computing.
- Utilize Molecular Computing and Optimal Computing.

**TEXT BOOK:**

1. Sahni V. and Goswami D., Nano Computing, McGraw Hill Education Asia Ltd. (2008), ISBN (13): 978007024892.

**REFERNCES:**

1. Sandeep K. Shukla and R. Iris Bahar., Nano, Quantum and Molecular Computing, Kluwer Academic Publishers 2004, ISBN: 1402080670.
2. Sahni V, Quantum Computing, McGraw Hill Education Asia Ltd. 2007.
3. Jean-Baptiste Waldner, Nanocomputers and Swarm Intelligence, John Wiley & Sons, Inc. 2008, ISBN (13): 978-1848210097.

**IT6011**

**KNOWLEDGE MANAGEMENT**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Learn the Evolution of Knowledge management.
- Be familiar with tools.
- Be exposed to Applications.
- Be familiar with some case studies.

**UNIT I INTRODUCTION 9**

An Introduction to Knowledge Management - The foundations of knowledge management- including cultural issues- technology applications organizational concepts and processes- management aspects- and decision support systems. The Evolution of Knowledge management: From Information Management to Knowledge Management - Key Challenges Facing the Evolution of Knowledge Management - Ethics for Knowledge Management.

**UNIT II CREATING THE CULTURE OF LEARNING AND KNOWLEDGE SHARING 8**

Organization and Knowledge Management - Building the Learning Organization. Knowledge Markets: Cooperation among Distributed Technical Specialists – Tacit Knowledge and Quality Assurance.

**UNIT III KNOWLEDGE MANAGEMENT-THE TOOLS 10**

Telecommunications and Networks in Knowledge Management - Internet Search Engines and Knowledge Management - Information Technology in Support of Knowledge Management - Knowledge Management and Vocabulary Control - Information Mapping in Information Retrieval - Information Coding in the Internet Environment - Repackaging Information.

**UNIT IV KNOWLEDGEMANAGEMENT-APPLICATION 9**

Components of a Knowledge Strategy - Case Studies (From Library to Knowledge Center, Knowledge Management in the Health Sciences, Knowledge Management in Developing Countries).

**UNIT V FUTURE TRENDS AND CASE STUDIES 9**

Advanced topics and case studies in knowledge management - Development of a knowledge management map/plan that is integrated with an organization's strategic and business plan - A case study on Corporate Memories for supporting various aspects in the process life -cycles of an organization.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Use the knowledge management tools.
- Develop knowledge management Applications.
- Design and develop enterprise applications.

**TEXT BOOK:**

1. Srikantaiah.T. K., Koenig, M., “Knowledge Management for the Information Professional” Information Today, Inc., 2000.

**REFERENCE:**

1. Nonaka, I., Takeuchi, H., “The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation”, Oxford University Press, 1995.

**CS6010**

**SOCIAL NETWORK ANALYSIS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Understand the concept of semantic web and related applications.
- Learn knowledge representation using ontology.
- Understand human behaviour in social web and related communities.
- Learn visualization of social networks.

**UNIT I INTRODUCTION 9**

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

**UNIT II MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION 9**

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.

**UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 9**

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks - Multi-Relational characterization of dynamic social network communities.

**UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES 9**

Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

**UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS 9**

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Develop semantic web related applications.
- Represent knowledge using ontology.
- Predict human behaviour in social web and related communities.
- Visualize social networks.

**TEXT BOOKS:**

1. Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer 2007.
2. Borko Furht, "Handbook of Social Network Technologies and Applications", 1<sup>st</sup> Edition, Springer, 2010.

**REFERENCES:**

1. Guandong Xu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", First Edition Springer, 2011.

2. Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.

**CS6013**

**FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT**

**L T P C  
3 0 0 3**

**OBJECTIVE:**

This program can be offered with all Undergraduate programs/courses for all engineering streams. The FSIPD program aims to improve student's awareness and understanding of the basic concepts involved in Integrated product Development (IPD) by providing exposure to the key product development concepts. Students, who complete this program, will stand a better chance to be considered for jobs in the Engineering industry.

**COURSE OBJECTIVES:**

After completing this program, the student will be able to obtain the technical skills needed to effectively play the entry level design engineer role in an engineering organization.

**The student will be able to:**

- Understand the global trends and development methodologies of various types of products and services
- Conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- Understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- Understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- Gain knowledge of the Innovation & Product Development process in the Business Context

**UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT**

**9**

Global Trends Analysis and Product decision - Social Trends - Technical Trends- Economical Trends - Environmental Trends - Political/Policy Trends - Introduction to Product Development Methodologies and Management - Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle - Product Development Planning and Management

**UNIT II REQUIREMENTS AND SYSTEM DESIGN**

**9**

Requirement Engineering - Types of Requirements - Requirement Engineering - Traceability Matrix and Analysis - Requirement Management - System Design & Modeling - Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design

**UNIT III DESIGN AND TESTING****9**

Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques – Challenges in Integration of Engineering Disciplines - Concept Screening & Evaluation - Detailed Design - Component Design and Verification – Mechanical, Electronics and Software Subsystems - High Level Design/Low Level Design of S/W Program - Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing – Prototyping - Introduction to Rapid Prototyping and Rapid Manufacturing - System Integration, Testing, Certification and Documentation

**UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL)SUPPORT****9**

Introduction to Product verification processes and stages - Introduction to Product validation processes and stages - Product Testing standards and Certification - Product Documentation - Sustenance - Maintenance and Repair – Enhancements - Product EoL - Obsolescence Management - Configuration Management - EoL Disposal

**UNIT V BUSINESS DYNAMICS ENGINEERING SERVICES INDUSTRY****9**

The Industry - Engineering Services Industry - Product development in Industry versus Academia - The IPD Essentials - Introduction to vertical specific product development processes - Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and S/W systems – Product development Trade-offs - Intellectual Property Rights and Confidentiality - Security and configuration management.

**TOTAL: 45 PERIODS****COURSE OUTCOMES:****The students will be able to**

- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer
- Work independently as well as in teams
- Manage a project from start to finish

**COURSE MATERIAL AND PEDAGOGY:**

- NASSCOM has agreed to prepare / revise the course materials [selected teachers Anna University from major disciplines will be included in the process] as PPT slides for all the UNITS. The PPTs can be printed and given to each student if necessary at a Nominal Fee. This is the best possible material for this special course.
- NASSCOM will train the teachers of Anna University to enable them to teach this course. A training programme for nearly 3500 teachers needs to be organized. The team is exploring use of technology including the EDUSAT facility at Anna University.
- The course is to be offered as an elective to all UG Students both in the Constituent Colleges and Affiliated colleges of Anna University.

**TEXT BOOKS [INDIAN ECONOMY EDITIONS]:**

1. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", TataMcGraw Hill, Fifth Edition, New Delhi, 2011
2. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, New Delhi, 2005.

## REFERENCES:

1. Hiriyappa B, "Corporate Strategy – Managing the Business", Authorhouse, USA, 2013
2. Peter F Drucker, "People and Performance", Butterworth – Heinemann [Elsevier], Oxford, UK, 2004.
3. Vinod Kumar Garg and Venkitakrishnan N K, "Enterprise Resource Planning – Concepts and Practice", Prentice Hall India, New Delhi, 2003
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, New Delhi, 2013.

**MG6088**

**SOFTWARE PROJECT MANAGEMENT**

**L T P C**  
**3 0 0 3**

## OBJECTIVES:

- To outline the need for Software Project Management
- To highlight different techniques for software cost estimation and activity planning.

### **UNIT I PROJECT EVALUATION AND PROJECT PLANNING**

**9**

Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

### **UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION**

**9**

Software process and Process Models – Choice of Process models - mental delivery – Rapid Application development – Agile methods – Extreme Programming – SCRUM – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II A Parametric Productivity Model - Staffing Pattern.

### **UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT**

**9**

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Monitoring – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical patterns – Cost schedules.

### **UNIT IV PROJECT MANAGEMENT AND CONTROL**

**9**

Framework for Management and control – Collection of data Project termination – Visualizing progress – Cost monitoring – Earned Value Analysis- Project tracking – Change control- Software Configuration Management – Managing contracts – Contract Management.

### **UNIT V STAFFING IN SOFTWARE PROJECTS**

**9**

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham-Hackman job characteristic model – Ethical and Programmed concerns – Working in teams – Decision making – Team structures – Virtual teams – Communications genres – Communication plans.

**TOTAL: 45 PERIODS**

## OUTCOMES:

- At the end of the course the students will be able to practice Project Management principles while developing a software.

## TEXTBOOK:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

**REFERENCES:**

1. Robert K. Wysocki "Effective Software Project Management" – Wiley Publication, 2011.
2. Walker Royce: "Software Project Management"- Addison-Wesley, 1998.
3. Gopalaswamy Ramesh, "Managing Global Software Projects" – McGraw Hill Education (India), Fourteenth Reprint 2013.

**GE6075****PROFESSIONAL ETHICS IN ENGINEERING****L T P C  
3 0 0 3****OBJECTIVES:**

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

**UNIT I HUMAN VALUES****10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

**UNIT II ENGINEERING ETHICS****9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

**UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION****9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

**UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS****9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

**UNIT V GLOBAL ISSUES****8**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society

**TEXTBOOKS:**

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

## REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd., New Delhi 2013.
6. World Community Service Centre, ' Value Education', Vethathiri publications, Erode, 2011

## Web sources:

1. [www.onlineethics.org](http://www.onlineethics.org)
2. [www.nspe.org](http://www.nspe.org)
3. [www.globalethics.org](http://www.globalethics.org)
4. [www.ethics.org](http://www.ethics.org)

CS6011

NATURAL LANGUAGE PROCESSING

L T P C  
3 0 0 3

## OBJECTIVES:

The student should be made to:

- Learn the techniques in natural language processing.
- Be familiar with the natural language generation.
- Be exposed to machine translation.
- Understand the information retrieval techniques.

### UNIT I OVERVIEW AND LANGUAGE MODELING

8

Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages-NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.

### UNIT II WORD LEVEL AND SYNTACTIC ANALYSIS

9

Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging.

Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.

### UNIT III SEMANTIC ANALYSIS AND DISCOURSE PROCESSING

10

Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure.

### UNIT IV NATURAL LANGUAGE GENERATION AND MACHINE TRANSLATION

9

Natural Language Generation: Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation- Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.

## UNIT V INFORMATION RETRIEVAL AND LEXICAL RESOURCES

9

Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net-Stemmers-POS Tagger- Research Corpora.

**TOTAL: 45 PERIODS**

### OUTCOMES:

**Upon completion of the course, the student should be able to:**

- Analyze the natural language text.
- Generate the natural language.
- Do machine translation.
- Apply information retrieval techniques.

### TEXT BOOK:

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

### REFERENCES:

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2<sup>nd</sup> Edition, Prentice Hall, 2008.
2. James Allen, "Natural Language Understanding", 2<sup>nd</sup> edition, Benjamin /Cummings publishing company, 1995.

**CS6012**

**SOFT COMPUTING**

**L T P C**  
**3 0 0 3**

### OBJECTIVES:

**The student should be made to:**

- Learn the various soft computing frame works.
- Be familiar with design of various neural networks.
- Be exposed to fuzzy logic.
- Learn genetic programming.
- Be exposed to hybrid systems.

## UNIT I INTRODUCTION

9

Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models - important technologies - applications.

Fuzzy logic: Introduction - crisp sets- fuzzy sets - crisp relations and fuzzy relations: cartesian product of relation - classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm- Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts.

## UNIT II NEURAL NETWORKS

9

McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks - adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative autoassociative memory network & iterative associative memory network – unsupervised learning networks: Kohonen self organizing feature maps, LVQ – CP networks, ART network.

### **UNIT III FUZZY LOGIC**

**9**

Membership functions: features, fuzzification, methods of membership value assignments-Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.

### **UNIT IV GENETIC ALGORITHM**

**9**

Genetic algorithm and search space - general genetic algorithm – operators - Generational cycle - stopping condition – constraints - classification - genetic programming – multilevel optimization – real life problem- advances in GA.

### **UNIT V HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS**

**9**

Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems - simplified fuzzy ARTMAP - Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Apply various soft computing frame works.
- Design of various neural networks.
- Use fuzzy logic.
- Apply genetic programming.
- Discuss hybrid soft computing.

#### **TEXT BOOKS:**

1. J.S.R.Jang, C.T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI / Pearson Education 2004.
2. S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2011.

#### **REFERENCES:**

1. S.Rajasekaran and G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications", Prentice-Hall of India Pvt. Ltd., 2006.
2. George J. Klir, Ute St. Clair, Bo Yuan, "Fuzzy Set Theory: Foundations and Applications" Prentice Hall, 1997.
3. David E. Goldberg, "Genetic Algorithm in Search Optimization and Machine Learning" Pearson Education India, 2013.
4. James A. Freeman, David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Education India, 1991.
5. Simon Haykin, "Neural Networks Comprehensive Foundation" Second Edition, Pearson Education, 2005.

**OBJECTIVES:**

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.

**UNIT I INTRODUCTION TO DISASTERS 9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

**UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

**UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

**UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

**UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management

**TEXTBOOK:**

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IAS and Sage Publishers, New Delhi, 2010.

**REFERENCES**

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

**ANNA UNIVERSITY, CHENNAI**  
**AFFILIATED INSTITUTIONS**  
**R-2013**

**B.E. ELECTRONICS AND COMMUNICATION ENGINEERING**  
**I – VIII SEMESTERS CURRICULUM AND SYLLABUS**

**SEMESTER I**

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	HS6151	<u>Technical English – I</u>	3	1	0	4
2.	MA6151	<u>Mathematics – I</u>	3	1	0	4
3.	PH6151	<u>Engineering Physics – I</u>	3	0	0	3
4.	CY6151	<u>Engineering Chemistry – I</u>	3	0	0	3
5.	GE6151	<u>Computer Programming</u>	3	0	0	3
6.	GE6152	<u>Engineering Graphics</u>	2	0	3	4
<b>PRACTICALS</b>						
7.	GE6161	<u>Computer Practices Laboratory</u>	0	0	3	2
8.	GE6162	<u>Engineering Practices Laboratory</u>	0	0	3	2
9.	GE6163	<u>Physics and Chemistry Laboratory - I</u>	0	0	2	1
<b>TOTAL</b>			<b>17</b>	<b>2</b>	<b>11</b>	<b>26</b>

**SEMESTER II**

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	HS6251	<u>Technical English – II</u>	3	1	0	4
2.	MA6251	<u>Mathematics – II</u>	3	1	0	4
3.	PH6251	<u>Engineering Physics – II</u>	3	0	0	3
4.	CY6251	<u>Engineering Chemistry – II</u>	3	0	0	3
5.	EC6201	<u>Electronic Devices</u>	3	0	0	3
6.	EE6201	<u>Circuit Theory</u>	3	1	0	4
<b>PRACTICALS</b>						
7.	GE6262	<u>Physics and Chemistry Laboratory - II</u>	0	0	2	1
8.	EC6211	<u>Circuits and Devices Laboratory</u>	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>3</b>	<b>5</b>	<b>24</b>

### SEMESTER III

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MA6351	<u>Transforms and Partial Differential Equations</u>	3	1	0	4
2.	EE6352	<u>Electrical Engineering and Instrumentation</u>	3	1	0	4
3.	EC6301	<u>Object Oriented Programming and Data Structures</u>	3	0	0	3
4.	EC6302	<u>Digital Electronics</u>	3	0	0	3
5.	EC6303	<u>Signals and Systems</u>	3	1	0	4
6.	EC6304	<u>Electronic Circuits- I</u>	3	1	0	4
<b>PRACTICAL</b>						
7.	EC6311	<u>Analog and Digital Circuits Laboratory</u>	0	0	3	2
8.	EC6312	<u>OOPS and Data Structures Laboratory</u>	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>4</b>	<b>6</b>	<b>26</b>

### SEMESTER IV

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MA6451	Probability and Random Processes	3	1	0	4
2.	EC6401	<u>Electronic Circuits II</u>	3	0	0	3
3.	EC6402	<u>Communication Theory</u>	3	0	0	3
4.	EC6403	Electromagnetic Fields	3	1	0	4
5.	EC6404	<u>Linear Integrated Circuits</u>	3	0	0	3
6.	EC6405	<u>Control System Engineering</u>	3	0	0	3
<b>PRACTICAL</b>						
7.	EC6411	<u>Circuit and Simulation Integrated Laboratory</u>	0	0	3	2
8.	EC6412	<u>Linear Integrated Circuit Laboratory</u>	0	0	3	2
9.	EE6461	<u>Electrical Engineering and Control System Laboratory</u>	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>2</b>	<b>9</b>	<b>26</b>

### SEMESTER V

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	EC6501	<u>Digital Communication</u>	3	0	0	3
2.	EC6502	<u>Principles of Digital Signal Processing</u>	3	1	0	4
3.	EC6503	<u>Transmission Lines and Wave Guides</u>	3	1	0	4
4.	GE6351	<u>Environmental Science and Engineering</u>	3	0	0	3
5.	EC6504	<u>Microprocessor and Microcontroller</u>	3	0	0	3
<b>PRACTICAL</b>						
6.	EC6511	<u>Digital Signal Processing Laboratory</u>	0	0	3	2
7.	EC6512	<u>Communication System Laboratory</u>	0	0	3	2
8.	EC6513	<u>Microprocessor and Microcontroller Laboratory</u>	0	0	3	2
		<b>TOTAL</b>	<b>15</b>	<b>2</b>	<b>9</b>	<b>23</b>

### SEMESTER VI

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MG6851	<u>Principles of Management</u>	3	0	0	3
2.	CS6303	<u>Computer Architecture</u>	3	0	0	3
3.	CS6551	<u>Computer Networks</u>	3	0	0	3
4.	EC6601	<u>VLSI Design</u>	3	0	0	3
5.	EC6602	<u>Antenna and Wave propagation</u>	3	0	0	3
6.		Elective I	3	0	0	3
<b>PRACTICAL</b>						
7.	EC6611	<u>Computer Networks Laboratory</u>	0	0	3	2
8.	EC6612	<u>VLSI Design Laboratory</u>	0	0	3	2
9.	GE6674	<u>Communication and Soft Skills - Laboratory Based</u>	0	0	4	2
		<b>TOTAL</b>	<b>18</b>	<b>0</b>	<b>10</b>	<b>24</b>

### SEMESTER VII

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	EC6701	<u>RF and Microwave Engineering</u>	3	0	0	3
2.	EC6702	<u>Optical Communication and Networks</u>	3	0	0	3
3.	EC6703	<u>Embedded and Real Time Systems</u>	3	0	0	3
4.		Elective II	3	0	0	3
5.		Elective III	3	0	0	3
6.		Elective IV	3	0	0	3
<b>PRACTICAL</b>						
7.	EC6711	<u>Embedded Laboratory</u>	0	0	3	2
8.	EC6712	<u>Optical and Microwave Laboratory</u>	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>0</b>	<b>6</b>	<b>22</b>

### SEMESTER VIII

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	EC6801	<u>Wireless Communication</u>	3	0	0	3
2.	EC6802	<u>Wireless Networks</u>	3	0	0	3
3.		Elective V	3	0	0	3
4.		Elective VI	3	0	0	3
<b>PRACTICAL</b>						
5.	EC6811	<u>Project Work</u>	0	0	12	6
<b>TOTAL</b>			<b>12</b>	<b>0</b>	<b>12</b>	<b>18</b>

**TOTAL CREDITS:189**

### SEMESTER VI

#### ELECTIVE – I

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	EC6001	<u>Medical Electronics</u>	3	0	0	3
2.	EC6002	<u>Advanced Digital Signal Processing</u>	3	0	0	3
3.	CS6401	<u>Operating Systems</u>	3	0	0	3
4.	EC6003	<u>Robotics and Automation</u>	3	0	0	3

**SEMESTER VII****ELECTIVE- II**

<b>SL. No.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
5.	EC6004	<u>Satellite Communication</u>	3	0	0	3
6.	EC6005	<u>Electronic Testing</u>	3	0	0	3
7.	EC6006	Avionics	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
8.	CS6012	<u>Soft Computing</u>	3	0	0	3
9.	IT6005	<u>Digital Image Processing</u>	3	0	0	3
10.	CS6013	Foundation Skills in Integrated Product Development	3	0	0	3

**ELECTIVE- III**

<b>SL. No.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
11.	EC6007	<u>Speech Processing</u>	3	0	0	3
12.	EC6008	<u>Web Technology</u>	3	0	0	3
13.	EC6009	<u>Advanced Computer Architecture</u>	3	0	0	3
14.	EC 6010	<u>Electronics Packaging</u>	3	0	0	3
15.	EC6011	<u>Electro Magnetic Interference and Compatibility</u>	3	0	0	3

**ELECTIVE - IV**

<b>SL. No.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
16.	EC6012	<u>CMOS Analog IC Design</u>	3	0	0	3
17.	EC6013	<u>Advanced Microprocessors and Microcontrollers</u>	3	0	0	3
18.	EC6014	<u>Cognitive Radio</u>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
19.	EC6015	<u>Radar and Navigational Aids</u>	3	0	0	3
20.	EC6016	<u>Opto Electronic Devices</u>	3	0	0	3

**SEMESTER VIII****ELECTIVE –V**

<b>SL. No.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
21.	EC6017	<u>RF System Design</u>	3	0	0	3
22.	CS6003	<u>Ad hoc and Sensors Networks</u>	3	0	0	3
23.	GE6082	<u>Indian Constitution and Society</u>	3	0	0	3
24.	EC6018	<u>Multimedia Compression and Communication</u>	3	0	0	3
25.	GE6075	<u>Professional Ethics in Engineering</u>	3	0	0	3
26.	GE6083	Disaster Management	3	0	0	3

**ELECTIVE – VI**

<b>SL. No.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
27.	EC6019	<u>Data Converters</u>	3	0	0	3
28.	CS6701	<u>Cryptography and Network Security</u>	3	0	0	3
29.	GE6757	<u>Total Quality Management</u>	3	0	0	3
30.	MG6071	<u>Entrepreneurship Development</u>	3	0	0	3
31.	MG6088	<u>Software Project Management</u>	3	0	0	3
32.	GE6084	Human Rights	3	0	0	3

**OBJECTIVES:**

- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.

**UNIT I****9+3**

Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one's place, important festivals etc. – Introducing oneself, one's family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one's leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words - Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

**UNIT II****9+3**

Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking and answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Process descriptions (general/specific) - Definitions - Recommendations – Instructions; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association (connotation); E-materials - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

**UNIT III****9+3**

Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading - Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause and effect / compare and contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

**UNIT IV****9+3**

Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations and acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.

## UNIT V

9+3

Listening - Listening to different accents, Listening to Speeches/Presentations, Listening to broadcast and telecast from Radio and TV; Speaking - Giving impromptu talks, Making presentations on given topics; Reading - Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email; Writing - Creative writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items (fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar and Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents - Interpreting posters.

**TOTAL (L:45+T:15): 60 PERIODS**

### OUTCOMES:

#### Learners should be able to:

- Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- Read different genres of texts adopting various reading strategies.
- Listen/view and comprehend different spoken discourses/excerpts in different accents.

### TEXTBOOKS:

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

### REFERENCES:

1. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice. Oxford University Press, New Delhi. 2011
2. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi. 2006
3. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005
4. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi. 2001
5. Viswamohan, Aysha. English for Technical Communication. Tata McGraw-Hill, New Delhi. 2008

### EXTENSIVE Reading (Not for Examination)

1. Kalam, Abdul. Wings of Fire. Universities Press, Hyderabad. 1999.

### WEBSITES:

1. <http://www.usingenglish.com>
2. <http://www.uefap.com>

### TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like self introduction, peer introduction, group poster making, grammar and vocabulary games, etc.
- Discussions
- Role play activities
- Short presentations
- Listening and viewing activities with follow up activities like discussion, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc.

## EVALUATION PATTERN:

### Internal assessment: 20%

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Reviews
- Creative writing
- Poster making, etc.

### All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual speaking activities, Pair work activities like role play, Interview, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded from simple to complex, from direct to inferential
- ✓ Writing assessment: Writing paragraphs, essays etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content.

### End Semester Examination: 80%

MA6151

MATHEMATICS – I

L T P C  
3 1 0 4

### OBJECTIVES:

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

### UNIT I MATRICES

9+3

Eigen values and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

**UNIT II SEQUENCES AND SERIES 9+3**  
Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test, Integral test and D’Alembert’s ratio test – Alternating series – Leibnitz’s test – Series of positive and negative terms – Absolute and conditional convergence.

**UNIT III APPLICATIONS OF DIFFERENTIAL CALCULUS 9+3**  
Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals.

**UNIT IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES 9+3**  
Limits and Continuity – Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor’s series for functions of two variables – Maxima and minima of functions of two variables – Lagrange’s method of undetermined multipliers.

**UNIT V MULTIPLE INTEGRALS 9+3**  
Double integrals in cartesian and polar coordinates – Change of order of integration – Area enclosed by plane curves – Change of variables in double integrals – Area of a curved surface - Triple integrals – Volume of Solids.

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES:**

- This course equips students to have basic knowledge and understanding in one fields of materials, integral and differential calculus.

**TEXT BOOKS:**

1. Bali N. P and Manish Goyal, “A Text book of Engineering Mathematics”, Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
2. Grewal. B.S, “Higher Engineering Mathematics”, 41<sup>st</sup> Edition, Khanna Publications, Delhi, 2011.

**REFERENCES:**

- 1 Dass, H.K., and Er. Rajnish Verma, “Higher Engineering Mathematics”, S. Chand Private Ltd., 2011.
- 2 Glyn James, “Advanced Modern Engineering Mathematics”, 3<sup>rd</sup> Edition, Pearson Education, 2012.
- 3 Peter V. O’Neil, “Advanced Engineering Mathematics”, 7<sup>th</sup> Edition, Cengage learning, 2012.
- 4 Ramana B.V, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, 2008.
- 5 Sivarama Krishna Das P. and Rukmangadachari E., “Engineering Mathematics”, Volume I, Second Edition, PEARSON Publishing, 2011.

**PH6151**

**ENGINEERING PHYSICS – I**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

**UNIT I CRYSTAL PHYSICS 9**

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment)- Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

**UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 9**

Elasticity- Hooke's law - Relationship between three moduli of elasticity (qualitative) – stress -strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending- I-shaped girders  
Modes of heat transfer- thermal conductivity- Newton's law of cooling - Linear heat flow – Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel)

**UNIT III QUANTUM PHYSICS 9**

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment -Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

**UNIT IV ACOUSTICS AND ULTRASONICS 9**

Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies.  
Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications - Sonogram

**UNIT V PHOTONICS AND FIBRE OPTICS 9**

Spontaneous and stimulated emission- Population inversion -Einstein's A and B coefficients - derivation. Types of lasers – Nd:YAG, CO<sub>2</sub>, Semiconductor lasers (homojunction & heterojunction)- Industrial and Medical Applications.  
Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

The students will have knowledge on the basics of physics related to properties of matter, Optics, acoustics etc., and they will apply these fundamental principles to solve practical problems related to materials used for engineering applications

**TEXT BOOKS:**

1. Arumugam M. Engineering Physics. Anuradha publishers, 2010.
2. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai publishers, 2009
3. Mani Naidu S. Engineering Physics, Second Edition, PEARSON Publishing, 2011.

**REFERENCES:**

1. Searls and Zemansky. University Physics, 2009
2. Mani P. Engineering Physics I. Dhanam Publications, 2011.
3. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009.
4. Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011.
5. Rajagopal K. Engineering Physics. PHI, New Delhi, 2011.
6. Senthilkumar G. Engineering Physics I. VRB Publishers, 2011.

**CY6151****ENGINEERING CHEMISTRY - I****L T P C  
3 0 0 3****OBJECTIVES:**

- To make the students conversant with basics of polymer chemistry.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- To acquaint the students with the basics of nano materials, their properties and applications.

**UNIT I POLYMER CHEMISTRY****9**

Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: T<sub>g</sub>, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Preparation, properties and uses of Nylon 6,6, and Epoxy resin.

**UNIT II CHEMICAL THERMODYNAMICS****9**

Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions (problems); Criteria of spontaneity; Gibbs-Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore(problems).

**UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY****9**

Photochemistry: Laws of photochemistry - Grothuss–Draper law, Stark–Einstein law and Lambert-Beer Law. Quantum efficiency – determination- Photo processes - Internal Conversion, Inter-system crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitization. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram only).

**UNIT IV PHASE RULE AND ALLOYS****9**

Phase rule: Introduction, definition of terms with examples, One Component System- water system - Reduced phase rule - Two Component Systems- classification – lead-silver system, zinc-magnesium system. Alloys: Introduction- Definition- Properties of alloys- Significance of alloying, Functions and effect of alloying elements- Ferrous alloys- Nichrome and Stainless steel – heat treatment of steel; Non-ferrous alloys – brass and bronze.

**UNIT V NANO CHEMISTRY****9**

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. nanoparticles: nano cluster, nano rod, nanotube(CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrodeposition, chemical vapour deposition, laser ablation; Properties and applications

**TOTAL :45 PERIODS****OUTCOMES:**

The knowledge gained on polymer chemistry, thermodynamics. spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these subjects for further learning.

**TEXT BOOKS:**

1. Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010
2. Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009.

**REFERENCES:**

1. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.
3. Gowariker V.R. , Viswanathan N.V. and Jayadev Sreedhar, "Polymer Science", New Age International P (Ltd.), Chennai, 2006.
4. Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.

**GE6151****COMPUTER PROGRAMMING****L T P C  
3 0 0 3****OBJECTIVES:****The students should be made to:**

- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

**UNIT I INTRODUCTION****8**

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

**UNIT II C PROGRAMMING BASICS 10**  
Problem formulation – Problem Solving - Introduction to ‘C’ programming –fundamentals – structure of a ‘C’ program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in ‘C’ – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

**UNIT III ARRAYS AND STRINGS 9**  
Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

**UNIT IV FUNCTIONS AND POINTERS 9**  
Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

**UNIT V STRUCTURES AND UNIONS 9**  
Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design C Programs for problems.
- Write and execute C programs for simple applications

**TEXTBOOKS:**

1. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2. Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, First Edition, Oxford University Press, 2009
3. Yashavant P. Kanetkar. “Let Us C”, BPB Publications, 2011.

**REFERENCES:**

1. Byron S Gottfried, “Programming with C”, Schaum’s Outlines, Second Edition, Tata McGraw-Hill, 2006.
2. Dromey R.G., “How to Solve it by Computer”, Pearson Education, Fourth Reprint, 2007.
3. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006.

**GE6152**

**ENGINEERING GRAPHICS**

**L T P C**  
**2 0 3 4**

**OBJECTIVES:**

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products
- To expose them to existing national standards related to technical drawings.

**CONCEPTS AND CONVENTIONS (Not for Examination)**

**1**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

**UNIT I PLANE CURVES AND FREE HAND SKETCHING 5+9**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

**UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 5+ 9**

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

**UNIT III PROJECTION OF SOLIDS 5+9**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

**UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+9**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

**UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+9**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

**COMPUTER AIDED DRAFTING (Demonstration Only) 3**

Introduction to drafting packages and demonstration of their use.

**TOTAL: 75 PERIODS**

**OUTCOMES:**

**On Completion of the course the student will be able to:**

- Perform free hand sketching of basic geometrical constructions and multiple views of objects.
- Do orthographic projection of lines and plane surfaces.
- Draw projections and solids and development of surfaces.
- Prepare isometric and perspective sections of simple solids.
- Demonstrate computer aided drafting.

**TEXT BOOK:**

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50<sup>th</sup> Edition, 2010.

## REFERENCES:

1. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
2. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2<sup>nd</sup> Edition, 2009.
4. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.
5. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

## Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

## Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

GE6161

COMPUTER PRACTICES LABORATORY

L T P C  
0 0 3 2

## OBJECTIVES:

The student should be made to:

- Be familiar with the use of Office software.
- Be exposed to presentation and visualization tools.
- Be exposed to problem solving techniques and flow charts.
- Be familiar with programming in C.
- Learn to use Arrays, strings, functions, structures and unions.

## LIST OF EXPERIMENTS:

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions – Includes Parameter Passing
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

TOTAL : 45 PERIODS

**OUTCOMES:****At the end of the course, the student should be able to:**

- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.
- Develop recursive programs.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

Standalone desktops with C compiler 30 Nos.

(or)

Server with C compiler supporting 30 terminals or more.

**GE6162****ENGINEERING PRACTICES LABORATORY****L T P C****0 0 3 2****OBJECTIVES:**

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

**GROUP A (CIVIL & MECHANICAL)****I CIVIL ENGINEERING PRACTICE****9****Buildings:**

- (a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

**Plumbing Works:**

- (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- (b) Study of pipe connections requirements for pumps and turbines.
- (c) Preparation of plumbing line sketches for water supply and sewage works.
- (d) Hands-on-exercise:  
Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
- (e) Demonstration of plumbing requirements of high-rise buildings.

**Carpentry using Power Tools only:**

- (a) Study of the joints in roofs, doors, windows and furniture.
- (b) Hands-on-exercise:  
Wood work, joints by sawing, planning and cutting.

**II MECHANICAL ENGINEERING PRACTICE****13****Welding:**

- (a) Preparation of arc welding of butt joints, lap joints and tee joints.
- (b) Gas welding practice

**Basic Machining:**

- (a) Simple Turning and Taper turning
- (b) Drilling Practice

**Sheet Metal Work:**

- (a) Forming & Bending:
- (b) Model making – Trays, funnels, etc.
- (c) Different type of joints.

**Machine assembly practice:**

- (a) Study of centrifugal pump
- (b) Study of air conditioner

**Demonstration on:**

- (a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
- (b) Foundry operations like mould preparation for gear and step cone pulley.
- (c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

**GROUP B (ELECTRICAL & ELECTRONICS)**

- |            |   |           |
|------------|---|-----------|
| <b>III</b> | <b>ELECTRICAL ENGINEERING PRACTICE</b>  | <b>10</b> |
|            | <ol style="list-style-type: none"><li>1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.</li><li>2. Fluorescent lamp wiring.</li><li>3. Stair case wiring</li><li>4. Measurement of electrical quantities – voltage, current, power &amp; power factor in RLC circuit.</li><li>5. Measurement of energy using single phase energy meter.</li><li>6. Measurement of resistance to earth of an electrical equipment.</li></ol> |           |
| <b>IV</b>  | <b>ELECTRONICS ENGINEERING PRACTICE</b>   | <b>13</b> |
|            | <ol style="list-style-type: none"><li>1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.</li><li>2. Study of logic gates AND, OR, EOR and NOT.</li><li>3. Generation of Clock Signal.</li><li>4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.</li><li>5. Measurement of ripple factor of HWR and FWR.</li></ol>  |           |

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Ability to fabricate carpentry components and pipe connections including plumbing works.
- Ability to use welding equipments to join the structures.
- Ability to fabricate electrical and electronics circuits.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:  
CIVIL**

- |   |          |
|---|----------|
| 1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. | 15 Sets. |
| 2. Carpentry vice (fitted to work bench)  | 15 Nos.  |
| 3. Standard woodworking tools   | 15 Sets. |
| 4. Models of industrial trusses, door joints, furniture joints  | 5 each   |
| 5. Power Tools: (a) Rotary Hammer   | 2 Nos    |
| (b) Demolition Hammer   | 2 Nos    |
| (c) Circular Saw  | 2 Nos    |
| (d) Planer  | 2 Nos    |
| (e) Hand Drilling Machine   | 2 Nos    |
| (f) Jigsaw  | 2 Nos    |

**MECHANICAL**

- |   |           |
|---|-----------|
| 1. Arc welding transformer with cables and holders                            | 5 Nos.    |
| 2. Welding booth with exhaust facility  | 5 Nos.    |
| 3. Welding accessories like welding shield, chipping hammer, wire brush, etc. | 5 Sets.   |
| 4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.    | 2 Nos.    |
| 5. Centre lathe   | 2 Nos.    |
| 6. Hearth furnace, anvil and smithy tools                                     | 2 Sets.   |
| 7. Moulding table, foundry tools  | 2 Sets.   |
| 8. Power Tool: Angle Grinder  | 2 Nos     |
| 9. Study-purpose items: centrifugal pump, air-conditioner                     | One each. |

**ELECTRICAL**

- |   |         |
|---|---------|
| 1. Assorted electrical components for house wiring                  | 15 Sets |
| 2. Electrical measuring instruments                                 | 10 Sets |
| 3. Study purpose items: Iron box, fan and regulator, emergency lamp | 1 each  |
| 4. Megger (250V/500V)   | 1 No.   |
| 5. Power Tools: (a) Range Finder                                    | 2 Nos   |
| (b) Digital Live-wire detector                                      | 2 Nos   |

**ELECTRONICS**

- |   |         |
|---|---------|
| 1. Soldering guns   | 10 Nos. |
| 2. Assorted electronic components for making circuits                 | 50 Nos. |
| 3. Small PCBs   | 10 Nos. |
| 4. Multimeters  | 10 Nos. |
| 5. Study purpose items: Telephone, FM radio, low-voltage power supply |         |

**REFERENCES:**

1. Jeyachandran K., Natarajan S. & Balasubramanian S., "A Primer on Engineering Practices Laboratory", Anuradha Publications, (2007).
2. Jeyapooan T., Saravanapandian M. & Pranitha S., "Engineering Practices Lab Manual", Vikas Publishing House Pvt.Ltd, (2006)
3. Bawa H.S., "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, (2007).
4. Rajendra Prasad A. & Sarma P.M.M.S., "Workshop Practice", Sree Sai Publication, (2002).
5. Kannaiah P. & Narayana K.L., "Manual on Workshop Practice", Scitech Publications, (1999).

**PHYSICS LABORATORY – I****OBJECTIVES:**

To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

**LIST OF EXPERIMENTS**

(Any FIVE Experiments)

- 1 (a) Determination of Wavelength, and particle size using Laser  
(b) Determination of acceptance angle in an optical fiber.
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
3. Determination of wavelength of mercury spectrum – spectrometer grating
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of Young's modulus by Non uniform bending method
6. Determination of specific resistance of a given coil of wire – Carey Foster's Bridge

**OUTCOMES:**

The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Diode laser, lycopodium powder, glass plate, optical fiber.
2. Ultrasonic interferometer
3. Spectrometer, mercury lamp, grating
4. Lee's Disc experimental set up
5. Traveling microscope, meter scale, knife edge, weights
6. Carey foster's bridge set up  
(Vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

**CHEMISTRY LABORATORY-I****LIST OF EXPERIMENTS**

(Any FIVE Experiments)

**OBJECTIVES:**

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by vacuometry.

- 1 Determination of DO content of water sample by Winkler's method.
- 2 Determination of chloride content of water sample by argentometric method
- 3 Determination of strength of given hydrochloric acid using pH meter
- 4 Determination of strength of acids in a mixture using conductivity meter
- 5 Estimation of iron content of the water sample using spectrophotometer  
(1,10- phenanthroline / thiocyanate method)
- 6 Determination of molecular weight of polyvinylalcohol using Ostwald viscometer
- 7 Conductometric titration of strong acid vs strong base

**TOTAL: 30 PERIODS**

**OUTCOMES:**

The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

- |                       |   |        |
|-----------------------|---|--------|
| 1. Iodine flask       | - | 30 Nos |
| 2. pH meter           | - | 5 Nos  |
| 3. Conductivity meter | - | 5 Nos  |
| 4. Spectrophotometer  | - | 5 Nos  |
| 5. Ostwald Viscometer | - | 10 Nos |

**Common Apparatus : Pipette, Burette, conical flask, porcelain tile, dropper (each 30 Nos.)**

**REFERENCES:**

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New Yor (2001).
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry", LBS Singapore (1994).
3. Jeffery G.H., Bassett J., Mendham J.and Denny vogel's R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980.

**HS6251****TECHNICAL ENGLISH II****L T P C****3 1 0 4****OBJECTIVES:**

- To make learners acquire listening and speaking skills in both formal and informal contexts.
- To help them develop their reading skills by familiarizing them with different types of reading strategies.
- To equip them with writing skills needed for academic as well as workplace contexts.
- To make them acquire language skills at their own pace by using e-materials and language lab components.

**UNIT I****9+3**

Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on topics like weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; Writing - Effective use of SMS for sending short notes and messages - Using 'emoticons' as symbols in email messages; Grammar - Regular and irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. 'can') - Homophones (e.g. 'some', 'sum'); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

**UNIT II****9+3**

Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his / her success,

thanking one's friends / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercises on Grammar and vocabulary, Extensive reading activity (reading stories / novels), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students' dialogues.

### **UNIT III**

**9+3**

Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret, etc.); Reading - Speed reading – reading passages with time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading articles from journals - Format for journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. 'rock', 'train', 'ring'); E-materials - Interactive exercise on Grammar and vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU and RIE materials – Attending a meeting and writing minutes.

### **UNIT IV**

**9+3**

Listening - Listening to a telephone conversation, Viewing model interviews (face-to-face, telephonic and video conferencing); Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary - Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on Grammar and Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

### **UNIT V**

**9+3**

Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading; Writing – Checklist - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; E-materials - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises; Language Lab - Different models of group discussion.

**TOTAL (L:45+T:15): 60 PERIODS**

### **OUTCOMES:**

Learners should be able to

- speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies.
- write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
- read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
- listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

## TEXTBOOKS

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

## REFERENCES

1. Anderson, Paul V. Technical Communication: A Reader-Centered Approach. Cengage. New Delhi. 2008
2. Muralikrishna, & Sunita Mishra. Communication Skills for Engineers. Pearson, New Delhi. 2011
3. Riordan, Daniel. G. Technical Communication. Cengage Learning, New Delhi. 2005
4. Sharma, Sangeetha & Binod Mishra. Communication Skills for Engineers and Scientists. PHI Learning, New Delhi. 2009
5. Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA. 2007

## EXTENSIVE Reading (Not for Examination)

1. Khera, Shiv. You can Win. Macmillan, Delhi. 1998.

## Websites

1. <http://www.englishclub.com>
2. <http://owl.english.purdue.edu>

## TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like individual writing and presentations, group discussions, interviews, reporting, etc
- Long presentations using visual aids
- Listening and viewing activities with follow up activities like discussions, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc
- Projects like group reports, mock interviews etc using a combination of two or more of the language skills

## EVALUATION PATTERN:

### Internal assessment: 20%

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Report
- Creative writing, etc.

All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual presentations, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded following Bloom's taxonomy
- ✓ Writing assessment: Writing essays, CVs, reports etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content graded following Bloom's taxonomy.

### End Semester Examination: 80%

**OBJECTIVES:**

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

**UNIT I VECTOR CALCULUS****9+3**

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

**UNIT II ORDINARY DIFFERENTIAL EQUATIONS****9+3**

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

**UNIT III LAPLACE TRANSFORM****9+3**

Laplace transform – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Transforms of unit step function and impulse functions – Transform of periodic functions. Inverse Laplace transform -Statement of Convolution theorem – Initial and final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

**UNIT IV ANALYTIC FUNCTIONS****9+3**

Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping:  $w = z+k$ ,  $kz$ ,  $1/z$ ,  $z^2$ ,  $e^z$  and bilinear transformation.

**UNIT V COMPLEX INTEGRATION****9+3**

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor's and Laurent's series expansions – Singular points – Residues – Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES:**

- The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.

**TEXT BOOKS:**

1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd.,2011.
2. Grewal. B.S, "Higher Engineering Mathematics", 41<sup>st</sup> Edition, Khanna Publications, Delhi, 2011.

## REFERENCES:

1. Dass, H.K., and Er. Rajnish Verma," Higher Engineering Mathematics", S. Chand Private Ltd., 2011
2. Glyn James, "Advanced Modern Engineering Mathematics", 3<sup>rd</sup> Edition, Pearson Education, 2012.
3. Peter V. O'Neil," Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.
4. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., "Engineering Mathematics" Volume II, Second Edition, PEARSON Publishing 2011.

PH6251

ENGINEERING PHYSICS – II

L T P C  
3 0 0 3

## OBJECTIVES:

- To enrich the understanding of various types of materials and their applications in engineering and technology.

### UNIT I CONDUCTING MATERIALS

9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

### UNIT II SEMICONDUCTING MATERIALS

9

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

### UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS

9

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications  
Superconductivity : properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High  $T_c$  superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

### UNIT IV DIELECTRIC MATERIALS

9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

### UNIT V ADVANCED ENGINEERING MATERIALS

9

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications

**TOTAL: 45 PERIODS**

**OUTCOMES:**

The students will have the knowledge on physics of materials and that knowledge will be used by them in different engineering and technology applications

**TEXT BOOKS:**

1. Arumugam M., Materials Science. Anuradha publishers, 2010
2. Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009

**REFERENCES:**

1. Palanisamy P.K. Materials Science. SCITECH Publishers, 2011
2. Senthilkumar G. Engineering Physics II. VRB Publishers, 2011
3. Mani P. Engineering Physics II. Dhanam Publications, 2011
4. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009

**CY6251****ENGINEERING CHEMISTRY-II**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- Principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.

**UNIT I WATER TECHNOLOGY****9**

Introduction to boiler feed water-requirements-formation of deposits in steam boilers and heat exchangers- disadvantages (wastage of fuels, decrease in efficiency, boiler explosion) prevention of scale formation -softening of hard water -external treatment zeolite and demineralization - internal treatment- boiler compounds (phosphate, calgon, carbonate, colloidal) - caustic embrittlement-boiler corrosion-priming and foaming- desalination of brackish water –reverse osmosis.

**UNIT II ELECTROCHEMISTRY AND CORROSION****9**

Electrochemical cell - redox reaction, electrode potential- origin of electrode potential- oxidation potential- reduction potential, measurement and applications - electrochemical series and its significance - Nernst equation (derivation and problems). Corrosion- causes- factors- types-chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Paints- constituents and function. Electroplating of Copper and electroless plating of nickel.

**UNIT III ENERGY SOURCES****9**

Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion- differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells:Types of batteries- alkaline battery- lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H<sub>2</sub> -O<sub>2</sub> fuel cell- applications.

**UNIT IV ENGINEERING MATERIALS****9**

Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties – refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Portland cement- manufacture and properties - setting and hardening of cement, special cement-waterproof and white cement–properties and uses. Glass - manufacture, types, properties and uses.

**UNIT V FUELS AND COMBUSTION****9**

Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- coal-analysis of coal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) - petroleum- manufacture of synthetic petrol (Bergius process)- knocking- octane number - diesel oil- cetane number - natural gas- compressed natural gas(CNG)- liquefied petroleum gases(LPG)- producer gas- water gas. Power alcohol and bio diesel. Combustion of fuels: introduction- theoretical calculation of calorific value- calculation of stoichiometry of fuel and air ratio-ignition temperature- explosive range - flue gas analysis (ORSAT Method).

**TOTAL: 45 PERIODS****OUTCOMES:**

The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

**TEXT BOOKS:**

1. Vairam S, Kalyani P and SubaRamesh., “Engineering Chemistry”., Wiley India Pvt Ltd., New Delhi., 2011
2. Dara S.S and Umare S.S. “Engineering Chemistry”, S. Chand & Company Ltd., New Delhi , 2010

**REFERENCES:**

1. Kannan P. and Ravikrishnan A., “Engineering Chemistry”, Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009
2. AshimaSrivastava and Janhavi N N., “Concepts of Engineering Chemistry”, ACME Learning Private Limited., New Delhi., 2010.
3. RenuBapna and Renu Gupta., “Engineering Chemistry”, Macmillan India Publisher Ltd., 2010.
4. Pahari A and Chauhan B., “Engineering Chemistry”., Firewall Media., New Delhi., 2010

**EC6201****ELECTRONIC DEVICES****L T P C  
3 0 0 3****OBJECTIVES:****The student should be made to:**

- Be exposed to basic electronic devices
- Be familiar with the theory, construction, and operation of Basic electronic devices.

**UNIT I SEMICONDUCTOR DIODE****9**

PN junction diode, Current equations, Diffusion and drift current densities, forward and reverse bias characteristics, Switching Characteristics.

**UNIT II BIPOLAR JUNCTION 9**  
 NPN -PNP -Junctions-Early effect-Current equations – Input and Output characteristics of CE, CB  
 CC-Hybrid - $\pi$  model - h-parameter model, Ebers Moll Model- Gummel Poon-model, Multi Emitter  
 Transistor.

**UNIT III FIELD EFFECT TRANSISTORS 9**  
 JFETs – Drain and Transfer characteristics,-Current equations-Pinch off voltage and its significance-  
 MOSFET- Characteristics- Threshold voltage -Channel length modulation, D-MOSFET, E-MOSFET-  
 ,Current equation - Equivalent circuit model and its parameters, FINFET,DUAL GATE MOSFET.

**UNIT IV SPECIAL SEMICONDUCTOR DEVICES 9**  
 Metal-Semiconductor Junction- MESFET, Schottky barrier diode-Zener diode-Varactor diode –Tunnel  
 diode- Gallium Arsenide device, LASER diode, LDR.

**UNIT V POWER DEVICES AND DISPLAY DEVICES 9**  
 UJT, SCR, Diac, Triac, Power BJT- Power MOSFET- DMOS-VMOS. LED, LCD, Photo transistor,  
 Opto Coupler, Solar cell, CCD.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Explain the theory, construction, and operation of basic electronic devices.
- Use the basic electronic devices

**TEXT BOOKS**

1. Donald A Neaman, “Semiconductor Physics and Devices”, Third Edition, Tata Mc GrawHill Inc. 2007.

**REFERENCES:**

1. Yang, “Fundamentals of Semiconductor devices”, McGraw Hill International Edition, 1978.
2. Robert Boylestad and Louis Nashelsky, “Electron Devices and Circuit Theory” Pearson Prentice Hall, 10<sup>th</sup> edition,July 2008.

**EE6201**

**CIRCUIT THEORY**

**L T P C**  
**3 1 0 4**

**OBJECTIVES:**

- To introduce electric circuits and its analysis
- To impart knowledge on solving circuits using network theorems
- To introduce the phenomenon of resonance in coupled circuits.
- To educate on obtaining the transient response of circuits.
- To Phasor diagrams and analysis of three phase circuits

**UNIT I BASIC CIRCUITS ANALYSIS 12**

Ohm’s Law – Kirchoffs laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh  
 current and node voltage method of analysis for D.C and A.C. circuits – Phasor Diagram – Power,  
 Power Factor and Energy

**UNIT II NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS 12**

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Norton & Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem.

**UNIT III RESONANCE AND COUPLED CIRCUITS 12**

Series and parallel resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

**UNIT IV TRANSIENT RESPONSE FOR DC CIRCUITS 12**

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input – Characterization of two port networks in terms of Z,Y and h parameters.

**UNIT V THREE PHASE CIRCUITS 12**

Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & unbalanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

- Ability analyse electrical circuits
- Ability to apply circuit theorems
- Ability to analyse AC and DC Circuits

**TEXT BOOKS:**

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, “Engineering Circuits Analysis”, Tata McGraw Hill publishers, 6<sup>th</sup> edition, New Delhi, 2003.
2. Joseph A. Edminister, Mahmood Nahri, “Electric circuits”, Schaum’s series, Tata McGraw-Hill, New Delhi, 2001.

**REFERENCES:**

1. Paranjothi SR, “Electric Circuits Analysis,” New Age International Ltd., New Delhi, 1996.
2. Sudhakar A and Shyam Mohan SP, “Circuits and Network Analysis and Synthesis”,Tata McGraw Hill, 2007.
3. Chakrabati A, “Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, 1999.
4. Charles K. Alexander, Mathew N.O. Sadiku, “Fundamentals of Electric Circuits”, Second Edition, McGraw Hill, 2003.

**GE6262**

**PHYSICS AND CHEMISTRY LABORATORY – II**

**L T P C  
0 0 2 1**

**PHYSICS LABORATORY – II**

**OBJECTIVES:**

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

**(Any FIVE Experiments)**

1. Determination of Young’s modulus by uniform bending method

2. Determination of band gap of a semiconductor
3. Determination of Coefficient of viscosity of a liquid –Poiseuille's method
4. Determination of Dispersive power of a prism - Spectrometer
5. Determination of thickness of a thin wire – Air wedge method
6. Determination of Rigidity modulus – Torsion pendulum

**OUTCOMES:**

The students will have the ability to test materials by using their knowledge of applied physics principles in optics and properties of matter.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Traveling microscope, meter scale, Knife edge, weights
2. Band gap experimental set up
3. Burette, Capillary tube, rubber tube, stop clock, beaker and weighing balance
4. spectrometer, prism, sodium vapour lamp.
5. Air-wedge experimental set up.
6. Torsion pendulum set up.  
(vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

**CHEMISTRY LABORATORY -II  
(Any FIVE Experiments)**

**OBJECTIVES:**

To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

- 1 Determination of alkalinity in water sample
- 2 Determination of total, temporary & permanent hardness of water by EDTA method
- 3 Estimation of copper content of the given solution by EDTA method
- 4 Estimation of iron content of the given solution using potentiometer
- 5 Estimation of sodium present in water using flame photometer
- 6 Corrosion experiment – weight loss method
- 7 Conductometric precipitation titration using  $\text{BaCl}_2$  and  $\text{Na}_2\text{SO}_4$
- 8 Determination of CaO in Cement.

**TOTAL : 30 PERIODS**

**OUTCOMES:**

The students will be conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis.

**REFERENCES:**

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York 2001.
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry, LBS Singapore (1994).
3. Jeffery G.H, Bassett J., Mendham J. and Denny R.C., "Vogel's Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
5. Kolthoff I.M. and Sandell E.B. et al. Quantitative chemical analysis, Mcmillan, Madras 1980

**Laboratory classes on alternate weeks for Physics and Chemistry.**

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Potentiometer	-	5 Nos
2. Flame photo meter	-	5 Nos
3. Weighing Balance	-	5 Nos
4. Conductivity meter	-	5 Nos

**Common Apparatus : Pipette, Burette, conical flask, porcelain tile, dropper (30 Nos each)**

**EC6211**

**CIRCUITS AND DEVICES LABORATORY**

**L T P C**  
**0 0 3 2**

#### OBJECTIVES:

**The student should be made to:**

- Be exposed to the characteristics of basic electronic devices
- Be exposed to RL and RC circuits
- Be familiar with Thevinin & Norton theorem KVL & KCL, and Super Position Theorems

#### LIST OF EXPERIMENTS:

1. Characteristics of PN Junction Diode
2. Zener diode Characteristics & Regulator using Zener diode
3. Common Emitter input-output Characteristics
4. Common Base input-output Characteristics
5. FET Characteristics
6. SCR Characteristics
7. Clipper and Clamper & FWR
8. Verifications Of Thevinin & Norton theorem
9. Verifications Of KVL & KCL
10. Verifications Of Super Position Theorem
11. verifications of maximum power transfer & reciprocity theorem
12. Determination Of Resonance Frequency of Series & Parallel RLC Circuits
13. Transient analysis of RL and RC circuits

**TOTAL: 45 PERIODS**

#### OUTCOMES:

**At the end of the course, the student should be able to:**

- Learn the characteristics of basic electronic devices
- Design RL and RC circuits
- Verify Thevinin & Norton theorem KVL & KCL, and Super Position Theorems

#### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

BC 107, BC 148,2N2646,BFW10	- 25 each
1N4007, Zener diodes	- 25 each
Resistors, Capacitors, Inductors	- sufficient quantities
Bread Boards	- 15 Nos
CRO (30MHz)	- 10 Nos.
Function Generators (3MHz)	- 10 Nos.
Dual Regulated Power Supplies ( 0 – 30V)	- 10 Nos.

**OBJECTIVES:**

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

**UNIT I PARTIAL DIFFERENTIAL EQUATIONS****9+3**

Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order partial differential equations - Lagrange's linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

**UNIT II FOURIER SERIES****9+3**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

**UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS****9+3**

Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

**UNIT IV FOURIER TRANSFORMS****9+3**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

**UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS****9+3**

Z- transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES:**

- The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

**TEXT BOOKS:**

1. Veerarajan. T., "Transforms and Partial Differential Equations", Second reprint, Tata Mc Graw Hill Education Pvt. Ltd., New Delhi, 2012.
2. Grewal. B.S., "Higher Engineering Mathematics", 42<sup>nd</sup> Edition, Khanna Publishers, Delhi, 2012.
3. Narayanan.S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.

**REFERENCES:**

1. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7<sup>th</sup> Edition, Laxmi Publications Pvt Ltd , 2007.
2. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-Graw Hill Publishing Company Limited, New Delhi, 2008.
3. Glyn James, "Advanced Modern Engineering Mathematics", 3<sup>rd</sup> Edition, Pearson Education, 2007.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8<sup>th</sup> Edition, Wiley India, 2007.

5. Ray Wylie. C and Barrett.L.C, "Advanced Engineering Mathematics" Sixth Edition, Tata Mc Graw Hill Education Pvt Ltd, New Delhi, 2012.
6. Datta.K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.

**EE6352**

**ELECTRICAL ENGINEERING AND INSTRUMENTATION**

**L T P C**  
**3 1 0 4**

**OBJECTIVES:**

- To introduce three phase supply and power measurement.
- To understand concepts in electrical generators, motors and transformers.
- To introduce power generation, transmission and distribution concepts.
- To learn basic measurement concepts.
- To learn the concepts of electronic measurements.
- To learn about importance of digital instruments in measurements

**UNIT I DC MACHINES**

**9**

Three phase circuits, a review. Construction of DC machines – Theory of operation of DC generators – Characteristics of DC generators- Operating principle of DC motors – Types of DC motors and their characteristics – Speed control of DC motors- Applications.

**UNIT II TRANSFORMER**

**9**

Introduction – Single phase transformer construction and principle of operation – EMF equation of transformer-Transformer no-load phasor diagram — Transformer on-load phasor diagram — Equivalent circuit of transformer – Regulation of transformer –Transformer losses and efficiency-All day efficiency –auto transformers.

**UNIT III INDUCTION MACHINES AND SYNCHRONOUS MACHINES**

**9**

Principle of operation of three-phase induction motors – Construction –Types – Equivalent circuit – Construction of single-phase induction motors – Types of single phase induction motors – Double revolving field theory – starting methods - Principles of alternator – Construction details – Types – Equation of induced EMF – Voltage regulation. Methods of starting of synchronous motors – Torque equation – V curves – Synchronous motors.

**UNIT IV BASICS OF MEASUREMENT AND INSTRUMENTATION**

**9**

Static and Dynamic Characteristics of Measurement – Errors in Measurement - Classification of Transducers – Variable resistive – Strain gauge, thermistor RTD – transducer - Variable Capacitive Transducer – Capacitor Microphone - Piezo Electric Transducer – Variable Inductive transducer – LVDT, RVDT

**UNIT V ANALOG AND DIGITAL INSTRUMENTS**

**9**

DVM, DMM – Storage Oscilloscope. Comparison of Analog and Digital Modes of operation, Application of measurement system, Errors. Measurement of R, L and C, Wheatstone, Kelvin, Maxwell, Anderson, Schering and Wien bridges Measurement of Inductance, Capacitance, Effective resistance at high frequency, Q-Meter.

**TOTAL (L:45+T:15): 60 PERIODS**

## OUTCOMES:

### Students will be able to understand

- The three phase supply and power measurement.
- The concepts in electrical generators, motors and transformers.
- The basic measurement and instrumentation based devices.
- The relevance of digital instruments in measurements.

## TEXT BOOKS:

1. I.J Nagarath and Kothari DP, "Electrical Machines", McGraw-Hill Education (India) Pvt Ltd 4<sup>th</sup> Edition ,2010
2. A.K.Sawhney, "A Course in Electrical & Electronic Measurements and Instrumentation", Dhanpat Rai and Co, 2004.

## REFERENCES:

1. Del Toro, "Electrical Engineering Fundamentals" Pearson Education, New Delhi, 2007.
2. W.D.Cooper & A.D.Helfrick, "Modern Electronic Instrumentation and Measurement Techniques", 5<sup>th</sup> Edition, PHI, 2002.
3. John Bird, "Electrical Circuit Theory and Technology", Elsevier, First Indian Edition, 2006.
4. Thereja .B.L, "Fundamentals of Electrical Engineering and Electronics", S Chand & Co Ltd, 2008.
5. H.S.Kalsi, "Electronic Instrumentation", Tata Mc Graw-Hill Education, 2004.
6. J.B.Gupta, "Measurements and Instrumentation", S K Kataria & Sons, Delhi, 2003.

**EC6301**

**OBJECT ORIENTED PROGRAMMING AND DATA STRUCTURES**

**L T P C  
3 0 0 3**

## OBJECTIVES:

- To comprehend the fundamentals of object oriented programming, particularly in C++.
- To use object oriented programming to implement data structures.
- To introduce linear, non-linear data structures and their applications.

## UNIT I DATA ABSTRACTION & OVERLOADING

**9**

Overview of C++ – Structures – Class Scope and Accessing Class Members – Reference Variables – Initialization – Constructors – Destructors – Member Functions and Classes – Friend Function – Dynamic Memory Allocation – Static Class Members – Container Classes and Integrators – Proxy Classes – Overloading: Function overloading and Operator Overloading.

## UNIT II INHERITANCE & POLYMORPHISM

**9**

Base Classes and Derived Classes – Protected Members – Casting Class pointers and Member Functions – Overriding – Public, Protected and Private Inheritance – Constructors and Destructors in derived Classes – Implicit Derived – Class Object To Base – Class Object Conversion – Composition Vs. Inheritance – Virtual functions – This Pointer – Abstract Base Classes and Concrete Classes – Virtual Destructors – Dynamic Binding.

## UNIT III LINEAR DATA STRUCTURES

**10**

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation — singly linked lists –Polynomial Manipulation - Stack ADT – Queue ADT - Evaluating arithmetic expressions

#### **UNIT IV NON-LINEAR DATA STRUCTURES**

**9**

Trees – Binary Trees – Binary tree representation and traversals – Application of trees: Set representation and Union-Find operations – Graph and its representations – Graph Traversals – Representation of Graphs – Breadth-first search – Depth-first search - Connected components.

#### **UNIT V SORTING and SEARCHING**

**8**

Sorting algorithms: Insertion sort - Quick sort - Merge sort - Searching: Linear search –Binary Search

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Explain the concepts of Object oriented programming.
- Write simple applications using C++.
- Discuss the different methods of organizing large amount of data.

#### **TEXT BOOKS:**

1. Deitel and Deitel, "C++, How To Program", Fifth Edition, Pearson Education, 2005.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Third Edition, Addison-Wesley, 2007.

#### **REFERENCES:**

1. Bhushan Trivedi, "Programming with ANSI C++, A Step-By-Step approach", Oxford University Press, 2010.
2. Goodrich, Michael T., Roberto Tamassia, David Mount, "Data Structures and Algorithms in C++", 7<sup>th</sup> Edition, Wiley. 2004.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Second Edition, Mc Graw Hill, 2002.
4. Bjarne Stroustrup, "The C++ Programming Language", 3<sup>rd</sup> Edition, Pearson Education, 2007.
5. Ellis Horowitz, Sartaj Sahni and Dinesh Mehta, "Fundamentals of Data Structures in C++", Galgotia Publications, 2007.

**EC6302**

**DIGITAL ELECTRONICS**

**L T P C  
3 0 0 3**

#### **OBJECTIVES:**

- To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
- To introduce the methods for simplifying Boolean expressions
- To outline the formal procedures for the analysis and design of combinational circuits
- and sequential circuits
- To introduce the concept of memories and programmable logic devices.
- To illustrate the concept of synchronous and asynchronous sequential circuits

#### **UNIT I MINIMIZATION TECHNIQUES AND LOGIC GATES**

**9**

**Minimization Techniques:** Boolean postulates and laws – De-Morgan's Theorem - Principle of Duality - Boolean expression - Minimization of Boolean expressions — Minterm – Maxterm - Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map Minimization – Don't care conditions – Quine - Mc Cluskey method of minimization.

**Logic Gates:** AND, OR, NOT, NAND, NOR, Exclusive–OR and Exclusive–NOR Implementations of Logic Functions using gates, NAND–NOR implementations – Multi level gate implementations- Multi output gate implementations. TTL and CMOS Logic and their characteristics – Tristate gates

## **UNIT II COMBINATIONAL CIRCUITS**

**9**

Design procedure – Half adder – Full Adder – Half subtractor – Full subtractor – Parallel binary adder, parallel binary Subtractor – Fast Adder - Carry Look Ahead adder – Serial Adder/Subtractor - BCD adder – Binary Multiplier – Binary Divider - Multiplexer/ Demultiplexer – decoder - encoder – parity checker – parity generators – code converters - Magnitude Comparator.

## **UNIT III SEQUENTIAL CIRCUITS**

**9**

Latches, Flip-flops - SR, JK, D, T, and Master-Slave – Characteristic table and equation –Application table – Edge triggering – Level Triggering – Realization of one flip flop using other flip flops – serial adder/subtractor- Asynchronous Ripple or serial counter – Asynchronous Up/Down counter - Synchronous counters – Synchronous Up/Down counters – Programmable counters – Design of Synchronous counters: state diagram- State table –State minimization –State assignment - Excitation table and maps-Circuit implementation - Modulo–n counter, Registers – shift registers - Universal shift registers – Shift register counters – Ring counter – Shift counters - Sequence generators.

## **UNIT IV MEMORY DEVICES**

**9**

Classification of memories – ROM - ROM organization - PROM – EPROM – EEPROM –EAPROM, RAM – RAM organization – Write operation – Read operation – Memory cycle - Timing wave forms – Memory decoding – memory expansion – Static RAM Cell- Bipolar RAM cell – MOSFET RAM cell – Dynamic RAM cell –Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using ROM, PLA, PAL

## **UNIT V SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS**

**9**

**Synchronous Sequential Circuits:** General Model – Classification – Design – Use of Algorithmic State Machine – Analysis of Synchronous Sequential Circuits

**Asynchronous Sequential Circuits:** Design of fundamental mode and pulse mode circuits – Incompletely specified State Machines – Problems in Asynchronous Circuits – Design of Hazard Free Switching circuits. Design of Combinational and Sequential circuits using VERILOG.

**TOTAL: 45 PERIODS**

### **OUTCOMES:**

#### **Students will be able to:**

- Analyze different methods used for simplification of Boolean expressions.
- Design and implement Combinational circuits.
- Design and implement synchronous and asynchronous sequential circuits.
- Write simple HDL codes for the circuits.

### **TEXT BOOK:**

1. M. Morris Mano, “Digital Design”, 4<sup>th</sup> Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.

## REFERENCES:

1. John F.Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 2008
2. John.M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.
3. Charles H.Roth. "Fundamentals of Logic Design", 6<sup>th</sup> Edition, Thomson Learning, 2013.
4. Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", 6<sup>th</sup> Edition, TMH, 2006.
5. Thomas L. Floyd, "Digital Fundamentals", 10<sup>th</sup> Edition, Pearson Education Inc, 2011
6. Donald D.Givone, "Digital Principles and Design", TMH, 2003.

EC6303

SIGNALS AND SYSTEMS

L T P C  
3 1 0 4

## OBJECTIVES:

- To understand the basic properties of signal & systems and the various methods of classification
- To learn Laplace Transform & Fourier transform and their properties
- To know Z transform & DTFT and their properties
- To characterize LTI systems in the Time domain and various Transform domains

### UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 9

Continuous time signals (CT signals) - Discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Sinusoidal, Exponential, Classification of CT and DT signals - Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals - CT systems and DT systems- Classification of systems – Static & Dynamic, Linear & Nonlinear, Time-variant & Time-invariant, Causal & Noncausal, Stable & Unstable.

### UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS 9

Fourier series analysis-spectrum of Continuous Time (CT) signals- Fourier and Laplace Transforms in CT Signal Analysis - Properties.

### UNIT III LINEAR TIME INVARIANT- CONTINUOUS TIME SYSTEMS 9

Differential Equation-Block diagram representation-impulse response, convolution integrals-Fourier and Laplace transforms in Analysis of CT systems

### UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 9

Baseband Sampling - DTFT – Properties of DTFT - Z Transform – Properties of Z Transform

### UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS 9

Difference Equations-Block diagram representation-Impulse response - Convolution sum- Discrete Fourier and Z Transform Analysis of Recursive & Non-Recursive systems

**TOTAL (L:45+T:15): 60 PERIODS**

## OUTCOMES:

**Upon the completion of the course, students will be able to:**

- Analyze the properties of signals & systems
- Apply Laplace transform, Fourier transform, Z transform and DTFT in signal analysis
- Analyze continuous time LTI systems using Fourier and Laplace Transforms
- Analyze discrete time LTI systems using Z transform and DTFT

**TEXT BOOK:**

1. Allan V. Oppenheim, S. Wilsky and S. H. Nawab, "Signals and Systems", Pearson, 2007.

**REFERENCES:**

1. B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford, 2009.
2. R. E. Zeimer, W. H. Tranter and R. D. Fannin, "Signals & Systems - Continuous and Discrete", Pearson, 2007.
3. John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 2007.
4. M. J. Roberts, "Signals & Systems Analysis using Transform Methods & MATLAB", Tata McGraw Hill, 2007.

**EC6304****ELECTRONIC CIRCUITS – I****L T P C  
3 1 0 4****OBJECTIVES:****The student should be made to**

- Learn about biasing of BJTs and MOSFETs
- Design and construct amplifiers
- Construct amplifiers with active loads
- Study high frequency response of all amplifiers

**UNIT I POWER SUPPLIES AND BIASING OF DISCRETE BJT AND MOSFET 9**

**Rectifiers with filters-** DC Load line, operating point, Various biasing methods for BJT-Design-Stability-Bias compensation, Thermal stability, Design of biasing for JFET, Design of biasing for MOSFET

**UNIT II BJT AMPLIFIERS 9**

Small signal Analysis of Common Emitter-AC Load line, Voltage swing limitations, Common collector and common base amplifiers – Differential amplifiers- CMRR- Darlington Amplifier- Bootstrap technique - Cascaded stages - Cascode Amplifier-**Large signal Amplifiers – Class A , Class B and Class C Power Amplifiers .**

**UNIT III JFET AND MOSFET AMPLIFIERS 9**

Small signal analysis of JFET amplifiers- Small signal Analysis of MOSFET and JFET, Common source amplifier, Voltage swing limitations, Small signal analysis of MOSFET and JFET Source follower and Common Gate amplifiers, - BiMOS Cascode amplifier

**UNIT IV FREQUENCY ANALYSIS OF BJT AND MOSFET AMPLIFIERS 9**

Low frequency and Miller effect, High frequency analysis of CE and MOSFET CS amplifier, Short circuit current gain, cut off frequency –  $f_{\alpha}$  and  $f_{\beta}$  unity gain and Determination of bandwidth of single stage and multistage amplifiers

**UNIT V IC MOSFET AMPLIFIERS 9**

IC Amplifiers- IC biasing Current steering circuit using MOSFET- MOSFET current sources- PMOS and NMOS current sources. Amplifier with active loads - enhancement load, Depletion load and PMOS and NMOS current sources load- CMOS common source and source follower- CMOS differential amplifier- CMRR.

**TOTAL (L: 45+T: 15): 60 PERIODS**

## **OUTCOMES:**

**Upon Completion of the course, the students will be able to:**

- Design circuits with transistor biasing.
- Design simple amplifier circuits.
- Analyze the small signal equivalent circuits of transistors.
- Design and analyze large signal amplifiers.

## **TEXT BOOK:**

1. Donald .A. Neamen, Electronic Circuit Analysis and Design –2<sup>nd</sup> Edition, Tata Mc Graw Hill, 2009.

## **REFERENCES:**

1. Adel .S. Sedra, Kenneth C. Smith, “Micro Electronic Circuits”, 6<sup>th</sup> Edition, Oxford University Press, 2010.
2. David A., “Bell Electronic Devices and Circuits”, Oxford Higher Education Press, 5<sup>th</sup> Edition, 2010
3. Behzad Razavi, “Design of Analog CMOS Integrated Circuits”, Tata Mc Graw Hill, 2007.
4. Paul Gray, Hurst, Lewis, Meyer “Analysis and Design of Analog Integrated Circuits”, 4<sup>th</sup> Edition ,John Willey & Sons 2005
5. Millman.J. and Halkias C.C, “Integrated Electronics”, Mc Graw Hill, 2001.
6. D.Schilling and C.Belove, “Electronic Circuits”, 3<sup>rd</sup> Edition, Mc Graw Hill, 1989.
7. **Robert L. Boylestad and Louis Nasheresky, “Electronic Devices and Circuit Theory”, 10<sup>th</sup> Edition, Pearson Education / PHI, 2008.**

**EC6311**

**ANALOG AND DIGITAL CIRCUITS LABORATORY**

**L T P C  
0 0 3 2**

## **OBJECTIVES:**

**The student should be made to:**

- Study the characteristic of CE, CB and CC Amplifier
- Learn the frequency response of CS Amplifiers
- Study the Transfer characteristic of differential amplifier
- Perform experiment to obtain the bandwidth of single stage and multistage amplifiers
- Perform SPICE simulation of **Electronic Circuits**

## **LIST OF ANALOG EXPERIMENTS:**

1. Half Wave and Full Wave Rectifiers, Filters, Power supplies
2. Frequency Response of CE, CB, CC and CS amplifiers
3. Darlington Amplifier
4. Differential Amplifiers- Transfer characteristic, CMRR Measurement
5. Cascode / Cascade amplifier
6. Class A and Class B Power Amplifiers
7. Determination of bandwidth of single stage and multistage amplifiers
8. Spice Simulation of Common Emitter and Common Source amplifiers

## **LIST OF DIGITAL EXPERIMENTS**

9. Design and implementation of code converters using logic gates  
(i) BCD to excess-3 code and vice versa (ii) Binary to gray and vice-versa
10. Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder using IC 7483
11. Design and implementation of Multiplexer and De-multiplexer using logic gates

12. Design and implementation of encoder and decoder using logic gates
13. Construction and verification of 4 bit ripple counter and Mod-10 / Mod-12 Ripple counters
14. Design and implementation of 3-bit synchronous up/down counter
15. Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- flops.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Differentiate cascade and cascade amplifier.
- Analyze the limitation in bandwidth of single stage and multi stage amplifier
- Simulate amplifiers using Spice
- Measure CMRR in differential amplifier

**LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS, 2 STUDENTS / EXPERIMENT:**

Equipments for Analog Lab

CRO (30MHz)	– 15 Nos.
Signal Generator /Function Generators (3 MHz)	– 15 Nos
Dual Regulated Power Supplies ( 0 – 30V)	– 15 Nos.
Standalone desktop PCs with SPICE software	– 15 Nos.
Transistor/FET (BJT-NPN-PNP and NMOS/PMOS)	– 50 Nos
Components and Accessories	

Equipments for Digital Lab

Dual power supply/ single mode power supply	- 15 Nos
IC Trainer Kit	- 15 Nos
Bread Boards	- 15 Nos
Computer with HDL software	- 15 Nos
Seven segment display	-15 Nos
Multimeter	- 15 Nos
ICs each 50 Nos	
7400/ 7402 / 7404 / 7486 / 7408 / 7432 / 7483 / 74150 /	
74151 / 74147 / 7445 / 7476/7491/ 555 / 7494 / 7447 / 74180 /	
7485 / 7473 / 74138 / 7411 / 7474	

**EC6312**

**OOPS AND DATA STRUCTURES LABORATORY**

**L T P C**  
**0 0 3 2**

**OBJECTIVES:**

**The student should be made to:**

- Learn C++ programming language.
- Be exposed to the different data structures
- Be familiar with applications using different data structures

**LIST OF EXPERIMENTS:**

1. Basic Programs for C++ Concepts
2. Array implementation of List Abstract Data Type (ADT)
3. Linked list implementation of List ADT
4. Cursor implementation of List ADT
5. Stack ADT - Array and linked list implementations
6. The next two exercises are to be done by implementing the following source files

- i. Program source files for Stack Application 1
- ii. Array implementation of Stack ADT
- iii. Linked list implementation of Stack ADT
- iv. Program source files for Stack Application 2
- v. An appropriate header file for the Stack ADT should be included in (i) and (iv)
7. Implement any Stack Application using array implementation of Stack ADT (by implementing files (i) and (ii) given above) and then using linked list
8. Implementation of Stack ADT (by using files (i) and implementing file (iii))
9. Implement another Stack Application using array and linked list implementations of Stack ADT (by implementing files (iv) and using file (ii), and then by using files (iv) and (iii))
11. Queue ADT – Array and linked list implementations
12. Search Tree ADT - Binary Search Tree
13. Implement an interesting application as separate source files and using any of the searchable ADT files developed earlier. Replace the ADT file alone with other appropriate ADT files. Compare the performance.
14. Quick Sort

**TOTAL: 45 PERIODS**

**REFERENCE:**

[spoken-tutorial.org](http://spoken-tutorial.org).

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design and implement C++ programs for manipulating stacks, queues, linked lists, trees, and graphs.
- Apply good programming design methods for program development.
- Apply the different data structures for implementing solutions to practical problems.

**LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

Standalone desktops with C++ Compiler - 30 Nos.

(or)

Server with C++ compiler supporting 30 terminals or more.

**MA6451**

**PROBABILITY AND RANDOM PROCESSES**

**L T P C**  
**3 1 0 4**

**OBJECTIVES:**

To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems etc in communication engineering.

**UNIT I RANDOM VARIABLES**

**9+3**

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions.

**UNIT II TWO - DIMENSIONAL RANDOM VARIABLES**

**9+3**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables.

**UNIT III RANDOM PROCESSES****9+3**

Classification – Stationary process – Markov process - Poisson process – Random telegraph process.

**UNIT IV CORRELATION AND SPECTRAL DENSITIES****9+3**

Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties.

**UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS****9+3**

Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and Cross correlation functions of input and output.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES:**

- The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable. Able to analyze the response of random inputs to linear time invariant systems.

**TEXT BOOKS:**

1. Ibe.O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 1<sup>st</sup> Indian Reprint, 2007.
2. Peebles. P.Z., "Probability, Random Variables and Random Signal Principles", Tata Mc Graw Hill, 4<sup>th</sup> Edition, New Delhi, 2002.

**REFERENCES:**

1. Yates. R.D. and Goodman. D.J., "Probability and Stochastic Processes", 2<sup>nd</sup> Edition, Wiley India Pvt. Ltd., Bangalore, 2012.
2. Stark. H., and Woods. J.W., "Probability and Random Processes with Applications to Signal Processing", 3<sup>rd</sup> Edition, Pearson Education, Asia, 2002.
3. Miller. S.L. and Childers. D.G., "Probability and Random Processes with Applications to Signal Processing and Communications", Academic Press, 2004.
4. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata Mc Graw Hill Edition, New Delhi, 2004.
5. Cooper. G.R., Mc Gillem. C.D., "Probabilistic Methods of Signal and System Analysis", 3<sup>rd</sup> Indian Edition, Oxford University Press, New Delhi, 2012.

**EC6401****ELECTRONIC CIRCUITS II****L T P C  
3 0 0 3****OBJECTIVES:**

- To understand the advantages and method of analysis of feedback amplifiers.
- To understand the analysis and design of LC and RC oscillators, amplifiers, multivibrators, and time base generators.

**UNIT I FEEDBACK AMPLIFIERS****9**

General Feedback Structure – Properties of negative feedback – Basic Feedback Topologies – Feedback amplifiers – Series – Shunt, Series – Series, Shunt – Shunt and Shunt – Series Feedback – Determining the Loop Gain – Stability Problem – Nyquist Plot – Effect of feedback on amplifier poles – Frequency Compensation.

**UNIT II OSCILLATORS****9**

Classification, Barkhausen Criterion - Mechanism for start of oscillation and stabilization of amplitude, General form of an Oscillator, Analysis of LC oscillators - Hartley, Colpitts, Clapp, Franklin, Armstrong, Tuned collector oscillators, RC oscillators - phase shift - Wienbridge - Twin-T Oscillators, Frequency range of RC and LC Oscillators, Quartz Crystal Construction, Electrical equivalent circuit of Crystal, Miller and Pierce Crystal oscillators, frequency stability of oscillators.

**UNIT III TUNED AMPLIFIERS****9**

Coil losses, unloaded and loaded Q of tank circuits, small signal tuned amplifiers - Analysis of capacitor coupled single tuned amplifier - double tuned amplifier - effect of cascading single tuned and double tuned amplifiers on bandwidth - Stagger tuned amplifiers - large signal tuned amplifiers - Class C tuned amplifier - Efficiency and applications of Class C tuned amplifier - Stability of tuned amplifiers - Neutralization - Hazeltine neutralization method.

**UNIT IV WAVE SHAPING AND MULTIVIBRATOR CIRCUITS****9**

RC & RL Integrator and Differentiator circuits - Storage, Delay and Calculation of Transistor Switching Times - Speed-up Capacitor - Diode clippers, Diode comparator - Clampers. Collector coupled and Emitter coupled Astable multivibrator - Monostable multivibrator - Bistable multivibrators - Triggering methods for Bistable multivibrators - Schmitt trigger circuit

**UNIT V BLOCKING OSCILLATORS AND TIMEBASE GENERATORS****9**

UJT saw tooth waveform generator, Pulse transformers - equivalent circuit - response - applications, Blocking Oscillator - Free running blocking oscillator - Astable Blocking Oscillators with base timing - Push-pull Astable blocking oscillator with emitter timing, Frequency control using core saturation, Triggered blocking oscillator - Monostable blocking oscillator with base timing - Monostable blocking oscillator with emitter timing, Time base circuits - Voltage-Time base circuit, Current-Time base circuit - Linearization through adjustment of driving waveform.

**TOTAL: 45 PERIODS****OUTCOMES:**

Upon Completion of the course, the students will be able to

- Design and analyze feedback amplifiers.
- Design LC and RC oscillators, tuned amplifiers, wave shaping circuits, multivibrators, blocking oscillators and time base generators.
- Analyze performance of tuned amplifiers.

**TEXT BOOK:**

1. Sedra and Smith, "Micro Electronic Circuits"; Sixth Edition, Oxford University Press, 2011.

**REFERENCES:**

1. Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", 10<sup>th</sup> Edition, Pearson Education / PHI, 2008
2. David A. Bell, "Electronic Devices and Circuits", Fifth Edition, Oxford University Press, 2008.
3. Millman J. and Taub H., "Pulse Digital and Switching Waveforms", TMH, 2000.
4. Millman and Halkias. C., Integrated Electronics, TMH, 2007.

**OBJECTIVES:**

- To introduce the concepts of various analog modulations and their spectral characteristics.
- To understand the properties of random process.
- To know the effect of noise on communication systems.
- To study the limits set by Information Theory.

**UNIT I AMPLITUDE MODULATION****9**

Generation and detection of AM wave-spectra-DSBSC, Hilbert Transform, Pre-envelope & complex envelope - SSB and VSB –comparison -Superheterodyne Receiver.

**UNIT II ANGLE MODULATION****9**

Phase and frequency modulation-Narrow Band and Wide band FM - Spectrum - FM modulation and demodulation – FM Discriminator- PLL as FM Demodulator - Transmission bandwidth.

**UNIT III RANDOM PROCESS****9**

Random variables, Central limit Theorem, Random Process, Stationary Processes, Mean, Correlation & Covariance functions, Power Spectral Density, Ergodic Processes, Gaussian Process, Transmission of a Random Process Through a LTI filter.

**UNIT IV NOISE CHARACTERIZATION****9**

Noise sources and types – Noise figure and noise temperature – Noise in cascaded systems. Narrow band noise – PSD of in-phase and quadrature noise –Noise performance in AM systems – Noise performance in FM systems – Pre-emphasis and de-emphasis – Capture effect, threshold effect.

**UNIT V INFORMATION THEORY****9**

Entropy - Discrete Memoryless channels - Channel Capacity -Hartley - Shannon law - Source coding theorem - Huffman & Shannon - Fano codes

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of the course, the students would**

- Design AM communication systems.
- Design Angle modulated communication systems
- Apply the concepts of Random Process to the design of Communication systems
- Analyze the noise performance of AM and FM systems

**TEXT BOOKS:**

1. J.G.Proakis, M.Salehi, “Fundamentals of Communication Systems”, Pearson Education 2006.
2. S. Haykin, “Digital Communications”, John Wiley, 2005.

**REFERENCES:**

1. B.P.Lathi, “Modern Digital and Analog Communication Systems”, 3<sup>rd</sup> Edition, Oxford University Press, 2007.
2. B.Sklar, “Digital Communications Fundamentals and Applications”, 2<sup>nd</sup> Edition Pearson Education 2007
3. H P Hsu, Schaum Outline Series - “Analog and Digital Communications” TMH 2006
4. Couch.L., "Modern Communication Systems", Pearson, 2001.

**OBJECTIVES:**

- To impart knowledge on the basics of static electric and magnetic field and the associated laws.
- To give insight into the propagation of EM waves and also to introduce the methods in computational electromagnetics.
- To make students have depth understanding of antennas, electronic devices, Waveguides is possible.

**UNIT I      STATIC ELECTRIC FIELD****9**

Vector Algebra, Coordinate Systems, Vector differential operator, Gradient, Divergence, Curl, Divergence theorem, Stokes theorem, Coulombs law, Electric field intensity, Point, Line, Surface and Volume charge distributions, Electric flux density, Gauss law and its applications, Gauss divergence theorem, Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

**UNIT II      CONDUCTORS AND DIELECTRICS****9**

Conductors and dielectrics in Static Electric Field, Current and current density, Continuity equation, Polarization, Boundary conditions, Method of images, Resistance of a conductor, Capacitance, Parallel plate, Coaxial and Spherical capacitors, Boundary conditions for perfect dielectric materials, Poisson's equation, Laplace's equation, Solution of Laplace equation, Application of Poisson's and Laplace's equations.

**UNIT III     STATIC MAGNETIC FIELDS****9**

Biot -Savart Law, Magnetic field Intensity, Estimation of Magnetic field Intensity for straight and circular conductors, Ampere's Circuital Law, Point form of Ampere's Circuital Law, Stokes theorem, Magnetic flux and magnetic flux density, The Scalar and Vector Magnetic potentials, Derivation of Steady magnetic field Laws.

**UNIT IV     MAGNETIC FORCES AND MATERIALS****9**

Force on a moving charge, Force on a differential current element, Force between current elements, Force and torque on a closed circuit, The nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions involving magnetic fields, The magnetic circuit, Potential energy and forces on magnetic materials, Inductance, Basic expressions for self and mutual inductances, Inductance evaluation for solenoid, toroid, coaxial cables and transmission lines, Energy stored in Magnetic fields.

**UNIT V      TIME VARYING FIELDS AND MAXWELL'S EQUATIONS****9**

Fundamental relations for Electrostatic and Magnetostatic fields, Faraday's law for Electromagnetic induction, Transformers, Motional Electromotive forces, Differential form of Maxwell's equations, Integral form of Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and their solutions, Poynting's theorem, Time harmonic fields, Electromagnetic Spectrum.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES:**

Upon completion of the course, the students would be able to

- Analyze field potentials due to static changes and static magnetic fields.
- Explain how materials affect electric and magnetic fields.
- Analyze the relation between the fields under time varying situations.
- Discuss the principles of propagation of uniform plane waves.

**TEXT BOOKS:**

1. William H Hayt and Jr John A Buck, "Engineering Electromagnetics" , Tata Mc Graw-Hill Publishing Company Ltd, New Delhi, 2008
2. Sadiku MH, "Principles of Electromagnetics", Oxford University Press Inc, New Delhi, 2009

**REFERENCES:**

1. David K Cheng, "Field and Wave Electromagnetics", Pearson Education Inc, Delhi, 2004
2. John D Kraus and Daniel A Fleisch, "Electromagnetics with Applications", Mc Graw Hill Book Co, 2005
3. Karl E Longman and Sava V Savov, "Fundamentals of Electromagnetics", Prentice Hall of India, New Delhi, 2006
4. Ashutosh Pramanic, "Electromagnetism", Prentice Hall of India , New Delhi, 2006

**EC6404****LINEAR INTEGRATED CIRCUITS****L T P C****3 0 0 3****OBJECTIVES:**

- To introduce the basic building blocks of linear integrated circuits.
- To learn the linear and non-linear applications of operational amplifiers.
- To introduce the theory and applications of analog multipliers and PLL.
- To learn the theory of ADC and DAC.
- To introduce the concepts of waveform generation and introduce some special function ICs.

**UNIT I BASICS OF OPERATIONAL AMPLIFIERS****9**

Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, Basic information about op-amps – Ideal Operational Amplifier - General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations.

**UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS****9**

Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.

**UNIT III ANALOG MULTIPLIER AND PLL****9**

Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing.

**UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS****9**

Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode  $R \square 2R$  Ladder types - switches for D/A converters, high speed sample-and-hold circuits, A/D Converters – specifications - Flash type - Successive Approximation type - Single Slope type – Dual Slope type - A/D Converter using Voltage-to-Time Conversion - Over-sampling A/D Converters.

## **UNIT V WAVEFORM GENERATORS AND SPECIAL FUNCTION ICs 9**

Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555, IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Monolithic switching regulator, Switched capacitor filter IC MF10, Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers and fibre optic IC.

**TOTAL: 45 PERIODS**

### **OUTCOMES:**

**Upon Completion of the course, the students will be able to:**

- Design linear and non linear applications of op – amps.
- Design applications using analog multiplier and PLL.
- Design ADC and DAC using op – amps.
- Generate waveforms using op – amp circuits.
- Analyze special function ICs.

### **TEXT BOOKS:**

1. D.Roy Choudhry, Shail Jain, “Linear Integrated Circuits”, New Age International Pvt. Ltd., 2000.
2. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, 3<sup>rd</sup> Edition, Tata Mc Graw-Hill, 2007.

### **REFERENCES:**

1. Ramakant A. Gayakwad, “OP-AMP and Linear ICs”, 4<sup>th</sup> Edition, Prentice Hall / Pearson Education, 2001.
2. Robert F.Coughlin, Frederick F.Driscoll, “Operational Amplifiers and Linear Integrated Circuits”, Sixth Edition, PHI, 2001.
3. B.S.Sonde, “System design using Integrated Circuits”, 2<sup>nd</sup> Edition, New Age Pub, 2001
4. Gray and Meyer, “Analysis and Design of Analog Integrated Circuits”, Wiley International, 2005.
5. Michael Jacob, “Applications and Design with Analog Integrated Circuits”, Prentice Hall of India, 1996.
6. William D.Stanley, “Operational Amplifiers with Linear Integrated Circuits”, Pearson Education, 2004.
7. S.Salivahanan & V.S. Kanchana Bhaskaran, “Linear Integrated Circuits”, TMH, 2008.

**EC6405**

**CONTROL SYSTEM ENGINEERING**

**L T P C  
3 0 0 3**

### **OBJECTIVES:**

- To introduce the elements of control system and their modeling using various Techniques.
- To introduce methods for analyzing the time response, the frequency response and the stability of systems
- To introduce the state variable analysis method

## **UNIT I CONTROL SYSTEM MODELING 9**

Basic Elements of Control System – Open loop and Closed loop systems - Differential equation - Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems - Block diagram reduction Techniques - Signal flow graph

**UNIT II TIME RESPONSE ANALYSIS****9**

Time response analysis - First Order Systems - Impulse and Step Response analysis of second order systems - Steady state errors – P, PI, PD and PID Compensation, Analysis using MATLAB

**UNIT III FREQUENCY RESPONSE ANALYSIS****9**

Frequency Response - Bode Plot, Polar Plot, Nyquist Plot - Frequency Domain specifications from the plots - Constant M and N Circles - Nichol's Chart - Use of Nichol's Chart in Control System Analysis. Series, Parallel, series-parallel Compensators - Lead, Lag, and Lead Lag Compensators, Analysis using MATLAB.

**UNIT IV STABILITY ANALYSIS****9**

Stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, Stability, Dominant Poles, Application of Root Locus Diagram - Nyquist Stability Criterion - Relative Stability, Analysis using MATLAB

**UNIT V STATE VARIABLE ANALYSIS****9**

State space representation of Continuous Time systems – State equations – Transfer function from State Variable Representation – Solutions of the state equations - Concepts of Controllability and Observability – State space representation for Discrete time systems. Sampled Data control systems – Sampling Theorem – Sampler & Hold – Open loop & Closed loop sampled data systems.

**TOTAL: 45 PERIODS****OUTCOMES:****Upon completion of the course, students will be able to:**

- Perform time domain and frequency domain analysis of control systems required for stability analysis.
- Design the compensation technique that can be used to stabilize control systems.

**TEXTBOOK:**

1. J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5<sup>th</sup> Edition, 2007.

**REFERENCES:**

1. Benjamin.C.Kuo, "Automatic control systems", Prentice Hall of India, 7<sup>th</sup> Edition,1995.
2. M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 2<sup>nd</sup> Edition, 2002.
3. Schaum's Outline Series, "Feed back and Control Systems" Tata Mc Graw-Hill, 2007.
4. John J.D'Azzo & Constantine H.Houpis, "Linear Control System Analysis and Design", Tata Mc Graw-Hill, Inc., 1995.
5. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Addison – Wesley, 1999.

**OBJECTIVES:**

- To gain hands on experience in designing electronic circuits.
- To learn simulation software used in circuit design.
- To learn the fundamental principles of amplifier circuits
- To understand Bias in Amplifier circuits
- **To differentiate feedback amplifiers and oscillators.**
- To study the characteristic of source follower
- **To understand the concepts of multivibrators**

**DESIGN AND ANALYSIS OF THE FOLLOWING CIRCUITS**

1. Series and Shunt feedback amplifiers-Frequency response, Input and output impedance calculation
2. RC Phase shift oscillator and Wien Bridge Oscillator
3. Hartley Oscillator and Colpitts Oscillator
4. Single Tuned Amplifier
5. RC Integrator and Differentiator circuits
6. Astable and Monostable multivibrators
7. Clippers and Clampers
8. Free running Blocking Oscillators

**SIMULATION USING SPICE (Using Transistor):**

1. Tuned Collector Oscillator
2. Twin -T Oscillator / Wein Bridge Oscillator
3. Double and Stagger tuned Amplifiers
4. Bistable Multivibrator
5. Schmitt Trigger circuit with Predictable hysteresis
6. Monostable multivibrator with emitter timing and base timing
7. Voltage and Current Time base circuits

**TOTAL: 45 PERIODS****OUTCOMES:**

On completion of this lab course, the students will be able to

- Analyze various types of feedback amplifiers
- Design oscillators, tuned amplifiers, wave-shaping circuits and multivibrators
- Design and simulate feedback amplifiers, oscillators, tuned amplifiers, wave-shaping circuits and multivibrators using SPICE Tool.

**LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER EXPERIMENT:**

CRO (Min 30MHz)	– 15 Nos.
Signal Generator /Function Generators (2 MHz)	– 15 Nos
Dual Regulated Power Supplies ( 0 – 30V)	– 15 Nos.
Digital Multimeter	– 15 Nos
Digital LCR Meter	– 2 Nos
Standalone desktops PC	– 15 Nos.
Transistor/FET (BJT-NPN-PNP and NMOS/PMOS)	– 50 Nos

Components and Accessories:

Transistors, Resistors, Capacitors, Inductors, diodes, Zener Diodes, Bread Boards, Transformers.

SPICE Circuit Simulation Software: (any public domain or commercial software)

**OBJECTIVES:**

- To expose the students to linear and integrated circuits
- To understand the basics of linear integrated circuits and available ICs
- To understand characteristics of operational amplifier.
- To apply operational amplifiers in linear and nonlinear applications.
- To acquire the basic knowledge of special function IC.
- To use PICE software for circuit design

**LIST OF EXPERIMENTS:****DESIGN AND TESTING OF**

1. Inverting, Non inverting and Differential amplifiers.
2. Integrator and Differentiator.
3. Instrumentation amplifier
4. Active low-pass, High-pass and band-pass filters.
5. Astable & Monostable multivibrators and Schmitt Trigger using op-amp.
6. Phase shift and Wien bridge oscillators using op-amp.
7. Astable and monostable multivibrators using NE555 Timer.
8. PLL characteristics and its use as Frequency Multiplier.
9. DC power supply using LM317 and LM723.
10. Study of SMPS.

**SIMULATION USING SPICE**

1. Simulation of Experiments 3, 4, 5, 6 and 7.
2. D/A and A/D converters (Successive approximation)
3. Analog multiplier
4. CMOS Inverter, NAND and NOR

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Design oscillators and amplifiers using operational amplifiers.
- Design filters using Opamp and perform experiment on frequency response.
- Analyse the working of PLL and use PLL as frequency multiplier.
- Design DC power supply using ICs.
- Analyse the performance of oscillators and multivibrators using SPICE

**LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS (2 students per Experiment)**

CRO (Min 30MHz) – 15 Nos.

Signal Generator /Function Generators (2 MHz) – 15 Nos

Dual Regulated Power Supplies ( 0 – 30V) – 15 Nos.

Digital Multimeter – 15 Nos

IC tester - 5 Nos

Standalone desktops PC – 15 Nos.

SPICE Circuit Simulation Software: (any public domain or commercial software)

Components and Accessories: - 50 Nos

Transistors, Resistors, Capacitors, diodes, Zener diodes, Bread Boards, Transformers, wires, Power transistors, Potentiometer, A/D and D/A convertors, LEDs

Note: Op-Amps uA741, LM 301, LM311, LM 324, LM317, LM723, 7805, 7812, 2N3524, 2N3525, 2N3391, AD 633, LM 555, LM 565 may be used.

**OBJECTIVES:**

- To provide hands on experience with generators and motors.
- To Understand the working of DC/AC motors and generators
- To study the characteristics of transducers
- To learn the use of transformer
- To understand the behavior of linear system through simulation
- To gain knowledge of controllers

**LIST OF EXPERIMENTS:**

1. Study of DC & AC motor starters
2. Study of three phase circuits
3. Speed Control of DC shunt motor
4. Load Test on DC shunt motor
5. OCC & Load Characteristics of DC shunt generator
6. Transfer Function of separately excited D.C.Generator.
7. Regulation of three phase alternator
8. Open Circuit and Short Circuit test on single phase transformer to draw its equivalent circuit
9. Load test on single-phase transformer
10. Load test on single phase and three-phase Induction motor
11. Measurement of passive elements using Bridge Networks.
12. Study of transducers and characterization.
13. Digital simulation of linear systems.
14. Stability Analysis of Linear system using MATLAB or equivalent Software.
15. Study the effect of P, PI, PID controllers using MATLAB or equivalent Software.
16. Design of Lead and Lag compensator.

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Perform experiments to study the load characteristics of DC motors / generators.
- Design bridge network circuit to measure the values of passive component.
- Analyse the stability of linear system through simulation software.
- Obtain transfer function of DC generators.

**LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

- |   |   |
|---|---|
| 1. DC Shunt Motor with Loading Arrangement  | 2 |
| 2. 3HP,220V,14A,750RPM,0.6A(Shunt field)  |   |
| 3. DC Shunt Motor Coupled With Three phase Alternator   | 1 |
| 4. DC Shunt Motor - kW: 5.2 / volts: 220 / Amps: 27.5/  |   |
| 5. Speed: 1500 RPM/ Field current: 0.9A   |   |
| 6. Three phase Alternator - kVA: 7.5/ volts: 415/ Amps: 10.4<br>Speed: 1500 RPM/ Field current: 2A. |   |
| 7. Single Phase Transformer; 2 KVA,230/110-166 V  | 1 |
| 8. Three Phase Induction Motor with Loading Arrangement   | 1 |
| 9. (3.7KW,415v,7.5A,1430 RPM)   |   |
| 10. Single Phase Induction Motor with Loading Arrangement   | 1 |
| 11. (230V,5HP,17A)  |   |
| 12. DC Shunt Motor Coupled With DC Compound Generator   | 1 |

13. (DC Shunt Motor: kW: 7.4/ volts: 220/ Amps: 38.5/ Speed: 960 RPM Field current1.2A)	
14. (DC Compound Generator: kW: 7.5/ volts: 220/ Amps: 38.5/ Speed: 960 RPM / Field current1.2A)	
15. Tachometer –Digital/Analog	8
16. Single Phase Auto Transformer;(0-270)V	2
17. Three Phase Auto Transformer;(0-270)V	1
18. MC Voltmeter-(0-300/600)V	5
19. MC Ammeter (0-10/20)A	5
20. MC Ammeter (0-2/1)A	4
21. MI Voltmeter (0-300/600)V	5
22. MI Ammeter (0-10/20)A	6
23. MI Ammeter (0-1/2)A	4
24. UPF Wattmeter (300/600V,10/20A)	4
25. LPF Wattmeter (300/600V,10/20A)	4
26. Single Phase Resistive Loading Bank(10KW)	2
27. Three Phase Resistive Loading Bank(10KW)	2
28. SPST switch	2
29. Fuse various ranges	As per the requirement
30. Wires	As per the requirement
31. Rheostats(100Ω,1A;250Ω,1.5A;75Ω,16A,1000Ω,1A)	Each 2
32. Computers with MATLAB or equivalent Software.	

**EC6501**

**DIGITAL COMMUNICATION**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To know the principles of sampling & quantization
- To study the various waveform coding schemes
- To learn the various baseband transmission schemes
- To understand the various Band pass signaling schemes
- To know the fundamentals of channel coding

**UNIT I SAMPLING & QUANTIZATION**

**9**

Low pass sampling – Aliasing- Signal Reconstruction-Quantization - Uniform & non-uniform quantization - quantization noise - Logarithmic Companding of speech signal- PCM - TDM

**UNIT II WAVEFORM CODING**

**9**

Prediction filtering and DPCM - Delta Modulation - ADPCM & ADM principles-Linear Predictive Coding

**UNIT III BASEBAND TRANSMISSION**

**9**

Properties of Line codes- Power Spectral Density of Unipolar / Polar RZ & NRZ – Bipolar NRZ - Manchester- ISI – Nyquist criterion for distortionless transmission – Pulse shaping – Correlative coding - Mary schemes – Eye pattern - Equalization

**UNIT IV DIGITAL MODULATION SCHEME** **9**  
Geometric Representation of signals - Generation, detection, PSD & BER of Coherent BPSK, BFSK & QPSK - QAM - Carrier Synchronization - structure of Non-coherent Receivers - Principle of DPSK.

**UNIT V ERROR CONTROL CODING** **9**  
Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes - Convolutional codes - Vitterbi Decoder

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to**

- Design PCM systems
- Design and implement base band transmission schemes
- Design and implement band pass signaling schemes
- Analyze the spectral characteristics of band pass signaling schemes and their noise performance
- Design error control coding schemes

**TEXT BOOK:**

1. S. Haykin, "Digital Communications", John Wiley, 2005

**REFERENCES:**

1. B. Sklar, "Digital Communication Fundamentals and Applications", 2<sup>nd</sup> Edition, Pearson Education, 2009
2. B.P.Lathi, "Modern Digital and Analog Communication Systems" 3<sup>rd</sup> Edition, Oxford University Press 2007.
3. H P Hsu, Schaum Outline Series - "Analog and Digital Communications", TMH 2006
4. J.G Proakis, "Digital Communication", 4<sup>th</sup> Edition, Tata Mc Graw Hill Company, 2001.

**EC6502 PRINCIPLES OF DIGITAL SIGNAL PROCESSING** **L T P C**  
**3 1 0 4**

**OBJECTIVES:**

- To learn discrete Fourier transform and its properties
- To know the characteristics of IIR and FIR filters learn the design of infinite and finite impulse response filters for filtering undesired signals
- To understand Finite word length effects
- To study the concept of Multirate and adaptive filters

**UNIT I DISCRETE FOURIER TRANSFORM** **9**  
Discrete Signals and Systems- A Review – Introduction to DFT – Properties of DFT – Circular Convolution - Filtering methods based on DFT – FFT Algorithms –Decimation in time Algorithms, Decimation in frequency Algorithms – Use of FFT in Linear Filtering.

**UNIT II IIR FILTER DESIGN** **9**  
Structures of IIR – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives – (LPF, HPF, BPF, BRF) filter design using frequency translation.

**UNIT III      FIR FILTER DESIGN** **9**  
Structures of FIR – Linear phase FIR filter – Fourier Series - Filter design using windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques – Finite word length effects in digital Filters: Errors, Limit Cycle, Noise Power Spectrum.

**UNIT IV      FINITE WORDLENGTH EFFECTS** **9**  
Fixed point and floating point number representations – ADC –Quantization- Truncation and Rounding errors - Quantization noise – coefficient quantization error – Product quantization error - Overflow error – Roundoff noise power - limit cycle oscillations due to product round off and overflow errors – Principle of scaling

**UNIT V      DSP APPLICATIONS** **9**  
Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor – Adaptive Filters: Introduction, Applications of adaptive filtering to equalization.

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to**

- apply DFT for the analysis of digital signals & systems
- design IIR and FIR filters
- characterize finite Word length effect on filters
- design the Multirate Filters
- apply Adaptive Filters to equalization

**TEXT BOOK:**

1. John G. Proakis & Dimitris G.Manolakis, “Digital Signal Processing – Principles, Algorithms & Applications”, Fourth Edition, Pearson Education / Prentice Hall, 2007.

**REFERENCES:**

1. Emmanuel C..Ifeachor, & Barrie.W.Jervis, “Digital Signal Processing”, Second Edition, Pearson Education / Prentice Hall, 2002.
2. Sanjit K. Mitra, “Digital Signal Processing – A Computer Based Approach”, Tata Mc Graw Hill, 2007.
3. A.V.Oppenheim, R.W. Schafer and J.R. Buck, “Discrete-Time Signal Processing”, 8<sup>th</sup> Indian Reprint, Pearson, 2004.
4. Andreas Antoniou, “Digital Signal Processing”, Tata Mc Graw Hill, 2006.

**EC6503**

**TRANSMISSION LINES AND WAVE GUIDES**

**L T P C**  
**3 1 0 4**

**OBJECTIVES:**

- To introduce the various types of transmission lines and to discuss the losses associated.
- To give thorough understanding about impedance transformation and matching.
- To use the Smith chart in problem solving.
- To impart knowledge on filter theories and waveguide theories

**UNIT I TRANSMISSION LINE THEORY****9**

General theory of Transmission lines - the transmission line - general solution - The infinite line - Wavelength, velocity of propagation - Waveform distortion - the distortion-less line - Loading and different methods of loading - Line not terminated in  $Z_0$  - Reflection coefficient - calculation of current, voltage, power delivered and efficiency of transmission - Input and transfer impedance - Open and short circuited lines - reflection factor and reflection loss.

**UNIT II HIGH FREQUENCY TRANSMISSION LINES****9**

Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on the dissipation-less line, Standing Waves, Nodes, Standing Wave Ratio - Input impedance of the dissipation-less line - Open and short circuited lines - Power and impedance measurement on lines - Reflection losses - Measurement of VSWR and wavelength.

**UNIT III IMPEDANCE MATCHING IN HIGH FREQUENCY LINES****9**

Impedance matching: Quarter wave transformer - Impedance matching by stubs - Single stub and double stub matching - Smith chart - Solutions of problems using Smith chart - Single and double stub matching using Smith chart.

**UNIT IV PASSIVE FILTERS****9**

Characteristic impedance of symmetrical networks - filter fundamentals, Design of filters: Constant K - Low Pass, High Pass, Band Pass, Band Elimination, m- derived sections - low pass, high pass composite filters.

**UNIT V WAVE GUIDES AND CAVITY RESONATORS****9**

General Wave behaviours along uniform Guiding structures, Transverse Electromagnetic waves, Transverse Magnetic waves, Transverse Electric waves, TM and TE waves between parallel plates, TM and TE waves in Rectangular wave guides, Bessel's differential equation and Bessel function, TM and TE waves in Circular wave guides, Rectangular and circular cavity Resonators.

**OUTCOMES:**

Upon completion of the course, students will be able to:

- Discuss the propagation of signals through transmission lines.
- Analyze signal propagation at Radio frequencies.
- Explain radio propagation in guided systems.
- Utilize cavity resonators.

**TEXT BOOKS**

1. John D Ryder, "Networks, lines and fields", 2<sup>nd</sup> Edition, Prentice Hall India, 2010.

**REFERENCES**

1. E.C.Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", Prentice Hall of India, 2006.
2. G.S.N Raju "Electromagnetic Field Theory and Transmission Lines" , Pearson Education, First edition 2005.

**OBJECTIVES:****To the study of nature and the facts about environment.**

- To find and implement scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY****12**

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds  
Field study of simple ecosystems – pond, river, hill slopes, etc.

**UNIT II ENVIRONMENTAL POLLUTION****10**

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry-Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO<sub>2</sub>, NO<sub>x</sub>, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies – Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

**UNIT III NATURAL RESOURCES****10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and

desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins –Biochemical degradation of pollutants, Bioconversion of pollutants.

Field study of local area to document environmental assets – river/forest/grassland/hill/mountain.

#### **UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides. Public awareness.

#### **UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environment at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions.
- Development and improvement in standard of living has lead to serious environmental disasters.

#### **TEXT BOOKS:**

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2<sup>nd</sup> Edition, Pearson Education, 2004.
2. Benny Joseph, 'Environmental Science and Engineering', Tata Mc Graw-Hill, New Delhi, 2006.

#### **REFERENCES:**

1. R.K. Trivedi, "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standard", Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, "Environmental law", Prentice Hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press 2005

**OBJECTIVES:**

The student should be made to:

- Study the Architecture of 8086 microprocessor.
- Learn the design aspects of I/O and Memory Interfacing circuits.
- Study about communication and bus interfacing.
- Study the Architecture of 8051 microcontroller.

**UNIT I THE 8086 MICROPROCESSOR****9**

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

**UNIT II 8086 SYSTEM BUS STRUCTURE****9**

8086 signals – Basic configurations – System bus timing –System design using 8086 – IO programming – Introduction to Multiprogramming – System Bus Structure - Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.

**UNIT III I/O INTERFACING****9**

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

**UNIT IV MICROCONTROLLER****9**

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

**UNIT V INTERFACING MICROCONTROLLER****9**

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation.

**TOTAL: 45 PERIODS****OUTCOMES:**

At the end of the course, the student should be able to:

- Design and implement programs on 8086 microprocessor.
- Design I/O circuits.
- Design Memory Interfacing circuits.
- Design and implement 8051 microcontroller based systems.

**TEXT BOOKS:**

1. Yu-Cheng Liu, Glenn A.Gibson, “Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design”, Second Edition, Prentice Hall of India, 2007.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Second Edition, Pearson education, 2011.

**REFERENCE:**

1. Douglas V.Hall, "Microprocessors and Interfacing, Programming and Hardware", TMH, 2012

**EC6511****DIGITAL SIGNAL PROCESSING LABORATORY****L T P C****0 0 3 2****OBJECTIVES:****The student should be made to:**

- To implement Linear and Circular Convolution
- To implement FIR and IIR filters
- To study the architecture of DSP processor
- To demonstrate Finite word length effect

**LIST OF EXPERIMENTS:****MATLAB / EQUIVALENT SOFTWARE PACKAGE**

1. Generation of sequences (functional & random) & correlation
2. Linear and Circular Convolutions
3. Spectrum Analysis using DFT
4. FIR filter design
5. IIR filter design
6. Multirate Filters
7. Equalization

**DSP PROCESSOR BASED IMPLEMENTATION**

8. Study of architecture of Digital Signal Processor
9. MAC operation using various addressing modes
10. Linear Convolution
11. Circular Convolution
12. FFT Implementation
13. Waveform generation
14. IIR and FIR Implementation
15. Finite Word Length Effect

**TOTAL: 45 PERIODS****OUTCOMES:****Students will be able to**

- Carry out simulation of DSP systems
- Demonstrate their abilities towards DSP processor based implementation of DSP systems
- Analyze Finite word length effect on DSP systems
- Demonstrate the applications of FFT to DSP
- Implement adaptive filters for various applications of DSP

**LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS (2 STUDENTS PER SYSTEM)**

PCs with Fixed / Floating point DSP Processors (Kit / Add-on Cards) 15 Units

**LIST OF SOFTWARE REQUIRED:**MATLAB with Simulink and Signal Processing Tool Box or Equivalent Software in desktop systems  
-15 Nos

Signal Generators (1MHz) – 15 Nos

CRO (20MHz) -15 Nos

**OBJECTIVES:**

**The student should be made to:**

- To visualize the effects of sampling and TDM
- To Implement AM & FM modulation and demodulation
- To implement PCM & DM
- To implement FSK, PSK and DPSK schemes
- To implement Equalization algorithms
- To implement Error control coding schemes

**LIST OF EXPERIMENTS:**

1. Signal Sampling and reconstruction
2. Time Division Multiplexing
3. AM Modulator and Demodulator
4. FM Modulator and Demodulator
5. Pulse Code Modulation and Demodulation
6. Delta Modulation and Demodulation
7. Observation (simulation) of signal constellations of BPSK, QPSK and QAM
8. Line coding schemes
9. FSK, PSK and DPSK schemes (Simulation)
10. Error control coding schemes - Linear Block Codes (Simulation)
11. Communication link simulation
12. Equalization – Zero Forcing & LMS algorithms(simulation)

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Simulate end-to-end Communication Link
- Demonstrate their knowledge in base band signaling schemes through implementation of FSK, PSK and DPSK
- Apply various channel coding schemes & demonstrate their capabilities towards the improvement of the noise performance of communication system
- Simulate & validate the various functional modules of a communication system

**LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS (3 STUDENTS PER EXPERIMENT):**

- i) Kits for Signal Sampling, TDM, AM, FM, PCM, DM and Line Coding Schemes
- ii) CROs – 15 Nos
- iii) MATLAB / SCILAB or equivalent software package for simulation experiments
- iv) PCs - 10 Nos

**OBJECTIVES:****The student should be made to:**

- Introduce ALP concepts and features
- Write ALP for arithmetic and logical operations in 8086 and 8051
- Differentiate Serial and Parallel Interface
- Interface different I/Os with Microprocessors
- Be familiar with MASM

**LIST OF EXPERIMENTS:****8086 Programs using kits and MASM**

1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. Code conversion, decimal arithmetic and Matrix operations.
4. Floating point operations, string manipulations, sorting and searching
5. Password checking, Print RAM size and system date
6. Counters and Time Delay

**Peripherals and Interfacing Experiments**

7. Traffic light control
8. Stepper motor control
9. Digital clock
10. Key board and Display
11. Printer status
12. Serial interface and Parallel interface
13. A/D and D/A interface and Waveform Generation

**8051 Experiments using kits and MASM**

14. Basic arithmetic and Logical operations
15. Square and Cube program, Find 2's complement of a number
16. Unpacked BCD to ASCII

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Write ALP Programmes for fixed and Floating Point and Arithmetic
- Interface different I/Os with processor
- Generate waveforms using Microprocessors
- Execute Programs in 8051
- Explain the difference between simulator and Emulator

**LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:****HARDWARE:**

8086 development kits	- 30 nos
Interfacing Units	- Each 10 nos
Microcontroller	- 30 nos

**SOFTWARE:**

Intel Desktop Systems with MASM	- 30 nos
8086 Assembler	
8051 Cross Assembler	

**OBJECTIVES:**

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization .

**UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS****9**

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

**UNIT II PLANNING****9**

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

**UNIT III ORGANISING****9**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

**UNIT IV DIRECTING****9**

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

**UNIT V CONTROLLING****9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

**TOTAL: 45 PERIODS****OUTCOMES :**

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

**TEXTBOOKS:**

- Stephen P. Robbins & Mary Coulter, "Management", 10<sup>th</sup> Edition, Prentice Hall (India) Pvt. Ltd., 2009.
- JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6<sup>th</sup> Edition, Pearson Education, 2004.

**REFERENCES:**

- Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" 7<sup>th</sup> Edition, Pearson Education, 2011.
- Robert Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008.
- Harold Koontz & Heinz Weihrich "Essentials of management" Tata Mc Graw Hill, 1998.
- Tripathy PC & Reddy PN, "Principles of Management", Tata McGraw Hill, 1999.

**OBJECTIVES:**

- To make students understand the basic structure and operation of digital computer.
- To understand the hardware-software interface.
- To familiarize the students with arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations.
- To expose the students to the concept of pipelining.
- To familiarize the students with hierarchical memory system including cache memories and virtual memory.
- To expose the students with different ways of communicating with I/O devices and standard I/O interfaces.

**UNIT I OVERVIEW & INSTRUCTIONS****9**

Eight ideas – Components of a computer system – Technology – Performance – Power wall – Uniprocessors to multiprocessors; Instructions – operations and operands – representing instructions – Logical operations – control operations – Addressing and addressing modes.

**UNIT II ARITHMETIC OPERATIONS****7**

ALU - Addition and subtraction – Multiplication – Division – Floating Point operations – Subword parallelism.

**UNIT III PROCESSOR AND CONTROL UNIT****11**

Basic MIPS implementation – Building datapath – Control Implementation scheme – Pipelining – Pipelined datapath and control – Handling Data hazards & Control hazards – Exceptions.

**UNIT IV PARALLELISM****9**

Instruction-level-parallelism – Parallel processing challenges – Flynn's classification – Hardware multithreading – Multicore processors

**UNIT V MEMORY AND I/O SYSTEMS****9**

Memory hierarchy - Memory technologies – Cache basics – Measuring and improving cache performance - Virtual memory, TLBs - Input/output system, programmed I/O, DMA and interrupts, I/O processors.

**TOTAL: 45 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design arithmetic and logic unit.
- Design and analyse pipelined control units
- Evaluate performance of memory systems.
- Understand parallel processing architectures.

**TEXT BOOK:**

1. David A. Patterson and John L. Hennessey, "Computer Organization and Design", Fifth edition, Morgan Kaufman / Elsevier, 2014.

**REFERENCES:**

1. V.Carl Hamacher, Zvonko G. Varanescic and Safat G. Zaky, "Computer Organisation", VI edition, Mc Graw-Hill Inc, 2012.
2. William Stallings "Computer Organization and Architecture", Seventh Edition, Pearson Education, 2006.
3. Vincent P. Heuring, Harry F. Jordan, "Computer System Architecture", Second Edition, Pearson Education, 2005.

4. Govindarajalu, "Computer Architecture and Organization, Design Principles and Applications", first edition, Tata Mc Graw Hill, New Delhi, 2005.
5. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata Mc Graw Hill, 1998.
6. <http://nptel.ac.in/>.

**CS6551**

**COMPUTER NETWORKS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Understand the division of network functionalities into layers.
- Be familiar with the components required to build different types of networks
- Be exposed to the required functionality at each layer
- Learn the flow control and congestion control algorithms

**UNIT I FUNDAMENTALS & LINK LAYER**

**9**

Building a network – Requirements - Layering and protocols - Internet Architecture – Network software – Performance ; Link layer Services - Framing - Error Detection - Flow control

**UNIT II MEDIA ACCESS & INTERNETWORKING**

**9**

Media access control - Ethernet (802.3) - Wireless LANs – 802.11 – Bluetooth - Switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP, ICMP )

**UNIT III ROUTING**

**9**

Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Multicast – addresses – multicast routing (DVMRP, PIM)

**UNIT IV TRANSPORT LAYER**

**9**

Overview of Transport layer - UDP - Reliable byte stream (TCP) - Connection management - Flow control - Retransmission – TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements

**UNIT V APPLICATION LAYER**

**9**

Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS - SNMP

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Identify the components required to build different types of networks
- Choose the required functionality at each layer for given application
- Identify solution for each functionality at each layer
- Trace the flow of information from one node to another node in the network

**TEXT BOOK:**

1. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers, 2011.

## REFERENCES:

1. James F. Kurose, Keith W. Ross, "Computer Networking - A Top-Down Approach Featuring the Internet", Fifth Edition, Pearson Education, 2009.
2. Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2010.
3. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", Mc Graw Hill Publisher, 2011.
4. Behrouz A. Forouzan, "Data communication and Networking", Fourth Edition, Tata McGraw – Hill, 2011.

EC6601

VLSI DESIGN

L T P C

3 0 0 3

## OBJECTIVES:

- In this course, the MOS circuit realization of the various building blocks that is common to any microprocessor or digital VLSI circuit is studied.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed.
- The main focus in this course is on the transistor circuit level design and realization for digital operation and the issues involved as well as the topics covered are quite distinct from those encountered in courses on CMOS Analog IC design.

### UNIT I MOS TRANSISTOR PRINCIPLE

9

NMOS and PMOS transistors, Process parameters for MOS and CMOS, Electrical properties of CMOS circuits and device modeling, Scaling principles and fundamental limits, CMOS inverter scaling, propagation delays, Stick diagram, Layout diagrams

### UNIT II COMBINATIONAL LOGIC CIRCUITS

9

Examples of Combinational Logic Design, Elmore's constant, Pass transistor Logic, Transmission gates, static and dynamic CMOS design, Power dissipation – Low power design principles

### UNIT III SEQUENTIAL LOGIC CIRCUITS

9

Static and Dynamic Latches and Registers, Timing issues, pipelines, clock strategies, Memory architecture and memory control circuits, Low power memory circuits, Synchronous and Asynchronous design

### UNIT IV DESIGNING ARITHMETIC BUILDING BLOCKS

9

Data path circuits, Architectures for ripple carry adders, carry look ahead adders, High speed adders, accumulators, Multipliers, dividers, Barrel shifters, speed and area tradeoff

### UNIT V IMPLEMENTATION STRATEGIES

9

Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures.

**TOTAL: 45 PERIODS**

## **OUTCOMES:**

### **Upon completion of the course, students should**

- Explain the basic CMOS circuits and the CMOS process technology.
- Discuss the techniques of chip design using programmable devices.
- Model the digital system using Hardware Description Language.

## **TEXTBOOKS:**

1. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, "Digital Integrated Circuits: A Design Perspective", Second Edition, Prentice Hall of India, 2003.
2. M.J. Smith, "Application Specific Integrated Circuits", Addison Wesley, 1997

## **REFERENCES:**

1. N.Weste, K.Eshraghian, "Principles of CMOS VLSI Design", Second Edition, Addison Wesley 1993
2. R.Jacob Baker, Harry W.Li., David E.Boyee, "CMOS Circuit Design, Layout and Simulation", Prentice Hall of India 2005
3. A.Pucknell, Kamran Eshraghian, "BASIC VLSI Design", Third Edition, Prentice Hall of India, 2007.

**EC6602**

## **ANTENNA AND WAVE PROPAGATION**

**L T P C**  
**3 0 0 3**

### **OBJECTIVES:**

- To give insight of the radiation phenomena.
- To give a thorough understanding of the radiation characteristics of different types of antennas
- To create awareness about the different types of propagation of radio waves at different frequencies

### **UNIT I FUNDAMENTALS OF RADIATION**

**9**

Definition of antenna parameters – Gain, Directivity, Effective aperture, Radiation Resistance, Band width, Beam width, Input Impedance. Matching – Baluns, Polarization mismatch, Antenna noise temperature, Radiation from oscillating dipole, Half wave dipole. Folded dipole, Yagi array.

### **UNIT II APERTURE AND SLOT ANTENNAS**

**9**

Radiation from rectangular apertures, Uniform and Tapered aperture, Horn antenna , Reflector antenna , Aperture blockage , Feeding structures , Slot antennas ,Microstrip antennas – Radiation mechanism – Application ,Numerical tool for antenna analysis

### **UNIT III ANTENNA ARRAYS**

**9**

N element linear array, Pattern multiplication, Broadside and End fire array – Concept of Phased arrays, Adaptive array, Basic principle of antenna Synthesis-Binomial array

### **UNIT IV SPECIAL ANTENNAS**

**9**

Principle of frequency independent antennas –Spiral antenna, Helical antenna, Log periodic. Modern antennas- Reconfigurable antenna, Active antenna, Dielectric antennas, Electronic band gap structure and applications, Antenna Measurements-Test Ranges, Measurement of Gain, Radiation pattern, Polarization, VSWR

## UNIT V PROPAGATION OF RADIO WAVES

9

Modes of propagation , Structure of atmosphere , Ground wave propagation , Tropospheric propagation , Duct propagation, Troposcatter propagation , Flat earth and Curved earth concept Sky wave propagation – Virtual height, critical frequency , Maximum usable frequency – Skip distance, Fading , Multi hop propagation

**TOTAL: 45 PERIODS**

### OUTCOMES:

**Upon completion of the course, students will be able to:**

- Explain the various types of antennas and wave propagation.
- Write about the radiation from a current element.
- Analyze the antenna arrays, aperture antennas and special antennas such as frequency independent and broad band

### TEXT BOOK:

1. John D Kraus, "Antennas for all Applications", 3<sup>rd</sup> Edition, Mc Graw Hill, 2005.

### REFERENCES:

1. Edward C.Jordan and Keith G.Balmain" Electromagnetic Waves and Radiating Systems" Prentice Hall of India, 2006
2. R.E.Collin,"Antennas and Radiowave Propagation", Mc Graw Hill 1985.
3. Constantine.A.Balanis "Antenna Theory Analysis and Design", Wiley Student Edition, 2006.
4. Rajeswari Chatterjee, "Antenna Theory and Practice" Revised Second Edition New Age International Publishers, 2006.
5. S. Drabowitch, "Modern Antennas" Second Edition, Springer Publications, 2007.
6. Robert S.Elliott "Antenna Theory and Design" Wiley Student Edition, 2006.
7. H.Sizun "Radio Wave Propagation for Telecommunication Applications", First Indian Reprint, Springer Publications, 2007.

EC6611

COMPUTER NETWORKS LABORATORY

L T P C  
0 0 3 2

### OBJECTIVES:

**The student should be made to:**

- Learn to communicate between two desktop computers.
- Learn to implement the different protocols
- Be familiar with socket programming.
- Be familiar with the various routing algorithms
- Be familiar with simulation tools.

### LIST OF EXPERIMENTS:

1. Implementation of Error Detection / Error Correction Techniques
2. Implementation of Stop and Wait Protocol and sliding window
3. Implementation and study of Goback-N and selective repeat protocols
4. Implementation of High Level Data Link Control
5. Study of Socket Programming and Client – Server model
6. Write a socket Program for Echo/Ping/Talk commands.
7. To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
8. Network Topology - Star, Bus, Ring
9. Implementation of distance vector routing algorithm

10. Implementation of Link state routing algorithm
11. Study of Network simulator (NS) and simulation of Congestion Control Algorithms using NS
12. Encryption and decryption.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to**

- Communicate between two desktop computers.
- Implement the different protocols
- Program using sockets.
- Implement and compare the various routing algorithms
- Use simulation tool.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

**SOFTWARE**

- C / C++ / Java / Equivalent Compiler
- Network simulator like NS2/ NS3 / Glomosim/OPNET/ Equivalent 30

**HARDWARE**

Standalone desktops 30 Nos

**EC6612**

**VLSI DESIGN LABORATORY**

**L T P C**

**0 0 3 2**

**OBJECTIVES:**

- To learn Hardware Descriptive Language(Verilog/VHDL)
- To learn the fundamental principles of VLSI circuit design in digital and analog domain
- To familiarise fusing of logical modules on FPGAs
- To provide hands on design experience with professional design (EDA) platforms.

**LIST OF EXPERIMENTS**

**FPGA BASED EXPERIMENTS.**

1. HDL based design entry and simulation of simple counters, state machines, adders (min 8 bit) and multipliers (4 bit min).
2. Synthesis, P&R and post P&R simulation of the components simulated in (1) above. Critical paths and static timing analysis results to be identified. Identify and verify possible conditions under which the blocks will fail to work correctly.
3. Hardware fusing and testing of each of the blocks simulated in (1). Use of either chipscope feature (Xilinx) or the signal tap feature (Altera) is a must. Invoke the PLL and demonstrate the use of the PLL module for clock generation in FPGAs.

**IC DESIGN EXPERIMENTS: (BASED ON CADENCE / MENTOR GRAPHICS / EQUIVALENT)**

4. Design and simulation of a simple 5 transistor differential amplifier. Measure gain, ICMR, and CMRR
5. Layout generation, parasitic extraction and resimulation of the circuit designed in (1)
6. Synthesis and Standard cell based design of an circuits simulated in 1(I) above. Identification of critical paths, power consumption.



**UNIT IV INTERVIEW SKILLS****12**

Different types of Interview format- answering questions- offering information- mock interviews-body language( paralinguistic features)- articulation of sounds- intonation.

**UNIT V SOFT SKILLS****12**

**Motivation- emotional intelligence**-Multiple intelligences- emotional intelligence- managing changes-time management-stress management-leadership traits-team work- career planning - intercultural communication- creative and critical thinking

**TOTAL: 60 PERIODS****Teaching Methods:**

1. To be totally learner-centric with minimum teacher intervention as the course revolves around practice.
2. Suitable audio/video samples from Podcast/YouTube to be used for illustrative purposes.
3. Portfolio approach for writing to be followed. Learners are to be encouraged to blog, tweet, text and email employing appropriate language.
4. GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.
5. Learners are to be assigned to read/write/listen/view materials outside the classroom as well for gaining proficiency and better participation in the class.

**Lab Infrastructure:**

S. No.	Description of Equipment (minimum configuration)	Qty Required
1	<b>Server</b>	1 No.
	• PIV System	
	• 1 GB RAM / 40 GB HDD	
	• OS: Win 2000 server	
	• Audio card with headphones	
• JRE 1.3		
2	<b>Client Systems</b>	60 Nos.
	• PIII or above	
	• 256 or 512 MB RAM / 40 GB HDD	
	• OS: Win 2000	
	• Audio card with headphones	
• JRE 1.3		
3	Handicam	1 No.
4	Television 46"	1 No.
5	Collar mike	1 No.
6	Cordless mike	1 No.
7	Audio Mixer	1 No.
8	DVD recorder/player	1 No.
9	LCD Projector with MP3/CD/DVD provision for Audio/video facility	1 No.

**Evaluation:****Internal: 20 marks**

Record maintenance: Students should write a report on a regular basis on the activities conducted, focusing on the details such as the description of the activity, ideas emerged, learning outcomes and so on. At the end of the semester records can be evaluated out of 20 marks.

**External: 80 marks**

Online Test	- 35 marks
Interview	- 15 marks
Presentation	- 15 marks
Group Discussion	- 15 marks

**Note on Internal and External Evaluation:**

1. Interview – mock interview can be conducted on one-on-one basis.
2. Speaking – example for role play:
  - a. Marketing engineer convincing a customer to buy his product.
  - b. Telephonic conversation- fixing an official appointment / placing an order / enquiring and so on.
3. Presentation – should be extempore on simple topics.
4. Discussion – topics of different kinds; general topics, and case studies.

**OUTCOMES:****At the end of the course, learners should be able to**

- Take international examination such as IELTS and TOEFL
- Make presentations and Participate in Group Discussions.
- Successfully answer questions in interviews.

**REFERENCES:**

1. **Business English Certificate Materials**, Cambridge University Press.
2. **Graded Examinations in Spoken English and Spoken English for Work** downloadable materials from Trinity College, London.
3. **International English Language Testing System** Practice Tests, Cambridge University Press.
4. Interactive Multimedia Programs on **Managing Time and Stress**.
5. **Personality Development** (CD-ROM), Times Multimedia, Mumbai.
6. Robert M Sherfield and et al. **“Developing Soft Skills”** 4th edition, New Delhi: Pearson Education, 2009.

**Web Sources:**

- <http://www.slideshare.net/rohitjsh/presentation-on-group-discussion>  
[http://www.washington.edu/doi/TeamN/present\\_tips.html](http://www.washington.edu/doi/TeamN/present_tips.html)  
<http://www.oxforddictionaries.com/words/writing-job-applications>  
<http://www.kent.ac.uk/careers/cv/coveringletters.htm>  
[http://www.mindtools.com/pages/article/newCDV\\_34.htm](http://www.mindtools.com/pages/article/newCDV_34.htm)

**OBJECTIVES:**

- To inculcate understanding of the basics required for circuit representation of RF networks.
- To deal with the issues in the design of microwave amplifier.
- To instill knowledge on the properties of various microwave components.
- To deal with the microwave generation and microwave measurement techniques

**UNIT I TWO PORT NETWORK THEORY 9**

Review of Low frequency parameters: Impedance, Admittance, Hybrid and ABCD parameters, Different types of interconnection of Two port networks, High Frequency parameters, Formulation of S parameters, Properties of S parameters, Reciprocal and lossless Network, Transmission matrix, RF behavior of Resistors, Capacitors and Inductors.

**UNIT II RF AMPLIFIERS AND MATCHING NETWORKS 9**

Characteristics of Amplifiers, Amplifier power relations, Stability considerations, Stabilization Methods, Noise Figure, Constant VSWR, Broadband, High power and Multistage Amplifiers, Impedance matching using discrete components, Two component matching Networks, Frequency response and quality factor, T and Pi Matching Networks, Microstrip Line Matching Networks.

**UNIT III PASSIVE AND ACTIVE MICROWAVE DEVICES 9**

Terminations, Attenuators, Phase shifters, Directional couplers, Hybrid Junctions, Power dividers, Circulator, Isolator, Impedance matching devices: Tuning screw, Stub and quarter wave transformers. Crystal and Schottky diode detector and mixers, PIN diode switch, Gunn diode oscillator, IMPATT diode oscillator and amplifier, Varactor diode, Introduction to MIC.

**UNIT IV MICROWAVE GENERATION 9**

Review of conventional vacuum Triodes, Tetrodes and Pentodes, High frequency effects in vacuum Tubes, Theory and application of Two cavity Klystron Amplifier, Reflex Klystron oscillator, Traveling wave tube amplifier, Magnetron oscillator using Cylindrical, Linear, Coaxial Voltage tunable Magnetrons, Backward wave Crossed field amplifier and oscillator.

**UNIT V MICROWAVE MEASUREMENTS 9**

Measuring Instruments : Principle of operation and application of VSWR meter, Power meter, Spectrum analyzer, Network analyzer, Measurement of Impedance, Frequency, Power, VSWR, Q-factor, Dielectric constant, Scattering coefficients, Attenuation, S-parameters.

**TOTAL: 45 PERIODS****OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Explain the active & passive microwave devices & components used in Microwave communication systems.
- Analyze the multi- port RF networks and RF transistor amplifiers.
- Generate Microwave signals and design microwave amplifiers.
- Measure and analyze Microwave signal and parameters.

**TEXT BOOKS:**

1. Reinhold Ludwig and Gene Bogdanov, "RF Circuit Design: Theory and Applications", Pearson Education Inc., 2011
2. Robert E Colin, "Foundations for Microwave Engineering", John Wiley & Sons Inc, 2005

**REFERENCES:**

1. David M. Pozar, "Microwave Engineering", Wiley India (P) Ltd, New Delhi, 2008.
2. Thomas H Lee, "Planar Microwave Engineering: A Practical Guide to Theory, Measurements and Circuits", Cambridge University Press, 2004.
3. Mathew M Radmanesh, "RF and Microwave Electronics", Prentice Hall, 2000.
4. Annapurna Das and Sisir K Das, "Microwave Engineering", Tata Mc Graw Hill Publishing Company Ltd, New Delhi, 2005.

**EC6702****OPTICAL COMMUNICATION AND NETWORKS****L T P C****3 0 0 3****OBJECTIVES:**

- To Facilitate the knowledge about optical fiber sources and transmission techniques
- To Enrich the idea of optical fiber networks algorithm such as SONET/SDH and optical CDMA.
- To Explore the trends of optical fiber measurement systems.

**UNIT I INTRODUCTION TO OPTICAL FIBERS****9**

Evolution of fiber optic system- Element of an Optical Fiber Transmission link-- Total internal reflection-Acceptance angle –Numerical aperture – Skew rays Ray Optics-Optical Fiber Modes and Configurations -Mode theory of Circular Wave guides- Overview of Modes-Key Modal concepts-Linearly Polarized Modes -Single Mode Fibers-Graded Index fiber structure.

**UNIT II SIGNAL DEGRADATION OPTICAL FIBERS****9**

Attenuation - Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides-Information Capacity determination -Group Delay-Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers-Mode Coupling -Design Optimization of SM fibers-RI profile and cut-off wavelength.

**UNIT III FIBER OPTICAL SOURCES AND COUPLING****9**

Direct and indirect Band gap materials-LED structures -Light source materials -Quantum efficiency and LED power, Modulation of a LED, lasers Diodes-Modes and Threshold condition -Rate equations -External Quantum efficiency -Resonant frequencies -Laser Diodes, Temperature effects, Introduction to Quantum laser, Fiber amplifiers- Power Launching and coupling, Lencing schemes, Fiber -to- Fiber joints, Fiber splicing-Signal to Noise ratio , Detector response time.

**UNIT IV FIBER OPTIC RECEIVER AND MEASUREMENTS****9**

Fundamental receiver operation, Pre amplifiers, Error sources – Receiver Configuration– Probability of Error – Quantum limit.Fiber Attenuation measurements- Dispersion measurements – Fiber Refractive index profile measurements – Fiber cut- off Wave length Measurements – Fiber Numerical Aperture Measurements – Fiber diameter measurements.

## **UNIT V OPTICAL NETWORKS AND SYSTEM TRANSMISSION**

**9**

Basic Networks – SONET / SDH – Broadcast – and –select WDM Networks –Wavelength Routed Networks – Non linear effects on Network performance –Link Power budget -Rise time budget- Noise Effects on System Performance-Operational Principles of WDM Performance of WDM + EDFA system – Solutions – Optical CDMA – Ultra High Capacity Networks.

**TOTAL: 45 PERIODS**

### **OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Discuss the various optical fiber modes, configurations and various signal degradation factors associated with optical fiber.
- Explain the various optical sources and optical detectors and their use in the optical communication system.
- Analyze the digital transmission and its associated parameters on system performance.

### **TEXT BOOKS:**

1. Gerd Keiser, "Optical Fiber Communication" Mc Graw -Hill International, 4<sup>th</sup> Edition., 2010.
2. John M. Senior, "Optical Fiber Communication", Second Edition, Pearson Education, 2007.

### **REFERENCES:**

1. Ramaswami, Sivarajan and Sasaki "Optical Networks", Morgan Kaufmann, 2009.
2. J.Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 3<sup>rd</sup> Edition, 2008.
3. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.

**EC6703**

**EMBEDDED AND REAL TIME SYSTEMS**

**L T P C  
3 0 0 3**

### **OBJECTIVES:**

**The student should be made to:**

- Learn the architecture and programming of ARM processor.
- Be familiar with the embedded computing platform design and analysis.
- Be exposed to the basic concepts of real time Operating system.
- Learn the system design techniques and networks for embedded systems

## **UNIT I INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS**

**9**

Complex systems and micro processors– Embedded system design process –Design example: Model train controller- Instruction sets preliminaries - ARM Processor – CPU: programming input and output-supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance- CPU power consumption.

## **UNIT II EMBEDDED COMPUTING PLATFORM DESIGN**

**9**

The CPU Bus-Memory devices and systems–Designing with computing platforms – consumer electronics architecture – platform-level performance analysis - Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.

**UNIT III PROCESSES AND OPERATING SYSTEMS 9**

Introduction – Multiple tasks and multiple processes – Multirate systems- Preemptive real-time operating systems- Priority based scheduling- Interprocess communication mechanisms – Evaluating operating system performance- power optimization strategies for processes – Example Real time operating systems-POSIX-Windows CE.

**UNIT V SYSTEM DESIGN TECHNIQUES AND NETWORKS 9**

Design methodologies- Design flows - Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques- Distributed embedded systems – MPSoCs and shared memory multiprocessors.

**UNIT V CASE STUDY 9**

Data compressor - Alarm Clock - Audio player - Software modem-Digital still camera - Telephone answering machine-Engine control unit – Video accelerator.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Describe the architecture and programming of ARM processor.
- Outline the concepts of embedded systems
- Explain the basic concepts of real time Operating system design.
- Use the system design techniques to develop software for embedded systems
- Differentiate between the general purpose operating system and the real time operating system
- Model real-time applications using embedded-system concepts

**TEXT BOOK:**

1. Marilyn Wolf, “Computers as Components - Principles of Embedded Computing System Design”, Third Edition “Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.

**REFERENCES:**

1. Jonathan W.Valvano, “Embedded Microcomputer Systems Real Time Interfacing”, Third Edition Cengage Learning, 2012.
2. David. E. Simon, “An Embedded Software Primer”, 1<sup>st</sup> Edition, Fifth Impression, Addison-Wesley Professional, 2007.
3. Raymond J.A. Buhr, Donald L.Bailey, “An Introduction to Real-Time Systems- From Design to Networking with C/C++”, Prentice Hall, 1999.
4. C.M. Krishna, Kang G. Shin, “Real-Time Systems”, International Editions, Mc Graw Hill 1997
5. K.V.K.K.Prasad, “Embedded Real-Time Systems: Concepts, Design & Programming”, Dream Tech Press, 2005.
6. Sriram V Iyer, Pankaj Gupta, “Embedded Real Time Systems Programming”, Tata Mc Graw Hill, 2004.

**OBJECTIVES:****The student should be made to:**

- Learn the working of ARM processor
- Understand the Building Blocks of Embedded Systems
- Learn the concept of memory map and memory interface
- Know the characteristics of Real Time Systems
- Write programs to interface memory, I/Os with processor
- Study the interrupt performance

**LIST OF EXPERIMENTS**

1. Study of ARM evaluation system
2. Interfacing ADC and DAC.
3. Interfacing LED and PWM.
4. Interfacing real time clock and serial port.
5. Interfacing keyboard and LCD.
6. Interfacing EPROM and interrupt.
7. Mailbox.
8. Interrupt performance characteristics of ARM and FPGA.
9. Flashing of LEDS.
10. Interfacing stepper motor and temperature sensor.
11. Implementing zigbee protocol with ARM.

**OUTCOMES:****At the end of the course, the student should be able to:**

- Write programs in ARM for a specific Application
- Interface memory and Write programs related to memory operations
- Interface A/D and D/A convertors with ARM system
- Analyse the performance of interrupt
- Write programmes for interfacing keyboard, display, motor and sensor.
- Formulate a mini project using embedded system

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS (3 students per batch)**

1. Embedded trainer kits with ARM board 10 No.s
2. Embedded trainer kits suitable for wireless communication 10 No.s
3. Adequate quantities of Hardware, software and consumables

**OBJECTIVES:****The student should be made to:**

1. Understand the working principle of optical sources, detector, fibers and microwave components
2. Develop understanding of simple optical communication link.
3. Learn about the characteristics and measurements in optical fiber
4. Know about the behavior of microwave components.

5. Practice microwave measurement procedures

## LIST OF EXPERIMENTS

### OPTICAL EXPERIMENTS

1. DC Characteristics of LED and PIN Photo diode
2. Mode Characteristics of Fibers
3. Measurement of connector and bending losses
4. Fiber optic Analog and Digital Link- frequency response(analog) and eye diagram (digital)
5. Numerical Aperture determination for Fibers
6. Attenuation Measurement in Fibers

### MICROWAVE EXPERIMENTS

1. Reflex klystron or Gunn diode characteristics and basic microwave parameter measurement such as VSWR, frequency, wavelength.
2. Directional Coupler Characteristics.
3. Radiation Pattern of Horn Antenna.
4. S-parameter Measurement of the following microwave components (Isolator, Circulator, E plane Tee, H Plane Tee, Magic Tee)
5. Attenuation and Power Measurement

**TOTAL: 45 PERIODS**

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS 3 STUDENTS PER EXPERIMENT:

1. Trainer kit for carrying out LED and PIN diode characteristics, Digital multi meter, optical power meter. – 2 Nos
2. Trainer kit for determining the mode characteristics, losses in optical fiber.- 2 Nos
3. Trainer kit for analyzing Analog and Digital link performance, 2 Mbps PRBS Data source, 10 MHz signal generator, 20 MHz Digital storage Oscilloscope. - 2 Nos
4. Kit for measuring Numerical aperture and Attenuation of fiber - 2 Nos
5. MM/SM Glass and plastic fiber patch chords with ST/SC/E2000 connectors - 2 set
6. LEDs with ST / SC / E2000 receptacles – 650 / 850 nm - 2 set
7. PiN PDs with ST / SC / E2000 receptacles – 650 / 850 nm - 2 set
8. Microwave test Bench at X band to determine Directional coupler characteristics. - 2 Nos
9. Microwave test Bench at X band and Antenna turn table to measure Radiation pattern of Horn antenna, 2 Horn antennas. - 2 Nos
10. Microwave test Bench at X band to determine VSWR for Isolator and Circulator, VSWR meter, Isolator, Circulator, E Plane Tee, H plane Tee. - 2 Nos
11. Microwave test Bench at X band, Variable attenuator, Detector and 20 MHz Digital / Analog Oscilloscope. - 2 Nos

**Note:** Microwave test bench comprises of Reflex klystron or Gunn diode with power supply, Gunn oscillator, PIN modulator, Isolator, Fixed and Variable Attenuator, frequency meter, Slotted section, Wave guides, detector with mount, Termination, Movable short, Slide screw tuner, Horn antenna, Directional coupler and 20 MHz Digital / Analog Oscilloscope.

### OUTCOMES:

**At the end of the course, the student should be able to:**

- Analyze the performance of simple optical link.
- Test microwave and optical components.
- Analyse the mode characteristics of fiber
- Analyse the radiation of pattern of antenna.

**OBJECTIVES:**

**The student should be made to:**

- Know the characteristic of wireless channel
- Learn the various cellular architectures
- Understand the concepts behind various digital signaling schemes for fading channels
- Be familiar the various multipath mitigation techniques
- Understand the various multiple antenna systems

**UNIT I WIRELESS CHANNELS****9**

Large scale path loss – Path loss models: Free Space and Two-Ray models -Link Budget design – Small scale fading- Parameters of mobile multipath channels – Time dispersion parameters- Coherence bandwidth – Doppler spread & Coherence time, Fading due to Multipath time delay spread – flat fading – frequency selective fading – Fading due to Doppler spread – fast fading – slow fading.

**UNIT II CELLULAR ARCHITECTURE****9**

Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations–Cellular concept- Frequency reuse - channel assignment- hand off- interference & system capacity- trunking & grade of service – Coverage and capacity improvement.

**UNIT III DIGITAL SIGNALING FOR FADING CHANNELS****9**

Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR.

**UNIT IV MULTIPATH MITIGATION TECHNIQUES****9**

Equalisation – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity – Micro and Macrodiversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver,

**UNIT V MULTIPLE ANTENNA TECHNIQUES****9**

MIMO systems – spatial multiplexing -System model -Pre-coding - Beam forming - transmitter diversity, receiver diversity- Channel state information-capacity in fading and non-fading channels.

**TOTAL: 45 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- Characterize wireless channels
- Design and implement various signaling schemes for fading channels
- Design a cellular system
- Compare multipath mitigation techniques and analyze their performance
- Design and implement systems with transmit/receive diversity and MIMO systems and analyze their performance

**TEXTBOOKS:**

1. Rappaport, T.S., "Wireless communications", Second Edition, Pearson Education, 2010.
2. Andreas.F. Molisch, "Wireless Communications", John Wiley – India, 2006.

## REFERENCES:

1. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.
2. Upena Dalal, "Wireless Communication", Oxford University Press, 2009.
3. Van Nee, R. and Ramji Prasad, "OFDM for wireless multimedia communications", Artech House, 2000.

**EC6802**

**WIRELESS NETWORKS**

**L T P C**  
**3 0 0 3**

## OBJECTIVES:

- To study about Wireless networks, protocol stack and standards.
- To study about fundamentals of 3G Services, its protocols and applications.
- To study about evolution of 4G Networks, its architecture and applications.

### UNIT I WIRELESS LAN

**9**

Introduction-WLAN technologies: Infrared, UHF narrowband, spread spectrum -IEEE802.11: System architecture, protocol architecture, physical layer, MAC layer, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, Radio Layer, Baseband layer, Link manager Protocol, security - IEEE802.16-WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX

### UNIT II MOBILE NETWORK LAYER

**9**

Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6- Network layer in the internet- Mobile IP session initiation protocol - mobile ad-hoc network: Routing, Destination Sequence distance vector, Dynamic source routing

### UNIT III MOBILE TRANSPORT LAYER

**9**

TCP enhancements for wireless protocols - Traditional TCP: Congestion control, fast retransmit/fast recovery, Implications of mobility - Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing, Selective retransmission, Transaction oriented TCP - TCP over 3G wireless networks.

### UNIT IV WIRELESS WIDE AREA NETWORK

**9**

Overview of UTRAN Terrestrial Radio access network-UMTS Core network Architecture: 3G-MSC, 3G-SGSN, 3G-GGSN, SMS-GMSC/SMS-IW MSC, Firewall, DNS/DHCP-High speed Downlink packet access (HSDPA)- LTE network architecture and protocol.

### UNIT V 4G NETWORKS

**9**

Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO systems, Adaptive Modulation and coding with time slot scheduler, Cognitive Radio.

**TOTAL: 45 PERIODS**

## OUTCOMES:

**Upon completion of the course, the students will be able to**

- Conversant with the latest 3G/4G and WiMAX networks and its architecture.
- Design and implement wireless network environment for any application using latest wireless protocols and standards.

- Implement different type of applications for smart phones and mobile devices with latest network strategies.

**TEXT BOOKS:**

1. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education 2012.(Unit I,II,III)
2. Vijay Garg, "Wireless Communications and networking", First Edition, Elsevier 2007.(Unit IV,V)

**REFERENCES:**

1. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband", Second Edition, Academic Press, 2008.
2. Anurag Kumar, D.Manjunath, Joy kuri, "Wireless Networking", First Edition, Elsevier 2011.
3. Simon Haykin , Michael Moher, David Koilpillai, "Modern Wireless Communications", First Edition, Pearson Education 2013

**EC6811**

**PROJECT WORK**

**L T P C  
0 0 12 6**

**OBJECTIVES:**

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL: 180 PERIODS**

**OUTCOMES:**

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

**EC6001**

**MEDICAL ELECTRONICS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To gain knowledge about the various physiological parameters both electrical and non electrical and the methods of recording and also the method of transmitting these parameters.
- To study about the various assist devices used in the hospitals.
- To gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.

<b>UNIT I</b>	<b>ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING</b>	<b>9</b>
The origin of Bio-potentials; biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, lead systems and recording methods, typical waveforms and signal characteristics.		
<b>UNIT II</b>	<b>BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT</b>	<b>9</b>
pH, PO <sub>2</sub> , PCO <sub>2</sub> , colorimeter, Auto analyzer, Blood flow meter, cardiac output, respiratory measurement, Blood pressure, temperature, pulse, Blood Cell Counters.		
<b>UNIT III</b>	<b>ASSIST DEVICES</b>	<b>9</b>
Cardiac pacemakers, DC Defibrillator, Dialyser, Heart lung machine		
<b>UNIT IV</b>	<b>PHYSICAL MEDICINE AND BIOTELEMETRY</b>	<b>9</b>
Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy Telemetry principles, frequency selection, biotelemetry, radiopill, electrical safety		
<b>UNIT V</b>	<b>RECENT TRENDS IN MEDICAL INSTRUMENTATION</b>	<b>9</b>
Thermograph, endoscopy unit, Laser in medicine, cryogenic application, Introduction to telemedicine		

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Discuss the application of electronics in diagnostic and therapeutic area.
- Measure biochemical and various physiological information.
- Describe the working of units which will help to restore normal functioning.

**TEXTBOOKS:**

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007.
2. John G.Webster, "Medical Instrumentation Application and Design", 3<sup>rd</sup> Edition, Wiley India Edition, 2007

**REFERENCES:**

1. Khandpur, R.S., "Handbook of Biomedical Instrumentation", TATA Mc Graw-Hill, New Delhi, 2003.
2. Joseph J.Carr and John M.Brown, "Introduction to Biomedical Equipment Technology", John Wiley and Sons, New York, 2004.

**EC6002**

**ADVANCED DIGITAL SIGNAL PROCESSING**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To bring out the concepts related to stationary and non-stationary random signals
- To emphasize the importance of true estimation of power spectral density
- To introduce the design of linear and adaptive systems for filtering and linear prediction
- To introduce the concept of wavelet transforms in the context of image processing

<b>UNIT I</b>	<b>DISCRETE-TIME RANDOM SIGNALS</b>	<b>9</b>
Discrete random process – Ensemble averages, Stationary and ergodic processes, Autocorrelation and Autocovariance properties and matrices, White noise, Power Spectral Density, Spectral Factorization, Innovations Representation and Process, Filtering random processes, ARMA, AR and MA processes.		
<b>UNIT II</b>	<b>SPECTRUM ESTIMATION</b>	<b>9</b>
Bias and Consistency, Periodogram, Modified periodogram, Blackman-Tukey method, Welch method, Parametric methods of spectral estimation, Levinson-Durbin recursion		
<b>UNIT III</b>	<b>LINEAR ESTIMATION AND PREDICTION</b>	<b>9</b>
Forward and Backward linear prediction, Filtering - FIR Wiener filter- Filtering and linear prediction, non-causal and causal IIR Wiener filters, Discrete Kalman filter.		
<b>UNIT IV</b>	<b>ADAPTIVE FILTERS</b>	<b>9</b>
Principles of adaptive filter – FIR adaptive filter – Newton’s Steepest descent algorithm – LMS algorithm – Adaptive noise cancellation, Adaptive equalizer, Adaptive echo cancellers.		
<b>UNIT V</b>	<b>WAVELET TRANSFORM</b>	<b>9</b>
Multiresolution analysis, Continuous and discrete wavelet transform, Short Time Fourier Transform, Application of wavelet transform, Cepstrum and Homomorphic filtering.		

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Explain the parametric methods for power spectrum estimation.
- Discuss adaptive filtering techniques using LMS algorithm and the applications of adaptive filtering.
- Analyze the wavelet transforms.

**TEXTBOOKS:**

1. Monson H, Hayes, “Statistical Digital Signal Processing and Modeling”, John Wiley and Sons Inc., New York, Indian Reprint, 2007.
2. John G.Proakis, Dimitris G. Manolakis, “Digital Signal Processing”, Pearson, Fourth 2007.
3. Dwight F. Mix, “Random Signal Processing”, Prentice Hall, 1995.

**REFERENCE:**

1. Sophocles J. Orfanidis, “Optimum Signal Processing, An Introduction”, Mc Graw Hill, 1990.

**CS6401**

**OPERATING SYSTEMS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Study the basic concepts and functions of operating systems.
- Understand the structure and functions of OS.
- Learn about Processes, Threads and Scheduling algorithms.
- Understand the principles of concurrency and Deadlocks.
- Learn various memory management schemes.
- Study I/O management and File systems.
- Learn the basics of Linux system and perform administrative tasks on Linux Servers.

**UNIT I OPERATING SYSTEMS OVERVIEW 9**

Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization- Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

**UNIT II PROCESS MANAGEMENT 9**

Processes-Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication; Threads- Overview, Multicore Programming, Multithreading Models; Windows 7 - Thread and SMP Management. Process Synchronization - Critical Section Problem, Mutex Locks, Semaphores, Monitors; CPU Scheduling and Deadlocks.

**UNIT III STORAGE MANAGEMENT 9**

Main Memory-Contiguous Memory Allocation, Segmentation, Paging, 32 and 64 bit architecture Examples; Virtual Memory- Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

**UNIT IV I/O SYSTEMS 9**

Mass Storage Structure- Overview, Disk Scheduling and Management; File System Storage-File Concepts, Directory and Disk Structure, Sharing and Protection; File System Implementation- File System Structure, Directory Structure, Allocation Methods, Free Space Management, I/O Systems.

**UNIT V CASE STUDY 9**

Linux System- Basic Concepts;System Administration-Requirements for Linux System Administrator, Setting up a LINUX Multifunction Server, Domain Name System, Setting Up Local Network Services; Virtualization- Basic Concepts, Setting Up Xen,VMware on Linux Host and Adding Guest OS.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design various Scheduling algorithms.
- Apply the principles of concurrency.
- Design deadlock, prevention and avoidance algorithms.
- Compare and contrast various memory management schemes.
- Design and Implement a prototype file systems.
- Perform administrative tasks on Linux Servers.

**TEXT BOOK:**

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9<sup>th</sup> Edition, John Wiley and Sons Inc., 2012.

**REFERENCES:**

1. William Stallings, "Operating Systems – Internals and Design Principles", 7<sup>th</sup> Edition, Prentice Hall, 2011.
2. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Addison Wesley, 2001.
3. Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata Mc Graw Hill Education", 1996.
4. D M Dhamdhare, "Operating Systems: A Concept-Based Approach", Second Edition, Tata Mc Graw-Hill Education, 2007.
5. <http://nptel.ac.in/>.

**OBJECTIVES:**

- To study the various parts of robots and fields of robotics.
- To study the various kinematics and inverse kinematics of robots.
- To study the Euler, Lagrangian formulation of Robot dynamics.
- To study the trajectory planning for robot.
- To study the control of robots for some specific applications.

**UNIT I BASIC CONCEPTS****9**

Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Asimov’s laws of robotics – dynamic stabilization of robots.

**UNIT II POWER SOURCES AND SENSORS****9**

Hydraulic, pneumatic and electric drives – determination of HP of motor and gearing ratio – variable speed arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fiber optic and tactile sensors.

**UNIT III MANIPULATORS, ACTUATORS AND GRIPPERS****9**

Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations.

**UNIT IV KINEMATICS AND PATH PLANNING****9**

Solution of inverse kinematics problem – multiple solution jacobian work envelop – hill Climbing Techniques – robot programming languages

**UNIT V CASE STUDIES****9**

Mutiple robots – machine interface – robots in manufacturing and non- manufacturing applications – robot cell design – selection of robot.

**TOTAL: 45 PERIODS****OUTCOMES:****Upon completion of the course, the student should be able to:**

- Explain the basic concepts of working of robot
- Analyze the function of sensors in the robot
- Write program to use a robot for a typical application
- Use Robots in different applications

**TEXT BOOKS:**

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., “Industrial Robotics”, Mc Graw-Hill Singapore, 1996.
2. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998.

**REFERENCES:**

1. Deb. S.R., “Robotics Technology and flexible Automation”, John Wiley, USA 1992.
2. Klafter R.D., Chimielewski T.A., Negin M., “Robotic Engineering – An integrated approach”, Prentice Hall of India, New Delhi, 1994.
3. Mc Kerrow P.J. “Introduction to Robotics”, Addison Wesley, USA, 1991.
4. Issac Asimov “Robot”, Ballantine Books, New York, 1986.
5. Barry Leatham - Jones, "Elements of industrial Robotics" PITMAN Publishing, 1987.
6. Mikell P.Groover, Mitchell Weiss, Roger N.Nagel Nicholas G.Odrey, "Industrial Robotics Technology, Programming and Applications ", McGraw Hill Book Company 1986.
7. Fu K.S. Gonzaleaz R.C. and Lee C.S.G., "Robotics Control Sensing, Vision and Intelligence" McGraw Hill International Editions, 1987.

**OBJECTIVES:**

- To understand the basics of satellite orbits.
- To understand the satellite segment and earth segment.
- To analyze the various methods of satellite access.
- To understand the applications of satellites.

**UNIT I SATELLITE ORBITS****9**

Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility –eclipse-Sub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion.

**UNIT II SPACE SEGMENT AND SATELLITE LINK DESIGN****9**

Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command. Satellite uplink and downlink Analysis and Design, link budget, E/N calculation- performance impairments-system noise, inter modulation and interference, Propagation Characteristics and Frequency considerations- System reliability and design lifetime.

**UNIT III EARTH SEGMENT****9**

Introduction – Receive – Only home TV systems – Outdoor unit – Indoor unit for analog (FM) TV – Master antenna TV system – Community antenna TV system – Transmit – Receive earth stations – Problems – Equivalent isotropic radiated power – Transmission losses – Free-space transmission – Feeder losses – Antenna misalignment losses – Fixed atmospheric and ionospheric losses – Link power budget equation – System noise – Antenna noise – Amplifier noise temperature – Amplifiers in cascade – Noise factor – Noise temperature of absorptive networks – Overall system noise temperature – Carrier-to- Noise ratio – Uplink – Saturation flux density – Input back off – The earth station - HPA – Downlink – Output back off – Satellite TWTA output – Effects of rain – Uplink rain– Fade margin – Downlink rain – Fade margin – Combined uplink and downlink C/N ratio – Inter modulation noise.

**UNIT IV SATELLITE ACCESS****9**

Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, Assignment Methods, Spread Spectrum communication, compression – encryption.

**UNIT V SATELLITE APPLICATIONS****9**

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. Direct Broadcast satellites (DBS)- Direct to home Broadcast (DTH), Digital audio broadcast (DAB)- Worldspace services, Business TV(BTV), GRAMSAT, Specialized services – E –mail, Video conferencing, Internet.

**TOTAL: 45 PERIODS****OUTCOMES:****Upon Completion of the course, the students will be able to:**

- Analyze the satellite orbits.
- Analyze the earth segment and space segment.
- Design various satellite applications

**TEXT BOOK:**

1. Dennis Roddy, "Satellite Communication", 4<sup>th</sup> Edition, Mc Graw Hill International, 2006.

## REFERENCES:

1. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, "Satellite Communication Systems Engineering", Prentice Hall/Pearson, 2007.
2. N.Agarwal, "Design of Geosynchronous Space Craft", Prentice Hall, 1986.
3. Bruce R. Elbert, "The Satellite Communication Applications", Hand Book, Artech House Boston London, 1997.
4. Tri T. Ha, "Digital Satellite Communication", II<sup>nd</sup> edition, 1990.
5. Emanuel Fthenakis, "Manual of Satellite Communications", Mc Graw Hill Book Co., 1984.
6. Robert G. Winch, "Telecommunication Trans Mission Systems", Mc Graw-Hill Book Co., 1983.
7. Brian Ackroyd, "World Satellite Communication and earth station Design", BSP professional Books, 1990.
8. G.B.Bleazard, "Introducing Satellite communications", NCC Publication, 1985.
9. M.Richharia, "Satellite Communication Systems-Design Principles", Macmillan 2003.

**EC6005**

**ELECTRONIC TESTING**

**L T P C**  
**3 0 0 3**

## OBJECTIVES:

- To understand the basics of testing and the testing equipments
- To understand the different testing methods

### **UNIT I INTRODUCTION**

**9**

Test process and automatic test equipment, test economics and product quality, fault modeling

### **UNIT II DIGITAL TESTING**

**9**

Logic and fault simulation, testability measures, combinational and sequential circuit test generation.

### **UNIT III ANALOG TESTING**

**9**

Memory Test, DSP Based Analog and Mixed Signal Test, Model based analog and mixed signal test, delay test, IIDQ test.

### **UNIT IV DESIGN FOR TESTABILITY**

**9**

Built-in self-test, Scan chain design, Random Logic BIST, Memory BIST, Boundary scan test standard, Analog test bus, Functional Microprocessor Test, Fault Dictionary, Diagnostic Tree, Testable System Design, Core Based Design and Test Wrapper Design, Test design for SOCs

### **UNIT V LOADED BOARD TESTING**

**9**

Unpowered short circuit tests, unpowered analog tests, Powered in-circuit analog, digital and mixed signal tests, optical and X-ray inspection procedures, functional block level design of in-circuit test equipment

**TOTAL: 45 PERIODS**

## OUTCOMES:

Upon completion of the course, students

- Explain different testing equipments.
- Design the different testing schemes for a circuit.
- Discuss the need for test process

## TEXT BOOK:

1. Michael L. Bushnell and Vishwani D. Agarwal, "Essentials of Electronic Testing for Digital, Memory & Mixed-Signal VLSI Circuits", Springer, 2006.

**REFERENCE:**

1. Dimitris Gizopoulos , “Advances in Electronic Testing” , Springer 2006.

**EC6006**

**AVIONICS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To understand the needs for avionics for both Civil and military aircraft.
- To introduce various digital electronic principles and working operations of digital circuit.
- To integrate the digital electronics with cockpit equipments
- To understand the various principles in flight disk and cockpit panels.
- To study the communication and navigation equipment
- To study certificate aspects of the Avionics system

**UNIT I INTRODUCTION TO AVIONICS**

**9**

Basics of Avionics-Basics of Cockpits-Need for Avionics in civil and military aircraft and space systems – Integrated Avionics Architecture –Military and Civil system – Typical avionics System and Sub systems – Design and Technologies.

**UNIT II DIGITAL AVIONICS BUS ARCHITECTURE**

**9**

Avionics Bus architecture–Data buses MIL–RS 232- RS422-RS 485-AFDX/ARINC-664-MIL STD 1553 B–ARINC 429–ARINC 629- Aircraft system Interface

**UNIT III FLIGHT DECK AND COCKPITS**

**9**

Control and display technologies CRT, LED, LCD, EL and plasma panel - Touch screen - Direct voice input (DVI) – ARINC 818-Civil cockpit and military cockpit: MFDS, PFDS-HUD, HMD, HMI

**UNIT IV AVIONICS SYSTEMS**

**9**

Communication Systems - Navigation systems - Flight control systems - Radar electronic Warfare - Utility systems Reliability and maintainability Fundamentals- Certification-Military and civil aircrafts.

**UNIT V ON BOARD NAVIGATION SYSTEMS**

**9**

Over view of navigational aids, Flight planning, Area navigation, required time of arrival, RNAV architecture , performance aspects, approach and landing challenges, regulatory and safety aspects, INS, GPS and GNSS characteristics.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will:**

- Describe the hardware required for aircraft.
- Explain the communication and navigation techniques used in aircrafts.
- Discuss about the autopilot and cockpit display related concepts.

**TEXT BOOK:**

1. R.P.G. Collinson, “Introduction to Avionics”, Chapman & Hall Publications, 1996.

## REFERENCES:

1. Cary R .Spitzer, "The Avionics Handbook", CRC Press, 2000.
2. Middleton, D.H. "Avionics Systems", Longman Scientific and Technical, Longman Group UK Ltd., England, 1989.
3. Spitzer, C.R. "Digital Avionics Systems", Prentice Hall, Englewood Cliffs, N.J., U.S.A., 1987.
4. Brain Kendal, "Manual of Avionics", The English Book House, 3<sup>rd</sup> Edition, New Delhi, 1993
5. Jim Curren, "Trend in Advanced Avionics", IOWA State University, 1992.

CS6012

SOFT COMPUTING

L T P C  
3 0 0 3

## OBJECTIVES:

The student should be made to:

- Learn the various soft computing frame works
- Be familiar with design of various neural networks
- Be exposed to fuzzy logic
- Learn genetic programming.
- Be exposed to hybrid systems.

### UNIT I INTRODUCTION

9

Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models - important technologies - applications.

Fuzzy logic: Introduction - crisp sets- fuzzy sets - crisp relations and fuzzy relations: cartesian product of relation - classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm- Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts.

### UNIT II NEURAL NETWORKS

9

McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks - adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative autoassociative memory network & iterative associative memory network – unsupervised learning networks: Kohonen self organizing feature maps, LVQ – CP networks, ART network.

### UNIT III FUZZY LOGIC

9

Membership functions: features, fuzzification, methods of membership value assignments- Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.

### UNIT IV GENETIC ALGORITHM

9

Genetic algorithm and search space - general genetic algorithm – operators - Generational cycle - stopping condition – constraints - classification - genetic programming – multilevel optimization – real life problem- advances in GA

## **UNIT V HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS**

**9**

Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems - simplified fuzzy ARTMAP - Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.

**TOTAL : 45 PERIODS**

### **OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Apply various soft computing frame works.
- Design of various neural networks.
- Use fuzzy logic.
- Apply genetic programming.
- Discuss hybrid soft computing.

### **TEXT BOOKS:**

1. J.S.R.Jang, C.T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI / Pearson Education 2004.
2. S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2011.

### **REFERENCES:**

1. S.Rajasekaran and G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications", Prentice-Hall of India Pvt. Ltd., 2006.
2. George J. Klir, Ute St. Clair, Bo Yuan, "Fuzzy Set Theory: Foundations and Applications" Prentice Hall, 1997.
3. David E. Goldberg, "Genetic Algorithm in Search Optimization and Machine Learning" Pearson Education India, 2013.
4. James A. Freeman, David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Education India, 1991.
5. Simon Haykin, "Neural Networks Comprehensive Foundation" Second Edition, Pearson Education, 2005.

**IT6005**

**DIGITAL IMAGE PROCESSING**

**L T P C  
3 0 0 3**

### **OBJECTIVES:**

**The student should be made to:**

- Learn digital image fundamentals.
- Be exposed to simple image processing techniques.
- Be familiar with image compression and segmentation techniques.
- Learn to represent image in form of features.

## **UNIT I DIGITAL IMAGE FUNDAMENTALS**

**8**

Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - color models.

**UNIT II IMAGE ENHANCEMENT****10**

**Spatial Domain:** Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering – **Frequency Domain:** Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.

**UNIT III IMAGE RESTORATION AND SEGMENTATION****9**

**Noise models** – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering **Segmentation:** Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation- Morphological processing- erosion and dilation.

**UNIT IV WAVELETS AND IMAGE COMPRESSION****9**

Wavelets – Subband coding - Multiresolution expansions - **Compression:** Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards.

**UNIT V IMAGE REPRESENTATION AND RECOGNITION****9**

Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments – Boundary description – Shape number – Fourier Descriptor, moments- Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

**TOTAL: 45 PERIODS****OUTCOMES:**

**Upon successful completion of this course, students will be able to:**

- Discuss digital image fundamentals.
- Apply image enhancement and restoration techniques.
- Use image compression and segmentation Techniques.
- Represent features of images.

**TEXT BOOK:**

1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2010.

**REFERENCES:**

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
2. Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.
3. William K Pratt, “Digital Image Processing”, John Willey, 2002.
4. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 2011.
5. <http://eeweb.poly.edu/~onur/lectures/lectures.html>.
6. <http://www.caen.uiowa.edu/~dip/LECTURE/lecture.html>

**OBJECTIVE:**

This program can be offered with all Undergraduate programs/courses for all engineering streams. The FSIPD program aims to improve student's awareness and understanding of the basic concepts involved in Integrated product Development (IPD) by providing exposure to the key product development concepts. Students, who complete this program, will stand a better chance to be considered for jobs in the Engineering industry.

**COURSE OBJECTIVES:**

After completing this program, the student will be able to obtain the technical skills needed to effectively play the entry level design engineer role in an engineering organization.

**The student will be able to:**

- Understand the global trends and development methodologies of various types of products and services
- Conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- Understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- Understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- Gain knowledge of the Innovation & Product Development process in the Business Context

**UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT****9**

Global Trends Analysis and Product decision - Social Trends - Technical Trends- Economical Trends - Environmental Trends - Political/Policy Trends - Introduction to Product Development Methodologies and Management - Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle - Product Development Planning and Management

**UNIT II REQUIREMENTS AND SYSTEM DESIGN****9**

Requirement Engineering - Types of Requirements - Requirement Engineering - Traceability Matrix and Analysis - Requirement Management - System Design & Modeling - Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design

**UNIT III DESIGN AND TESTING****9**

Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques – Challenges in Integration of Engineering Disciplines - Concept Screening & Evaluation - Detailed Design - Component Design and Verification – Mechanical, Electronics and Software Subsystems - High Level Design/Low Level Design of S/W Program - Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing – Prototyping - Introduction to Rapid Prototyping and Rapid Manufacturing - System Integration, Testing, Certification and Documentation

**UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL)SUPPORT 9**

Introduction to Product verification processes and stages - Introduction to Product validation processes and stages - Product Testing standards and Certification - Product Documentation - Sustenance - Maintenance and Repair – Enhancements - Product EoL - Obsolescence Management - Configuration Management - EoL Disposal

**UNIT V BUSINESS DYNAMICS ENGINEERING SERVICES INDUSTRY 9**

The Industry - Engineering Services Industry - Product development in Industry versus Academia - The IPD Essentials - Introduction to vertical specific product development processes - Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and S/W systems – Product development Trade-offs - Intellectual Property Rights and Confidentiality - Security and configuration management.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

**The students will be able to**

- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer
- Work independently as well as in teams
- Manage a project from start to finish

**COURSE MATERIAL AND PEDAGOGY:**

- NASSCOM has agreed to prepare / revise the course materials [selected teachers Anna University from major disciplines will be included in the process] as PPT slides for all the UNITS. The PPTs can be printed and given to each student if necessary at a Nominal Fee. This is the best possible material for this special course.
- NASSCOM will train the teachers of Anna University to enable them to teach this course. A training programme for nearly 3500 teachers needs to be organized. The team is exploring use of technology including the EDUSAT facility at Anna University.
- The course is to be offered as an elective to all UG Students both in the Constituent Colleges and Affiliated colleges of Anna University.

**TEXT BOOKS [INDIAN ECONOMY EDITIONS]:**

1. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", TataMcGraw Hill, Fifth Edition, New Delhi, 2011
2. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, New Delhi, 2005.

**REFERENCES:**

1. Hiriappa B, "Corporate Strategy – Managing the Business", Authorhouse, USA, 2013
2. Peter F Drucker, "People and Performance", Butterworth – Heinemann [Elsevier], Oxford, UK, 2004.
3. Vinod Kumar Garg and Venkitakrishnan N K, "Enterprise Resource Planning – Concepts and Practice", Prentice Hall India, New Delhi, 2003
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, New Delhi, 2013.

**OBJECTIVES:**

- To introduce speech production and related parameters of speech.
- To show the computation and use of techniques such as short time Fourier transform, linear predictive coefficients and other coefficients in the analysis of speech.
- To understand different speech modeling procedures such as Markov and their implementation issues.

**UNIT I BASIC CONCEPTS****10**

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – Acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.

**UNIT II SPEECH ANALYSIS****10**

Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures–mathematical and perceptual – Log–Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

**UNIT III SPEECH MODELING****8**

Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.

**UNIT IV SPEECH RECOGNITION****8**

Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – n-grams, context dependent sub-word units; Applications and present status.

**UNIT V SPEECH SYNTHESIS****9**

Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

**TOTAL: 45 PERIODS****OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Model speech production system and describe the fundamentals of speech.
- Extract and compare different speech parameters.
- Choose an appropriate statistical speech model for a given application.
- Design a speech recognition system.
- Use different speech synthesis techniques.

**TEXTBOOKS:**

1. Lawrence Rabiner and Biing-Hwang Juang, “Fundamentals of Speech Recognition”, Pearson Education, 2003.
2. Daniel Jurafsky and James H Martin, “Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Pearson Education, 2002.
3. Frederick Jelinek, “Statistical Methods of Speech Recognition”, MIT Press, 1997.

## REFERENCES:

1. Steven W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", California Technical Publishing, 1997.
2. Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education, 2004.
3. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons, 1999.
4. Ben Gold and Nelson Morgan, "Speech and Audio Signal Processing, Processing and Perception of Speech and Music", Wiley- India Edition, 2006.

EC6008

WEB TECHNOLOGY

L T P C

3 0 0 3

## OBJECTIVES:

- To design and create user interfaces using Java frames and applets.
- To have a basic idea about network programming using Java.
- To create simple Web pages and provide client side validation.
- To create dynamic web pages using server side scripting

### UNIT I JAVA FUNDAMENTALS

9

Java Data types – Class – Object – I / O Streams – File Handling concepts – Threads – Applets – Swing Framework – Reflection

### UNIT II JAVA NETWORKING FUNDAMENTALS

9

Overview of Java Networking - TCP - UDP - InetAddress and Ports - Socket Programming - Working with URLs - Internet Protocols simulation - HTTP - SMTP - POP - FTP - Remote Method Invocation - Multithreading Concepts

### UNIT III CLIENT SIDE TECHNOLOGIES

9

XML - Document Type Definition - XML Schema - Document Object Model - Presenting XML - Using XML Parsers: DOM and SAX – JavaScript Fundamentals - Evolution of AJAX - AJAX Framework - Web applications with AJAX - AJAX with PHP - AJAX with Databases

### UNIT IV SERVER SIDE TECHNOLOGIES

9

Servlet Overview - Life cycle of a Servlet - Handling HTTP request and response - Using Cookies - Session tracking - Java Server Pages - Anatomy of JSP - Implicit JSP Objects – JDBC - Java Beans - Advantages - Enterprise Java Beans - EJB Architecture - Types of Beans - EJB Transactions

### UNIT V APPLICATION DEVELOPMENT ENVIRONMENT

9

Overview of MVC architecture - Java Server Faces: Features - Components - Tags - **Struts:** Working principle of Struts - Building model components - View components - Controller components - Forms with Struts - Presentation tags - Developing Web applications - **Hibernate:** Configuration Settings - Mapping persistent classes - Working with persistent objects - Concurrency - Transactions - Caching - Queries for retrieval of objects - **Spring:** Framework - Controllers - Developing simple applications.

**TOTAL: 45 PERIODS**

## OUTCOMES:

Upon completion of the course, students will be able to:

- Have knowledge about the fundamental Java networking technologies.
- Design their own web services using the client server concepts
- Describe the techniques involved to support real-time Software development.

**TEXT BOOK:**

1. Deitel, Deitel, Goldberg, "Internet & World Wide Web How to Program", Third Edition, Pearson Education, 2006.

**REFERENCES:**

1. Marty Hall and Larry Brown, "Core Servlets and Javasever Pages", Second Edition
2. Bryan Basham, Kathy Siegra, Bert Bates, "Head First Servlets and JSP", Second Edition
3. Uttam K Roy, "Web Technologies", Oxford University Press, 2011.

**EC6009****ADVANCED COMPUTER ARCHITECTURE****L T P C  
3 0 0 3****OBJECTIVES:****The student should be made to:**

- Understand the micro-architectural design of processors
- Learn about the various techniques used to obtain performance improvement and power savings in current processors

**UNIT I FUNDAMENTALS OF COMPUTER DESIGN****9**

Review of Fundamentals of CPU, Memory and IO – Trends in technology, power, energy and cost, Dependability - Performance Evaluation

**UNIT II INSTRUCTION LEVEL PARALLELISM****9**

ILP concepts – Pipelining overview - Compiler Techniques for Exposing ILP – Dynamic Branch Prediction – Dynamic Scheduling – Multiple instruction Issue – Hardware Based Speculation – Static scheduling - Multi-threading - Limitations of ILP – Case Studies.

**UNIT III DATA-LEVEL PARALLELISM****9**

Vector architecture – SIMD extensions – Graphics Processing units – Loop level parallelism.

**UNIT IV THREAD LEVEL PARALLELISM****9**

Symmetric and Distributed Shared Memory Architectures – Performance Issues –Synchronization – Models of Memory Consistency – Case studies: Intel i7 Processor, SMT & CMP Processors

**UNIT V MEMORY AND I/O****9**

Cache Performance – Reducing Cache Miss Penalty and Miss Rate – Reducing Hit Time – Main Memory and Performance – Memory Technology. Types of Storage Devices – Buses – RAID – Reliability, Availability and Dependability – I/O Performance Measures.

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Evaluate performance of different architectures with respect to various parameters
- Analyze performance of different ILP techniques
- Identify cache and memory related issues in multi-processors

**TEXT BOOK:**

1. John L Hennessey and David A Patterson, "Computer Architecture A Quantitative Approach", Morgan Kaufmann/ Elsevier, Fifth Edition, 2012.

**REFERENCES:**

1. Kai Hwang and Faye Briggs, "Computer Architecture and Parallel Processing", Mc Graw-Hill International Edition, 2000.
2. Sima D, Fountain T and Kacsuk P, "Advanced Computer Architectures: A Design Space Approach", Addison Wesley, 2000.

**EC6010**

**ELECTRONICS PACKAGING**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To give a comprehensive introduction to the various packaging types used along with the associated same the thermal, speed, signal and integrity power issues.
- To introduce about CAD used in designing wiring boards

**UNIT I OVERVIEW OF ELECTRONIC SYSTEMS PACKAGING**

**9**

Definition of a system and history of semiconductors, Products and levels of packaging, Packaging aspects of handheld products, Definition of PWB, Basics of Semiconductor and Process flowchart, Wafer fabrication, inspection and testing, Wafer packaging; Packaging evolution; Chip connection choices, Wire bonding, TAB and flip chip.

**UNIT II SEMICONDUCTOR PACKAGES**

**9**

Single chip packages or modules (SCM), Commonly used packages and advanced packages; Materials in packages; Thermal mismatch in packages; Multichip modules (MCM)-types; System-in-package (SIP); Packaging roadmaps; Hybrid circuits; Electrical Design considerations in systems packaging, Resistive, Capacitive and Inductive Parasitics, Layout guidelines and the Reflection problem, Interconnection.

**UNIT III CAD FOR PRINTED WIRING BOARDS**

**9**

Benefits from CAD; Introduction to DFM, DFR & DFT, Components of a CAD package and its highlights, Beginning a circuit design with schematic work and component, layout, DFM check, list and design rules; Design for Reliability, Printed Wiring Board Technologies: Board-level packaging aspects, Review of CAD output files for PCB fabrication; Photo plotting and mask generation, Process flow-chart; Vias; PWB substrates; Surface preparation, Photoresist and application methods; UV exposure and developing; Printing technologies for PWBs, PWB etching; PWB etching; Resist stripping; Screen-printing technology, through-hole manufacture process steps; Panel and pattern plating methods, Solder mask for PWBs; Multilayer PWBs; Introduction to, microvias, Microvia technology and Sequential build-up technology process flow for high-density, interconnects

**UNIT IV SURFACE MOUNT TECHNOLOGY AND THERMAL CONSIDERATIONS**

**9**

SMD benefits; Design issues; Introduction to soldering, Reflow and Wave Soldering methods to attach SMDs, Solders; Wetting of solders; Flux and its properties; Defects in wave soldering, Vapour phase soldering, BGA soldering and Desoldering/Repair; SMT failures, SMT failure library and Tin Whisker, Tin-lead and lead-free solders; Phase diagrams; Thermal profiles for reflow soldering; Lead free Alloys, Lead-free solder considerations; Green electronics; RoHS compliance and e-waste recycling, Issues, Thermal Design considerations in systems packaging (L. Umanand, Thermal Design considerations in systems packaging

**UNIT V EMBEDDED PASSIVES TECHNOLOGY****9**

Introduction to embedded passives; Need for embedded passives; Design Library; Embedded resistor processes, Embedded capacitors; Processes for embedding capacitors; Case study examples.

**TOTAL: 45 PERIODS****OUTCOMES:**

Given an electronic system PCB or integrated circuit design specifications, the student should be in a position to recommend the appropriate packaging style to be used, and propose a design a design procedure and solution for the same.

**TEXT BOOK:**

1. Rao R. Tummala, "Fundamentals of Microsystems Packaging", McGraw Hill, NY, 2001

**REFERENCE:**

1. William D. Brown, "Advanced Electronic Packaging", IEEE Press, 1999.

**EC6011****ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY****L T P C****3 0 0 3****OBJECTIVES:**

- To tutor the basics of EMI,EMC
- To instill knowledge on the EMI coupling mechanism and its mitigation techniques
- To impart comprehensive insight about the current EMC standards and about various measurement techniques

**UNIT I BASIC THEORY****8**

Introduction to EMI and EMC, Intra and inter system EMI, Elements of Interference, Sources and Victims of EMI, Conducted and Radiated EMI emission and susceptibility, Case Histories, Radiation hazards to humans, Various issues of EMC, EMC Testing categories, EMC Engineering Application.

**UNIT II COUPLING MECHANISM****9**

Electromagnetic field sources and Coupling paths, Coupling via the supply network, Common mode coupling, Differential mode coupling, Impedance coupling, Inductive and Capacitive coupling, Radiative coupling, Ground loop coupling, Cable related emissions and coupling, Transient sources, Automotive transients.

**UNIT III EMI MITIGATION TECHNIQUES****10**

Working principle of Shielding and Murphy's Law, LF Magnetic shielding, Apertures and shielding effectiveness, Choice of Materials for H, E, and free space fields, Gasketting and sealing, PCB Level shielding, Principle of Grounding, Isolated grounds, Grounding strategies for Large systems, Grounding for mixed signal systems, Filter types and operation, Surge protection devices, Transient protection.

**UNIT IV STANDARDS AND REGULATION****9**

Need for Standards, Generic/General Standards for Residential and Industrial environment, Basic Standards, Product Standards, National and International EMI Standardizing Organizations; IEC, ANSI, FCC, AS/NZS, CISPR, BSI, CENELEC, ACEC. Electro Magnetic Emission and susceptibility standards and specifications, MIL461E Standards.

**UNIT V EMI TEST METHODS AND INSTRUMENTATION 9**

Fundamental considerations, EMI Shielding effectiveness tests, Open field test, TEM cell for immunity test, Shielded chamber, Shielded anechoic chamber, EMI test receivers, Spectrum analyzer, EMI test wave simulators, EMI coupling networks, Line impedance stabilization networks, Feed through capacitors, Antennas, Current probes, MIL -STD test methods, Civilian STD test methods.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Find solution to EMI Sources, EMI problems in PCB level / Subsystem and system level design.
- To measure emission immunity level from different systems to couple with the prescribed EMC standards

**TEXT BOOK:**

1. Clayton Paul, "Introduction to Electromagnetic Compatibility", Wiley Interscience, 2006

**REFERENCES:**

1. V Prasad Kodali, "Engineering Electromagnetic Compatibility", IEEE Press, Newyork, 2001.
2. Henry W. Ott, "Electromagnetic Compatibility Engineering", John Wiley & Sons Inc, Newyork, 2009
3. Daryl Gerke and William Kimmel, "EDN's Designer's Guide to Electromagnetic Compatibility", Elsevier Science & Technology Books, 2002
4. W Scott Bennett, "Control and Measurement of Unintentional Electromagnetic Radiation", John Wiley & Sons Inc., (Wiley Interscience Series) 1997.
5. Dr Kenneth L Kaiser, "The Electromagnetic Compatibility Handbook", CRC Press 2005,

**EC6012**

**CMOS ANALOG IC DESIGN**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To study designs with better precision in data conversion
- To study various ADC and DAC circuit architectures

**UNIT I SAMPLE AND HOLD 9**

Properties of MOS Switches, multiplexed input architectures, recycling architecture, open and closed loop sampling architectures, switched capacitor and current mode architectures.

**UNIT II BUILDING BLOCK OF DATA CONVERSION CIRCUITS: 9**

Amplifiers, open loop and closed loop amplifiers, gain boosting, common mode feedback, bipolar, CMOS and BiCMOS comparators.

**UNIT III PRECISION TECHNIQUES 9**

Comparator cancellation, input and output offset storage principles, comparators using offset cancelled latches, opamp offset cancellation, ADC and DAC calibration techniques.

**UNIT IV ADC/DAC ARCHITECTURES 9**

DAC Performance metrics, reference multiplication and division, switching and logical functions of DACs, Current steering architectures, DAC Performance metrics, Flash ADC architecture, Gray encoding, thermometer encoding and metastability.

## **UNIT V OVER SAMPLING CONVERTERS**

**9**

Delta sigma modulators, alternative modulator architectures, quantization and noise shaping, decimation filtering, implementation of Delta sigma modulators, delta sigma DACs,

**TOTAL: 45 PERIODS**

### **OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Build Data Conversion circuits.
- Discuss calibration techniques
- Analyze ADC/DAC Architecture and Performance

### **TEXT BOOK:**

1. B.Razavi “Data Conversion System Design” IEEE Press and John Wiley, 1995.

### **REFERENCE:**

1. Phillip Allen and Douglas Holmberg “CMOS Analog Circuit Design” Second Edition, Oxford University Press, 2004.

**EC6013**

**ADVANCED MICROPROCESSORS AND MICROCONTROLLERS**

**L T P C**

**3 0 0 3**

### **OBJECTIVES:**

- To expose the students to the fundamentals of microprocessor architecture.
- To introduce the advanced features in microprocessors and microcontrollers.
- To enable the students to understand various microcontroller architectures.

## **UNIT I HIGH PERFORMANCE CISC ARCHITECTURE – PENTIUM**

**9**

CPU Architecture- Bus Operations – Pipelining – Branch predication – floating point unit- Operating Modes –Paging – Multitasking – Exception and Interrupts – Instruction set – addressing modes – Programming the Pentium processor.

## **UNIT II HIGH PERFORMANCE RISC ARCHITECTURE – ARM**

**9**

Arcon RISC Machine – Architectural Inheritance – Core & Architectures - Registers – Pipeline - Interrupts – ARM organization - ARM processor family – Co-processors - ARM instruction set- Thumb Instruction set - Instruction cycle timings - The ARM Programmer’s model – ARM Development tools – ARM Assembly Language Programming - C programming – Optimizing ARM Assembly Code – Optimized Primitives.

## **UNIT III ARM APPLICATION DEVELOPMENT**

**9**

Introduction to DSP on ARM –FIR filter – IIR filter – Discrete fourier transform – Exception handling – Interrupts – Interrupt handling schemes- Firmware and bootloader – Embedded Operating systems – Integrated Development Environment- STDIO Libraries – Peripheral Interface – Application of ARM Processor - Caches – Memory protection Units – Memory Management units – Future ARM Technologies.

## **UNIT IV MOTOROLA 68HC11 MICROCONTROLLERS**

**9**

Instruction set addressing modes – operating modes- Interrupt system- RTC-Serial Communication Interface – A/D Converter PWM and UART.

**UNIT V PIC MICROCONTROLLER****9**

CPU Architecture – Instruction set – interrupts- Timers- I<sup>2</sup>C Interfacing –UART- A/D Converter –PWM and introduction to C-Compilers.

**TOTAL: 45 PERIODS****OUTCOMES:**

- The student will be able to work with suitable microprocessor / microcontroller for a specific real world application.

**TEXT BOOK:**

1. Andrew N.Sloss, Dominic Symes and Chris Wright “ ARM System Developer’s Guide : Designing and Optimizing System Software” , First edition, Morgan Kaufmann Publishers, 2004.

**REFERENCES:**

1. Steve Furber , “ARM System –On –Chip architecture”, Addison Wesley, 2000.
2. Daniel Tabak , “Advanced Microprocessors”, Mc Graw Hill. Inc., 1995
3. James L. Antonakos , “ The Pentium Microprocessor”, Pearson Education, 1997.
4. Gene .H.Miller, “Micro Computer Engineering”, Pearson Education , 2003.
5. John .B.Peatman , “Design with PIC Microcontroller”, Prentice Hall, 1997.
6. James L.Antonakos, “An Introduction to the Intel family of Microprocessors”, Pearson Education, 1999.
7. Barry.B.Brey,“The Intel Microprocessors Architecture, Programming and Interfacing”, PHI,2002.
8. Valvano, "Embedded Microcomputer Systems", Thomson Asia PVT LTD first reprint 2001.  
Readings: Web links [www.ocw.nit.edu](http://www.ocw.nit.edu) [www.arm.com](http://www.arm.com)

**EC6014****COGNITIVE RADIO****L T P C  
3 0 0 3****OBJECTIVES:**

The student should be made to:

- Know the basics of the software defined radios.
- Learn the design of the wireless networks based on the cognitive radios
- Understand the concepts of wireless networks and next generation networks

**UNIT I INTRODUCTION TO SOFTWARE DEFINED RADIO****9**

Definitions and potential benefits, software radio architecture evolution, technology tradeoffs and architecture implications.

**UNIT II SDR ARCHITECTURE****9**

Essential functions of the software radio, basic SDR, hardware architecture, Computational processing resources, software architecture, top level component interfaces, interface topologies among plug and play modules,.

**UNIT III INTRODUCTION TO COGNITIVE RADIOS****9**

Marking radio self-aware, cognitive techniques – position awareness, environment awareness in cognitive radios, optimization of radio resources, Artificial Intelligence Techniques.

#### **UNIT IV COGNITIVE RADIO ARCHITECTURE**

**9**

Cognitive Radio - functions, components and design rules, Cognition cycle - orient, plan, decide and act phases, Inference Hierarchy, Architecture maps, Building the Cognitive Radio Architecture on Software defined Radio Architecture.

#### **UNIT V NEXT GENERATION WIRELESS NETWORKS**

**9**

The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

**Upon completion of the course, students will be able to**

- Describe the basics of the software defined radios.
- Design the wireless networks based on the cognitive radios
- Explain the concepts behind the wireless networks and next generation networks

#### **TEXT BOOKS:**

1. Joseph Mitola III, "Software Radio Architecture: Object-Oriented Approaches to Wireless System Engineering", John Wiley & Sons Ltd. 2000.
2. Thomas W. Rondeau, Charles W. Bostain, "Artificial Intelligence in Wireless communication", ARTECH HOUSE .2009.
3. Bruce A. Fette, "Cognitive Radio Technology", Elsevier, 2009.
4. Ian F. Akyildiz, Won – Yeol Lee, Mehmet C. Vuran, Shantidev Mohanty, "Next generation / dynamic spectrum access / cognitive radio wireless networks: A Survey" Elsevier Computer Networks, May 2006.

#### **REFERENCES:**

1. Simon Haykin, "Cognitive Radio: Brain –Empowered Wireless Communications", IEEE Journal on selected areas in communications, Feb 2005.
2. Hasari Celebi, Huseyin Arslan, "Enabling Location and Environment Awareness in Cognitive Radios", Elsevier Computer Communications , Jan 2008.
3. Markus Dillinger, Kambiz Madani, Nancy Alonistioti, "Software Defined Radio", John Wiley, 2003.
4. Huseyin Arslan, "Cognitive Radio, SDR and Adaptive System", Springer, 2007.
5. Alexander M. Wyglinski, Maziarnekov, Y. Thomas Hu, "Cognitive Radio Communication and Networks", Elsevier, 2010.

**EC6015**

**RADAR AND NAVIGATIONAL AIDS**

**L T P C  
3 0 0 3**

#### **OBJECTIVES:**

- To apply Doppler principle to radars and hence detect moving targets, cluster, also to understand tracking radars
- To refresh principles of antennas and propagation as related to radars, also study of transmitters and receivers.
- To understand principles of navigation, in addition to approach and landing aids as related to navigation

<b>UNIT I</b>	<b>INTRODUCTION TO RADAR EQUATION</b>	<b>9</b>
Introduction- Basic Radar –The simple form of the Radar Equation- Radar Block Diagram- Radar Frequencies –Applications of Radar – The Origins of Radar - Detection of Signals in Noise- Receiver Noise and the Signal-to-Noise Ratio-Probability Density Functions- Probabilities of Detection and False Alarm- Integration of Radar Pulses- Radar Cross Section of Targets- Radar cross Section Fluctuations- Transmitter Power-Pulse Repetition Frequency- Antenna Parameters- System losses – Other Radar Equation Considerations		
<b>UNIT II</b>	<b>MTI AND PULSE DOPPLER RADAR</b>	<b>9</b>
Introduction to Doppler and MTI Radar- Delay –Line Cancellers- Staggered Pulse Repetition Frequencies –Doppler Filter Banks - Digital MTI Processing - Moving Target Detector - Limitations to MTI Performance - MTI from a Moving Platform (AMIT) – Pulse Doppler Radar – Other Doppler Radar Topics- Tracking with Radar –Monopulse Tracking –Conical Scan and Sequential Lobing - Limitations to Tracking Accuracy - Low-Angle Tracking - Tracking in Range - Other Tracking Radar Topics - Comparison of Trackers - Automatic Tracking with Surveillance Radars (ADT).		
<b>UNIT III</b>	<b>DETECTION OF SIGNALS IN NOISE</b>	<b>9</b>
Matched –Filter Receiver –Detection Criteria – Detectors –Automatic Detector - Integrators - Constant-False-Alarm Rate Receivers - The Radar operator - Signal Management - Propagation Radar Waves - Atmospheric Refraction -Standard propagation - Nonstandard Propagation - The Radar Antenna - Reflector Antennas - Electronically Steered Phased Array Antennas – Phase Shifters - Frequency-Scan Arrays <b>Radar Transmitters and Receivers</b> - Introduction –Linear Beam Power Tubes - Solid State RF Power Sources - Magnetron - Crossed Field Amplifiers - Other RF Power Sources – Other aspects of Radar Transmitter.- The Radar Receiver - Receiver noise Figure – Super heterodyne Receiver - Duplexers and Receiver Protectors- Radar Displays.		
<b>UNIT IV</b>	<b>RADIO DIRECTION AND RANGES</b>	<b>9</b>
Introduction - Four methods of Navigation .- The Loop Antenna - Loop Input Circuits - An Aural Null Direction Finder - The Goniometer - Errors in Direction Finding - Adcock Direction Finders - Direction Finding at Very High Frequencies - Automatic Direction Finders – The Commutated Aerial Direction Finder - Range and Accuracy of Direction Finders - The LF/MF Four course Radio Range - VHF Omni Directional Range(VOR) - VOR Receiving Equipment - Range and Accuracy of VOR – Recent Developments. <b>Hyperbolic Systems of Navigation (Loran and Decca)</b> - Loran-A - Loran-A Equipment - Range and precision of Standard Loran - Loran-C - The Decca Navigation System -Decca Receivers - Range and Accuracy of Decca - The Omega System		
<b>UNIT V</b>	<b>SATELLITE NAVIGATION SYSTEM</b>	<b>9</b>
Distance Measuring Equipment - Operation of DME - TACAN - TACAN Equipment - Instrument Landing System - Ground Controlled Approach System - Microwave Landing System(MLS) The Doppler Effect - Beam Configurations -Doppler Frequency Equations - Track Stabilization - Doppler Spectrum - Components of the Doppler Navigation System - Doppler range Equation - Accuracy of Doppler Navigation Systems. Inertial Navigation - Principles of Operation - Navigation Over the Earth – Components of an Inertial Navigation System - Earth Coordinate Mechanization - Strapped-Down Systems - Accuracy of Inertial Navigation Systems-The Transit System - Navstar Global Positioning System (GPS)		
		<b>TOTAL:45 PERIODS</b>

**OUTCOMES:**

Upon completion of the course, students will be able to:

- Explain principles of navigation, in addition to approach and landing aids as related to navigation
- Derive and discuss the Range equation and the nature of detection.
- Describe about the navigation systems using the satellite.

**TEXTBOOKS:**

1. Merrill I. Skolnik , " Introduction to Radar Systems", 3<sup>rd</sup> Edition Tata Mc Graw-Hill 2003.
2. N.S.Nagaraja, "Elements of Electronic Navigation Systems", 2<sup>nd</sup> Edition, TMH, 2000.

**REFERENCES:**

1. Peyton Z. Peebles:, "Radar Principles", John Wiley, 2004
2. J.C Toomay, " Principles of Radar", 2<sup>nd</sup> Edition –PHI, 2004

**EC6016****OPTO ELECTRONIC DEVICES****L T P C  
3 0 0 3****OBJECTIVES:**

- To understand the basics of solid state physics.
- To understand the basics of display devices.
- To understand the optical detection devices.
- To understand the design of optoelectronic integrated circuits.

**UNIT I      ELEMENTS OF LIGHT AND SOLID STATE PHYSICS****9**

Wave nature of light, Polarization, Interference, Diffraction, Light Source, review of Quantum Mechanical concept, Review of Solid State Physics, Review of Semiconductor Physics and Semiconductor Junction Device.

**UNIT II      DISPLAY DEVICES AND LASERS****9**

Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Displays, Numeric Displays, Laser Emission, Absorption, Radiation, Population Inversion, Optical Feedback, Threshold condition, Laser Modes, Classes of Lasers, Mode Locking, laser applications.

**UNIT III      OPTICAL DETECTION DEVICES****9**

Photo detector, Thermal detector, Photo Devices, Photo Conductors, Photo diodes ,Detector Performance.

**UNIT IV      OPTOELECTRONIC MODULATOR****9**

Introduction, Analog and Digital Modulation, Electro-optic modulators, Magneto Optic Devices, Acoustoptic devices, Optical, Switching and Logic Devices.

**UNIT V      OPTOELECTRONIC INTEGRATED CIRCUITS****9**

Introduction, hybrid and Monolithic Integration, Application of Opto Electronic Integrated Circuits, Integrated transmitters and Receivers, Guided wave devices.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon Completion of the course, the students will be able to

- To design display devices.
- To design optoelectronic detection devices and modulators.
- To design optoelectronic integrated circuits.

**TEXTBOOKS:**

1. Pallab Bhattacharya “Semiconductor Opto Electronic Devices”, Prentice Hall of India Pvt., Ltd., New Delhi, 2006.
2. Jasprit Singh, “Opto Electronics – As Introduction to Materials and Devices”, Mc Graw-Hill International Edition, 1998

**REFERENCES:**

1. S C Gupta, Opto Electronic Devices and Systems, Prentice Hal of India, 2005.
2. J. Wilson and J.Haukes, “Opto Electronics – An Introduction”, Prentice Hall, 1995

**EC6017****RF SYSTEM DESIGN****L T P C  
3 0 0 3****OBJECTIVES:**

**The student should be made to:**

- Be familiar with RF transceiver system design for wireless communications.
- Be exposed to design methods of receivers and transmitters used in communication systems

**UNIT I CMOS PHYSICS, TRANSCEIVER SPECIFICATIONS AND ARCHITECTURES 9**

Introduction to MOSFET Physics, Noise: Thermal, shot, flicker, popcorn noise, Two port Noise theory, Noise Figure, THD, IP2, IP3, Sensitivity, SFDR, Phase noise - Specification distribution over a communication link, Homodyne Receiver, Heterodyne Receiver, Image reject, Low IF Receiver Architectures Direct up conversion Transmitter, Two step up conversion Transmitter

**UNIT II IMPEDANCE MATCHING AND AMPLIFIERS 9**

S-parameters with Smith chart, Passive IC components, Impedance matching networks, Common Gate, Common Source Amplifiers, OC Time constants in bandwidth estimation and enhancement, High frequency amplifier design, Power match and Noise match, Single ended and Differential LNAs, Terminated with Resistors and Source Degeneration LNAs.

**UNIT III FEEDBACK SYSTEMS AND POWER AMPLIFIERS 9**

Stability of feedback systems: Gain and phase margin, Root-locus techniques, Time and Frequency domain considerations , Compensation, General model – Class A, AB, B, C, D, E and F amplifiers, Power amplifier Linearization Techniques, Efficiency boosting techniques, ACPR metric, Design considerations

**UNIT IV PLL AND FREQUENCY SYNTHESIZERS 9**

Linearised Model, Noise properties, Phase detectors, Loop filters and Charge pumps, Integer-N frequency synthesizers, Direct Digital Frequency synthesizers

**UNIT V MIXERS AND OSCILLATORS****9**

Mixer characteristics, Non-linear based mixers, Quadratic mixers, Multiplier based mixers, Single balanced and double balanced mixers, sub sampling mixers, Oscillators describing Functions, Colpitts oscillators, Resonators, Tuned Oscillators, Negative resistance oscillators, Phase noise.

**TOTAL: 45 PERIODS****OUTCOMES:**

Upon Completion of the course, □ the students will be able to

- Design RF transceiver systems
- Use the systematic design methods of receivers and transmitters

**TEXT BOOKS:**

1. Thomas Lee, "The Design of Radio Frequency CMOS Integrated Circuits", Cambridge University Press, 2<sup>nd</sup> Edition, Cambridge, 2004.

**REFERENCES:**

1. Matthew M.Radmanesh, "Radio frequency and Microwave Electronics illustrated", Pearson Education Inc, Delhi, 2006.
2. B.Razavi, "RF Microelectronics", Pearson Education, 1997.
3. Devendra.K. Misra, "Radio Frequency and Microwave communication Circuits – Analysis and Design", John Wiley and Sons, Newyork,2004.
4. B. Razavi, "Design of Analog COMS Integrated Circuits", Mc Graw Hill, 2001.

**CS6003****AD HOC AND SENSOR NETWORKS****L T P C  
3 0 0 3****OBJECTIVES:**

**The student should be made to:**

- Understand the design issues in ad hoc and sensor networks.
- Learn the different types of MAC protocols.
- Be familiar with different types of adhoc routing protocols.
- Be expose to the TCP issues in adhoc networks.
- Learn the architecture and protocols of wireless sensor networks.

**UNIT I INTRODUCTION****9**

Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs) :concepts and architectures. Applications of Ad Hoc and Sensor Networks. Design Challenges in Ad hoc and Sensor Networks.

**UNIT II MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS****9**

Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols- Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11

**UNIT III ROUTING PROTOCOLS AND TRANSPORT LAYER IN AD HOC WIRELESS NETWORKS 9**

Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing (on-demand), hybrid routing- Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.

**UNIT IV WIRELESS SENSOR NETWORKS (WSNS) AND MAC PROTOCOLS 9**

Single node architecture: hardware and software components of a sensor node - WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.

**UNIT V WSN ROUTING, LOCALIZATION & QOS 9**

Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Explain the concepts, network architectures and applications of ad hoc and wireless sensor networks
- Analyze the protocol design issues of ad hoc and sensor networks
- Design routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issues
- Evaluate the QoS related performance measurements of ad hoc and sensor networks

**TEXT BOOK:**

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ", Prentice Hall Professional Technical Reference, 2008.

**REFERENCES:**

1. Carlos De Moraes Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2006.
2. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication - 2002.
3. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2005
4. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, and Applications", John Wiley, 2007.
5. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

**GE6082**

**INDIAN CONSTITUTION AND SOCIETY**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To know about Indian constitution.
- To know about central and state government functionalities in India.
- To know about Indian society.

**UNIT I INTRODUCTION 9**  
Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

**UNIT II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT 9**  
Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

**UNIT III STRUCTURE AND FUNCTION OF STATE GOVERNMENT 9**  
State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

**UNIT IV CONSTITUTION FUNCTIONS 9**  
Indian Federal System – Center – State Relations – President’s Rule – Constitutional Amendments – Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

**UNIT V INDIAN SOCIETY 9**  
Society : Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India; Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Understand the functions of the Indian government
- Understand and abide the rules of the Indian constitution.
- Understand and appreciate different culture among the people.

**TEXTBOOKS:**

1. Durga Das Basu, “Introduction to the Constitution of India “, Prentice Hall of India, New Delhi.
2. R.C.Agarwal, (1997) “Indian Political System”, S.Chand and Company, New Delhi.
3. Maciver and Page, “ Society: An Introduction Analysis “, Mac Milan India Ltd., New Delhi.
4. K.L.Sharma, (1997) “Social Stratification in India: Issues and Themes”, Jawaharlal Nehru University, New Delhi.

**REFERENCES:**

1. Sharma, Brij Kishore, “ Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.
2. U.R.Gahai, “Indian Political System “, New Academic Publishing House, Jalaendhar.
3. R.N. Sharma, “Indian Social Problems “, Media Promoters and Publishers Pvt. Ltd.

**EC6018**

**MULTIMEDIA COMPRESSION AND COMMUNICATION**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To have a complete understanding of error–control coding.
- To understand encoding and decoding of digital data streams.
- To introduce methods for the generation of these codes and their decoding techniques.
- To have a detailed knowledge of compression and decompression techniques.
- To introduce the concepts of multimedia communication.

- UNIT I MULTIMEDIA COMPONENTS 9**  
Introduction - Multimedia skills - Multimedia components and their characteristics - Text, sound, images, graphics, animation, video, hardware.
- UNIT II AUDIO AND VIDEO COMPRESSION 9**  
Audio compression–DPCM-Adaptive PCM –adaptive predictive coding-linear Predictive coding-code excited LPC-perpetual coding Video compression –principles-H.261-H.263-MPEG 1, 2, and 4.
- UNIT III TEXT AND IMAGE COMPRESSION 9**  
Compression principles-source encoders and destination encoders-lossless and lossy compression-entropy encoding –source encoding -text compression –static Huffman coding dynamic coding – arithmetic coding –Lempel ziv-welsh Compression-image compression
- UNIT IV VOIP TECHNOLOGY 9**  
Basics of IP transport, VoIP challenges, H.323/ SIP –Network Architecture, Protocols, Call establishment and release, VoIP and SS7, Quality of Service- CODEC Methods- VOIP applicability
- UNIT V MULTIMEDIA NETWORKING 9**  
Multimedia networking -Applications-streamed stored and audio-making the best Effort service-protocols for real time interactive Applications-distributing multimedia-beyond best effort service-secluding and policing Mechanisms-integrated services-differentiated Services-RSVP.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon Completion of the course, the students will be able to**

- Describe various multimedia components
- Describe compression and decompression techniques.
- Apply the compression concepts in multimedia communication.

**TEXT BOOK:**

1. Fred Halshall “Multimedia communication - Applications, Networks, Protocols and Standards”, Pearson Education, 2007.

**REFERENCES:**

1. Tay Vaughan, “Multimedia: Making it work”, 7<sup>th</sup> Edition, TMH 2008 98
2. Kurose and W.Ross “Computer Networking “a Top Down Approach”, Pearson Education 2005
3. Marcus Goncalves “Voice over IP Networks”, Mc Graw hill 1999.
4. KR. Rao,Z S Bojkovic, D A Milovanovic, “Multimedia Communication Systems: Techniques, Standards, and Networks”, Pearson Education 2007.
5. R. Steimnetz, K. Nahrstedt, “Multimedia Computing, Communications and Applications”, Pearson Education Ranjan Parekh, “Principles of Multimedia”, TMH 2007.

**OBJECTIVES:**

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

**UNIT I HUMAN VALUES****10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

**UNIT II ENGINEERING ETHICS****9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

**UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION****9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

**UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS****9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

**UNIT V GLOBAL ISSUES****8**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society

**TEXTBOOKS:**

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata Mc Graw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

**REFERENCES:**

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd., New Delhi 2013.
6. World Community Service Centre, "Value Education", Vethathiri publications, Erode, 2011

**Web sources:**

1. [www.onlineethics.org](http://www.onlineethics.org)
2. [www.nspe.org](http://www.nspe.org)
3. [www.globalethics.org](http://www.globalethics.org)
4. [www.ethics.org](http://www.ethics.org)

**GE6083****DISASTER MANAGEMENT****L T P C  
3 0 0 3****OBJECTIVES:**

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

**UNIT I INTRODUCTION TO DISASTERS 9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

**UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

**UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

**UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

## **UNIT V      DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS**

**9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

**TOTAL: 45 PERIODS**

### **OUTCOMES:**

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management

### **TEXTBOOK:**

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IAS and Sage Publishers, New Delhi, 2010.

### **REFERENCES**

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

**EC6019**

**DATA CONVERTERS**

**L T P C  
3 0 0 3**

### **OBJECTIVES:**

- To explain the basic operational and design principles of CMOS Analog to Digital and Digital to Analog converter architectures.
- To introduce the design calculations for developing the various blocks associated with a typical CMOS AD or DA converter.
- To make students decide the dimensions and bias conditions of all the MOS transistors involved in the design.

## **UNIT I      SAMPLE AND HOLD CIRCUITS**

**9**

Sampling switches, Conventional open loop and closed loop sample and hold architecture, Open loop architecture with miller compensation, multiplexed input architectures, recycling architecture switched capacitor architecture.

**UNIT II SWITCH CAPACITOR CIRCUITS AND COMPARATORS 9**

Switched-capacitor amplifiers, switched capacitor integrator, switched capacitor common mode feedback. Single stage amplifier as comparator, cascaded amplifier stages as comparator, latched comparators.

**UNIT III DIGITAL TO ANALOG CONVERSION 9**

Performance metrics, reference multiplication and division, switching and logic functions in AC, Resistor ladder DAC architecture, current steering DAC architecture.

**UNIT IV ANALOG TO DIGITAL CONVERSION 9**

Performance metric, Flash architecture, Pipelined Architecture, Successive approximation architecture, Time interleaved architecture.

**UNIT V PRECISION TECHNIQUES 9**

Comparator offset cancellation, Op Amp offset cancellation, Calibration techniques, range overlap and digital correction.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Explain sample and hold circuits
- Design ADC/DAC circuits
- Analyze ADC/DAC Architecture and Performance
- Discuss calibration techniques

**TEXT BOOK:**

1. Behzad Razavi, "Principles of data conversion System Design", IEEE press, 1995.

**REFERENCES:**

1. Franco Maloberti, "Data Converters", Springer, 2007.
2. Rudy Van de Plassche, "CMOS Integrated Analog-to-Digital and Digital-to-Analog Converters", Kluwer Academic Publishers, Boston, 2003.

**CS6701**

**CRYPTOGRAPHY AND NETWORK SECURITY**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Understand OSI security architecture and classical encryption techniques.
- Acquire fundamental knowledge on the concepts of finite fields and number theory.
- Understand various block cipher and stream cipher models.
- Describe the principles of public key cryptosystems, hash functions and digital signature.

**UNIT I INTRODUCTION & NUMBER THEORY 10**

Services, Mechanisms and attacks-the OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography).FINITE FIELDS AND NUMBER THEORY: Groups, Rings, Fields-Modular arithmetic-Euclid's algorithm-Finite fields- Polynomial Arithmetic –Prime numbers-Fermat's and Euler's theorem-Testing for primality -The Chinese remainder theorem- Discrete logarithms.

**UNIT II BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY 10**

Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. **Public key cryptography:** Principles of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography.

**UNIT III HASH FUNCTIONS AND DIGITAL SIGNATURES 8**

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS – El Gamal – Schnorr.

**UNIT IV SECURITY PRACTICE & SYSTEM SECURITY 8**

Authentication applications – Kerberos – X.509 Authentication services - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security.

**UNIT V E-MAIL, IP & WEB SECURITY 9**

**E-mail Security:** Security Services for E-mail-attacks possible through E-mail - establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. **IPSecurity:** Overview of IPsec - IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). **Web Security:** SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSLAttacks fixed in v3-Exportability-Encoding-Secure Electronic Transaction (SET).

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon Completion of the course, the students should be able to:**

- Compare various Cryptographic Techniques
- Design Secure applications
- Inject secure coding in the developed applications

**TEXT BOOKS:**

1. William Stallings, Cryptography and Network Security, 6<sup>th</sup> Edition, Pearson Education, March 2013. (UNIT I,II,III,IV).
2. Charlie Kaufman, Radia Perlman and Mike Speciner, “Network Security”, Prentice Hall of India, 2002. (UNIT V).

**REFERENCES:**

1. Behrouz A. Ferouzan, “Cryptography & Network Security”, Tata Mc Graw Hill, 2007.
2. Man Young Rhee, “Internet Security: Cryptographic Principles”, “Algorithms and Protocols”, Wiley Publications, 2003.
3. Charles Pfleeger, “Security in Computing”, 4<sup>th</sup> Edition, Prentice Hall of India, 2006.
4. Ulysess Black, “Internet Security Protocols”, Pearson Education Asia, 2000.
5. Charlie Kaufman and Radia Perlman, Mike Speciner, “Network Security, Second Edition, Private Communication in Public World”, PHI 2002.
6. Bruce Schneier and Neils Ferguson, “Practical Cryptography”, First Edition, Wiley Dreamtech India Pvt Ltd, 2003.
7. Douglas R Simson “Cryptography – Theory and practice”, First Edition, CRC Press, 1995.
8. <http://nptel.ac.in/>.

**OBJECTIVE :**

- To facilitate the understanding of Quality Management principles and process.

**UNIT I INTRODUCTION****9**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

**UNIT II TQM PRINCIPLES****9**

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

**UNIT III TQM TOOLS AND TECHNIQUES I****9**

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

**UNIT IV TQM TOOLS AND TECHNIQUES II****9**

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

**UNIT V QUALITY SYSTEMS****9**

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors..

**TOTAL: 45 PERIODS****OUTCOMES :**

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

**TEXTBOOK:**

- Dale H. Besterfield, et al., "Total quality Management", Pearson Education Asia, Third Edition, Indian Reprint 2006.

**REFERENCES:**

- James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8<sup>th</sup> Edition, First Indian Edition, Cengage Learning, 2012.
- Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
- Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

**OBJECTIVE:**

- To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

**UNIT I ENTREPRENEURSHIP****9**

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur  
Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

**UNIT II MOTIVATION****9**

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

**UNIT III BUSINESS****9**

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

**UNIT IV FINANCING AND ACCOUNTING****9**

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.

**UNIT V SUPPORT TO ENTREPRENEURS****9**

Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures - Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

**TOTAL : 45 PERIODS****OUTCOMES :**

- Upon completion of the course, students will be able to gain knowledge and skills needed to run a business successfully.

**TEXTBOOKS :**

- S.S.Khanka, "Entrepreneurial Development" S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.
- Donald F Kuratko, "Entrepreneurship – Theory, Process and Practice", 9<sup>th</sup> edition, Cengage Learning 2014.

**REFERENCES :**

- Hirsch R D, Peters M P, "Entrepreneurship" 8<sup>th</sup> Edition, Tata McGraw-Hill, 2013.
- Mathew J Manimala, "Entrepreneurship Theory at Cross Roads: paradigms and Praxis", 2<sup>nd</sup> Edition Dream Tech, 2005.
- Rajeev Roy, "Entrepreneurship" 2<sup>nd</sup> edition, Oxford University Press, 2011.
- EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development", Institute of India, Ahmadabad, 1986.

**OBJECTIVES:**

- To outline the need for Software Project Management
- To highlight different techniques for software cost estimation and activity planning.

**UNIT I PROJECT EVALUATION AND PROJECT PLANNING 9**

Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

**UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9**

Software process and Process Models – Choice of Process models - mental delivery – Rapid Application development – Agile methods – Extreme Programming – SCRUM – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II A Parametric Productivity Model - Staffing Pattern.

**UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 9**

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Monitoring – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical patterns – Cost schedules.

**UNIT IV PROJECT MANAGEMENT AND CONTROL 9**

Framework for Management and control – Collection of data Project termination – Visualizing progress – Cost monitoring – Earned Value Analysis- Project tracking – Change control- Software Configuration Management – Managing contracts – Contract Management.

**UNIT V STAFFING IN SOFTWARE PROJECTS 9**

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham-Hackman job characteristic model – Ethical and Programmed concerns – Working in teams – Decision making – Team structures – Virtual teams – Communications genres – Communication plans.

**TOTAL: 45 PERIODS****OUTCOMES:**

- At the end of the course the students will be able to practice Project Management principles while developing a software.

**TEXTBOOK:**

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata Mc Graw Hill, New Delhi, 2012.

**REFERENCES:**

1. Robert K. Wysocki “Effective Software Project Management”, Wiley Publication, 2011.
2. Walker Royce: “Software Project Management”, Addison Wesley, 1998.
3. Gopalswamy Ramesh, “Managing Global Software Projects” – Mc Graw Hill Education (India), Fourteenth Reprint 2013.

**OBJECTIVES :**

- To sensitize the Engineering students to various aspects of Human Rights.

**UNIT I****9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

**UNIT II****9**

Evolution of the concept of Human Rights Magna carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

**UNIT III****9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

**UNIT IV****9**

Human Rights in India – Constitutional Provisions / Guarantees.

**UNIT V****9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Engineering students will acquire the basic knowledge of human rights.

**REFERENCES:**

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

## AFFILIATED INSTITUTIONS

### B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

R – 2013

#### PROGRAM EDUCATIONAL OBJECTIVES :

1. To prepare the students have successful career in industry and motivate for higher education.
2. To provide strong foundation in basic science and mathematics necessary to formulate, solve and analyze electrical and electronics problems
3. To provide strong foundation in circuit theory, field theory, control theory and signal processing concepts.
4. To provide good knowledge of Electrical power apparatus and their applications in power systems
5. To provide knowledge on basic electronics to power electronics and their applications in power engineering
6. To provide an opportunity to work in inter disciplinary groups
7. To promote student awareness for life long learning and inculcate professional ethics
8. To provide necessary foundation on computational platforms and software applications related to the respective field of engineering.

#### PROGRAM OUTCOMES :

- a) Ability to understand and apply differential equations, integrals, matrix theory, probability theory and Laplace, Fourier and Z transformations for engineering problems
- b) Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.
- c) Ability to model and analyze electrical apparatus and their application to power system
- d) Ability to understand and analyze power system operation, stability, control and protection.
- e) Ability to handle the engineering aspects of electrical energy generation and utilization.
- f) Ability to understand and analyse, linear and digital electronic circuits.
- g) Ability to review, prepare and present technological developments
- h) Ability to form a group and develop or solve engineering hardware and problems
- i) To understand and apply computing platform and software for engineering problems.
- j) To understand ethical issues, environmental impact and acquire management skills.

Program Educational Objective	Program Outcome									
	a	b	c	d	e	f	g	h	i	j
1		x		x		x	x		x	x
2	x									
3		x								
4				x						
5						x				
6								x		
7							x	x		
8						x			x	

**ANNA UNIVERSITY, CHENNAI**

**AFFILIATED INSTITUTIONS**

**R - 2013**

**B. E. ELECTRICAL AND ELECTRONICS ENGINEERING**

**I TO VIII SEMESTERS CURRICULUM AND SYLLABUS**

**SEMESTER I**

<b>S.NO.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>						
1.	HS6151	Technical English - I	3	1	0	4
2.	MA6151	Mathematics - I	3	1	0	4
3.	PH6151	Engineering Physics - I	3	0	0	3
4.	CY6151	Engineering Chemistry - I	3	0	0	3
5.	GE6151	Computer Programming	3	0	0	3
6.	GE6152	Engineering Graphics	2	0	3	4
<b>PRACTICAL</b>						
7.	GE6161	Computer Practices Laboratory	0	0	3	2
8.	GE6162	Engineering Practices Laboratory	0	0	3	2
9.	GE6163	Physics and Chemistry Laboratory - I	0	0	2	1
			<b>17</b>	<b>2</b>	<b>11</b>	<b>26</b>

**SEMESTER II**

<b>S.NO.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>						
1.	HS6251	Technical English - II	3	1	0	4
2.	MA6251	Mathematics - II	3	1	0	4
3.	PH6251	Engineering Physics - II	3	0	0	3
4.	CY6251	Engineering Chemistry - II	3	0	0	3
5.	GE6251	Basic Civil and Mechanical Engineering	4	0	0	4
6.	EE6201	Circuit Theory	3	1	0	4
<b>PRACTICAL</b>						
7.	GE6262	Physics and Chemistry Laboratory - II	0	0	2	1
8.	GE6263	Computer Programming Laboratory	0	1	2	2
9.	EE6211	Electric Circuits Laboratory	0	0	3	2
<b>TOTAL</b>			<b>19</b>	<b>4</b>	<b>7</b>	<b>27</b>

**SEMESTER III**

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MA6351	Transforms and Partial Differential Equations	3	1	0	4
2.	EE6301	Digital Logic Circuits	3	1	0	4
3.	EE6302	Electromagnetic Theory	3	1	0	4
4.	GE6351	Environmental Science and Engineering	3	0	0	3
5.	EC6202	Electronic Devices and Circuits	3	1	0	4
6.	EE6303	Linear Integrated Circuits and Applications	3	0	0	3
<b>PRACTICAL</b>						
7.	EC6361	Electronics Laboratory	0	0	3	2
8.	EE6311	Linear and Digital Integrated Circuits Laboratory	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>4</b>	<b>6</b>	<b>26</b>

**SEMESTER IV**

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MA6459	Numerical Methods	3	1	0	4
2.	EE6401	Electrical Machines - I	3	1	0	4
3.	CS6456	Object Oriented Programming	3	0	0	3
4.	EE6402	Transmission and Distribution	3	0	0	3
5.	EE6403	Discrete Time Systems and Signal Processing	3	0	0	3
6.	EE6404	Measurements and Instrumentation	3	0	0	3
<b>PRACTICAL</b>						
7.	CS6461	Object Oriented Programming Laboratory	0	0	3	2
8.	EE6411	Electrical Machines Laboratory - I	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>2</b>	<b>6</b>	<b>24</b>

**SEMESTER V**

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	EE6501	Power System Analysis	3	0	0	3
2.	EE6502	Microprocessors and Microcontrollers	3	0	0	3
3.	ME6701	Power Plant Engineering	3	0	0	3
4.	EE6503	Power Electronics	3	0	0	3
5.	EE6504	Electrical Machines - II	3	1	0	4
6.	IC6501	Control Systems	3	1	0	4
<b>PRACTICAL</b>						
7.	EE6511	Control and Instrumentation Laboratory	0	0	3	2
8.	GE6674	Communication and Soft Skills- Laboratory Based	0	0	4	2
9.	EE6512	Electrical Machines Laboratory - II	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>2</b>	<b>10</b>	<b>26</b>

**SEMESTER VI**

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	EC6651	Communication Engineering	3	0	0	3
2.	EE6601	Solid State Drives	3	0	0	3
3.	EE6602	Embedded Systems	3	0	0	3
4.	EE6603	Power System Operation and Control	3	0	0	3
5.	EE6604	Design of Electrical Machines	3	1	0	4
6.		Elective - I	3	0	0	3
<b>PRACTICAL</b>						
7.	EE6611	Power Electronics and Drives Laboratory	0	0	3	2
8.	EE6612	Microprocessors and Microcontrollers Laboratory	0	0	3	2
9.	EE6613	Presentation Skills and Technical Seminar	0	0	2	1
<b>TOTAL</b>			<b>18</b>	<b>1</b>	<b>8</b>	<b>24</b>

**SEMESTER VII**

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	EE6701	High Voltage Engineering	3	0	0	3
2.	EE6702	Protection and Switchgear	3	0	0	3
3.	EE6703	Special Electrical Machines	3	0	0	3
4.	MG6851	Principles of Management	3	0	0	3
5.		Elective – II	3	0	0	3
6.		Elective – III	3	0	0	3
<b>PRACTICAL</b>						
7.	EE6711	Power System Simulation Laboratory	0	0	3	2
8.	EE6712	Comprehension	0	0	2	1
<b>TOTAL</b>			<b>18</b>	<b>0</b>	<b>5</b>	<b>21</b>

**SEMESTER VIII**

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	EE6801	Electric Energy Generation, Utilization and Conservation	3	0	0	3
2.		Elective – IV	3	0	0	3
3.		Elective – V	3	0	0	3
<b>PRACTICAL</b>						
4.	EE6811	Project Work	0	0	12	6
<b>TOTAL</b>			<b>9</b>	<b>0</b>	<b>12</b>	<b>15</b>

**TOTAL CREDITS: 189**

**ELECTIVE - I**

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	EE6001	Visual Languages and Applications	3	0	0	3
2.	IC6601	Advanced Control System	3	0	0	3
3.	EE6002	Power System Transients	3	0	0	3
4.	EE6003	Optimisation Techniques	3	0	0	3

**ELECTIVE - II**

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
5.	EI6703	Fibre Optics and Laser Instruments	3	0	0	3
6.	EI6704	Biomedical Instrumentation	3	0	0	3
7.	EE6004	Flexible AC Transmission Systems	3	0	0	3
8.	EE6005	Power Quality	3	0	0	3
9.	EE6006	Applied Soft Computing	3	0	0	3

**ELECTIVE - III**

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
10.	GE6081	Fundamentals of Nanoscience	3	0	0	3
11.	IC6002	System Identification and Adaptive Control	3	0	0	3
12.	EE6007	Micro Electro Mechanical Systems	3	0	0	3
13.	EE6008	Microcontroller Based System Design	3	0	0	3

**ELECTIVE - IV**

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
14.	EE6009	Power Electronics for Renewable Energy Systems	3	0	0	3
15.	EE6010	High Voltage Direct Current Transmission	3	0	0	3
16.	EE6011	Power System Dynamics	3	0	0	3
17.	IC6003	Principles of Robotics	3	0	0	3
18.	GE6083	Disaster Management	3	0	0	3

**ELECTIVE - V**

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
19.	GE6075	Professional Ethics in Engineering	3	0	0	3
20.	GE6757	Total Quality Management	3	0	0	3
21.	EC6002	Advanced Digital Signal Processing	3	0	0	3
22.	EE6012	Computer Aided Design of Electrical Apparatus	3	0	0	3
23.	EC6601	VLSI Design	3	0	0	3
24.	GE6084	Human Rights	3	0	0	3
25.	MA6468	Probability and Statistics	3	1	0	4
26.	EI6001	Data Structures and Algorithms	3	0	0	3

**OBJECTIVES:**

- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.

**UNIT I****9+3**

Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one's place, important festivals etc. – Introducing oneself, one's family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one's leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words - Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

**UNIT II****9+3**

Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking and answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Process descriptions (general/specific) - Definitions - Recommendations – Instructions; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association (connotation); E-materials - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

**UNIT III****9+3**

Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading - Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause and effect / compare and contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

**UNIT IV****9+3**

Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations and acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.

## UNIT V

9+3

Listening - Listening to different accents, Listening to Speeches/Presentations, Listening to broadcast and telecast from Radio and TV; Speaking - Giving impromptu talks, Making presentations on given topics; Reading - Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email; Writing - Creative writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items (fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar and Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents - Interpreting posters.

**TOTAL (L:45+T:15): 60 PERIODS**

### OUTCOMES:

Learners should be able to

- speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- read different genres of texts adopting various reading strategies.
- listen/view and comprehend different spoken discourses/excerpts in different accents

### TEXTBOOKS:

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

### REFERENCES:

1. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice. Oxford University Press, New Delhi. 2011.
2. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi. 2006.
3. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005
4. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi. 2001.
5. Viswamohan, Aysha. English for Technical Communication. Tata McGraw-Hill, New Delhi. 2008.

### EXTENSIVE Reading (Not for Examination)

1. Kalam, Abdul. Wings of Fire. Universities Press, Hyderabad. 1999.

### WEBSITES:

1. <http://www.usingenglish.com>
2. <http://www.uefap.com>

### TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like self introduction, peer introduction, group poster making, grammar and vocabulary games, etc.
- Discussions
- Role play activities
- Short presentations
- Listening and viewing activities with follow up activities like discussion, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc.

### EVALUATION PATTERN:

**Internal assessment: 20%**

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Reviews
- Creative writing
- Poster making, etc.

All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual speaking activities, Pair work activities like role play, Interview, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded from simple to complex, from direct to inferential
- ✓ Writing assessment: Writing paragraphs, essays etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content.

**End Semester Examination: 80%****MA6151****MATHEMATICS – I**

**L T P C**  
**3 1 0 4**

**OBJECTIVES:**

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

**UNIT I      MATRICES****9+3**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

**UNIT II SEQUENCES AND SERIES****9+3**

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test, Integral test and D’Alembert’s ratio test – Alternating series – Leibnitz’s test – Series of positive and negative terms – Absolute and conditional convergence.

**UNIT III APPLICATIONS OF DIFFERENTIAL CALCULUS****9+3**

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals.

**UNIT IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES****9+3**

Limits and Continuity – Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor’s series for functions of two variables – Maxima and minima of functions of two variables – Lagrange’s method of undetermined multipliers.

**UNIT V MULTIPLE INTEGRALS****9+3**

Double integrals in cartesian and polar coordinates – Change of order of integration – Area enclosed by plane curves – Change of variables in double integrals – Area of a curved surface - Triple integrals – Volume of Solids.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES:**

- This course equips students to have basic knowledge and understanding in one fields of materials, integral and differential calculus.

**TEXT BOOKS:**

1. Bali N. P and Manish Goyal, “A Text book of Engineering Mathematics”, Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
2. Grewal. B.S, “Higher Engineering Mathematics”, 41<sup>st</sup> Edition, Khanna Publications, Delhi, 2011.

**REFERENCES:**

1. Dass, H.K., and Er. Rajnish Verma, “Higher Engineering Mathematics”, S. Chand Private Ltd., 2011.
2. Glyn James, “Advanced Modern Engineering Mathematics”, 3<sup>rd</sup> Edition, Pearson Education, 2012.
3. Peter V. O’Neil, “Advanced Engineering Mathematics”, 7th Edition, Cengage learning, 2012.
4. Ramana B.V, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., “Engineering Mathematics”, Volume I, Second Edition, PEARSON Publishing, 2011.

**OBJECTIVES:**

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

**UNIT I CRYSTAL PHYSICS****9**

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment) – Crystal growth techniques – solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

**UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS****9**

Elasticity- Hooke's law - Relationship between three moduli of elasticity (qualitative) – stress -strain diagram – Poisson's ratio – Factors affecting elasticity – Bending moment – Depression of a cantilever – Young's modulus by uniform bending- I-shaped girders  
Modes of heat transfer- thermal conductivity- Newton's law of cooling - Linear heat flow – Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel)

**UNIT III QUANTUM PHYSICS****9**

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment -Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

**UNIT IV ACOUSTICS AND ULTRASONICS****9**

Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination – factors affecting acoustics of buildings and their remedies.  
Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications - Sonogram

**UNIT V PHOTONICS AND FIBRE OPTICS****9**

Spontaneous and stimulated emission- Population inversion -Einstein's A and B coefficients - derivation. Types of lasers – Nd:YAG, CO<sub>2</sub>, Semiconductor lasers (homojunction & heterojunction)- Industrial and Medical Applications.  
Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

**TOTAL: 45 PERIODS****OUTCOMES:**

- The students will have knowledge on the basics of physics related to properties of matter, optics, acoustics etc., and they will apply these fundamental principles to solve practical problems related to materials used for engineering applications.

**TEXT BOOKS:**

- Arumugam M. Engineering Physics. Anuradha publishers, 2010
- Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai publishers, 2009
- Mani Naidu S. Engineering Physics, Second Edition, PEARSON Publishing, 2011.

**REFERENCES:**

1. Searls and Zemansky. University Physics, 2009
2. Mani P. Engineering Physics I. Dhanam Publications, 2011
3. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009
4. Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011
5. Rajagopal K. Engineering Physics. PHI, New Delhi, 2011
6. Senthilkumar G. Engineering Physics I. VRB Publishers, 2011.

**CY6151****ENGINEERING CHEMISTRY - I****L T P C  
3 0 0 3****OBJECTIVES:**

- To make the students conversant with basics of polymer chemistry.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- To acquaint the students with the basics of nano materials, their properties and applications.

**UNIT I POLYMER CHEMISTRY****9**

Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: T<sub>g</sub>, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Preparation, properties and uses of Nylon 6,6, and Epoxy resin.

**UNIT II CHEMICAL THERMODYNAMICS****9**

Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions (problems); Criteria of spontaneity; Gibbs-Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore(problems).

**UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY****9**

Photochemistry: Laws of photochemistry - Grotthuss–Draper law, Stark–Einstein law and Lambert-Beer Law. Quantum efficiency – determination- Photo processes - Internal Conversion, Inter-system crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitization. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram only).

**UNIT IV PHASE RULE AND ALLOYS****9**

Phase rule: Introduction, definition of terms with examples, One Component System- water system - Reduced phase rule - Two Component Systems- classification – lead-silver system, zinc-magnesium system. Alloys: Introduction- Definition- Properties of alloys- Significance of alloying,

Functions and effect of alloying elements- Ferrous alloys- Nichrome and Stainless steel – heat treatment of steel; Non-ferrous alloys – brass and bronze.

## **UNIT V NANO CHEMISTRY**

**9**

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: nano cluster, nano rod, nanotube(CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrode position, chemical vapour deposition, laser ablation; Properties and applications

**TOTAL :45 PERIODS**

### **OUTCOMES:**

- The knowledge gained on polymer chemistry, thermodynamics. spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these subjects for further learning.

### **TEXT BOOKS:**

1. Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010
2. Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009

### **REFERENCES:**

1. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.
3. Gowariker V.R. , Viswanathan N.V. and JayadevSreedhar, "Polymer Science", New Age International P (Ltd.), Chennai, 2006.
4. Ozin G. A. and Arsenault A. C., "Nanotechnology: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.

**GE6151**

**COMPUTER PROGRAMMING**

**L T P C  
3 0 0 3**

### **OBJECTIVES:**

**The students should be made to:**

- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

## **UNIT I INTRODUCTION**

**8**

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

**UNIT II C PROGRAMMING BASICS 10**

Problem formulation – Problem Solving - Introduction to ‘ C’ programming –fundamentals – structure of a ‘C’ program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in ‘C’ – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

**UNIT III ARRAYS AND STRINGS 9**

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

**UNIT IV FUNCTIONS AND POINTERS 9**

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

**UNIT V STRUCTURES AND UNIONS 9**

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design C Programs for problems.
- Write and execute C programs for simple applications.

**TEXTBOOKS:**

1. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2. Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, First Edition, Oxford University Press, 2009
3. Yashavant P. Kanetkar. “ Let Us C”, BPB Publications, 2011.

**REFERENCES:**

1. Byron S Gottfried, “Programming with C”, Schaum’s Outlines, Second Edition, Tata McGraw-Hill, 2006.
2. Dromey R.G., “How to Solve it by Computer”, Pearson Education, Fourth Reprint, 2007.
3. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006.

**OBJECTIVES:**

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

**CONCEPTS AND CONVENTIONS (Not for Examination)**

1

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

**UNIT I PLANE CURVES AND FREE HAND SKETCHING**

5+9

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

**UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES**

5+9

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

**UNIT III PROJECTION OF SOLIDS**

5+9

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

**UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES**

5+9

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

**UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS**

6+9

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

**COMPUTER AIDED DRAFTING (Demonstration Only)**

3

Introduction to drafting packages and demonstration of their use.

**TOTAL : 75 PERIODS**

**OUTCOMES:**

On Completion of the course the student will be able to

- perform free hand sketching of basic geometrical constructions and multiple views of objects.
- do orthographic projection of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- prepare isometric and perspective sections of simple solids.
- demonstrate computer aided drafting.

**TEXT BOOK:**

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50<sup>th</sup> Edition, 2010.

**REFERENCES:**

1. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
2. Luzzader, Warren.J. and Duff, John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2<sup>nd</sup> Edition, 2009.
4. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.
5. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

**Publication of Bureau of Indian Standards:**

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

**Special points applicable to University Examinations on Engineering Graphics:**

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

**OBJECTIVES:**

**The student should be made to:**

- Be familiar with the use of Office software.
- Be exposed to presentation and visualization tools.
- Be exposed to problem solving techniques and flow charts.
- Be familiar with programming in C.
- Learn to use Arrays, strings, functions, structures and unions.

**LIST OF EXPERIMENTS:**

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions – Includes Parameter Passing
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.
- Develop recursive programs.

**LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:**

Standalone desktops with C compiler      30 Nos.

(or)

Server with C compiler supporting 30 terminals or more.

**OBJECTIVES:**

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

**GROUP A (CIVIL & MECHANICAL)****I CIVIL ENGINEERING PRACTICE****9****Buildings:**

- Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

**Plumbing Works:**

- Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- Study of pipe connections requirements for pumps and turbines.
- Preparation of plumbing line sketches for water supply and sewage works.
- Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

- Demonstration of plumbing requirements of high-rise buildings.

**Carpentry using Power Tools only:**

- Study of the joints in roofs, doors, windows and furniture.
- Hands-on-exercise:

Wood work, joints by sawing, planing and cutting.

**II MECHANICAL ENGINEERING PRACTICE****13****Welding:**

- Preparation of arc welding of butt joints, lap joints and tee joints.
- Gas welding practice

**Basic Machining:**

- Simple Turning and Taper turning
- Drilling Practice

**Sheet Metal Work:**

- Forming & Bending:
- Model making – Trays, funnels, etc.
- Different type of joints.

**Machine assembly practice:**

- Study of centrifugal pump
- Study of air conditioner

**Demonstration on:**

- Smithy operations, upsetting, swaging, setting down and bending. Example –

- Exercise – Production of hexagonal headed bolt.
- (b) Foundry operations like mould preparation for gear and step cone pulley.
- (c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

### **GROUP B (ELECTRICAL & ELECTRONICS)**

- III ELECTRICAL ENGINEERING PRACTICE 10**
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
  2. Fluorescent lamp wiring.
  3. Stair case wiring
  4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
  5. Measurement of energy using single phase energy meter.
  6. Measurement of resistance to earth of an electrical equipment.
- IV ELECTRONICS ENGINEERING PRACTICE 13**
1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
  2. Study of logic gates AND, OR, EOR and NOT.
  3. Generation of Clock Signal.
  4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
  5. Measurement of ripple factor of HWR and FWR.

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

- ability to fabricate carpentry components and pipe connections including plumbing works.
- ability to use welding equipments to join the structures.
- ability to fabricate electrical and electronics circuits.

#### **REFERENCES:**

1. Jeyachandran K., Natarajan S. & Balasubramanian S., “A Primer on Engineering Practices Laboratory”, Anuradha Publications, 2007.
2. Jeyapoovan T., Saravanapandian M. & Pranitha S., “Engineering Practices Lab Manual”, Vikas PUBLISHING House Pvt.Ltd, 2006.
3. Bawa H.S., “Workshop Practice”, Tata McGraw – Hill Publishing Company Limited, 2007.
4. Rajendra Prasad A. & Sarma P.M.M.S., “Workshop Practice”, Sree Sai Publication, 2002.
5. Kannaiah P. & Narayana K.L., “Manual on Workshop Practice”, Scitech Publications, 1999.

### **LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

#### **CIVIL**

- |   |          |
|---|----------|
| 1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. | 15 Sets. |
| 2. Carpentry vice (fitted to work bench)  | 15 Nos.  |
| 3. Standard woodworking tools   | 15 Sets. |
| 4. Models of industrial trusses, door joints, furniture joints  | 5 each   |
| 5. Power Tools: (a) Rotary Hammer   | 2 Nos    |
| (b) Demolition Hammer   | 2 Nos    |
| (c) Circular Saw  | 2 Nos    |
| (d) Planer  | 2 Nos    |
| (e) Hand Drilling Machine   | 2 Nos    |
| (f) Jigsaw  | 2 Nos    |

## MECHANICAL

- |   |           |
|---|-----------|
| 1. Arc welding transformer with cables and holders                            | 5 Nos.    |
| 2. Welding booth with exhaust facility  | 5 Nos.    |
| 3. Welding accessories like welding shield, chipping hammer, wire brush, etc. | 5 Sets.   |
| 4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.    | 2 Nos.    |
| 5. Centre lathe   | 2 Nos.    |
| 6. Hearth furnace, anvil and smithy tools                                     | 2 Sets.   |
| 7. Moulding table, foundry tools  | 2 Sets.   |
| 8. Power Tool: Angle Grinder  | 2 Nos     |
| 9. Study-purpose items: centrifugal pump, air-conditioner                     | One each. |

## ELECTRICAL

- |  |         |
|--|---------|
| 1. Assorted electrical components for house wiring                         | 15 Sets |
| 2. Electrical measuring instruments  | 10 Sets |
| 3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each |         |
| 4. Megger (250V/500V)  | 1 No.   |
| 5. Power Tools: (a) Range Finder   | 2 Nos   |
| (b) Digital Live-wire detector   | 2 Nos   |

## ELECTRONICS

- |   |         |
|---|---------|
| 1. Soldering guns   | 10 Nos. |
| 2. Assorted electronic components for making circuits                 | 50 Nos. |
| 3. Small PCBs   | 10 Nos. |
| 4. Multimeters  | 10 Nos. |
| 5. Study purpose items: Telephone, FM radio, low-voltage power supply |         |

GE6163

PHYSICS AND CHEMISTRY LABORATORY – I

L T P C  
0 0 2 1

PHYSICS LABORATORY – I

### OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

### LIST OF EXPERIMENTS

(Any FIVE Experiments)

- (a) Determination of Wavelength, and particle size using Laser  
(b) Determination of acceptance angle in an optical fiber.
- Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
- Determination of wavelength of mercury spectrum – spectrometer grating
- Determination of thermal conductivity of a bad conductor – Lee's Disc method.

5. Determination of Young's modulus by Non uniform bending method
6. Determination of specific resistance of a given coil of wire – Carey Foster's Bridge

**OUTCOMES:**

- The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Diode laser, lycopodium powder, glass plate, optical fiber.
2. Ultrasonic interferometer
3. Spectrometer, mercury lamp, grating
4. Lee's Disc experimental set up
5. Traveling microscope, meter scale, knife edge, weights
6. Carey foster's bridge set up  
(vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

**CHEMISTRY LABORATORY- I**

**OBJECTIVES:**

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by vacometry.

**LIST OF EXPERIMENTS**

(Any FIVE Experiments)

- 1 Determination of DO content of water sample by Winkler's method.
- 2 Determination of chloride content of water sample by argentometric method.
- 3 Determination of strength of given hydrochloric acid using pH meter.
- 4 Determination of strength of acids in a mixture using conductivity meter.
- 5 Estimation of iron content of the water sample using spectrophotometer.  
(1,10- phenanthroline / thiocyanate method).
- 6 Determination of molecular weight of polyvinylalcohol using Ostwald viscometer.
- 7 Conductometric titration of strong acid vs strong base.

**TOTAL: 30 PERIODS**

**OUTCOMES:**

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

**REFERENCES:**

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York 2001.
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry", LBS Singapore 1994.
3. Jeffery G.H., Bassett J., Mendham J. and Denny vogel's R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980.

## LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Iodine flask	-	30 Nos
2. pH meter	-	5 Nos
3. Conductivity meter	-	5 Nos
4. Spectrophotometer	-	5 Nos
5. Ostwald Viscometer	-	10 Nos

**Common Apparatus : Pipette, Burette, conical flask, porcelain tile, dropper (each 30 Nos.)**

**HS6251**

**TECHNICAL ENGLISH II**

**L T P C**  
**3 1 0 4**

### **OBJECTIVES:**

- To make learners acquire listening and speaking skills in both formal and informal contexts.
- To help them develop their reading skills by familiarizing them with different types of reading strategies.
- To equip them with writing skills needed for academic as well as workplace contexts.
- To make them acquire language skills at their own pace by using e-materials and language lab components.

### **UNIT I**

**9+3**

Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on topics like weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; Writing - Effective use of SMS for sending short notes and messages - Using 'emojicons' as symbols in email messages; Grammar - Regular and irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. 'can') - Homophones (e.g. 'some', 'sum'); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

### **UNIT II**

**9+3**

Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercises on Grammar and vocabulary, Extensive reading activity (reading stories / novels), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students' dialogues.

### **UNIT III**

**9+3**

Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret, etc.); Reading - Speed reading – reading passages with time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading articles from journals - Format for journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause

and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. 'rock', 'train', 'ring'); E-materials - Interactive exercise on Grammar and vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU and RIE materials – Attending a meeting and writing minutes.

#### **UNIT IV**

**9+3**

Listening - Listening to a telephone conversation, Viewing model interviews (face-to-face, telephonic and video conferencing); Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary - Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on Grammar and Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

#### **UNIT V**

**9+3**

Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading; Writing – Checklist - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; E-materials - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises; Language Lab - Different models of group discussion.

**TOTAL (L:45+T:15): 60 PERIODS**

#### **OUTCOMES:**

Learners should be able to

- speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies.
- write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
- read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
- listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

#### **TEXTBOOKS:**

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

#### **REFERENCES:**

1. Anderson, Paul V. Technical Communication: A Reader-Centered Approach. Cengage. New Delhi. 2008.
2. Muralikrishna, & Sunita Mishra. Communication Skills for Engineers. Pearson, New Delhi. 2011.
3. Riordan, Daniel. G. Technical Communication. Cengage Learning, New Delhi. 2005

4. Sharma, Sangeetha & Binod Mishra. Communication Skills for Engineers and Scientists. PHI Learning, New Delhi. 2009.
5. Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA. 2007.

#### **EXTENSIVE Reading (Not for Examination)**

1. Khera, Shiv. You can Win. Macmillan, Delhi. 1998.

#### **Websites**

1. <http://www.englishclub.com>
2. <http://owl.english.purdue.edu>

#### **TEACHING METHODS:**

- Lectures
- Activities conducted individually, in pairs and in groups like individual writing and presentations, group discussions, interviews, reporting, etc
- Long presentations using visual aids
- Listening and viewing activities with follow up activities like discussions, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc
- Projects like group reports, mock interviews etc using a combination of two or more of the language skills

#### **EVALUATION PATTERN:**

##### **Internal assessment: 20%**

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Report
- Creative writing, etc.

All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual presentations, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded following Bloom's taxonomy
- ✓ Writing assessment: Writing essays, CVs, reports etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content graded following Bloom's taxonomy.

##### **End Semester Examination: 80%**

**OBJECTIVES:**

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

**UNIT I VECTOR CALCULUS****9+3**

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

**UNIT II ORDINARY DIFFERENTIAL EQUATIONS****9+3**

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

**UNIT III LAPLACE TRANSFORM****9+3**

Laplace transform – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Transforms of unit step function and impulse functions – Transform of periodic functions. Inverse Laplace transform -Statement of Convolution theorem – Initial and final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

**UNIT IV ANALYTIC FUNCTIONS****9+3**

Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping:  $w = z+k$ ,  $kz$ ,  $1/z$ ,  $z^2$ ,  $e^z$  and bilinear transformation.

**UNIT V COMPLEX INTEGRATION****9+3**

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor's and Laurent's series expansions – Singular points – Residues – Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES:**

- The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.

**TEXT BOOKS:**

1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd.,2011.
2. Grewal. B.S, "Higher Engineering Mathematics", 41<sup>st</sup> Edition, Khanna Publications, Delhi, 2011.

**REFERENCES:**

1. Dass, H.K., and Er. Rajnish Verma," Higher Engineering Mathematics", S. Chand Private Ltd., 2011
2. Glyn James, "Advanced Modern Engineering Mathematics", 3<sup>rd</sup> Edition, Pearson Education, 2012.
3. Peter V. O'Neil," Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.
4. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., "Engineering Mathematics" Volume II, Second Edition, PEARSON Publishing, 2011.

**PH6251****ENGINEERING PHYSICS – II****L T P C  
3 0 0 3****OBJECTIVES:**

- To enrich the understanding of various types of materials and their applications in engineering and technology.

**UNIT I CONDUCTING MATERIALS****9**

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

**UNIT II SEMICONDUCTING MATERIALS****9**

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

**UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS****9**

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications

Superconductivity: properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High  $T_c$  superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

**UNIT IV DIELECTRIC MATERIALS****9**

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Clausius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

**UNIT V ADVANCED ENGINEERING MATERIALS****9**

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications

**TOTAL: 45 PERIODS****OUTCOMES:**

- The students will have the knowledge on physics of materials and that knowledge will be used by them in different engineering and technology applications.

**TEXT BOOKS:**

1. Arumugam M., Materials Science. Anuradha publishers, 2010
2. Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009

**REFERENCES:**

1. Palanisamy P.K. Materials Science. SCITECH Publishers, 2011.
2. Senthilkumar G. Engineering Physics II. VRB Publishers, 2011.
3. Mani P. Engineering Physics II. Dhanam Publications, 2011.
4. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009.

**CY6251****ENGINEERING CHEMISTRY - II****L T P C  
3 0 0 3****OBJECTIVES:**

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- Principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.

**UNIT I WATER TECHNOLOGY****9**

Introduction to boiler feed water-requirements-formation of deposits in steam boilers and heat exchangers- disadvantages (wastage of fuels, decrease in efficiency, boiler explosion) prevention of scale formation -softening of hard water -external treatment zeolite and demineralization - internal treatment- boiler compounds (phosphate, calgon, carbonate, colloidal) - caustic embrittlement -boiler corrosion-priming and foaming- desalination of brackish water –reverse osmosis.

**UNIT II ELECTROCHEMISTRY AND CORROSION****9**

Electrochemical cell - redox reaction, electrode potential- origin of electrode potential- oxidation potential- reduction potential, measurement and applications - electrochemical series and its significance - Nernst equation (derivation and problems). Corrosion- causes- factors- types-

chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Paints- constituents and function. Electroplating of Copper and electroless plating of nickel.

### **UNIT III ENERGY SOURCES 9**

Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion- differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery- nickel-cadmium battery- lithium battery- fuel cell  $H_2$  - $O_2$  fuel cell- applications.

### **UNIT IV ENGINEERING MATERIALS 9**

Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties – refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Portland cement- manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement – properties and uses. Glass - manufacture, types, properties and uses.

### **UNIT V FUELS AND COMBUSTION 9**

Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- coal- analysis of coal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) - petroleum- manufacture of synthetic petrol (Bergius process)- knocking- octane number - diesel oil- cetane number - natural gas- compressed natural gas (CNG)- liquefied petroleum gases (LPG)- producer gas- water gas. Power alcohol and bio diesel. Combustion of fuels: introduction- theoretical calculation of calorific value- calculation of stoichiometry of fuel and air ratio- ignition temperature- explosive range - flue gas analysis (ORSAT Method).

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

#### **TEXT BOOKS:**

1. Vairam S, Kalyani P and SubaRamesh., “Engineering Chemistry”., Wiley India Pvt Ltd., New Delhi., 2011.
2. Dara S.S, Umare S.S. “Engineering Chemistry”, S. Chand & Company Ltd., New Delhi , 2010.

#### **REFERENCES:**

- 1 Kannan P. and Ravikrishnan A., “Engineering Chemistry”, Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009.
2. Ashima Srivastava and Janhavi N N., “Concepts of Engineering Chemistry”, ACME Learning Private Limited., New Delhi., 2010.
3. Renu Bapna and Renu Gupta., “Engineering Chemistry”, Macmillan India Publisher Ltd., 2010.
4. Pahari A and Chauhan B., “Engineering Chemistry”., Firewall Media., New Delhi., 2010.

GE6251

**BASIC CIVIL AND MECHANICAL ENGINEERING**

**L T P C**  
**4 0 0 4**

**OBJECTIVES**

- To impart basic knowledge on Civil and Mechanical Engineering.
- To explain the materials used for the construction of civilized structures.
- To make the understand the fundamentals of construction of structure.
- To explain the component of power plant units and detailed explanation to IC engines their working principles.
- To explain the R & AC system.

**A – CIVIL ENGINEERING**

**UNIT I SURVEYING AND CIVIL ENGINEERING MATERIALS 15**

**Surveying:** Objects – types – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples.

**Civil Engineering Materials:** Bricks – stones – sand – cement – concrete – steel sections.

**UNIT II BUILDING COMPONENTS AND STRUCTURES 15**

**Foundations:** Types, Bearing capacity – Requirement of good foundations.

**Superstructure:** Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Mechanics – Internal and external forces – stress – strain – elasticity – Types of Bridges and Dams – Basics of Interior Design and Landscaping.

**TOTAL: 30 PERIODS**

**B – MECHANICAL ENGINEERING**

**UNIT III POWER PLANT ENGINEERING 10**

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

**UNIT IV IC ENGINES 10**

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

**UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM 10**

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.

**TOTAL: 30 PERIODS**

**OUTCOMES:**

- Ability to explain the usage of construction material and proper selection of construction materials.
- Ability to design building structures.
- Ability to identify the components use in power plant cycle.
- Ability to demonstrate working principles of petrol and diesel engine.

- Ability to explain the components of refrigeration and Air conditioning cycle.

**TEXT BOOKS:**

1. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering", Tata McGraw Hill Publishing Co., New Delhi, 1996.

**REFERENCES:**

1. Ramamrutham S., "Basic Civil Engineering", Dhanpat Rai Publishing Co. (P) Ltd. 1999.
2. Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, 2005.
3. Venugopal K. and Prahu Raja V., "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam, 2000.
4. Shantha Kumar S R J., "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, 2000.

**EE6201**

**CIRCUIT THEORY**

**L T P C**  
**3 1 0 4**

**OBJECTIVES:**

- To introduce electric circuits and its analysis
- To impart knowledge on solving circuits using network theorems
- To introduce the phenomenon of resonance in coupled circuits.
- To educate on obtaining the transient response of circuits.
- To Phasor diagrams and analysis of three phase circuits

**UNIT I BASIC CIRCUITS ANALYSIS**

**12**

Ohm's Law – Kirchoffs laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits – Phasor Diagram – Power, Power Factor and Energy.

**UNIT II NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS**

**12**

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Novton & Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem.

**UNIT III RESONANCE AND COUPLED CIRCUITS**

**12**

Series and paralled resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

**UNIT IV TRANSIENT RESPONSE FOR DC CIRCUITS**

**12**

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input – Characterization of two port networks in terms of Z,Y and h parameters.

**UNIT V THREE PHASE CIRCUITS**

**12**

Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

**OUTCOMES:**

- Ability analyse electrical circuits
- Ability to apply circuit theorems
- Ability to analyse AC and DC Circuits

**TEXT BOOKS:**

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, “Engineering Circuits Analysis”, Tata McGraw Hill publishers, 6<sup>th</sup> edition, New Delhi, 2003.
2. Joseph A. Edminister, Mahmood Nahri, “Electric circuits”, Schaum’s series, Tata McGraw-Hill, New Delhi, 2001.

**REFERENCES:**

1. Paranjothi SR, “Electric Circuits Analysis,” New Age International Ltd., New Delhi, 1996.
2. Sudhakar A and Shyam Mohan SP, “Circuits and Network Analysis and Synthesis”, Tata McGraw Hill, 2007.
3. Chakrabati A, “Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, 1999.
4. Charles K. Alexander, Mathew N.O. Sadiku, “Fundamentals of Electric Circuits”, Second Edition, McGraw Hill, 2003.

**GE6262**

**PHYSICS AND CHEMISTRY LABORATORY – II**

**L T P C**  
**0 0 2 1**

**PHYSICS LABORATORY – II**

**OBJECTIVES:**

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

**LIST OF EXPERIMENTS**

**(Any FIVE Experiments)**

1. Determination of Young’s modulus by uniform bending method
2. Determination of band gap of a semiconductor
3. Determination of Coefficient of viscosity of a liquid –Poiseuille’s method
4. Determination of Dispersive power of a prism - Spectrometer
5. Determination of thickness of a thin wire – Air wedge method
6. Determination of Rigidity modulus – Torsion pendulum

**OUTCOMES:**

- The students will have the ability to test materials by using their knowledge of applied physics principles in optics and properties of matter.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Traveling microscope, meter scale, Knife edge, weights
2. Band gap experimental set up
3. Burette, Capillary tube, rubber tube, stop clock, beaker and weighing balance
4. spectrometer, prism, sodium vapour lamp.
5. Air-wedge experimental set up.

6. Torsion pendulum set up.  
(vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

## CHEMISTRY LABORATORY - II

### OBJECTIVES:

- To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

### LIST OF EXPERIMENTS

#### (Any FIVE Experiments)

- Determination of alkalinity in water sample
- Determination of total, temporary & permanent hardness of water by EDTA method
- Estimation of copper content of the given solution by EDTA method
- Estimation of iron content of the given solution using potentiometer
- Estimation of sodium present in water using flame photometer
- Corrosion experiment – weight loss method
- Conductometric precipitation titration using  $\text{BaCl}_2$  and  $\text{Na}_2\text{SO}_4$
- Determination of CaO in Cement.

**TOTAL: 30 PERIODS**

### OUTCOMES:

- The students will be conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis.

### REFERENCES:

- Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York, 2001.
  - Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry, LBS Singapore ,1994.
  - Jeffery G.H, Bassett J., Mendham J. and Denny R.C., "Vogel's Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
  - Kolthoff I.M. and Sandell E.B. et al. Quantitative chemical analysis, McMillan, Madras 1980
- Laboratory classes on alternate weeks for Physics and Chemistry.**

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Potentiometer	-	5 Nos
2. Flame photo meter	-	5 Nos
3. Weighing Balance	-	5 Nos
4. Conductivity meter	-	5 Nos

**Common Apparatus : Pipette, Burette, conical flask, porcelain tile, dropper (30 Nos each)**

**OBJECTIVES:****The Students should be made to**

- Be exposed to Unix shell commands
- Be familiar with an editor on Unix
- Learn to program in Shell script
- Learn to write C programme for Unix platform

**LIST OF EXPERIMENTS****1. UNIX COMMANDS****15**

Study of Unix OS - Basic Shell Commands - Unix Editor

**2. SHELL PROGRAMMING****15**

Simple Shell program - Conditional Statements - Testing and Loops

**3. C PROGRAMMING ON UNIX****15**

Dynamic Storage Allocation-Pointers-Functions-File Handling

**TOTAL: 45 PERIODS****OUTCOMES:**

At the end of the course the students should be able to:

- Use Shell commands
- Design of Implement Unix shell scripts
- Write and execute C programs on Unix

**HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS****Hardware**

- UNIX Clone Server
- 33 Nodes (thin client or PCs)
- Printer – 3 Nos.

**Software**

- OS – UNIX Clone (33 user license or License free Linux)
- Compiler - C

**OBJECTIVES :**

- To provide practical experience with simulation of electrical circuits and verifying circuit theorems.

**LIST OF EXPERIMENTS**

1. Experimental verification of Kirchhoff's voltage and current laws
2. Experimental verification of network theorems (Thevenin, Norton, Superposition and maximum power transfer Theorem).
3. Study of CRO and measurement of sinusoidal voltage, frequency and power factor.
4. Experimental determination of time constant of series R-C electric circuits.
5. Experimental determination of frequency response of RLC circuits.
6. Design and Simulation of series resonance circuit.
7. Design and Simulation of parallel resonant circuits.
8. Simulation of low pass and high pass passive filters.
9. Simulation of three phase balanced and unbalanced star, delta networks circuits.
10. Experimental determination of power in three phase circuits by two-watt meter method .
11. Calibration of single phase energy meter.
12. Determination of two port network parameters.

**TOTAL: 45 PERIODS****OUTCOMES :**

- Ability to understand and apply circuit theorems and concepts in engineering applications.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

- 1 Regulated Power Supply: 0 – 15 V D.C - 10 Nos / Distributed Power Source.
- 2 Function Generator (1 MHz) - 10 Nos.
- 3 Single Phase Energy Meter - 1 No.
- 4 Oscilloscope (20 MHz) - 10 Nos.
- 5 Digital Storage Oscilloscope (20 MHz) – 1 No.
- 6 Circuit Simulation Software ( 5 Users ) (Pspice / Matlab /other Equivalent software Package) with PC( 5 Nos.) and Printer (1 No.)
- 7 AC/DC - Voltmeters (10 Nos.), Ammeters (10 Nos.) and Multi-meters (10 Nos.)
- 8 Single Phase Wattmeter – 3 Nos.
- 9 Decade Resistance Box, Decade Inductance Box, Decade Capacitance Box Each - 6 Nos.
- 10 Circuit Connection Boards - 10 Nos.

Necessary Quantities of Resistors, Inductors, Capacitors of various capacities (Quarter Watt to 10 Watt)

**OBJECTIVES:**

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

**UNIT I      PARTIAL DIFFERENTIAL EQUATIONS      9+3**

Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order partial differential equations - Lagrange's linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

**UNIT II      FOURIER SERIES      9+3**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

**UNIT III      APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS      9+3**

Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

**UNIT IV      FOURIER TRANSFORMS      9+3**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

**UNIT V      Z - TRANSFORMS AND DIFFERENCE EQUATIONS      9+3**

Z- transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES:**

- The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

**TEXT BOOKS:**

1. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.

2. Grewal B.S., "Higher Engineering Mathematics", 42<sup>nd</sup> Edition, Khanna Publishers, Delhi, 2012.
3. Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.

**REFERENCES:**

1. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7<sup>th</sup> Edition, Laxmi Publications Pvt Ltd, 2007.
2. Ramana. B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Glyn James, "Advanced Modern Engineering Mathematics", 3<sup>rd</sup> Edition, Pearson Education, 2007.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8<sup>th</sup> Edition, Wiley India, 2007.
5. Ray Wylie C and Barrett.L.C, "Advanced Engineering Mathematics" Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.
6. Datta K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.

**EE6301**

**DIGITAL LOGIC CIRCUITS**

**LT P C  
3 1 0 4**

**OBJECTIVES:**

- To study various number systems , simplify the logical expressions using Boolean functions
- To study implementation of combinational circuits
- To design various synchronous and asynchronous circuits.
- To introduce asynchronous sequential circuits and PLCs
- To introduce digital simulation for development of application oriented logic circuits.

**UNIT I NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES**

**9**

Review of number systems, binary codes, error detection and correction codes (Parity and Hamming code)- Digital Logic Families ,comparison of RTL, DTL, TTL, ECL and MOS families -operation, characteristics of digital logic family.

**UNIT II COMBINATIONAL CIRCUITS**

**9**

Combinational logic - representation of logic functions-SOP and POS forms, K-map representations-minimization using K maps - simplification and implementation of combinational logic - multiplexers and demultiplexers - code converters, adders, subtractors.

**UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS**

**9**

Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering - counters - asynchronous and synchronous type - Modulo counters - Shift registers - design of synchronous sequential circuits – Moore and Melay models- Counters, state diagram; state reduction; state assignment.

**UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABLE LOGIC DEVICES**

**9**

Asynchronous sequential logic circuits-Transition table, flow table-race conditions, hazards & errors in digital circuits; analysis of asynchronous sequential logic circuits-introduction to Programmable Logic Devices: PROM – PLA –PAL.

**UNIT V VHDL****9**

RTL Design – combinational logic – Sequential circuit – Operators – Introduction to Packages – Subprograms – Test bench. (Simulation /Tutorial Examples: adders, counters, flipflops, FSM, Multiplexers /Demultiplexers).

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES:**

- Ability to understand and analyse, linear and digital electronic circuits.

**TEXT BOOKS:**

1. Raj Kamal, ' Digital systems-Principles and Design', Pearson Education 2nd edition, 2007.
2. M. Morris Mano, 'Digital Design with an introduction to the VHDL', Pearson Education, 2013.
3. Comer "Digital Logic & State Machine Design, Oxford, 2012.

**REFERENCES:**

1. Mandal "Digital Electronics Principles & Application, McGraw Hill Edu,2013.
2. William Keitz, Digital Electronics-A Practical Approach with VHDL,Pearson,2013.
3. Floyd and Jain, 'Digital Fundamentals', 8th edition, Pearson Education, 2003.
4. Anand Kumar, Fundamentals of Digital Circuits,PHI,2013.
5. Charles H.Roth,Jr,Lizy Lizy Kurian John, 'Digital System Design using VHDL, Cengage, 2013.
6. John M.Yarbrough, 'Digital Logic, Application & Design', Thomson, 2002.
7. Gaganpreet Kaur, VHDL Basics to Programming, Pearson, 2013.
8. Botros, HDL Programming Fundamental, VHDL& Verilog, Cengage, 2013.

**EE6302****ELECTROMAGNETIC THEORY****L T P C  
3 1 0 4****OBJECTIVES:**

- To introduce the basic mathematical concepts related to electromagnetic vector fields
- To impart knowledge on the concepts of electrostatics, electrical potential, energy density and their applications.
- To impart knowledge on the concepts of magnetostatics, magnetic flux density, scalar and vector potential and its applications.
- To impart knowledge on the concepts of Faraday's law, induced emf and Maxwell's equations
- To impart knowledge on the concepts of Concepts of electromagnetic waves and Pointing vector.

**UNIT I ELECTROSTATICS – I****9**

Sources and effects of electromagnetic fields – Coordinate Systems – Vector fields –Gradient, Divergence, Curl – theorems and applications - Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and applications.



**OBJECTIVES:**

To the study of nature and the facts about environment.

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY****12**

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds

Field study of simple ecosystems – pond, river, hill slopes, etc.

**UNIT II ENVIRONMENTAL POLLUTION****10**

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry-Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO<sub>2</sub>, NO<sub>x</sub>, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies –

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

**UNIT III NATURAL RESOURCES****10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins –Biochemical

degradation of pollutants, Bioconversion of pollutants.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

#### **UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT**

**7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides.

Public awareness.

#### **UNIT V HUMAN POPULATION AND THE ENVIRONMENT**

**6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

**TOTAL : 45 PERIODS**

#### **OUTCOMES:**

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

#### **TEXT BOOKS :**

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.

#### **REFERENCES :**

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press 2005.

**OBJECTIVES:**

The student should be made to:

- Be familiar with the structure of basic electronic devices.
- Be exposed to the operation and applications of electronic devices.

**UNIT I PN JUNCTION DEVICES****9**

PN junction diode –structure, operation and V-I characteristics, diffusion and transient capacitance - Rectifiers – Half Wave and Full Wave Rectifier,– Display devices- LED, Laser diodes- Zener diode- characteristics-Zener Reverse characteristics – Zener as regulator

**UNIT II TRANSISTORS****9**

BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristor and IGBT - Structure and characteristics.

**UNIT III AMPLIFIERS****9**

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response – MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

**UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER****9**

BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers –Types (Qualitative analysis).

**UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS****9**

Advantages of negative feedback – voltage / current, series , Shunt feedback –positive feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES:**

- To explain the structure of the basic electronic devices.
- To design applications using the basic electronic devices.

**TEXT BOOKS:**

1. David A. Bell ,”Electronic Devices and Circuits”, Prentice Hall of India, 2004.
2. Sedra and smith, “Microelectronic Circuits “ Oxford University Press, 2004.

**REFERENCES:**

1. Rashid, “Micro Electronic Circuits” Thomson publications, 1999.
2. Floyd, “Electron Devices” Pearson Asia 5th Edition, 2001.
3. Donald A Neamen, “Electronic Circuit Analysis and Design” Tata McGraw Hill, 3<sup>rd</sup> Edition, 2003.
4. Robert L.Boylestad, “Electronic Devices and Circuit theory”, 2002.
5. Robert B. Northrop, “Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation”, CRC Press, 2004.

**OBJECTIVES:**

- To study the IC fabrication procedure.
- To study characteristics; realize circuits; design for signal analysis using Op-amp ICs.
- To study the applications of Op-amp.
- To study internal functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits, ADCs.

**UNIT I IC FABRICATION****9**

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance and FETs.

**UNIT II CHARACTERISTICS OF OPAMP****9**

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – Inverting and Non-inverting Amplifiers-V/I & I/V converters, summer, differentiator and integrator.

**UNIT III APPLICATIONS OF OPAMP****9**

Instrumentation amplifier, Log and Antilog Amplifiers, first and second order active filters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using opamps.

**UNIT IV SPECIAL ICs****9**

Functional block, characteristics & application circuits with 555 Timer Ic-566 voltage controlled oscillator Ic; 565-phase lock loop Ic, Analog multiplier ICs.

**UNIT V APPLICATION ICs****9**

IC voltage regulators –LM78XX,79XX Fixed voltage regulators - LM317, 723 Variable voltage regulators, switching regulator- SMPS- LM 380 power amplifier- ICL 8038 function generator IC.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Ability to understand and analyse, linear and digital electronic circuits.

**TEXT BOOKS:**

1. David A.Bell, 'Op-amp & Linear ICs', Oxford, 2013.
2. D.Roy Choudhary, Sheil B.Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.
3. Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI. 2000.

**REFERENCES:**

1. Fiore,"Opamps & Linear Integrated Circuits Concepts & Applications",Cengage,2010.
2. Floyd ,Buchla,"Fundamentals of Analog Circuits, Pearson, 2013.
3. Jacob Millman, Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system',Tata McGraw Hill, 2003.
4. Robert F.Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', PHI Learning, 6th edition,2012.

**OBJECTIVES:**

To enable the students to understand the behavior of semiconductor device based on experimentation

**LIST OF EXPERIMENTS:**

1. Characteristics of Semi conductor diode and Zener diode
2. Characteristics of a NPN Transistor under common emitter , common collector and common base configurations
3. Characteristics of JFET(Draw the equivalent circuit)
4. Characteristics of UJT and generation of saw tooth waveforms
5. Design and Frequency response characteristics of a Common Emitter amplifier
7. Characteristics of photo diode & photo transistor, Study of light activated relay circuit
8. Design and testing of RC phase shift, LC oscillators
9. Single Phase half-wave and full wave rectifiers with inductive and capacitive filters
10. Differential amplifiers using FET
11. Study of CRO for frequency and phase measurements
12. Astable and Monostable multivibrators
13. Realization of passive filters

**TOTAL : 45 PERIODS****OUTCOMES:**

- Ability to understand and analyse, linear and digital electronic circuits.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Semiconductor devices like Diode, Zener Diode, NPN Transistors, JFET, UJT, Photo diode, Photo Transistor
2. Resistors, Capacitors and inductors
3. Necessary digital IC 8
4. Function Generators 10
5. Regulated 3 output Power Supply 5,  $\pm 15V$  10
6. CRO 10
7. Storage Oscilloscope 1
8. Bread boards 10
9. Atleast one demo module each for the listed equipments.
10. Component data sheets to be provided

**OBJECTIVES:**

Working Practice in simulators / CAD Tools / Experiment test bench to learn design, testing and characterizing of circuit behaviour with digital and analog ICs.

**LIST OF EXPERIMENTS:**

1. Implementation of Boolean Functions, Adder/ Subtractor circuits.
2. Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa
3. Parity generator and parity checking
4. Encoders and Decoders
5. Counters: Design and implementation of 4-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.
6. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.
7. Study of multiplexer and demultiplexer
8. Timer IC application: Study of NE/SE 555 timer in Astable, Monostable operation.
9. Application of Op-Amp: inverting and non-inverting amplifier, Adder, comparator, Integrator and Differentiator.
10. Study of VCO and PLL ICs:
  - i. Voltage to frequency characteristics of NE/ SE 566 IC.
  - ii. Frequency multiplication using NE/SE 565 PLL IC.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Ability to understand and analyse, linear and digital electronic circuits.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:****(3 per Batch)**

S.No	Name of the equipments / Components	Quantity Required	Remarks
1	Dual ,(0-30V) variable Power Supply	10	-
2	CRO	9	30MHz
3	Digital Multimeter	10	Digital
4	Function Generator	8	1 MHz
5	IC Tester (Analog)	2	
6	Bread board	10	
7	Computer (PSPICE installed)	1	

<b>Consumables (Minimum of 25 Nos. each)</b>			
1	IC 741/ IC NE555/566/565	25	
2	Digital IC types	25	
3	LED	25	
4	LM317	25	
5	LM723	25	
6	ICSG3524 / SG3525	25	
7	Transistor – 2N3391	25	
8	Diodes,	25	IN4001,BY126
9	Zener diodes	25	
10	Potentiometer		
11	Step-down transformer	1	230V/12-0-12V
12	Capacitor		
13	Resistors 1/4 Watt Assorted	25	
14	Single Strand Wire		

**MA6459**

**NUMERICAL METHODS**

**L T P C  
3 1 0 4**

**OBJECTIVES:**

- This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology

**UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 10+3**

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method - Eigen values of a matrix by Power method.

**UNIT II INTERPOLATION AND APPROXIMATION 8+3**

Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

**UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+3**

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

**UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS**

**9+3**

Single Step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods - Milne's and Adams-Bashforth predictor corrector methods for solving first order equations.

**UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS**

**9+3**

Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES:**

- The students will have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

**TEXT BOOKS:**

1. Grewal. B.S., and Grewal. J.S., "Numerical methods in Engineering and Science", Khanna Publishers, 9<sup>th</sup> Edition, New Delhi, 2007.
2. Gerald. C. F., and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6<sup>th</sup> Edition, New Delhi, 2006.

**REFERENCES:**

1. Chapra. S.C., and Canale.R.P., "Numerical Methods for Engineers, Tata McGraw Hill, 5<sup>th</sup> Edition, New Delhi, 2007.
2. Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi, 2007.
3. Sankara Rao. K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, 3<sup>rd</sup> Edition, New Delhi, 2007.

**EE6401**

**ELECTRICAL MACHINES – I**

**L T P C**

**3 1 0 4**

**OBJECTIVES:**

- To introduce techniques of magnetic-circuit analysis and introduce magnetic materials
- To familiarize the constructional details, the principle of operation, prediction of performance, the methods of testing the transformers and three phase transformer connections.
- To study the working principles of electrical machines using the concepts of electromechanical energy conversion principles and derive expressions for generated voltage and torque developed in all Electrical Machines.
- To study the working principles of DC machines as Generator types, determination of their no-load/load characteristics, starting and methods of speed control of motors.
- To estimate the various losses taking place in D.C. Motor and to study the different testing methods to arrive at their performance.

**UNIT I MAGNETIC CIRCUITS AND MAGNETIC MATERIALS 9**

Magnetic circuits –Laws governing magnetic circuits - Flux linkage, Inductance and energy – Statically and Dynamically induced EMF - Torque – Properties of magnetic materials, Hysteresis and Eddy Current losses - AC excitation, introduction to permanent magnets-Transformer as a magnetically coupled circuit.

**UNIT II TRANSFORMERS 9**

Construction – principle of operation – equivalent circuit parameters – phasor diagrams, losses – testing – efficiency and voltage regulation-all day efficiency-Sumpner's test, per unit representation – inrush current - three phase transformers-connections – Scott Connection – Phasing of transformer–parallel operation of three phase transformers-auto transformer – tap changing transformers- tertiary winding.

**UNIT III ELECTROMECHANICAL ENERGY CONVERSION AND CONCEPTS IN ROTATING MACHINES 9**

Energy in magnetic system – Field energy and coenergy-force and torque equations – singly and multiply excited magnetic field systems-mmf of distributed windings – Winding Inductances-, magnetic fields in rotating machines – rotating mmf waves – magnetic saturation and leakage fluxes.

**UNIT IV DC GENERATORS 9**

Construction and components of DC Machine – Principle of operation - Lap and wave windings-EMF equations– circuit model – armature reaction –methods of excitation-commutation and interpoles - compensating winding –characteristics of DC generators.

**UNIT V DC MOTORS 9**

Principle and operations - types of DC Motors – Speed Torque Characteristics of DC Motors-starting and speed control of DC motors –Plugging, dynamic and regenerative braking- testing and efficiency – Retardation test- Swinburne's test and Hopkinson's test - Permanent magnet dc motors(PMDC)-DC Motor applications.

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES:**

- Ability to model and analyze electrical apparatus and their application to power system

**TEXT BOOKS:**

1. Nagrath I. J and Kothari D. P. 'Electric Machines', Fourth Edition, Tata McGraw Hill Publishing Company Ltd, 2010.
2. M.N.Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2009.
3. Fitzgerald. A.E., Charles Kingsely Jr, Stephen D.Umans, 'Electric Machinery', Sixth edition, Tata McGraw Hill Books Company, 2003.

**REFERENCES:**

1. P. C. Sen., 'Principles of Electrical Machines and Power Electronics', John Wiley & Sons, 1997.
2. Syed A. Nasar, Electric Machines and Power Systems: Volume I, McGraw-Hill College; International Edition, January 1995.
3. Deshpande M. V., "Electrical Machines" PHI Learning Pvt. Ltd., New Delhi, 2011.
4. P.S. Bimbhra, 'Electrical Machinery', Khanna Publishers, 2003.
5. S.Sarma & K.Pathak "Electric Machines", Cengage Learning India (P) Ltd., Delhi, 2011.

**OBJECTIVES:**

- To get a clear understanding of object-oriented concepts.
- To understand object oriented programming through C++.

**UNIT I OVERVIEW****9**

Why Object-Oriented Programming in C++ - Native Types and Statements –Functions and Pointers-Implementing ADTs in the Base Language.

**UNIT II BASIC CHARACTERISTICS OF OOP****9**

Data Hiding and Member Functions- Object Creation and Destruction- Polymorphism data abstraction: Iterators and Containers.

**UNIT III ADVANCED PROGRAMMING****9**

Templates, Generic Programming, and STL-Inheritance-Exceptions-OOP Using C++.

**UNIT IV OVERVIEW OF JAVA****9**

Data types, variables and arrays, operators, control statements, classes, objects, methods – Inheritance

**UNIT V EXCEPTION HANDLING****9**

Packages and Interfaces, Exception handling, Multithreaded programming, Strings, Input/Output

**TOTAL : 45 PERIODS****OUTCOMES:**

- Gain the basic knowledge on Object Oriented concepts.
- Ability to develop applications using Object Oriented Programming Concepts.
- Ability to implement features of object oriented programming to solve real world problems.

**TEXT BOOKS:**

1. Ira Pohl, "Object-Oriented Programming Using C++", Pearson Education Asia, 2003.
2. H.M.Deitel, P.J.Deitel, "Java : how to program", Fifth edition, Prentice Hall of India private limited, 2003.

**REFERENCES:**

1. Herbert Schildt, "The Java 2: Complete Reference", Fourth edition, TMH, 2002
2. Bjarne Stroustrup, "The C++ Programming Language", Pearson Education, 2004.
3. Stanley B. Lippman and Josee Lajoie , "C++ Primer", Pearson Education, 2003.
4. K.R.Venugopal, Rajkumar Buyya, T.Ravishankar, "Mastering C++", TMH, 2003.



**REFERENCES:**

1. B.R.Gupta, , S.Chand, 'Power System Analysis and Design'New Delhi, Fifth Edition, 2008.
2. Luces M.Fualken berry ,Walter Coffe, 'Electrical Power Distribution and Transmission', Pearson Education, 2007.
3. Hadi Saadat, 'Power System Analysis,' PSA Publishing; Third Edition, 2010.
4. J.Brian, Hardy and Colin R.Bayliss 'Transmission and Distribution in Electrical Engineering', Newnes; Fourth Edition, 2012.
5. G.Ramamurthy, "Handbook of Electrical power Distribution," Universities Press, 2013.

**EE6403****DISCRETE TIME SYSTEMS AND SIGNAL PROCESSING****L T P C  
3 0 0 3****OBJECTIVES:**

- To classify signals and systems & their mathematical representation.
- To analyse the discrete time systems.
- To study various transformation techniques & their computation.
- To study about filters and their design for digital implementation.
- To study about a programmable digital signal processor & quantization effects.

**UNIT I****INTRODUCTION****9**

Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect.

**UNIT II****DISCRETE TIME SYSTEM ANALYSIS****9**

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform,application to discrete systems - Stability analysis, frequency response – Convolution – Discrete TimeFourier transform , magnitude and phase representation.

**UNIT III****DISCRETE FOURIER TRANSFORM & COMPUTATION****9**

Discrete Fourier Transform- properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT &DIF using radix 2 FFT – Butterfly structure.

**UNIT IV****DESIGN OF DIGITAL FILTERS****9**

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. Analog filter design – Butterworth and Chebyshev approximations; IIR Filters, digital design using impulse invariant and bilinear transformation - mWarping, pre warping.

**UNIT V****DIGITAL SIGNAL PROCESSORS****9**

Introduction – Architecture – Features – Addressing Formats – Functional modes - Introduction to Commercial DSProcessors.

**TOTAL : 45 PERIODS**

## OUTCOMES:

- Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.

## TEXT BOOKS:

1. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, PHI. 2003.
2. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', McGraw Hill Edu, 2013.
3. Robert Schilling & Sandra L.Harris, 'Introduction to Digital Signal Processing using Matlab', Cengage Learning, 2014.

## REFERENCES:

1. Poorna Chandra S, Sasikala. B., Digital Signal Processing, Vijay Nicole/TMH, 2013.
2. B.P.Lathi, 'Principles of Signal Processing and Linear Systems', Oxford University Press, 2010
3. Taan S. ElAli, 'Discrete Systems and Digital Signal Processing with Mat Lab', CRC Press, 2009.
4. Sen M.kuo, woonseng...s.gan, "Digital Signal Processors, Architecture, Implementations & Applications, Pearson, 2013
5. Dimitris G.Manolakis, Vinay K. Ingle, applied Digital Signal Processing, Cambridge, 2012
6. Lonnie C.Ludeman, "Fundamentals of Digital Signal Processing", Wiley, 2013

EE6404

## MEASUREMENTS AND INSTRUMENTATION

L T P C  
3 0 0 3

### OBJECTIVES:

- To introduce the basic functional elements of instrumentation
- To introduce the fundamentals of electrical and electronic instruments
- To educate on the comparison between various measurement techniques
- To introduce various storage and display devices
- To introduce various transducers and the data acquisition systems

### UNIT I INTRODUCTION

9

Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration.

### UNIT II ELECTRICAL AND ELECTRONICS INSTRUMENTS

9

Principle and types of analog and digital voltmeters, ammeters, multimeters – Single and three phase wattmeters and energy meters – Magnetic measurements – Determination of B-H curve and measurements of iron loss – Instrument transformers – Instruments for measurement of frequency and phase.

### UNIT III COMPARISON METHODS OF MEASUREMENTS

9

D.C & A.C potentiometers, D.C & A.C bridges, transformer ratio bridges, self-balancing bridges. Interference & screening – Multiple earth and earth loops - Electrostatic and electromagnetic interference – Grounding techniques.

**UNIT IV STORAGE AND DISPLAY DEVICES 9**

Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & dot matrix display – Data Loggers.

**UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9**

Classification of transducers – Selection of transducers – Resistive, capacitive & inductive transducers – Piezoelectric, Hall effect, optical and digital transducers – Elements of data acquisition system – A/D, D/A converters – Smart sensors.

**TOTAL :45 PERIODS**

**OUTCOMES:**

- Ability to model and analyze electrical apparatus and their application to power system

**TEXT BOOKS:**

1. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.
2. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi, 2003.
3. Doebelin E.O. and Manik D.N., Measurement Systems – Applications and Design, Special Indian Edition, Tata McGraw Hill Education Pvt. Ltd., 2007.

**REFERENCES:**

1. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw Hill, II Edition 2004.
2. D.V.S. Moorthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2007.
3. A.J. Bouwens, 'Digital Instrumentation', Tata McGraw Hill, 1997.
4. Martin Reissland, 'Electrical Measurements', New Age International (P) Ltd., Delhi, 2001.
5. Alan. S. Morris, Principles of Measurements and Instrumentation, 2nd Edition, Prentice Hall of India, 2003.

**CS6461 OBJECT ORIENTED PROGRAMMING LABORATORY**

**L T P C  
0 0 3 2**

**OBJECTIVES:**

- To get a clear understanding of object-oriented concepts.
- To understand object oriented programming through C++ & JAVA.

**LIST OF EXPERIMENTS:**

**C++:**

1. program using functions
  - functions with default arguments
  - implementation of call by value, address, reference
2. simple classes for understanding objects, member functions & constructors
  - classes with primitive data members,
  - classes with arrays as data members
  - classes with pointers as data members
  - classes with constant data members
  - classes with static member functions
3. compile time polymorphism
  - operator overloading

- function overloading
- 4. run time polymorphism
  - inheritance
  - virtual functions
  - virtual base classes
  - templates
- 5. file handling
  - sequential access
  - random access

**JAVA:**

- 6. simple java applications
  - for understanding references to an instant of a class
  - handling strings in JAVA
- 7. simple package creation
  - developing user defined packages in java
- 8. interfaces
  - developing user defined interfaces
  - use predefined interfaces
- 9. threading
  - creation of threading in java applications
  - multi threading
- 10. exception handling mechanism in java
  - handling predefined exceptions
  - handling user defined exceptions

**TOTAL :45 PERIODS**

**OUTCOMES:**

- Gain the basic knowledge on Object Oriented concepts.
- Ability to develop applications using Object Oriented Programming Concepts.
- Ability to implement features of object oriented programming to solve real world problems.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

Standalone desktops with C++ compiler    30 Nos.

(or)

Server with C++ compiler supporting 30 terminals or more.

**OBJECTIVES :**

To expose the students to the operation of D.C. machines and transformers and give them experimental skill.

**LIST OF EXPERIMENTS:**

1. Open circuit and load characteristics of DC shunt generator- critical resistance and critical speed.
2. Load characteristics of DC compound generator with differential and cumulative connections.
3. Load test on DC shunt and compound motor.
4. Load test on DC series motor.
5. Swinburne's test and speed control of DC shunt motor.
6. Hopkinson's test on DC motor – generator set.
7. Load test on single-phase transformer and three phase transformers.
8. Open circuit and short circuit tests on single phase transformer.
9. Polarity Test and Sumpner's test on single phase transformers.
10. Separation of no-load losses in single phase transformer.
11. Study of starters and 3-phase transformers connections

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Ability to model and analyze electrical apparatus and their application to power system

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. DC Shunt Motor with Loading Arrangement – 3 nos
2. DC Shunt Motor Coupled With Three phase Alternator – 1 No.
3. Single Phase Transformer – 4 nos
4. DC Series Motor with Loading Arrangement – 1 No.
5. DC compound Motor with Loading Arrangement – 1 No.
6. Three Phase Induction Motor with Loading Arrangement – 2 nos
7. Single Phase Induction Motor with Loading Arrangement – 1 No.
8. DC Shunt Motor Coupled With DC Compound Generator – 2 nos
9. DC Shunt Motor Coupled With DC Shunt Motor – 1 No.
10. Tachometer -Digital/Analog – 8 nos
11. Single Phase Auto Transformer – 2 nos
12. Three Phase Auto Transformer – 1 No.
13. Single Phase Resistive Loading Bank – 2 nos
14. Three Phase Resistive Loading Bank. – 2 nos
15. SPST switch – 2 nos

**OBJECTIVES:**

- To model the power system under steady state operating condition.
- To apply numerical methods to solve the power flow problem.
- To model and analyze the system under faulted conditions.
- To model and analyze the transient behaviour of power system when it is subjected to a fault.

**UNIT I INTRODUCTION****9**

Need for system planning and operational studies – basic components of a power system.-Introduction to restructuring - Single line diagram – per phase and per unit analysis – Generator - transformer – transmission line and load representation for different power system studies.- Primitive network - construction of Y-bus using inspection and singular transformation methods – z-bus.

**UNIT II POWER FLOW ANALYSIS****9**

Importance of power flow analysis in planning and operation of power systems - statement of power flow problem - classification of buses - development of power flow model in complex variables form - iterative solution using Gauss-Seidel method - Q-limit check for voltage controlled buses – power flow model in polar form - iterative solution using Newton-Raphson method .

**UNIT III FAULT ANALYSIS – BALANCED FAULTS****9**

Importance of short circuit analysis - assumptions in fault analysis - analysis using Thevenin's theorem - Z-bus building algorithm - fault analysis using Z-bus – computations of short circuit capacity, post fault voltage and currents.

**UNIT IV FAULT ANALYSIS – UNBALANCED FAULTS****9**

Introduction to symmetrical components – sequence impedances – sequence circuits of synchronous machine, transformer and transmission lines - sequence networks analysis of single line to ground, line to line and double line to ground faults using Thevenin's theorem and Z-bus matrix.

**UNIT V STABILITY ANALYSIS****9**

Importance of stability analysis in power system planning and operation - classification of power system stability - angle and voltage stability – Single Machine Infinite Bus (SMIB) system: Development of swing equation - equal area criterion - determination of critical clearing angle and time – solution of swing equation by modified Euler method and Runge-Kutta fourth order method.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Ability to understand and analyze power system operation, stability, control and protection.

**TEXT BOOKS:**

1. Nagrath I.J. and Kothari D.P., 'Modern Power System Analysis', Tata McGraw-Hill, Fourth Edition, 2011.
2. John J. Grainger and W.D. Stevenson Jr., 'Power System Analysis', Tata McGraw-Hill, Sixth reprint, 2010.
3. P. Venkatesh, B.V. Manikandan, S. Charles Raja, A. Srinivasan, 'Electrical Power Systems- Analysis, Security and Deregulation', PHI Learning Private Limited, New Delhi, 2012.

**REFERENCES:**

1. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.

2. Kundur P., 'Power System Stability and Control, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.
3. Pai M A, 'Computer Techniques in Power System Analysis', Tata Mc Graw-Hill Publishing Company Ltd., New Delhi, Second Edition, 2007.
4. J. Duncan Glover, Mulukutla S. Sarma, Thomas J. Overbye, ' Power System Analysis & Design', Cengage Learning, Fifth Edition, 2012.
5. Olle. I. Elgerd, 'Electric Energy Systems Theory – An Introduction', Tata McGraw Hill Publishing Company Limited, New Delhi, Second Edition, 2012.
6. C.A.Gross, "Power System Analysis," Wiley India, 2011.

**EE6502**

**MICROPROCESSORS AND MICROCONTROLLERS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To study the Architecture of uP8085 & uC 8051
- To study the addressing modes & instruction set of 8085 & 8051.
- To introduce the need & use of Interrupt structure 8085 & 8051.
- To develop skill in simple applications development with programming 8085 & 8051
- To introduce commonly used peripheral / interfacing

**UNIT I 8085 PROCESSOR**

**9**

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.

**UNIT II PROGRAMMING OF 8085 PROCESSOR**

**9**

Instruction -format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up table - Subroutine instructions - stack.

**UNIT III 8051 MICRO CONTROLLER**

**9**

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts-Comparison to Programming concepts with 8085.

**UNIT IV PERIPHERAL INTERFACING**

**9**

Study on need, Architecture, configuration and interfacing, with ICs: 8255 , 8259 , 8254,8237,8251, 8279 ,- A/D and D/A converters &Interfacing with 8085& 8051.

**UNIT V MICRO CONTROLLER PROGRAMMING & APPLICATIONS**

**9**

Data Transfer, Manipulation, Control Algorithms& I/O instructions – Simple programming exercises- key board and display interface – Closed loop control of servo motor- stepper motor control – Washing Machine Control.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand and analyse, linear and digital electronic circuits.
- To understand and apply computing platform and software for engineering problems.

## TEXT BOOKS:

1. Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi , 2007.
2. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013.
3. Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.

## REFERENCES:

1. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.
2. N.Senthil Kumar, M.Saravanan, S.Jeevananthan, 'Microprocessors and Microcontrollers', Oxford,2013.
3. Valder – Perez, "Microcontroller – Fundamentals and Applications with Pic," Yeesdee Publishers, Tayler & Francis, 2013.

ME6701

POWER PLANT ENGINEERING

L T P C  
3 0 0 3

## OBJECTIVES:

- Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

### UNIT I COAL BASED THERMAL POWER PLANTS 10

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

### UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 10

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

### UNIT III NUCLEAR POWER PLANTS 7

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : *Boiling Water Reactor* (BWR), *Pressurized Water Reactor* (PWR), CANada Deuterium-Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

### UNIT IV POWER FROM RENEWABLE ENERGY 10

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, *Solar Photo Voltaic* (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

### UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS 8

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

**OUTCOMES:**

- Upon completion of this course, the Students can able to understand different types of power plant, and its functions and their flow lines and issues related to them.
- Analyse and solve energy and economic related issues in power sectors.

**TEXT BOOK:**

1. P.K. Nag, Power Plant Engineering, Tata McGraw – Hill Publishing Company Ltd., Third Edition, 2008.

**REFERENCES:**

1. M.M. El-Wakil, Power Plant Technology, Tata McGraw – Hill Publishing Company Ltd., 2010.
2. Black & Veatch, Springer, Power Plant Engineering, 1996.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, Standard Handbook of Power Plant Engineering, Second Edition, McGraw – Hill, 1998.
4. Godfrey Boyle, Renewable energy, Open University, Oxford University Press in association with the Open University, 2004.

**EE6503**

**POWER ELECTRONICS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To get an overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers
- To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and various configurations.

**UNIT I POWERSEMI-CONDUCTOR DEVICES**

**9**

Study of switching devices, Diode, SCR, TRIAC, GTO, BJT, MOSFET, IGBT-Static and Dynamic characteristics - Triggerring and commutation circuit for SCR- Design of Driver and snubber circuit.

**UNIT II PHASE-CONTROLLED CONVERTERS**

**9**

2-pulse,3-pulse and 6-pulseconverters– performance parameters –Effect of source inductance— Gate Circuit Schemes for Phase Control–Dual converters.

**UNIT III DC TO DC CONVERTER**

**9**

Step-down and step-up chopper-control strategy–Forced commutated chopper–Voltage commutated, Current commutated, Load commutated, Switched mode regulators- Buck, boost, buck- boost converter, Introduction to Resonant Converters.

**UNIT IV      INVERTERS****9**

Single phase and three phase voltage source inverters(both 120° mode and 180° mode)–Voltage & harmonic control–PWM techniques: Sinusoidal PWM, modified sinusoidal PWM - multiple PWM – Introduction to space vector modulation –Current source inverter.

**UNIT V      AC TO AC CONVERTERS****9**

Single phase and Three phase AC voltage controllers–Control strategy- Power Factor Control – Multistage sequence control -single phase and three phase cyclo converters –Introduction to Matrix converters.

**TOTAL:45 PERIODS****OUTCOMES:**

- Ability to understand and analyse, linear and digital electronic circuits.

**TEXT BOOKS:**

1. M.H.Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, PHI Third Edition, New Delhi, 2004.
2. P.S.Bimbhra "Power Electronics" Khanna Publishers, third Edition, 2003.
3. L. Umanand, " Power Electronics Essentials and Applications", Wiley, 2010.

**REFERENCES:**

1. Joseph Vithayathil, ' Power Electronics, Principles and Applications', McGraw Hill Series, 6<sup>th</sup> Reprint, 2013.
2. Ashfaq Ahmed Power Electronics for Technology Pearson Education, Indian reprint, 2003.
3. Philip T. Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.
4. Ned Mohan, Tore. M. Undel and, William. P. Robbins, ' Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition, 2003.
5. Daniel.W.Hart, "Power Electronics", Indian Edition, Mc Graw Hill, 3<sup>rd</sup> Print, 2013.
6. M.D. Singh and K.B. Khanchandani, "Power Electronics," Mc Graw Hill India, 2013.

**EE6504****ELECTRICAL MACHINES – II****L T P C  
3 1 0 4****OBJECTIVES:**

- To impart knowledge on Construction and performance of salient and non – salient type synchronous generators.
- To impart knowledge on Principle of operation and performance of synchronous motor.
- To impart knowledge on Construction, principle of operation and performance of induction machines.
- To impart knowledge on Starting and speed control of three-phase induction motors.
- To impart knowledge on Construction, principle of operation and performance of single phase induction motors and special machines.

**UNIT I      SYNCHRONOUS GENERATOR****9**

Constructional details – Types of rotors –winding factors- emf equation – Synchronous reactance – Armature reaction – Phasor diagrams of non salient pole synchronous generator connected to infinite bus--Synchronizing and parallel operation – Synchronizing torque -Change of excitation and

mechanical input- Voltage regulation – EMF, MMF, ZPF and A.S.A methods – steady state power-angle characteristics– Two reaction theory –slip test -short circuit transients - Capability Curves

**UNIT II SYNCHRONOUS MOTOR 9**

Principle of operation – Torque equation – Operation on infinite bus bars - V and Inverted V curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed-Hunting – natural frequency of oscillations – damper windings- synchronous condenser.

**UNIT III THREE PHASE INDUCTION MOTOR 9**

Constructional details – Types of rotors – Principle of operation – Slip –cogging and crawling-Equivalent circuit – Torque-Slip characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram – Separation of losses – Double cage induction motors –Induction generators – Synchronous induction motor.

**UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 9**

Need for starting – Types of starters – DOL, Rotor resistance, Autotransformer and Star-delta starters – Speed control – Voltage control, Frequency control and pole changing – Cascaded connection-V/f control – Slip power recovery scheme-Braking of three phase induction motor: Plugging, dynamic braking and regenerative braking.

**UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES 9**

Constructional details of single phase induction motor – Double field revolving theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis – Starting methods of single-phase induction motors – Capacitor-start capacitor run Induction motor- Shaded pole induction motor - Linear induction motor – Repulsion motor - Hysteresis motor - AC series motor- Servo motors- Stepper motors - introduction to magnetic levitation systems.

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES:**

- Ability to model and analyze electrical apparatus and their application to power system

**TEXT BOOKS:**

1. A.E. Fitzgerald, Charles Kingsley, Stephen. D.Umans, 'Electric Machinery', Tata Mc Graw Hill publishing Company Ltd, 2003.
2. D.P. Kothari and I.J. Nagrath, 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 2002.
3. P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, 2003.

**REFERENCES:**

1. M.N.Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2009.
2. Charless A. Gross, "Electric /Machines, "CRC Press, 2010.
3. K. Murugesh Kumar, 'Electric Machines', Vikas Publishing House Pvt. Ltd, 2002.
4. Syed A. Nasar, Electric Machines and Power Systems: Volume I, Mcgraw -Hill College; International ed Edition, January 1995.
5. Alexander S. Langsdorf, Theory of Alternating-Current Machinery, Tata McGraw Hill Publications, 2001.

**OBJECTIVES:**

- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed-loop frequency responses of systems.
- To introduce stability analysis and design of compensators
- To introduce state variable representation of physical systems and study the effect of state feedback

**UNIT I SYSTEMS AND THEIR REPRESENTATION 9**

Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

**UNIT II TIME RESPONSE 9**

Time response – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error – Root locus construction- Effects of P, PI, PID modes of feedback control –Time response analysis.

**UNIT III FREQUENCY RESPONSE 9**

Frequency response – Bode plot – Polar plot – Determination of closed loop response from open loop response - Correlation between frequency domain and time domain specifications- Effect of Lag, lead and lag-lead compensation on frequency response- Analysis.

**UNIT IV STABILITY AND COMPENSATOR DESIGN 9**

Characteristics equation – Routh Hurwitz criterion – Nyquist stability criterion- Performance criteria – Lag, lead and lag-lead networks – Lag/Lead compensator design using bode plots.

**UNIT V STATE VARIABLE ANALYSIS 9**

Concept of state variables – State models for linear and time invariant Systems – Solution of state and output equation in controllable canonical form – Concepts of controllability and observability – Effect of state feedback.

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES:**

- Ability to understand and apply basic science, circuit theory, theory control theory  
Signal processing and apply them to electrical engineering problems.

**TEXT BOOKS:**

1. M. Gopal, 'Control Systems, Principles and Design', 4<sup>th</sup> Edition, Tata McGraw Hill, New Delhi, 2012
2. S.K.Bhattacharya, Control System Engineering, 3<sup>rd</sup> Edition, Pearson, 2013.
3. Dhanesh. N. Manik, Control System, Cengage Learning, 2012.

**REFERENCES:**

1. Arthur, G.O.Mutambara, Design and Analysis of Control; Systems, CRC Press, 2009.
2. Richard C. Dorf and Robert H. Bishop, " Modern Control Systems", Pearson Prentice Hall, 2012.
3. Benjamin C. Kuo, Automatic Control systems, 7th Edition, PHI, 2010.
4. K. Ogata, 'Modern Control Engineering', 5th edition, PHI, 2012.

5. S.N.Sivanandam, S.N.Deepa, Control System Engineering using Mat Lab, 2<sup>nd</sup> Edition, Vikas Publishing, 2012.
6. S.Palani, Anoop. K.Jairath, Automatic Control Systems including Mat Lab, Vijay Nicole/ Mcgraw Hill Education, 2013.

**EE6511**

**CONTROL AND INSTRUMENTATION LABORATORY**

**LT P C**

**0 0 3 2**

**OBJECTIVES:**

To provide knowledge on analysis and design of control system along with basics of instrumentation

**LIST OF EXPERIMENTS:**

**CONTROLSYSTEMS:**

1. P, PI and PID controllers
2. Stability Analysis
3. Modeling of Systems – Machines, Sensors and Transducers
4. Design of Lag, Lead and Lag-Lead Compensators
5. Position Control Systems
6. Synchro-Transmitter- Receiver and Characteristics
7. Simulation of Control Systems by Mathematical development tools.

**INSTRUMENTATION:**

8. Bridge Networks –AC and DC Bridges
9. Dynamics of Sensors/Transducers
  - a. Temperature
  - b. Pressure
  - c. Displacement
  - d. Optical
  - e. Strain f. Flow
10. Power and Energy Measurement
11. Signal Conditioning
  - a. Instrumentation Amplifier
  - b. Analog – Digital and Digital –Analog converters (ADC and DACs)
12. Process Simulation.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory

control theory and apply them to electrical engineering problems.

## **LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

### **CONTROLSYSTEMS:**

1. PID kit – 1 No.  
DSO – 1 No.  
CRO Probe – 2 nos
2. Personal computers
3. DC motor – 1 No.  
Generator – 1 No. Rheostats – 2 nos  
Ammeters Voltmeters  
Connecting wires (3/20)
4. CRO 30MHz – 1 No.  
2MHz Function Generator – 1No.
5. Position Control Systems Kit (with manual) – 1 No., Tacho Generator Coupling set
6. AC Synchro transmitter & receiver – 1No.  
Digital multi meters

### **INSTRUMENTATION:**

7. R, L, C Bridge kit (with manual)
8. a) Electric heater – 1No.  
Thermometer – 1No. Thermistor (silicon type) RTD nickel type – 1No.  
b) 30 psi Pressure chamber (complete set) – 1No. Current generator (0 – 20mA)  
Air foot pump – 1 No. (with necessary connecting tubes)  
c) LVDT 20mm core length movable type – 1No. CRO 30MHz – 1No.  
d) Optical sensor – 1 No. Light source  
e) Strain Gauge Kit with Handy lever beam – 1No.  
100gm weights – 10 nos  
f) Flow measurement Trainer kit – 1 No.  
(1/2 HP Motor, Water tank, Digital Milliammeter, complete set)
9. Single phase Auto transformer – 1No.  
Watt-hour meter (energy meter) – 1No. Ammeter  
Voltmeter Rheostat Stop watch  
Connecting wires (3/20)
10. IC Transistor kit – 1No.

**OBJECTIVES:**

To enable learners to,

- Develop their communicative competence in English with specific reference to speaking and listening
- Enhance their ability to communicate effectively in interviews.
- Strengthen their prospects of success in competitive examinations.

**UNIT I LISTENING AND SPEAKING SKILLS 12**

Conversational skills (formal and informal)- group discussion- making effective presentations using computers, listening/watching interviews conversations, documentaries. Listening to lectures, discussions from TV/ Radio/ Podcast.

**UNIT II READING AND WRITING SKILLS 12**

Reading different genres of texts ranging from newspapers to creative writing. Writing job applications- cover letter- resume- emails- letters- memos- reports. Writing abstracts- summaries- interpreting visual texts.

**UNIT III ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS AND PLACEMENTS 12**

International English Language Testing System (IELTS) - Test of English as a Foreign Language (TOEFL) - Civil Service(Language related)- Verbal Ability.

**UNIT IV INTERVIEW SKILLS 12**

Different types of Interview format- answering questions- offering information- mock interviews-body language( paralinguistic features)- articulation of sounds- intonation.

**UNIT V SOFT SKILLS 12**

**Motivation- emotional intelligence**-Multiple intelligences- emotional intelligence- managing changes-time management-stress management-leadership traits-team work- career planning - intercultural communication- creative and critical thinking

**TOTAL: 60 PERIODS**

**Teaching Methods:**

1. To be totally learner-centric with minimum teacher intervention as the course revolves around practice.
2. Suitable audio/video samples from Podcast/YouTube to be used for illustrative purposes.
3. Portfolio approach for writing to be followed. Learners are to be encouraged to blog, tweet, text and email employing appropriate language.
4. GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.
5. Learners are to be assigned to read/write/listen/view materials outside the classroom as well for gaining proficiency and better participation in the class.

### Lab Infrastructure:

S. No.	Description of Equipment (minimum configuration)	Qty Required
1	<b>Server</b>	1 No.
	• PIV System	
	• 1 GB RAM / 40 GB HDD	
	• OS: Win 2000 server	
	• Audio card with headphones	
2	<b>Client Systems</b>	60 Nos.
	• PIII or above	
	• 256 or 512 MB RAM / 40 GB HDD	
	• OS: Win 2000	
	• Audio card with headphones	
3	Handicam	1 No.
	Television 46"	1 No.
5	Collar mike	1 No.
6	Cordless mike	1 No.
7	Audio Mixer	1 No.
8	DVD recorder/player	1 No.
9	LCD Projector with MP3/CD/DVD provision for Audio/video facility	1 No.

#### Evaluation:

##### Internal: 20 marks

Record maintenance: Students should write a report on a regular basis on the activities conducted, focusing on the details such as the description of the activity, ideas emerged, learning outcomes and so on. At the end of the semester records can be evaluated out of 20 marks.

##### External: 80 marks

Online Test	- 35 marks
Interview	- 15 marks
Presentation	- 15 marks
Group Discussion	- 15 marks

##### Note on Internal and External Evaluation:

1. Interview – mock interview can be conducted on one-on-one basis.
2. Speaking – example for role play:
  - a. Marketing engineer convincing a customer to buy his product.
  - b. Telephonic conversation- fixing an official appointment / placing an order / enquiring and so on.
3. Presentation – should be extempore on simple topics.
4. Discussion – topics of different kinds; general topics, and case studies.

#### OUTCOMES:

##### At the end of the course, learners should be able to

- Take international examination such as IELTS and TOEFL
- Make presentations and Participate in Group Discussions.
- Successfully answer questions in interviews.

#### REFERENCES:

1. **Business English Certificate Materials**, Cambridge University Press.

2. **Graded Examinations in Spoken English and Spoken English for Work** downloadable materials from Trinity College, London.
3. **International English Language Testing System** Practice Tests, Cambridge University Press.
4. Interactive Multimedia Programs on **Managing Time and Stress**.
5. **Personality Development** (CD-ROM), Times Multimedia, Mumbai.
6. Robert M Sherfield and et al. "**Developing Soft Skills**" 4th edition, New Delhi: Pearson Education, 2009.

**Web Sources:**

<http://www.slideshare.net/rohitjsh/presentation-on-group-discussion>

[http://www.washington.edu/doi/TeamN/present\\_tips.html](http://www.washington.edu/doi/TeamN/present_tips.html)

<http://www.oxforddictionaries.com/words/writing-job-applications>

<http://www.kent.ac.uk/careers/cv/coveringletters.htm>

[http://www.mindtools.com/pages/article/newCDV\\_34.htm](http://www.mindtools.com/pages/article/newCDV_34.htm)

**EE6512**

**ELECTRICAL MACHINES LABORATORY - II**

**LT P C  
0 0 3 2**

**OBJECTIVES:**

To expose the students to the operation of synchronous machines and induction motors and give them experimental skill.

**LIST OF EXPERIMENTS:**

1. Regulation of three phase alternator by emf and mmf methods.
2. Regulation of three phase alternator by ZPF and ASA methods.
3. Regulation of three phase salient pole alternator by slip test.
4. Measurements of negative sequence and zero sequence impedance of alternators.
5. V and Inverted V curves of Three Phase Synchronous Motor.
6. Load test on three-phase induction motor.
7. No load and blocked rotor test on three-phase induction motor(Determination of equivalent circuit parameters).
8. Separation of No-load losses of three-phase induction motor.
9. Load test on single-phase induction motor.
10. No load and blocked rotor test on single-phase induction motor.
11. Study of Induction motor Starters

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to model and analyze electrical apparatus and their application to power system

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Synchronous Induction motor 3HP – 1 No.
2. DC Shunt Motor Coupled With Three phase Alternator – 4 nos
3. DC Shunt Motor Coupled With Three phase Slip ring Induction motor – 1 No.

4. Three Phase Induction Motor with Loading Arrangement – 2 nos
5. Single Phase Induction Motor with Loading Arrangement – 2 nos
6. Tachometer -Digital/Analog – 8 nos
7. BLDC Motor – 1 No.
8. Single Phase Auto Transformer – 2 nos
9. Three Phase Auto Transformer – 3 nos
10. Single Phase Resistive Loading Bank – 2 nos
11. Three Phase Resistive Loading Bank – 2 nos
12. Capacitor Bank – 1 No.
13. SPST switch – 2 nos

**EC6651**

**COMMUNICATION ENGINEERING**

**LT P C  
3 0 0 3**

**OBJECTIVES:**

- To introduce different methods of analog communication and their significance
- To introduce Digital Communication methods for high bit rate transmission
- To introduce the concepts of source and line coding techniques for enhancing rating of transmission of minimizing the errors in transmission.
- To introduce MAC used in communication systems for enhancing the number of users.
- To introduce various media for digital communication

**UNIT I ANALOG COMMUNICATION**

**9**

AM – Frequency spectrum – vector representation – power relations – generation of AM – DSB, DSB/SC, SSB, VSB AM Transmitter & Receiver; FM and PM – frequency spectrum – power relations : NBFM & WBFM, Generation of FM and DM, Amstrong method & Reactance modulations : FM & PM frequency.

**UNIT II DIGITAL COMMUNICATION**

**9**

Pulse modulations – concepts of sampling and sampling theormes, PAM, PWM, PPM, PTM, quantization and coding : DCM, DM, slope overload error. ADM, DPCM, OOK systems – ASK, FSK, PSK, BSK, QPSK, QAM, MSK, GMSK, applications of Data communication.

**UNIT III SOURCE CODES, LINE CODES & ERROR CONTROL (Qualitative only)**

**9**

Primary communication – entropy, properties, BSC, BEC, source coding : Shaum, Fao, Huffman coding : noiseless coding theorem, BW – SNR trade off codes: NRZ, RZ, AMI, HDBP, ABQ, MBnBcodes : Efficiency of transmissions, error control codes and applications: convolutions & block codes.

**UNIT IV MULTIPLE ACCESS TECHNIQUES**

**9**

SS&MA techniques : FDMA, TDMA, CDMA, SDMA application in wire and wireless communication : Advantages (merits) :



permanent magnet synchronous motor.

## **UNIT V DESIGN OF CONTROLLERS FOR DRIVES**

**9**

Transfer function for DC motor / load and converter – closed loop control with Current and speed feedback–armature voltage control and field weakening mode – Design of controllers; current controller and speed controller- converter selection and characteristics.

**TOTAL: 45 PERIODS**

### **OUTCOMES:**

- Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.

### **TEXT BOOKS:**

1. Gopal K.Dubey, Fundamentals of Electrical Drives, Narosa Publishing House, 1992.
2. Bimal K.Bose. Modern Power Electronics and AC Drives, Pearson Education, 2002.
3. R.Krishnan, Electric Motor & Drives: Modeling, Analysis and Control, Prentice Hall of India, 2001.

### **REFERENCES:**

1. John Hindmarsh and Alasdain Renfrew, "Electrical Machines and Drives System," Elsevier 2012.
2. Shaahin Felizadeh, "Electric Machines and Drives", CRC Press(Taylor and Francis Group), 2013.
3. S.K.Pillai, A First course on Electrical Drives, Wiley Eastern Limited, 1993.
4. S. Sivanagaraju, M. Balasubba Reddy, A. Mallikarjuna Prasad "Power semiconductor drives" PHI, 5<sup>th</sup> printing, 2013.
5. N.K.De., P.K.SEN"Electric drives" PHI, 2012.
6. Vedam Subramanyam, "Thyristor Control of Electric Drives", Tata McGraw Hill, 2007.

**EE6602**

**EMBEDDED SYSTEMS**

**L T P C  
3 0 0 3**

### **OBJECTIVES:**

- To introduce the Building Blocks of Embedded System
- To Educate in Various Embedded Development Strategies
- To Introduce Bus Communication in processors, Input/output interfacing.
- To impart knowledge in Various processor scheduling algorithms.
- To introduce Basics of Real time operating system and example tutorials to discuss on one real-time operating system tool

## **UNIT I INTRODUCTION TO EMBEDDED SYSTEMS**

**9**

Introduction to Embedded Systems – The build process for embedded systems- Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.



**OBJECTIVES:**

- To have an overview of power system operation and control.
- To model power-frequency dynamics and to design power-frequency controller.
- To model reactive power-voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
- To study the economic operation of power system.
- To teach about SCADA and its application for real time operation and control of power systems.

**UNIT I INTRODUCTION 9**

An overview of power system operation and control - system load variation - load characteristics - load curves and load-duration curve - load factor - diversity factor - Importance of load forecasting and quadratic and exponential curve fitting techniques of forecasting – plant level and system level controls .

**UNIT II REAL POWER - FREQUENCY CONTROL 9**

Basics of speed governing mechanism and modeling - speed-load characteristics – load sharing between two synchronous machines in parallel - control area concept - LFC control of a single-area system - static and dynamic analysis of uncontrolled and controlled cases - two-area system – modeling - static analysis of uncontrolled case - tie line with frequency bias control - state variable model - integration of economic dispatch control with LFC.

**UNIT III REACTIVE POWER–VOLTAGE CONTROL 9**

Generation and absorption of reactive power - basics of reactive power control - excitation systems – modeling - static and dynamic analysis - stability compensation - methods of voltage control: tap-changing transformer, SVC (TCR + TSC) and STATCOM – secondary voltage control.

**UNIT IV UNIT COMMITMENT AND ECONOMIC DISPATCH 9**

Formulation of economic dispatch problem – I/O cost characterization – incremental cost curve - co-ordination equations without and with loss (No derivation of loss coefficients) - solution by direct method and -iteration method - statement of unit commitment problem – priority-list method - forward dynamic programming.

**UNIT V COMPUTER CONTROL OF POWER SYSTEMS 9**

Need for computer control of power systems - concept of energy control centre - functions - system monitoring - data acquisition and control - system hardware configuration – SCADA and EMS functions - network topology - state estimation – WLSE - Contingency Analysis - state transition diagram showing various state transitions and control strategies.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Ability to understand and analyze power system operation, stability, control and protection.

**TEXT BOOKS:**

1. Olle.I.Elgerd, 'Electric Energy Systems theory - An introduction', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010.
2. Allen. J. Wood and Bruce F. Wollenberg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2003.
3. Abhijit Chakrabarti, Sunita Halder, 'Power System Analysis Operation and Control', PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.

## REFERENCES:

1. Nagrath I.J. and Kothari D.P., 'Modern Power System Analysis', Tata McGraw-Hill, Fourth Edition, 2011.
2. Kundur P., 'Power System Stability and Control, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.
3. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.
4. N.V.Ramana, "Power System Operation and Control," Pearson, 2011.
5. C.A.Gross, "Power System Analysis," Wiley India, 2011.

**EE6604**

**DESIGN OF ELECTRICAL MACHINES**

**LT P C  
3 1 0 4**

## OBJECTIVES:

- To study mmf calculation and thermal rating of various types of electrical machines.
- To design armature and field systems for D.C. machines.
- To design core, yoke, windings and cooling systems of transformers.
- To design stator and rotor of induction machines.
- To design stator and rotor of synchronous machines and study their thermal behaviour.

## UNIT I INTRODUCTION

**9**

Major considerations in Electrical Machine Design - Electrical Engineering Materials – Space factor – Choice of Specific Electrical and Magnetic loadings - Thermal considerations - Heat flow – Temperature rise and Insulating Materials - Rating of machines – Standard specifications.

## UNIT II DC MACHINES

**9**

Output Equations – Main Dimensions – Choice of Specific Electric and Magnetic Loading - Magnetic Circuits Calculations - Carter's Coefficient - Net length of Iron –Real & Apparent flux densities – Selection of number of poles – Design of Armature – Design of commutator and brushes – performance prediction using design values.

## UNIT III TRANSFORMERS

**9**

Output Equations – Main Dimensions - kVA output for single and three phase transformers – Window space factor – Design of core and winding – Overall dimensions – Operating characteristics – No load current – Temperature rise in Transformers – Design of Tank - Methods of cooling of Transformers.

## UNIT IV INDUCTION MOTORS

**9**

Output equation of Induction motor – Main dimensions – Choice of Average flux density – Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings – Design of wound rotor – Magnetic leakage calculations – Leakage reactance of polyphase machines- Magnetizing current - Short circuit current – Operating characteristics- Losses and Efficiency.

## UNIT V SYNCHRONOUS MACHINES

**9**

Output equations – choice of Electrical and Magnetic Loading – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air

gap length – Design of rotor –Design of damper winding – Determination of full load field mmf – Design of field winding – Design of turbo alternators – Rotor design.

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES:**

- Ability to model and analyze electrical apparatus and their application to power system

**TEXT BOOKS:**

1. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 1984.
2. M.V.Deshpande "Design and Testing of Electrical Machine Design" Wheeler Publications, 2010.

**REFERENCES:**

1. A.Shanmuga Sundaram, G.Gangadharan, R.Palani 'Electrical Machine Design Data Book', New Age International Pvt. Ltd., Reprint, 2007.
2. R.K.Agarwal " Principles of Electrical Machine Design" Esskay Publications, Delhi, 2002.
3. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.

**EE6611**

**POWER ELECTRONICS AND DRIVES LABORATORY**

**LT P C  
0 0 3 2**

**OBJECTIVES:**

To provide hands on experience with power electronic converter design and testing

**LIST OF EXPERIMENTS:**

1. Gate Pulse Generation using R,RC and UJT.
2. Characteristics of SCR and Triac
3. Characteristics of MOSFET and IGBT
4. AC to DC half controlled converter
5. AC to DC fully controlled Converter
6. Step down and step up MOSFET based choppers
7. IGBT based single phase PWM inverter
8. IGBT based three phase PWM inverter
9. AC Voltage controller
10. Switched mode power converter.
11. Simulation of PE circuits (1 & 3 semiconverter, 1 & 3 full converter, dc-dc converters, ac voltage controllers).

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Ability to understand and analyse, linear and digital electronic circuits.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Device characteristics (for SCR, MOSFET, TRIAC and IGBT kit with builtin / discrete power supply and meters) - 2 each

2. Single phase SCR based half controlled converter and fully controlled converter along with built-in/separate/firing circuit/module and meter – 2 each
3. MOSFET based step up and step down choppers (Built in/ Discrete) – 1 each
4. IGBT based single phase PWM inverter module/Discrete Component – 2
5. IGBT based three phase PWM inverter module/Discrete Component – 2
6. Switched mode power converter module/Discrete Component – 2
7. SCR & TRIAC based 1 phase AC controller along with lamp or rheostat load - 2
8. Cyclo converter kit with firing module –
9. Dual regulated Dc power supply with common ground
10. Cathode ray Oscilloscope – 10
11. Isolation Transformer – 5
12. Single phase Auto transformer – 3
13. Components (Inductance, Capacitance ) 3 set for each
14. Multimeter – 5
15. LCR meter – 3
16. Rheostats of various ranges – 2 sets of 10 value
17. Work tables – 10
18. DC and AC meters of required ranges – 20
19. Component data sheets to be provided

**EE6612**

**MICROPROCESSORS AND MICROCONTROLLERS LABORATORY**

**LT P C  
0 0 3 2**

**OBJECTIVES:**

To provide training on programming of microprocessors and microcontrollers and understand the interface requirements.

**LIST OF EXPERIMENTS:**

1. Simple arithmetic operations: addition / subtraction / multiplication / division.
2. Programming with control instructions:
  - (i) Ascending / Descending order, Maximum / Minimum of numbers
  - (ii) Programs using Rotate instructions
  - (iii) Hex / ASCII / BCD code conversions.
3. Interface Experiments: with 8085
  - (i) A/D Interfacing. & D/A Interfacing.
4. Traffic light controller.
5. I/O Port / Serial communication
6. Programming Practices with Simulators/Emulators/open source

7. Read a key ,interface display
8. Demonstration of basic instructions with 8051 Micro controller execution, including:
  - (i) Conditional jumps, looping
  - (ii) Calling subroutines.
- 9.. Programming I/O Port 8051
  - (i) study on interface with A/D & D/A
  - (ii) study on interface with DC & AC motor .
10. Mini project development with processors.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Ability to understand and analyse, linear and digital electronic circuits.
- To understand and apply computing platform and software for engineering problems.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

Sl.No.	Description of Equipment	Quantity required
1.	8085 Microprocessor Trainer with Power Supply	15
2.	8051 Micro Controller Trainer Kit with power supply	15
3.	8255 Interface board	5
4.	8251 Interface board	5
5.	8259 Interface board	5
6.	8279 Keyboard / Display Interface board	5
7.	8254 timer counter	5
8.	ADC and DAC card	5
9.	AC & DC motor with Controller	5
10.	Traffic Light Control System	5

**EE6613**

**PRESENTATION SKILLS AND TECHNICAL SEMINAR**

**L T P C  
0 0 2 1**

**OBJECTIVES:**

- To encourage the students to study advanced engineering developments
- To prepare and present technical reports.
- To encourage the students to use various teaching aids such as over head projectors, power point presentation and demonstrative models.

**METHOD OF EVALUATION :**

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for a duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. Each student is expected to present atleast twice during the semester and the student is evaluated based on that. At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are given based on the report. A Faculty

guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also. Evaluation is 100% internal.

**TOTAL : 30 PERIODS**

**OUTCOMES:**

- Ability to review, prepare and present technological developments
- Ability to face the placement interviews

**EE6701**

**HIGH VOLTAGE ENGINEERING**

**LT P C  
3 0 0 3**

**OBJECTIVES:**

- To understand the various types of over voltages in power system and protection methods.
- Generation of over voltages in laboratories.
- Measurement of over voltages.
- Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
- Testing of power apparatus and insulation coordination.

**UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 9**

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary overvoltages, Corona and its effects – Reflection and Refraction of Travelling waves- Protection against overvoltages.

**UNIT II DIELECTRIC BREAKDOWN 9**

Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids, Maintenance of oil Quality – Breakdown mechanisms in solid and composite dielectrics.

**UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS 9**

Generation of High DC, AC, impulse voltages and currents - Triggering and control of impulse generators.

**UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS 9**

High Resistance with series ammeter – Dividers, Resistance, Capacitance and Mixed dividers - Peak Voltmeter, Generating Voltmeters - Capacitance Voltage Transformers, Electrostatic Voltmeters – Sphere Gaps - High current shunts- Digital techniques in high voltage measurement.

**UNIT V HIGH VOLTAGE TESTING & INSULATION COORDINATION 9**

High voltage testing of electrical power apparatus as per International and Indian standards – Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers- Insulation Coordination.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand and analyze power system operation, stability, control and protection.

**TEXT BOOKS:**

1. S.Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, Fifth Edition, 2013.
2. E. Kuffel and W.S. Zaengl, J.Kuffel, 'High voltage Engineering fundamentals', Newnes Second

Edition Elsevier , New Delhi, 2005.

3. Subir Ray,' An Introduction to High Voltage Engineering' PHI Learning Private Limited, New Delhi, Second Edition, 2013.

#### REFERENCES:

1. L.L. Alston, 'High Voltage Technology', Oxford University Press, First Indian Edition, 2011.
2. C.L. Wadhwa, 'High voltage Engineering', New Age International Publishers, Third Edition, 2010.

**EE6702**

**PROTECTION AND SWITCHGEAR**

**L T P C**  
**3 0 0 3**

#### OBJECTIVES:

- To educate the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
- To introduce the characteristics and functions of relays and protection schemes.
- To impart knowledge on apparatus protection
- To introduce static and numerical relays
- To impart knowledge on functioning of circuit breakers

#### **UNIT I PROTECTION SCHEMES**

**9**

Principles and need for protective schemes – nature and causes of faults – types of faults – fault current calculation using symmetrical components – Methods of Neutral grounding – Zones of protection and essential qualities of protection – Protection schemes

#### **UNIT II ELECTROMAGNETIC RELAYS**

**9**

Operating principles of relays - the Universal relay – Torque equation – R-X diagram – Electromagnetic Relays – Overcurrent, Directional, Distance, Differential, Negative sequence and Under frequency relays.

#### **UNIT III APPARATUS PROTECTION**

**9**

Current transformers and Potential transformers and their applications in protection schemes - Protection of transformer, generator, motor, busbars and transmission line.

#### **UNIT IV STATIC RELAYS AND NUMERICAL PROTECTION**

**9**

Static relays – Phase, Amplitude Comparators – Synthesis of various relays using Static comparators – Block diagram of Numerical relays – Overcurrent protection, transformer differential protection, distant protection of transmission lines.

#### **UNIT V CIRCUIT BREAKERS**

**9**

Physics of arcing phenomenon and arc interruption - DC and AC circuit breaking – re-striking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching - current chopping - interruption of capacitive current - Types of circuit breakers – air blast, air break, oil, SF6 and vacuum circuit breakers – comparison of different circuit breakers – Rating and selection of Circuit breakers.

**TOTAL : 45 PERIODS**

#### OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

**TEXT BOOKS:**

1. Sunil S.Rao, 'Switchgear and Protection', Khanna Publishers, New Delhi, 2008.
2. B.Rabindranath and N.Chander, 'Power System Protection and Switchgear', New Age International (P) Ltd., First Edition 2011.
3. M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarti, 'A Text Book on Power System Engineering', Dhanpat Rai & Co.,1998.

**REFERENCES:**

1. Badri Ram ,B.H. Vishwakarma, 'Power System Protection and Switchgear', New Age International Pvt Ltd Publishers, Second Edition 2011.
2. Y.G.Paithankar and S.R.Bhide, 'Fundamentals of power system protection', Second Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
3. C.L.Wadhwa, 'Electrical Power Systems', 6th Edition, New Age International (P) Ltd., 2010
4. Ravindra P.Singh, ' Switchgear and Power System Protection', PHI Learning Private Ltd., New Delhi, 2009.
5. Bhavesh Bhalja, R.P. Maheshwari, Nilesh G. Chotani,'Protection and Switchgear' Oxford University Press, 2011.

**EE6703****SPECIAL ELECTRICAL MACHINES****L T P C  
3 0 0 3****OBJECTIVES:**

- To impart knowledge on Construction, principle of operation and performance of synchronous reluctance motors.
- To impart knowledge on the Construction, principle of operation, control and performance of stepping motors.
- To impart knowledge on the Construction, principle of operation, control and performance of switched reluctance motors.
- To impart knowledge on the Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
- To impart knowledge on the Construction, principle of operation and performance of permanent magnet synchronous motors.

**UNIT I SYNCHRONOUS RELUCTANCE MOTORS****9**

Constructional features – Types – Axial and Radial flux motors – Operating principles – Variable Reluctance Motors – Voltage and Torque Equations - Phasor diagram - performance characteristics – Applications.

**UNIT II STEPPER MOTORS****9**

Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations – Torque equations – Modes of excitation – Characteristics – Drive circuits – Microprocessor control of stepper motors – Closed loop control-Concept of lead angle– Applications.

**UNIT III SWITCHED RELUCTANCE MOTORS (SRM) 9**

Constructional features – Rotary and Linear SRM - Principle of operation – Torque production – Steady state performance prediction- Analytical method -Power Converters and their controllers – Methods of Rotor position sensing – Sensor less operation – Characteristics and Closed loop control – Applications.

**UNIT IV PERMANENT MAGNET BRUSHLESS D.C. MOTORS 9**

Permanent Magnet materials – Minor hysteresis loop and recoil line-Magnetic Characteristics – Permeance coefficient -Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations –Commutation - Power Converter Circuits and their controllers – Motor characteristics and control– Applications.

**UNIT V PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM) 9**

Principle of operation – Ideal PMSM – EMF and Torque equations – Armature MMF – Synchronous Reactance – Sine wave motor with practical windings - Phasor diagram – Torque/speed characteristics - Power controllers - Converter Volt-ampere requirements– Applications.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to model and analyze electrical apparatus and their application to power system

**TEXT BOOKS:**

1. K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
2. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 1989.
3. T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984.

**REFERENCES:**

1. R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001.
2. P.P. Aearnley, 'Stepping Motors – A Guide to Motor Theory and Practice', Peter Perengrinus London, 1982.
3. T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.
4. E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014.

**MG6851**

**PRINCIPLES OF MANAGEMENT**

**LT P C  
3 0 0 3**

**OBJECTIVES:**

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.

**UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9**

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

**UNIT II PLANNING****9**

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

**UNIT III ORGANISING****9**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

**UNIT IV DIRECTING****9**

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

**UNIT V CONTROLLING****9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

**TEXT BOOKS:**

1. Stephen P. Robbins & Mary Coulter, “ Management”, Prentice Hall (India) Pvt. Ltd., 10<sup>th</sup> Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, Pearson Education, 6th Edition, 2004.

**REFERENCES:**

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, “Fundamentals of Management” Pearson Education, 7th Edition, 2011.
2. Robert Kreitner & Mamata Mohapatra, “ Management”, Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich “Essentials of Management” Tata McGraw Hill,1998.
4. Tripathy PC & Reddy PN, “Principles of Management”, Tata McGraw Hill, 1999.

**OBJECTIVES:**

To provide better understanding of power system analysis through digital simulation

**LIST OF EXPERIMENTS:**

1. Computation of Parameters and Modelling of Transmission Lines
2. Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
3. Load Flow Analysis - I : Solution of load flow and related problems using Gauss-Seidel Method
4. Load Flow Analysis - II: Solution of load flow and related problems using Newton Raphson.
5. Fault Analysis
6. Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System
7. Transient Stability Analysis of Multi machine Power Systems
8. Electromagnetic Transients in Power Systems
9. Load – Frequency Dynamics of Single- Area and Two-Area Power Systems
10. Economic Dispatch in Power Systems.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand and analyze power system operation, stability, control and protection.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Personal computers (Pentium-IV, 80GB, 512 MBRAM) – 25 nos
2. Printer laser- 1 No.
3. Dot matrix- 1 No.
4. Server (Pentium IV, 80GB, 1GBRAM) (High Speed Processor) – 1 No.
5. Software: any power system simulation software - 5 licenses
6. Compilers: C, C++, VB, VC++ - 25 users

**OBJECTIVES:**

To encourage the students to comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E Degree Course through periodic exercise.

**METHOD OF EVALUATION:**

The students will be assessed 100% internally through weekly test with objective type questions on all the subject related topics

**TOTAL : 30 PERIODS**

**OUTCOMES:**

- Ability to review, prepare and present technological developments

**OBJECTIVES:**

- To analyze the various concepts behind renewable energy resources.
- To introduce the energy saving concept by different ways of illumination.
- To understand the different methods of electric heating and electric welding.
- To introduce knowledge on Solar Radiation and Solar Energy Collectors
- To introduce concepts of Wind Energy and its utilization

**UNIT I ELECTRIC DRIVES AND TRACTION 9**

Fundamentals of electric drive - choice of an electric motor - application of motors for particular services - traction motors - characteristic features of traction motor - systems of railway electrification - electric braking - train movement and energy consumption - traction motor control - track equipment and collection gear.

**UNIT II ILLUMINATION 9**

Introduction - definition and meaning of terms used in illumination engineering - classification of light sources - incandescent lamps, sodium vapour lamps, mercury vapour lamps, fluorescent lamps – design of illumination systems - indoor lighting schemes - factory lighting halls - outdoor lighting schemes - flood lighting - street lighting - energy saving lamps, LED.

**UNIT III HEATING AND WELDING 9**

Introduction - advantages of electric heating – modes of heat transfer - methods of electric heating - resistance heating - arc furnaces - induction heating - dielectric heating - electric welding – types - resistance welding - arc welding - power supply for arc welding - radiation welding.

**UNIT IV SOLAR RADIATION AND SOLAR ENERGY COLLECTORS 9**

Introduction - solar constant - solar radiation at the Earth's surface - solar radiation geometry – estimation of average solar radiation - physical principles of the conversion of solar radiation into heat – flat-plate collectors - transmissivity of cover system - energy balance equation and collector efficiency - concentrating collector - advantages and disadvantages of concentrating collectors - performance analysis of a cylindrical - parabolic concentrating collector – Feedin Invertors.

**UNIT V WIND ENERGY 9**

Introduction - basic principles of wind energy conversion - site selection considerations - basic components of a WECS (Wind Energy Conversion System) - Classification of WECS - types of wind Turbines - analysis of aerodynamic forces acting on the blade - performances of wind.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Ability to understand and analyze power system operation, stability, control and protection.
- Ability to handle the engineering aspects of electrical energy generation and utilization.

**TEXT BOOKS:**

1. N.V. Suryanarayana, "Utilisation of Electric Power", Wiley Eastern Limited, New Age International Limited, 1993.
2. J.B.Gupta, "Utilisation Electric power and Electric Traction", S.K.Kataria and Sons, 2000.
3. G.D.Rai, "Non-Conventional Energy Sources", Khanna Publications Ltd., New Delhi, 1997.

**REFERENCES:**

1. R.K.Rajput, Utilisation of Electric Power, Laxmi publications Private Limited., 2007.

2. H.Partab, Art and Science of Utilisation of Electrical Energy”, Dhanpat Rai and Co., New Delhi, 2004.
3. C.L.Wadhwa, “Generation, Distribution and Utilisation of Electrical Energy”, New Age International Pvt.Ltd., 2003.
4. S. Sivanagaraju, M. Balasubba Reddy, D. Srilatha,’ Generation and Utilization of Electrical Energy’, Pearson Education, 2010.
5. Donals L. Steeby,’ Alternative Energy Sources and Systems’, Cengage Learning, 2012.

**EE6811**

**PROJECT WORK**

**L T P C  
0 0 12 6**

**OBJECTIVES:**

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL: 180 PERIODS**

**OUTCOMES:**

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

**OBJECTIVES :**

- To study about the concepts of windows programming models, MFC applications, drawing with the GDI, getting inputs from Mouse and the Keyboard.
- To study the concepts of Menu basics, menu magic and classic controls of the windows programming using VC++.
- To study the concept of Document/View Architecture with single & multiple document interface, toolbars, status bars and File I/O Serialization.
- To study about the integrated development programming event driven programming, variables, constants, procedures and basic ActiveX controls in visual basic.
- To understand the database and the database management system, visual data manager, data bound controls and ADO controls in VB.

**UNIT I FUNDAMENTALS OF WINDOWS AND MFC****9**

Messages - Windows programming - SDK style - Hungarian notation and windows data types - SDK programming in perspective. The benefits of C++ and MFC - MFC design philosophy – Document / View architecture - MFC class hierarchy - AFX functions. Application object - Frame window object - Message map. Drawing the lines – Curves – Ellipse – Polygons and other shapes. GDI pens – Brushes - GDI fonts - Deleting GDI objects and deselecting GDI objects. Getting input from the mouse: Client & Non-client - Area mouse messages - Mouse wheel - Cursor. Getting input from the keyboard: Input focus - Keystroke messages - Virtual key codes - Character & dead key messages.

**UNIT II RESOURCES AND CONTROLS****9**

Creating a menu – Loading and displaying a menu – Responding to menu commands – Command ranges - Updating the items in menu, update ranges – Keyboard accelerators. Creating menus programmatically - Modifying menus programmatically - The system menu - Owner draw menus – Cascading menus - Context menus. The C button class – C list box class – C static class - The font view application – C edit class – C combo box class – C scrollbar class. Model dialog boxes – Modeless dialog boxes.

**UNIT III DOCUMENT / VIEW ARCHITECTURE****9**

The in existence function revisited – Document object – View object – Frame window object – Dynamic object creation. SDI document template - Command routing. Synchronizing multiple views of a document – Mid squares application – Supporting multiple document types – Alternatives to MDI. Splitter Windows: Dynamic splitter window – Static splitter windows. Creating & initializing a toolbar - Controlling the toolbar's visibility – Creating & initializing a status bar - Creating custom status bar panes – Status bar support in appwizard. Opening, closing and creating the files - Reading & Writing – C file derivatives – Serialization basics - Writing serializable classes.

**UNIT IV FUNDAMENTALS OF VISUAL BASIC****9**

Menu bar – Tool bar – Project explorer – Toolbox – Properties window – Form designer – Form layout – Intermediate window. Designing the user interface: Aligning the controls – Running the application – Visual development and event driven programming.

Variables: Declaration – Types – Converting variable types – User defined data types - Lifetime of a variable. Constants - Arrays – Types of arrays. Procedures: Subroutines – Functions – Calling procedures. Text box controls – List box & Combo box controls – Scroll bar and slider controls – File controls.

**UNIT V DATABASE PROGRAMMING WITH VB****9**

Record sets – Data control – Data control properties, methods. Visual data manager: Specifying indices with the visual data manager – Entering data with the visual data manager. Data bound list control – Data bound combo box – Data bound grid control. Mapping databases: Database object – Table def object, Query def object. Programming the active database objects – ADO object model – Establishing a connection - Executing SQL statements – Cursor types and locking mechanism – Manipulating the record set object – Simple record editing and updating.

**TOTAL = 45 PERIODS****OUTCOMES:**

- To understand and apply computing platform and software for engineering problems.

**TEXT BOOKS:**

1. Jeff Prosise, 'Programming Windows With MFC', Second Edition, WP Publishers & Distributors (P) Ltd, Reprinted, 2002.
2. Evangelos Petroustos, 'Mastering Visual Basic 6.0', BPB Publications, 2002.

**REFERENCES:**

1. Herbert Schildt, 'MFC Programming From the Ground Up', Second Edition, Tata McGraw Hill, reprinted, 2002.
2. John Paul Muller, 'Visual C++ 6 From the Ground Up Second Edition', Tata McGraw Hill, Reprinted, 2002.
3. Curtis Smith & Micheal Amundsen, 'Teach Yourself Database Programming with Visual Basic 6 in 21 days', Techmedia Pub, 1999.

**IC6601****ADVANCED CONTROL SYSTEM**

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3	0	0	3

**OBJECTIVES :**

- To provide knowledge on design in state variable form
- To provide knowledge in phase plane analysis.
- To give basic knowledge in describing function analysis.
- To study the design of optimal controller.
- To study the design of optimal estimator including Kalman Filter

**UNIT I STATE VARIABLE DESIGN****9**

Introduction to state Model- effect of state Feedback- Necessary and Sufficient Condition for Arbitrary Pole-placement- pole placement Design- design of state Observers- separation principle- servo design: -State Feedback with integral control.

**UNIT II PHASE PLANE ANALYSIS****9**

Features of linear and non-linear systems - Common physical non-linearities – Methods of linearization Concept of phase portraits – Singular points – Limit cycles – Construction of phase portraits – Phase plane analysis of linear and non-linear systems – Isocline method.

**UNIT III DESCRIBING FUNCTION ANALYSIS****9**

**Basic concepts, derivation of describing functions for common non-linearities** – Describing function analysis of non-linear systems – limit cycles – Stability of oscillations.

**UNIT IV OPTIMAL CONTROL 9**  
Introduction - Time varying optimal control – LQR steady state optimal control – Solution of Ricatti's equation – Application examples.

**UNIT V OPTIMAL ESTIMATION 9**  
Optimal estimation – Kalman Bucy Filter-Solution by duality principle-Discrete systems- Kalman Filter- Application examples..

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to apply advanced control theory to practical engineering problems.

**TEXT BOOKS :**

1. K. P. Mohandas, "Modern Control Engineering", Sanguine Technical Publishers, 2006.
2. G. J. Thaler, " Automatic Control Systems", Jaico Publishing House, 1993.
3. M.Gopal, Modern Control System Theory, New Age International Publishers, 2002.

**REFERENCES:**

1. William S Levine, "Control System Fundamentals," The Control Handbook, CRC Press, Tayler and Francies Group, 2011.
2. Ashish Tewari, 'Modern Control Design with Matlab and Simulink', John Wiley, New Delhi, 2002.
3. K. Ogata, 'Modern Control Engineering', 4th edition, PHI, New Delhi, 2002.
4. T. Glad and L. Ljung,, "Control Theory –Multivariable and Non-Linear Methods", Taylor & Francis, 2002.
5. D.S.Naidu, "Optimal Control Systems" First Indian Reprint, CRC Press, 2009.

**EE6002**

**POWER SYSTEM TRANSIENTS**

**LT P C  
3 0 0 3**

**OBJECTIVES:**

- To study the generation of switching transients and their control using circuit – theoretical concept.
- To study the mechanism of lightning strokes and the production of lightning surges.
- To study the propagation, reflection and refraction of travelling waves.
- To study the impact of voltage transients caused by faults, circuit breaker action, load rejection on integrated power system.

**UNIT I INTRODUCTION AND SURVEY 9**  
Review and importance of the study of transients - causes for transients. RL circuit transient with sine wave excitation - double frequency transients - basic transforms of the RLC circuit transients. Different types of power system transients - effect of transients on power systems – role of the study of transients in system planning.

**UNIT II SWITCHING TRANSIENTS 9**  
Over voltages due to switching transients - resistance switching and the equivalent circuit for interrupting the resistor current - load switching and equivalent circuit - waveforms for transient

voltage across the load and the switch - normal and abnormal switching transients. Current suppression - current chopping - effective equivalent circuit. Capacitance switching - effect of source regulation - capacitance switching with a restrike, with multiple restrikes. Illustration for multiple restriking transients - ferro resonance.

**UNIT III LIGHTNING TRANSIENTS 9**

Review of the theories in the formation of clouds and charge formation - rate of charging of thunder clouds – mechanism of lightning discharges and characteristics of lightning strokes – model for lightning stroke - factors contributing to good line design - protection using ground wires - tower footing resistance - Interaction between lightning and power system.

**UNIT IV TRAVELING WAVES ON TRANSMISSION LINE COMPUTATION OF TRANSIENTS 9**

Computation of transients - transient response of systems with series and shunt lumped parameters and distributed lines. Traveling wave concept - step response - Bewely's lattice diagram - standing waves and natural frequencies - reflection and refraction of travelling waves.

**UNIT V TRANSIENTS IN INTEGRATED POWER SYSTEM 9**

The short line and kilometric fault - distribution of voltages in a power system - Line dropping and load rejection - voltage transients on closing and reclosing lines - over voltage induced by faults -switching surges on integrated system Qualitative application of EMTP for transient computation.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand and analyze power system operation, stability, control and protection.

**TEXT BOOKS:**

1. Allan Greenwood, 'Electrical Transients in Power Systems', Wiley Inter Science, New York, 2<sup>nd</sup> Edition, 1991.
2. Pritindra Chowdhari, "Electromagnetic transients in Power System", John Wiley and Sons Inc., Second Edition, 2009.
3. C.S. Indulkar, D.P.Kothari, K. Ramalingam, 'Power System Transients – A statistical approach', PHI Learning Private Limited, Second Edition, 2010.

**REFERENCES:**

1. M.S.Naidu and V.Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, Fifth Edition, 2013.
2. R.D. Begamudre, 'Extra High Voltage AC Transmission Engineering', Wiley Eastern Limited, 1986.
3. Y.Hase, Handbook of Power System Engineering," Wiley India, 2012.
4. J.L.Kirtley, "Electric Power Principles, Sources, Conversion, Distribution and use," Wiley, 2012.

**OBJECTIVES:**

- To introduce the basic concepts of linear programming
- To educate on the advancements in Linear programming techniques
- To introduce non-linear programming techniques
- To introduce the interior point methods of solving problems
- To introduce the dynamic programming method

**UNIT I LINEAR PROGRAMMING****9**

Introduction - formulation of linear programming model-Graphical solution–solving LPP using simplex algorithm – Revised Simplex Method.

**UNIT II ADVANCES IN LPP****9**

Dualit theory- Dual simplex method - Sensitivity analysis--Transportation problems– Assignment problems-Traveling sales man problem -Data Envelopment Analysis.

**UNIT III NON LINEAR PROGRAMMING****9**

Classification of Non Linear programming – Lagrange multiplier method – Karush – Kuhn Tucker conditions–Reduced gradient algorithms–Quadratic programming method – Penalty and Barrier method.

**UNIT IV INTERIOR POINT METHODS****9**

Karmarkar’s algorithm–Projection Scaling method–Dual affine algorithm–Primal affine algorithm Barrier algorithm.

**UNIT V DYNAMIC PROGRAMMING****9**

Formulation of Multi stage decision problem–Characteristics–Concept of sub-optimization and the principle of optimality–Formulation of Dynamic programming–Backward and Forward recursion–Computational procedure–Conversion of final value problem in to Initial value problem.

**TOTAL: 45 PERIODS****OUTCOMES:**

- To understand ethical issues, environmental impact and acquire management skills.

**TEXT BOOKS:**

1. Hillier and Lieberman “Introduction to Operations Research”, TMH, 2000.
2. R.Panneerselvam, “Operations Research”, PHI, 2006
3. Hamdy ATaha, “Operations Research –An Introduction”, Prentice Hall India, 2003.

**REFERENCES:**

1. Philips, Ravindran and Solberg, “Operations Research”, John Wiley, 2002.
2. Ronald L.Rardin, “Optimization in Operation Research” Pearson Education Pvt. Ltd. New Delhi, 2005.

**OBJECTIVES:**

- To expose the basic concepts of optical fibers and their industrial applications.
- To provide adequate knowledge about Industrial application of optical fibres.
- To provide basic concepts of lasers.
- To provide knowledge about Industrial application of lasers
- To provide knowledge about Industrial application of Holography and Medical applications of Lasers.

**UNIT I OPTICAL FIBRES AND THEIR PROPERTIES 9**

Principles of light propagation through a fibre - Different types of fibres and their properties, fibre characteristics – Absorption losses – Scattering losses – Dispersion – Connectors and splicers – Fibre termination – Optical sources – Optical detectors.

**UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBRES 9**

Fibre optic sensors – Fibre optic instrumentation system – Different types of modulators – Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

**UNIT III LASER FUNDAMENTALS 9**

Fundamental characteristics of lasers – Three level and four level lasers – Properties of laser – Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers – Gas lasers, solid lasers, liquid lasers, semiconductor lasers.

**UNIT IV INDUSTRIAL APPLICATION OF LASERS 9**

Laser for measurement of distance, length, velocity, acceleration, current, voltage and Atmospheric effect – Material processing – Laser heating, welding, melting and trimming of material – Removal and vaporization.

**UNIT V HOLOGRAM AND MEDICAL APPLICATIONS 9**

Holography – Basic principle - Methods – Holographic interferometry and application, Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser and tissue interactive – Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Ability to understand and analyze Instrumentation systems and their applications to various industries.

**TEXT BOOKS:**

1. R.P.Khare, Fiber Optics and Optoelectronics, Oxford university press, 2008.
2. J. Wilson and J.F.B. Hawkes, Introduction to Opto Electronics, Prentice Hall of India, 2001.

**REFERENCES:**

1. Asu Ram Jha, Fiber Optic Technology Applications to commercial, Industrial, Military and Space Optical systems, PHI learning Private limited, 2009.
2. M. Arumugam, Optical Fibre Communication and Sensors, Anuradha Agencies, 2002.
3. John F. Read, Industrial Applications of Lasers, Academic Press, 1978.

**OBJECTIVES:**

- To Introduce Fundamentals of Biomedical Engineering
- To study the communication mechanics in a biomedical system with few examples
- To study measurement of certain important electrical and non-electrical parameters
- To understand the basic principles in imaging techniques
- To have a basic knowledge in life assisting and therapeutic devices

**UNIT I FUNDAMENTALS OF BIOMEDICAL ENGINEERING 9**

Cell and its structure – Resting and Action Potential – Nervous system and its fundamentals - Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow - Biomechanics of bone - Biomechanics of soft tissues - Basic mechanics of spinal column and limbs -Physiological signals and transducers - Transducers – selection criteria – Piezo electric, ultrasonic transducers - Temperature measurements - Fibre optic temperature sensors.

**UNIT II NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES 9**

Measurement of blood pressure - Cardiac output - Heart rate - Heart sound - Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers, pH of blood –measurement of blood pCO<sub>2</sub>, pO<sub>2</sub>, finger-tip oxymeter - ESR, GSR measurements.

**UNIT III ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS 9**

Electrodes – Limb electrodes –floating electrodes – pregelled disposable electrodes - Micro, needle and surface electrodes – Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier - ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipments.

**UNIT IV IMAGING MODALITIES AND ANALYSIS 9**

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography –Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems - Analysis of digital images.

**UNIT V LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES 9**

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy - ICCU patient monitoring system - Nano Robots - Robotic surgery – Advanced 3D surgical techniques- Orthopedic prostheses fixation.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Ability to understand and analyze Instrumentation systems and their applications to various industries.

**TEXT BOOKS:**

1. Leslie Cromwell, Biomedical Instrumentation and Measurement, Prentice hall of India, New Delhi, 2007.
2. Joseph J.carr and John M. Brown, Introduction to Biomedical Equipment Technology, John Wiley and sons, New York, 4<sup>th</sup> Edition, 2012.

3. Khandpur R.S, Handbook of Biomedical Instrumentation, , Tata McGraw-Hill, New Delhi, 2<sup>nd</sup> Edition, 2003.

#### REFERENCES:

1. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, New York, 1998.
2. Duane Knudson, Fundamentals of Biomechanics, Springer, 2<sup>nd</sup> Edition, 2007.
3. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.
4. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.
5. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.

EE6004

FLEXIBLE AC TRANSMISSION SYSTEMS

L T P C  
3 0 0 3

#### OBJECTIVES:

- To introduce the reactive power control techniques
- To educate on static VAR compensators and their applications
- To provide knowledge on Thyristor controlled series capacitors
- To educate on STATCOM devices
- To provide knowledge on FACTS controllers

#### UNIT I INTRODUCTION

9

Reactive power control in electrical power transmission lines -Uncompensated transmission line - series compensation – Basic concepts of Static Var Compensator (SVC) – Thyristor Controlled Series capacitor (TCSC) – Unified power flow controller (UPFC).

#### UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS

9

Voltage control by SVC – Advantages of slope in dynamic characteristics – Influence of SVC on system voltage – Design of SVC voltage regulator –Modelling of SVC for power flow and fast transient stability – Applications: Enhancement of transient stability – Steady state power transfer – Enhancement of power system damping.

#### UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS

9

Operation of the TCSC – Different modes of operation – Modelling of TCSC – Variable reactance model – Modelling for Power Flow and stability studies. Applications: Improvement of the system stability limit – Enhancement of system damping.

#### UNIT IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS

9

Static Synchronous Compensator (STATCOM) – Principle of operation – V-I Characteristics. Applications: Steady state power transfer-enhancement of transient stability - prevention of voltage instability. SSSC-operation of SSSC and the control of power flow –modelling of SSSC in load flow and transient stability studies.

#### UNIT V CO-ORDINATION OF FACTS CONTROLLERS

9

Controller interactions – SVC – SVC interaction – Co-ordination of multiple controllers using linear control techniques – Control coordination using genetic algorithms.

**OUTCOMES:**

- Ability to understand and analyze power system operation, stability, control and protection.

**TEXT BOOKS:**

1. R.Mohan Mathur, Rajiv K.Varma, “Thyristor – Based Facts Controllers for Electrical Transmission Systems”, IEEE press and John Wiley & Sons, Inc, 2002.
2. Narain G. Hingorani, “Understanding FACTS -Concepts and Technology of Flexible AC Transmission Systems”, Standard Publishers Distributors, Delhi- 110 006, 2011.
3. K.R.Padiyar,” FACTS Controllers in Power Transmission and Distribution”, New Age International(P) Limited, Publishers, New Delhi, 2008.

**REFERENCES:**

1. A.T.John, “Flexible A.C. Transmission Systems”, Institution of Electrical and Electronic Engineers (IEEE), 1999.
2. V.K.Sood,HVDC and FACTS controllers – Applications of Static Converters in Power System, APRIL 2004 , Kluwer Academic Publishers, 2004.
3. Xiao – Ping Zang, Christian Rehtanz and Bikash Pal, “Flexible AC Transmission System: Modelling and Control” Springer, 2012.

**EE6005**

**POWER QUALITY**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To introduce the power quality problem
- To educate on production of voltages sags, over voltages and harmonics and methods of control.
- To study overvoltage problems
- To study the sources and effect of harmonics in power system
- To impart knowledge on various methods of power quality monitoring.

**UNIT I INTRODUCTION TO POWER QUALITY**

**9**

Terms and definitions: Overloading - under voltage - over voltage. Concepts of transients - short duration variations such as interruption - long duration variation such as sustained interruption. Sags and swells - voltage sag - voltage swell - voltage imbalance - voltage fluctuation - power frequency variations. International standards of power quality. Computer Business Equipment Manufacturers Associations (CBEMA) curve.

**UNIT II VOLTAGE SAGS AND INTERRUPTIONS**

**9**

Sources of sags and interruptions - estimating voltage sag performance. Thevenin’s equivalent source - analysis and calculation of various faulted condition. Voltage sag due to induction motor starting. Estimation of the sag severity - mitigation of voltage sags, active series compensators. Static transfer switches and fast transfer switches.

**UNIT III OVERVOLTAGES**

**9**

Sources of over voltages - Capacitor switching – lightning - ferro resonance. Mitigation of voltage swells - surge arresters - low pass filters - power conditioners. Lightning protection – shielding - line

arresters - protection of transformers and cables. An introduction to computer analysis tools for transients, PSCAD and EMTP.

#### **UNIT IV HARMONICS**

**9**

Harmonic sources from commercial and industrial loads, locating harmonic sources. Power system response characteristics - Harmonics Vs transients. Effect of harmonics - harmonic distortion - voltage and current distortion - harmonic indices - inter harmonics – resonance. Harmonic distortion evaluation - devices for controlling harmonic distortion - passive and active filters. IEEE and IEC standards.

#### **UNIT V POWER QUALITY MONITORING**

**9**

Monitoring considerations - monitoring and diagnostic techniques for various power quality problems - modeling of power quality (harmonics and voltage sag) problems by mathematical simulation tools - power line disturbance analyzer – quality measurement equipment - harmonic / spectrum analyzer - flicker meters - disturbance analyzer. Applications of expert systems for power quality monitoring.

**TOTAL : 45 PERIODS**

#### **OUTCOMES:**

- Ability to understand and analyze power system operation, stability, control and protection.

#### **TEXT BOOKS:**

1. Roger. C. Dugan, Mark. F. McGranagh, Surya Santoso, H.Wayne Beaty, 'Electrical Power Systems Quality' McGraw Hill, 2003. (For Chapters 1, 2, 3, 4 and 5).
2. **Eswald.F.Fudis and M.A.S.Masoum**, "Power Quality in Power System and Electrical Machines," Elsevier Academic Press, 2013.
3. J. Arrillaga, N.R. Watson, S. Chen, 'Power System Quality Assessment', Wiley, 2011.

#### **REFERENCES:**

1. G.T. Heydt, 'Electric Power Quality', 2<sup>nd</sup> Edition. (West Lafayette, IN, Stars in a Circle Publications, 1994). (For Chapter 1, 2, 3 and 5)
2. M.H.J Bollen, 'Understanding Power Quality Problems: Voltage Sags and Interruptions', (New York: IEEE Press, 1999). (For Chapters 1, 2, 3 and 5)
3. G.J.Wakileh, "Power Systems Harmonics – Fundamentals, Analysis and Filter Design," Springer 2007.
4. E.Aeha and M.Madrigal, "Power System Harmonics, Computer Modelling and Analysis, " Wiley India, 2012.
5. R.S.Vedam, M.S.Sarma, "Power Quality – VAR Compensation in Power Systems," CRC Press 2013.
6. C. Sankaran, 'Power Quality', CRC press, Taylor & Francis group, 2002.

**OBJECTIVES:**

- To expose the students to the concepts of feed forward neural networks.
- To provide adequate knowledge about feedback neural networks
- To provide adequate knowledge about fuzzy and neuro-fuzzy systems
- To provide comprehensive knowledge of fuzzy logic control to real time systems.
- To provide adequate knowledge of genetic algorithms and its application to economic dispatch and unit commitment problems.

**UNIT I ARCHITECTURES – ANN****9**

Introduction – Biological neuron – Artificial neuron – Neuron model – Supervised and unsupervised learning- Single layer – Multi layer feed forward network – Learning algorithm- Back propagation network.

**UNIT II NEURAL NETWORKS FOR CONTROL****9**

Feedback networks – Discrete time Hopfield networks – Transient response of continuous time system – Applications of artificial neural network - Process identification – Neuro controller for inverted pendulum.

**UNIT III FUZZY SYSTEMS****9**

Classical sets – Fuzzy sets – Fuzzy relations – Fuzzification – Defuzzification – Fuzzy rules - Membership function – Knowledge base – Decision-making logic – Introduction to neuro fuzzy system- Adaptive fuzzy system.

**UNIT IV APPLICATION OF FUZZY LOGIC SYSTEMS****9**

Fuzzy logic control: Home heating system - liquid level control - aircraft landing- inverted pendulum – fuzzy PID control, Fuzzy based motor control.

**UNIT V GENETIC ALGORITHMS****9**

Introduction-Gradient Search – Non-gradient search – Genetic Algorithms: binary and real representation schemes, selection methods, crossover and mutation operators for binary and real coding - constraint handling methods – applications to economic dispatch and unit commitment problems.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.
- To understand and apply computing platform and software for engineering problems.

**TEXT BOOKS:**

1. Laurance Fausett, Englewood cliffs, N.J., 'Fundamentals of Neural Networks', Pearson Education, 1992.
2. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', Tata McGraw Hill, 1997.
3. S.N.Sivanandam and S.N.Deepa, Principles of Soft computing, Wiley India Edition, 2<sup>nd</sup> Edition, 2013.

**REFERENCES:**

1. Simon Haykin, 'Neural Networks', Pearson Education, 2003.
2. John Yen & Reza Langari, 'Fuzzy Logic – Intelligence Control & Information', Pearson Education, New Delhi, 2003.

3. M.Gen and R.Cheng, Genetic algorithms and Optimization, Wiley Series in Engineering Design and Automation, 2000.
4. Hagan, Demuth, Beale, "Neural Network Design", Cengage Learning, 2012.
5. N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford, 2013.
6. William S.Levine, "Control System Advanced Methods," The Control Handbook CRC Press, 2011.

**GE6081**

**FUNDAMENTALS OF NANOSCIENCE**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

To learn about basis of nanomaterial science, preparation method, types and application

**UNIT I INTRODUCTION**

**8**

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering- Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

**UNIT II GENERAL METHODS OF PREPARATION**

**9**

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

**UNIT III NANOMATERIALS**

**12**

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO<sub>2</sub>,MgO, ZrO<sub>2</sub>, NiO, nanoalumina, CaO, AgTiO<sub>2</sub>, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

**UNIT IV CHARACTERIZATION TECHNIQUES**

**9**

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

**UNIT V APPLICATIONS**

**7**

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

**TEXT BOOKS :**

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale Charecterisation of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

**REFERENCES:**

1. G Timp, "Nanotechnology", AIP press/Springer, 1999.
2. Akhlesh Lakhtakia, "The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

**IC6002****SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL****L T P C  
3 0 0 3****OBJECTIVES:**

- To introduce Non parametric methods
- To impart knowledge on parameter estimation methods
- To impart knowledge on Recursive identification methods
- To impart knowledge on Adaptive control schemes
- To introduce stability, Robustness and Applications of adaptive control method

**UNIT I NON PARAMETRIC METHODS****9**

Non parametric methods: Transient analysis–frequency analysis–Correlation analysis–Spectral analysis.

**UNIT II PARAMETER ESTIMATION METHODS****9**

Least square estimation – best linear unbiased estimation under linear constraints – updating the parameter estimates for linear regression models–prediction error methods: description of prediction methods – optimal prediction – relation between prediction error methods and other identification methods – theoretical analysis - Instrumental variable methods: Description of instrumental variable methods – Input signal design for identification.

**UNIT III RECURSIVE IDENTIFICATION METHODS****9**

The recursive least square method – the recursive instrumental variable methods- the recursive prediction error methods – Maximum likelihood. Identification of systems operating in closed loop: Identifiability considerations – direct identification – indirect identification.

**UNIT IV ADAPTIVE CONTROL SCHEMES****9**

Introduction – Types of adaptive control–Gain scheduling controller–Model reference adaptive control schemes–Self tuning controller–MRAC and STC: Approaches–The Gradient approach – Lyapunov functions – Passivity theory – pole placement method – Minimum variance control – Predictive control.

**UNIT V ISSUES INADAPTIVE CONTROL AND APPLICATIONS****9**

Stability – Convergence – Robustness –Applications of adaptive control.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Ability to apply advanced control theory to practical engineering problems.

## TEXT BOOKS:

1. Soder Storm T and Peter Stoica, System Identification, Prentice Hall International, 1989.
2. Astrom, K.J. and Wittenmark, B., "Adaptive Control", Pearson Education, 2<sup>nd</sup> Edition, 2001.
3. Sastry, S. and Bodson, M., "Adaptive Control– Stability, Convergence and Robustness", Prentice Hall inc., New Jersey, 1989.

## REFERENCES:

1. Ljung L, System Identification: Theory for the user, Prentice Hall, Engle wood Cliffs, 1987.
2. Bela.G.Liptak., "Process Control and Optimization"., Instrument Engineers' Handbook., volume 2, CRC press and ISA, 2005.
3. William S. Levine, "Control Systems Advanced Methods, the Control Handbook, CRC Press, 2011.

EE6007

MICRO ELECTRO MECHANICAL SYSTEMS

L T P C  
3 0 0 3

## OBJECTIVES:

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

## UNIT I INTRODUCTION

9

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

## UNIT II SENSORS AND ACTUATORS-I

9

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys.

## UNIT III SENSORS AND ACTUATORS-II

9

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

## UNIT IV MICROMACHINING

9

Silicon Anisotropic Etching – Anisotropic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

**UNIT V POLYMER AND OPTICAL MEMS****9**

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Ability to understand the operation of micro devices, micro systems and their applications.
- Ability to design the micro devices, micro systems using the MEMS fabrication process.

**TEXT BOOKS:**

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012.
2. Stephen D Senturia, 'Microsystem Design', Springer Publication, 2000.
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

**REFERENCES:**

1. Nadim Maluf, " An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2001.
3. Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002.
4. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
5. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer, 2010.

**EE6008****MICROCONTROLLER BASED SYSTEM DESIGN****L T P C****3 0 0 3****OBJECTIVES:**

- To introduce the architecture of PIC microcontroller
- To educate on use of interrupts and timers
- To educate on the peripheral devices for data communication and transfer
- To introduce the functional blocks of ARM processor
- To educate on the architecture of ARM processors

**UNIT I INTRODUCTION TO PIC MICROCONTROLLER****9**

Introduction to PIC Microcontroller–PIC 16C6x and PIC16C7x Architecture–PIC16cxx– Pipelining - Program Memory considerations – Register File Structure - Instruction Set - Addressing modes – Simple Operations.

**UNIT II INTERRUPTS AND TIMER****9**

PIC micro controller Interrupts- External Interrupts-Interrupt Programming–Loop time subroutine - Timers-Timer Programming– Front panel I/O-Soft Keys– State machines and key switches– Display of Constant and Variable strings.

**UNIT III PERIPHERALS AND INTERFACING****9**

I<sup>2</sup>C Bus for Peripherals Chip Access– Bus operation-Bus subroutines– Serial EEPROM—Analog to

Digital Converter–UART-Baud rate selection–Data handling circuit–Initialization - LCD and keyboard Interfacing -ADC, DAC, and Sensor Interfacing.

**UNIT IV INTRODUCTION TO ARM PROCESSOR 9**

ARM Architecture –ARM programmer’s model –ARM Development tools- Memory Hierarchy –ARM Assembly Language Programming–Simple Examples–Architectural Support for Operating systems.

**UNIT V ARM ORGANIZATION 9**

3-Stage Pipeline ARM Organization– 5-Stage Pipeline ARM Organization–ARM Instruction Execution- ARM Implementation– ARM Instruction Set– ARM coprocessor interface– Architectural support for High Level Languages – Embedded ARM Applications.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- To understand and apply computing platform and software for engineering problems.
- To understand ethical issues, environmental impact and acquire management skills.

**TEXT BOOKS:**

1. Peatman, J.B., “Design with PIC Micro Controllers” Pearson Education, 3<sup>rd</sup> Edition, 2004.
2. Furber, S., “ARM System on Chip Architecture” Addison Wesley trade Computer Publication, 2000.

**REFERENCE:**

1. Mazidi, M.A., “PIC Microcontroller” Rollin Mckinlay, Danny causey Printice Hall of India, 2007.

**EE6009 POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS LT P C  
3 0 0 3**

**OBJECTIVES:**

- To Provide knowledge about the stand alone and grid connected renewable energy systems.
- To equip with required skills to derive the criteria for the design of power converters for renewable energy applications.
- To analyse and comprehend the various operating modes of wind electrical generators and solar energy systems.
- To design different power converters namely AC to DC, DC to DC and AC to AC converters for renewable energy systems.
- To develop maximum power point tracking algorithms.

**UNIT I INTRODUCTION 9**

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

**UNIT II ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION 9**

Reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

**UNIT III POWER CONVERTERS 9**

Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing  
Wind: Three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

**UNIT IV ANALYSIS OF WIND AND PV SYSTEMS 9**

Stand alone operation of fixed and variable speed wind energy conversion systems and solar system- Grid connection Issues -Grid integrated PMSG, SCIG Based WECS, grid Integrated solar system

**UNIT V HYBRID RENEWABLE ENERGY SYSTEMS 9**

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking (MPPT).

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand and analyze power system operation, stability, control and protection.
- Ability to handle the engineering aspects of electrical energy generation and utilization.

**TEXT BOOK:**

1. S. N. Bhadra, D.Kastha, S.Banerjee, "Wind Electrical Systems", Oxford University Press, 2005.
2. B.H.Khan Non-conventional Energy sources Tata McGraw-hill Publishing Company, New Delhi,2009.

**REFERENCES:**

1. Rashid .M. H "power electronics Hand book", Academic press, 2001.
2. Ion Boldea, "Variable speed generators", Taylor & Francis group, 2006.
3. Rai. G.D, "Non conventional energy sources", Khanna publishes, 1993.
4. Gray, L. Johnson, "Wind energy system", prentice hall linc, 1995.
5. Andrzej M. Trzynadlowski, 'Introduction to Modern Power Electronics', Second edition, wiley India Pvt. Ltd, 2012.

**EE6010 HIGH VOLTAGE DIRECT CURRENT TRANSMISSION LT P C  
3 0 0 3**

**OBJECTIVES:**

- To understand the concept, planning of DC power transmission and comparison with AC Power transmission.
- To analyze HVDC converters.
- To study about the HVDC system control.
- To analyze harmonics and design of filters.
- To model and analysis the DC system under study state.

**UNIT I INTRODUCTION 9**

DC Power transmission technology – Comparison of AC and DC transmission – Application of DC transmission – Description of DC transmission system – Planning for HVDC transmission – Modern trends in HVDC technology – DC breakers – Operating problems – HVDC transmission based on VSC – Types and applications of MTDC systems.

<b>UNIT II</b>	<b>ANALYSIS OF HVDC CONVERTERS</b>	<b>9</b>
Line commutated converter - Analysis of Graetz circuit with and without overlap - Pulse number – Choice of converter configuration – Converter bridge characteristics – Analysis of a 12 pulse converters – Analysis of VSC topologies and firing schemes.		
<b>UNIT III</b>	<b>CONVERTER AND HVDC SYSTEM CONTROL</b>	<b>9</b>
Principles of DC link control – Converter control characteristics – System control hierarchy – Firing angle control – Current and extinction angle control – Starting and stopping of DC link – Power control – Higher level controllers – Control of VSC based HVDC link.		
<b>UNIT IV</b>	<b>REACTIVE POWER AND HARMONICS CONTROL</b>	<b>9</b>
Reactive power requirements in steady state – Sources of reactive power – SVC and STATCOM – Generation of harmonics – Design of AC and DC filters – Active filters.		
<b>UNIT V</b>	<b>POWER FLOW ANALYSIS IN AC/DC SYSTEMS</b>	<b>9</b>
Per unit system for DC quantities – DC system model – Inclusion of constraints – Power flow analysis – case study.		

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Ability to understand and analyze power system operation, stability, control and protection.

**TEXT BOOKS:**

1. Padiyar, K. R., “HVDC power transmission system”, New Age International (P) Ltd., New Delhi, Second Edition, 2010.
2. Edward Wilson Kimbark, “Direct Current Transmission”, Vol. I, Wiley interscience, New York, London, Sydney, 1971.
3. Rakosh Das Begamudre, “Extra High Voltage AC Transmission Engineering”, New Age International (P) Ltd., New Delhi, 1990.

**REFERENCES:**

1. Kundur P., “Power System Stability and Control”, McGraw-Hill, 1993.
2. Colin Adamson and Hingorani N G, “High Voltage Direct Current Power Transmission”, Garraway Limited, London, 1960.
3. Arrillaga, J., “High Voltage Direct Current Transmission”, Peter Pregrinus, London, 1983.
4. S. Kamakshaiah, V. Kamaraju, ‘HVDC Transmission’, Tata McGraw Hill Education Private Limited, 2011.

**EE6011**

**POWER SYSTEM DYNAMICS**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To introduce the basics of dynamics and stability problems
- To educate on modeling of synchronous machines
- To educate on the excitation system and speed-governing controllers.
- To study small signal stability of a single-machine infinite bus system with excitation system and power system stabilizer.
- To educate on the transient stability simulation of multi machine power system.

**UNIT I INTRODUCTION****9**

Basics of system dynamics – numerical techniques – introduction to software packages to study the responses. Concept and importance of power system stability in the operation and design - distinction between transient and dynamic stability - complexity of stability problem in large system – necessity for reduced models - stability of interconnected systems.

**UNIT II SYNCHRONOUS MACHINE MODELLING****9**

Synchronous machine - flux linkage equations - Park's transformation - per unit conversion - normalizing the equations - equivalent circuit - current space model - flux linkage state space model. Sub-transient and transient inductances - time constants. Simplified models (one axis and constant flux linkage) - steady state equations and phasor diagrams.

**UNIT III MACHINE CONTROLLERS****9**

Exciter and voltage regulators - function and types of excitation systems - typical excitation system configuration - block diagram and state space representation of IEEE type 1 excitation system - saturation function - stabilizing circuit. Function of speed governing systems - block diagram and state space representation of IEEE mechanical hydraulic governor and electrical hydraulic governors for hydro turbines and steam turbines.

**UNIT IV TRANSIENT STABILITY****9**

State equation for multi machine system with one axis model and simulation – modelling of multi machine power system with one axis machine model including excitation system and speed governing system and simulation using R-K method of fourth order (Gill's technique) for transient stability analysis - power system stabilizer. For all simulations, the algorithm and flow chart have to be discussed.

**UNIT V DYNAMIC STABILITY****9**

System response to small disturbances - linear model of the unregulated synchronous machine and its modes of oscillation - regulated synchronous machine - distribution of power impact - linearization of the load equation for the one machine problem – simplified linear model - effect of excitation on dynamic stability - approximate system representation - supplementary stabilizing signals - dynamic performance measure - small signal performance measures.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Ability to understand and analyze power system operation, stability, control and protection.

**TEXT BOOKS:**

1. P.M. Anderson and A.A.Fouad, 'Power System Control and Stability', Galgotia Publications, New Delhi, 2003.
2. P. Kundur, 'Power System Stability and Control', McGraw Hill Inc., USA, 1994.
3. R.Ramanujam, "Power System Dynamics – Analysis and Simulation", PHI, 2009.

**REFERENCES:**

1. M.A.Pai and W.Sauer, 'Power System Dynamics and Stability', Pearson Education Asia, India, 2002.
2. James A.Momoh, Mohamed. E. El-Hawary. " Electric Systems, Dynamics and Stability with Artificial Intelligence applications", Marcel Dekker, USA First Edition, 2000.
3. C.A.Gross, "Power System Analysis," Wiley India, 2011.
4. B.M.Weedy, B.J.Lory, N.Jenkins, J.B.Ekanayake and G.Strbac," Electric Power Systems", Wiley India, 2013.
5. K.Umarao, "Computer Techniques and Models in Power System," I.K. International, 2007.

**OBJECTIVES:**

- To introduce the functional elements of Robotics
- To impart knowledge on the direct and inverse kinematics
- To introduce the manipulator differential motion and control
- To educate on various path planning techniques
- To introduce the dynamics and control of manipulators

**UNIT I BASIC CONCEPTS****9**

Brief history-Types of Robot–Technology-Robot classifications and specifications-Design and control issues- Various manipulators – Sensors - work cell - Programming languages.

**UNIT II DIRECT AND INVERSE KINEMATICS****9**

Mathematical representation of Robots - Position and orientation - Homogeneous transformation-Variou joints- Representation using the Denavit Hattenberg parameters -Degrees of freedom-Direct kinematics-Inverse kinematics-PUMA560 & SCARA robots- Solvability - Solution methods-Closed form solution.

**UNIT III MANIPULATOR DIFFERENTIAL MOTION AND STATICS****9**

Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance.

**UNIT IV PATH PLANNING****9**

Definition-Joint space technique-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation planning.

**UNIT V DYNAMICS AND CONTROL****9**

Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model -Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Ability to understand and analyze Instrumentation systems and their applications to various industries.

**TEXT BOOKS:**

1. R.K.Mittal and I.J.Nagrath, Robotics and Control,Tata McGraw Hill,New Delhi,4<sup>th</sup> Reprint, 2005.
2. JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.
3. M.P.Groover, M.Weiss,R.N. Nageland N. G.Odrej, Industrial Robotics, McGraw-Hill Singapore, 1996.

**REFERENCES:**

1. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
2. K. K.Appu Kuttan, Robotics, I K International, 2007.
3. Edwin Wise, Applied Robotics, Cengage Learning, 2003.
4. R.D.Klafter,T.A.Chimielewski and M.Negin, Robotic Engineering–An Integrated Approach, Prentice Hall of India, New Delhi, 1994.

5. B.K.Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998.
6. S.Ghoshal, “ Embedded Systems & Robotics” – Projects using the 8051 Microcontroller”, Cengage Learning, 2009.

**GE6083**

**DISASTER MANAGEMENT**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

**UNIT I INTRODUCTION TO DISASTERS**

**9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

**UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)**

**9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj

Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

**UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT**

**9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

**UNIT IV DISASTER RISK MANAGEMENT IN INDIA**

**9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

**UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS**

**9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man

Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management.

**TEXTBOOKS:**

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10: 1259007367, ISBN-13: 978-1259007361**]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IAS and Sage Publishers, New Delhi, 2010.

**REFERENCES**

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

**GE6075**

**PROFESSIONAL ETHICS IN ENGINEERING**

**LT P C  
3 0 0 3**

**OBJECTIVES:**

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

**UNIT I HUMAN VALUES**

**10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

**UNIT II ENGINEERING ETHICS**

**9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

**UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION**

**9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

**UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS**

**9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk -

Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

## **UNIT V GLOBAL ISSUES**

**8**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility.

**TOTAL: 45 PERIODS**

### **OUTCOMES:**

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

### **TEXT BOOKS:**

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

### **REFERENCES:**

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd., New Delhi, 2013.
6. World Community Service Centre, ' Value Education', Vethathiri publications, Erode, 2011.

### **Web sources:**

1. [www.onlineethics.org](http://www.onlineethics.org)
2. [www.nspe.org](http://www.nspe.org)
3. [www.globalethics.org](http://www.globalethics.org)
4. [www.ethics.org](http://www.ethics.org)

**GE6757**

**TOTAL QUALITY MANAGEMENT**

**L T P C**

**3 0 0 3**

### **OBJECTIVES:**

- To facilitate the understanding of Quality Management principles and process.

## **UNIT I INTRODUCTION**

**9**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

## **UNIT II TQM PRINCIPLES**

**9**

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal

- Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

**UNIT III TQM TOOLS AND TECHNIQUES I 9**

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

**UNIT IV TQM TOOLS AND TECHNIQUES II 9**

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

**UNIT V QUALITY SYSTEMS 9**

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

**TEXT BOOK:**

1. Dale H. Besterfield, et al., "Total quality Management", Pearson Education Asia, Third Edition, Indian Reprint, 2006.

**REFERENCES:**

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8<sup>th</sup> Edition, First Indian Edition, Cengage Learning, 2012.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

**EC6002**

**ADVANCED DIGITAL SIGNAL PROCESSING**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To bring out the concepts related to stationary and non-stationary random signals
- To emphasize the importance of true estimation of power spectral density
- To introduce the design of linear and adaptive systems for filtering and linear prediction
- To introduce the concept of wavelet transforms in the context of image processing

**UNIT I DISCRETE-TIME RANDOM SIGNALS 9**

Discrete random process – Ensemble averages, Stationary and ergodic processes, Autocorrelation and Autocovariance properties and matrices, White noise, Power Spectral Density, Spectral Factorization, Innovations Representation and Process, Filtering random processes, ARMA, AR and MA processes.

<b>UNIT II</b>	<b>SPECTRUM ESTIMATION</b>	<b>9</b>
Bias and Consistency, Periodogram, Modified periodogram, Blackman-Tukey method, Welch method, Parametric methods of spectral estimation, Levinson-Durbin recursion.		
<b>UNIT III</b>	<b>LINEAR ESTIMATION AND PREDICTION</b>	<b>9</b>
Forward and Backward linear prediction, Filtering - FIR Wiener filter- Filtering and linear prediction, non-causal and causal IIR Wiener filters, Discrete Kalman filter.		
<b>UNIT IV</b>	<b>ADAPTIVE FILTERS</b>	<b>9</b>
Principles of adaptive filter – FIR adaptive filter – Newton’s Steepest descent algorithm – LMS algorithm – Adaptive noise cancellation, Adaptive equalizer, Adaptive echo cancellers.		
<b>UNIT V</b>	<b>WAVELET TRANSFORM</b>	<b>9</b>
Multiresolution analysis, Continuous and discrete wavelet transform, Short Time Fourier Transform, Application of wavelet transform, Cepstrum and Homomorphic filtering.		
		<b>TOTAL: 45 PERIODS</b>

**OUTCOMES:**

Upon completion of the course, students will be able to:

- Explain the parametric methods for power spectrum estimation.
- Discuss adaptive filtering techniques using LMS algorithm and the applications of adaptive filtering.
- Analyze the wavelet transforms.

**TEXT BOOKS:**

1. Monson H, Hayes, “Statistical Digital Signal Processing and Modeling”, John Wiley and Sons Inc., New York, Indian Reprint, 2007.
2. John G.Proakis, Dimitris G. Manolakis, “Digital Signal Processing”, Pearson, Fourth, 2007.
3. Dwight F. Mix, “Random Signal Processing”, Prentice Hall, 1995.

**REFERENCE:**

1. Sophocles J. Orfanidis, “Optimum Signal Processing, An Introduction”, McGraw Hill, 1990.

<b>EE6012</b>	<b>COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS</b>	<b>LT P C</b>
		<b>3 0 0 3</b>

**OBJECTIVES:**

- To introduce the importance of computer aided design method.
- To provide basic electromagnetic field equations and the problem formulation for CAD applications.
- To get familiarized with Finite Element Method as applicable for Electrical Engineering.
- To introduce the organization of a typical CAD package.
- To introduce Finite Element Method for the design of different Electrical apparatus.

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Conventional design procedures – Limitations – Need for field analysis based design – Review of Basic principles of energy conversion – Development of Torque/Force.		

**UNIT II MATHEMATICAL FORMULATION OF FIELD PROBLEMS 9**

Electromagnetic Field Equations – Magnetic Vector/Scalar potential – Electrical vector /Scalar potential – Stored energy in Electric and Magnetic fields – Capacitance - Inductance- Laplace and Poisson's Equations – Energy functional.

**UNIT III PHILOSOPHY OF FEM 9**

Mathematical models – Differential/Integral equations – Finite Difference method – Finite element method – Energy minimization – Variational method- 2D field problems – Discretisation – Shape functions – Stiffness matrix – Solution techniques.

**UNIT IV CAD PACKAGES 9**

Elements of a CAD System –Pre-processing – Modelling – Meshing – Material properties- Boundary Conditions – Setting up solution – Post processing.

**UNIT V DESIGN APPLICATIONS 9**

Voltage Stress in Insulators – Capacitance calculation - Design of Solenoid Actuator – Inductance and force calculation – Torque calculation in Switched Reluctance Motor.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to model and analyze electrical apparatus and their application to power system.

**TEXT BOOKS:**

1. S.J Salon, 'Finite Element Analysis of Electrical Machines', Springer, YesDEE publishers, Indian reprint, 2007.
2. Nicola Bianchi, 'Electrical Machine Analysis using Finite Elements', CRC Taylor & Francis, 2005.

**REFERENCES:**

1. Joao Pedro, A. Bastos and Nelson Sadowski, 'Electromagnetic Modeling by Finite Element Methods', Marcell Dekker Inc., 2003.
2. P.P.Silvester and Ferrari, 'Finite Elements for Electrical Engineers', Cambridge University Press, 1983.
3. D.A.Lowther and P.P Silvester, 'Computer Aided Design in Magnetics', Springer Verlag, New York, 1986.
4. S.R.H.Hoole, 'Computer Aided Analysis and Design of Electromagnetic Devices', Elsevier, New York, 1989.
5. User Manuals of MAGNET, MAXWELL & ANSYS Softwares.

**EC6601**

**VLSI DESIGN**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

- In this course, the MOS circuit realization of the various building blocks that is common to any microprocessor or digital VLSI circuit is studied.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed.
- The main focus in this course is on the transistor circuit level design and realization for digital operation and the issues involved as well as the topics covered are quite distinct from those encountered in courses on CMOS Analog IC design.

<b>UNIT I</b>	<b>MOS TRANSISTOR PRINCIPLE</b>	<b>9</b>
NMOS and PMOS transistors, Process parameters for MOS and CMOS, Electrical properties of CMOS circuits and device modeling, Scaling principles and fundamental limits, CMOS inverter scaling, propagation delays, Stick diagram, Layout diagrams		
<b>UNIT II</b>	<b>COMBINATIONAL LOGIC CIRCUITS</b>	<b>9</b>
Examples of Combinational Logic Design, Elmore's constant, Pass transistor Logic, Transmission gates, static and dynamic CMOS design, Power dissipation – Low power design principles		
<b>UNIT III</b>	<b>SEQUENTIAL LOGIC CIRCUITS</b>	<b>9</b>
Static and Dynamic Latches and Registers, Timing issues, pipelines, clock strategies, Memory architecture and memory control circuits, Low power memory circuits, Synchronous and Asynchronous design		
<b>UNIT IV</b>	<b>DESIGNING ARITHMETIC BUILDING BLOCKS</b>	<b>9</b>
Data path circuits, Architectures for ripple carry adders, carry look ahead adders, High speed adders, accumulators, Multipliers, dividers, Barrel shifters, speed and area tradeoff		
<b>UNIT V</b>	<b>IMPLEMENTATION STRATEGIES</b>	<b>9</b>
Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures.		
		<b>TOTAL: 45 PERIODS</b>

**OUTCOMES:**

Upon completion of the course, students should

- Explain the basic CMOS circuits and the CMOS process technology.
- Discuss the techniques of chip design using programmable devices.
- Model the digital system using Hardware Description Language.

**TEXTBOOKS:**

1. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, "Digital Integrated Circuits: A Design Perspective", Second Edition, Prentice Hall of India, 2003.
2. M.J. Smith, "Application Specific Integrated Circuits", Addison Wesley, 1997

**REFERENCES:**

1. N.Weste, K.Eshraghian, "Principles of CMOS VLSI Design", Second Edition, Addison Wesley 1993
2. R.Jacob Baker, Harry W.Li., David E.Boyee, "CMOS Circuit Design, Layout and Simulation", Prentice Hall of India 2005
3. A.Pucknell, Kamran Eshraghian, "BASIC VLSI Design", Third Edition, Prentice Hall of India, 2007.

**OBJECTIVES :**

- To sensitize the Engineering students to various aspects of Human Rights.

**UNIT I****9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

**UNIT II****9**

Evolution of the concept of Human Rights Magna carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

**UNIT III****9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

**UNIT IV****9**

Human Rights in India – Constitutional Provisions / Guarantees.

**UNIT V****9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

**TOTAL : 45 PERIODS****OUTCOME :**

- Engineering students will acquire the basic knowledge of human rights.

**REFERENCES:**

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

**OBJECTIVES**

- This course aims at providing the required skill to apply the statistical tools in engineering problems.

**UNIT I RANDOM VARIABLES****9 + 3**

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions.

**UNIT II TWO - DIMENSIONAL RANDOM VARIABLES****9 + 3**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

**UNIT III TESTING OF HYPOTHESIS****9 + 3**

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample test based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

**UNIT IV DESIGN OF EXPERIMENTS****9 + 3**

One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design -  $2^2$  factorial design.

**UNIT V STATISTICAL QUALITY CONTROL****9 + 3**

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES:**

- The students will have a fundamental knowledge of the concepts of probability. Have knowledge of standard distributions which can describe real life phenomenon. Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

**TEXT BOOKS:**

- Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", 4<sup>th</sup> Edition, Tata McGraw Hill, 2007.
- Johnson. R.A. and Gupta. C.B., "Miller and Freund's Probability and Statistics for Engineers", 7<sup>th</sup> Edition, Pearson Education, Asia, 2007.
- Papoulis. A and Unnikrishnapillai. S., "Probability, Random Variables and Stochastic Processes " 4<sup>th</sup> Edition, Mc Graw Hill Education India , New Delhi , 2010.

**REFERENCES:**

- Devore. J.L., "Probability and Statistics for Engineering and the Sciences", 8<sup>th</sup> Edition, Cengage Learning, New Delhi, 2012.
- Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 8<sup>th</sup> Edition, Pearson Education, Asia , 2007.
- Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3<sup>rd</sup> Edition, Elsevier, 2004.

4. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.

**EI6001**

**DATA STRUCTURES AND ALGORITHMS**

**LT P C**

**3 0 0 3**

**OBJECTIVES:**

- To provide a good understanding of the fundamental data structures used in computer science
- To provide a good understanding of how several fundamental algorithms work, particularly those concerned with sorting, searching and graph manipulation
- To educate on the space and time efficiency of most algorithms
- To educate on design of new algorithms or modify existing ones for new applications
- To introduce graph algorithms

**UNIT I INTRODUCTION AND BASIC DATA STRUCTURES**

**9**

Problem solving techniques and examples-Abstract Data Type (ADT)-The list ADT Arrays- Stacks and Queues: Implementation and Application, Circular Queues.

**UNIT II ADVANCED DATA STRUCTURES**

**9**

Trees: Preliminaries-Binary Tree- Tree traversals-Binary search Trees-AVL Trees.

**UNIT III SORTING AND HASHING**

**9**

Sorting by Selection- Sorting by Insertion- Sorting by Exchange- Sorting by Diminishing Increment- Heap Sort- Heaps Maintaining the Heap Property-Building a Heap- Heap sort Algorithm-Quick sort-Description-Performance of quick sort-Analysis of Quick Sort. Hashing - General idea-Hash functions-Separate Chaining-Open Addressing-Rehashing-Extendible Hashing.

**UNIT IV ALGORITHM DESIGN TECHNIQUES**

**9**

The role of algorithms in computing-Getting Started-Growth of functions. Divide and conquer-dynamic programming-Greedy Algorithm – Backtracking.

**UNIT V GRAPHS ALGORITHMS**

**9**

Elementary Graph Algorithms-Minimum Spanning Trees-Single-source shortest paths-All pairs shortest paths.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- To understand and apply computing platform and software for engineering problems.

**TEXT BOOKS:**

1. M A Weiss," Data Structures and Algorithm Analysis in C++",3<sup>rd</sup> Edition, Pearson Education,2007.
2. D.Samantha, "Classic Data Structures", 2<sup>nd</sup> Edition, PHI Learning, 2012.
3. Thomas H Cormen, Charles E Leiserson and Ronald L Rivest," Introduction to Algorithms", 2<sup>nd</sup> Edition, prentice Hall of India, 2002

**REFERENCES:**

1. R G Dromey,"How to solve it by computers", Pearson Education Asia, 2005.
2. Robert L Kruse, Clovis L Tando and Bruce P Leung,"Data structures and Program Design in C",2<sup>nd</sup> Edition, Prentice Hall of India,1990.

3. D.S. Kushwaha & A.K. Misra, "Data Structures -4 Programming approach with C", PHI Learning, 2012.
4. Varsha H. Patil, "Data Structures Using C++" Oxford University Press, 2012.
5. Jean Paul Trembley, Paul G Sorenson, "An Introduction to Data Structures with Applications", 2nd Edition, Tata McGraw Hill, 2007.

**ANNA UNIVERSITY, CHENNAI**  
**AFFILIATED INSTITUTIONS**  
**R - 2013**

**B.E. MECHANICAL ENGINEERING**  
**I – VIII SEMESTERS CURRICULUM AND SYLLABUS**

**SEMESTER I**

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	HS6151	<u>Technical English – I</u>	3	1	0	4
2.	MA6151	<u>Mathematics – I</u>	3	1	0	4
3.	PH6151	<u>Engineering Physics – I</u>	3	0	0	3
4.	CY6151	<u>Engineering Chemistry – I</u>	3	0	0	3
5.	GE6151	<u>Computer Programming</u>	3	0	0	3
6.	GE6152	<u>Engineering Graphics</u>	2	0	3	4
<b>PRACTICALS</b>						
7.	GE6161	<u>Computer Practices Laboratory</u>	0	0	3	2
8.	GE6162	<u>Engineering Practices Laboratory</u>	0	0	3	2
9.	GE6163	<u>Physics and Chemistry Laboratory - I</u>	0	0	2	1
<b>TOTAL</b>			<b>17</b>	<b>2</b>	<b>11</b>	<b>26</b>

**SEMESTER II**

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	HS6251	<u>Technical English – II</u>	3	1	0	4
2.	MA6251	<u>Mathematics – II</u>	3	1	0	4
3.	PH6251	<u>Engineering Physics – II</u>	3	0	0	3
4.	CY6251	<u>Engineering Chemistry – II</u>	3	0	0	3
5.	GE6252	<u>Basic Electrical and Electronics Engineering</u>	4	0	0	4
6.	GE6253	<u>Engineering Mechanics</u>	3	1	0	4
<b>PRACTICALS</b>						
7.	GE6261	<u>Computer Aided Drafting and Modeling Laboratory</u>	0	1	2	2
8.	GE6262	<u>Physics and Chemistry Laboratory - II</u>	0	0	2	1
<b>TOTAL</b>			<b>19</b>	<b>4</b>	<b>4</b>	<b>25</b>

### SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MA6351	Transforms and Partial Differential Equations	3	1	0	4
2.	CE6306	Strength of Materials	3	1	0	4
3.	ME6301	Engineering Thermodynamics	3	0	0	3
4.	CE6451	Fluid Mechanics and Machinery	3	0	0	3
5.	ME6302	Manufacturing Technology - I	3	0	0	3
6.	EE6351	Electrical Drives and Controls	3	0	0	3
<b>PRACTICAL</b>						
7.	ME6311	Manufacturing Technology Laboratory - I	0	0	3	2
8.	CE6461	Fluid Mechanics and Machinery Laboratory	0	0	3	2
9.	EE6365	Electrical Engineering Laboratory	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>2</b>	<b>9</b>	<b>26</b>

### SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MA6452	Statistics and Numerical Methods	3	1	0	4
2.	ME6401	Kinematics of Machinery	3	0	0	3
3.	ME6402	Manufacturing Technology– II	3	0	0	3
4.	ME6403	Engineering Materials and Metallurgy	3	0	0	3
5.	GE6351	Environmental Science and Engineering	3	0	0	3
6.	ME6404	Thermal Engineering	3	0	0	3
<b>PRACTICAL</b>						
7.	ME6411	Manufacturing Technology Laboratory–II	0	0	3	2
8.	ME6412	Thermal Engineering Laboratory - I	0	0	3	2
9.	CE6315	Strength of Materials Laboratory	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>1</b>	<b>9</b>	<b>25</b>

### SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	ME6501	Computer Aided Design	3	0	0	3
2.	ME6502	Heat and Mass Transfer	3	0	0	3
3.	ME6503	Design of Machine Elements	3	0	0	3
4.	ME6504	Metrology and Measurements	3	0	0	3
5.	ME6505	Dynamics of Machines	3	0	0	3
6.	GE6075	Professional Ethics in Engineering	3	0	0	3
<b>PRACTICAL</b>						
7.	ME6511	Dynamics Laboratory	0	0	3	2
8.	ME6512	Thermal Engineering Laboratory-II	0	0	3	2
9.	ME6513	Metrology and Measurements Laboratory	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>0</b>	<b>9</b>	<b>24</b>

### SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	ME6601	Design of Transmission Systems	3	0	0	3
2.	MG6851	Principles of Management	3	0	0	3
3.	ME6602	Automobile Engineering	3	0	0	3
4.	ME6603	Finite Element Analysis	3	0	0	3
5.	ME6604	Gas Dynamics and Jet Propulsion	3	0	0	3
6.		Elective - I	3	0	0	3
<b>PRACTICAL</b>						
7.	ME6611	C.A.D. / C.A.M. Laboratory	0	0	3	2
8.	ME6612	Design and Fabrication Project	0	0	4	2
9.	GE6674	Communication and Soft Skills- Laboratory Based	0	0	4	2
<b>TOTAL</b>			<b>18</b>	<b>0</b>	<b>11</b>	<b>24</b>

### SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	ME6701	Power Plant Engineering	3	0	0	3
2.	ME6702	Mechatronics	3	0	0	3
3.	ME6703	Computer Integrated Manufacturing Systems	3	0	0	3
4.	GE6757	Total Quality Management	3	0	0	3
5.		Elective – II	3	0	0	3
6.		Elective – III	3	0	0	3
<b>PRACTICAL</b>						
7.	ME6711	Simulation and Analysis Laboratory	0	0	3	2
8.	ME6712	Mechatronics Laboratory	0	0	3	2
9.	ME6713	Comprehension	0	0	2	1
<b>TOTAL</b>			<b>18</b>	<b>0</b>	<b>8</b>	<b>23</b>

### SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MG6863	<u>Engineering Economics</u>	3	0	0	3
2.		Elective – IV	3	0	0	3
3.		Elective – V	3	0	0	3
<b>PRACTICAL</b>						
4.	ME6811	<u>Project Work</u>	0	0	12	6
<b>TOTAL</b>			<b>9</b>	<b>0</b>	<b>12</b>	<b>15</b>

**TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 188**

### ELECTIVES FOR B.E. MECHANICAL ENGINEERING

#### SEMESTER VI

##### Elective I

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	MG6072	<u>Marketing Management</u>	3	0	0	3
2.	ME6001	Quality Control and Reliability Engineering	3	0	0	3
3.	ME6002	Refrigeration and Air conditioning	3	0	0	3
4.	ME6003	Renewable Sources of Energy	3	0	0	3
5.	ME6004	Unconventional Machining Processes	3	0	0	3

#### SEMESTER VII

##### Elective II

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	ME6005	Process Planning and Cost Estimation	3	0	0	3
2.	ME6006	Design of Jigs, Fixtures and Press Tools	3	0	0	3
3.	ME6007	Composite Materials and Mechanics	3	0	0	3
4.	ME6008	Welding Technology	3	0	0	3
5.	ME6009	Energy Conservation and Management	3	0	0	3
6.	GE6083	Disaster Management	3	0	0	3

##### Elective III

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	ME6010	Robotics	3	0	0	3
2.	GE6081	Fundamentals of Nanoscience	3	0	0	3
3.	ME6011	Thermal Turbo Machines	3	0	0	3
4.	ME6012	Maintenance Engineering	3	0	0	3
5.	EE6007	<u>Micro Electro Mechanical Systems</u>	3	0	0	3
6.	ME6021	<u>Hydraulics and Pneumatics</u>	3	0	0	3

**SEMESTER-VIII**  
**Elective IV**

<b>SL. NO.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1.	IE6605	Production Planning and Control	3	0	0	3
2.	MG6071	Entrepreneurship Development	3	0	0	3
3.	ME6013	Design of Pressure Vessels and Piping	3	0	0	3
4.	ME6014	Computational Fluid Dynamics	3	0	0	3
5.	ME6015	Operations Research	3	0	0	3
6.	GE6084	Human Rights	3	0	0	3

**Elective V**

<b>SL. NO.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1.	ME6016	Advanced I.C. Engines	3	0	0	3
2.	ME6017	Design of Heat Exchangers	3	0	0	3
3.	ME6018	Additive Manufacturing	3	0	0	3
4.	ME6019	Non Destructive Testing and Materials	3	0	0	3
5.	ME6020	Vibration and Noise Control	3	0	0	3

**OBJECTIVES:**

- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.

**UNIT I****9+3**

Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one's place, important festivals etc. – Introducing oneself, one's family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one's leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words - Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

**UNIT II****9+3**

Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking and answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Process descriptions (general/specific) - Definitions - Recommendations – Instructions; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association (connotation); E-materials - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

**UNIT III****9+3**

Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading - Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause and effect / compare and contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

**UNIT IV****9+3**

Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations and acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.

## UNIT V

9+3

Listening - Listening to different accents, Listening to Speeches/Presentations, Listening to broadcast and telecast from Radio and TV; Speaking - Giving impromptu talks, Making presentations on given topics; Reading - Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email; Writing - Creative writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items (fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar and Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents - Interpreting posters.

**TOTAL (L:45+T:15): 60 PERIODS**

### OUTCOMES:

Learners should be able to

- Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- Read different genres of texts adopting various reading strategies.
- Listen/view and comprehend different spoken discourses/excerpts in different accents

### TEXTBOOKS:

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

### REFERENCES:

1. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice. Oxford University Press, New Delhi. 2011.
2. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi. 2006.
3. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005
4. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi. 2001.
5. Viswamohan, Aysha. English for Technical Communication. Tata McGraw-Hill, New Delhi. 2008.

### EXTENSIVE Reading (Not for Examination)

1. Kalam, Abdul. Wings of Fire. Universities Press, Hyderabad. 1999.

### WEBSITES:

1. <http://www.usingenglish.com>
2. <http://www.uefap.com>

### TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like self introduction, peer introduction, group poster making, grammar and vocabulary games, etc.
- Discussions
- Role play activities
- Short presentations
- Listening and viewing activities with follow up activities like discussion, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc.

## EVALUATION PATTERN:

### Internal assessment: 20%

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Reviews
- Creative writing
- Poster making, etc.

All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual speaking activities, Pair work activities like role play, Interview, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded from simple to complex, from direct to inferential
- ✓ Writing assessment: Writing paragraphs, essays etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content.

### End Semester Examination: 80%

MA6151

MATHEMATICS – I

L T P C  
3 1 0 4

### OBJECTIVES:

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

### UNIT I MATRICES

9+3

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

### UNIT II SEQUENCES AND SERIES

9+3

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test, Integral test and D’Alembert’s ratio test – Alternating series – Leibnitz’s test – Series of positive and negative terms – Absolute and conditional convergence.

**UNIT III APPLICATIONS OF DIFFERENTIAL CALCULUS 9+3**  
Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals.

**UNIT IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES 9+3**  
Limits and Continuity – Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor’s series for functions of two variables – Maxima and minima of functions of two variables – Lagrange’s method of undetermined multipliers.

**UNIT V MULTIPLE INTEGRALS 9+3**  
Double integrals in cartesian and polar coordinates – Change of order of integration – Area enclosed by plane curves – Change of variables in double integrals – Area of a curved surface - Triple integrals – Volume of Solids.

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES:**

- This course equips students to have basic knowledge and understanding in one fields of materials, integral and differential calculus.

**TEXT BOOKS:**

1. Bali N. P and Manish Goyal, “A Text book of Engineering Mathematics”, Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
2. Grewal. B.S, “Higher Engineering Mathematics”, 41<sup>st</sup> Edition, Khanna Publications, Delhi, 2011.

**REFERENCES:**

1. Dass, H.K., and Er. Rajnish Verma, “Higher Engineering Mathematics”, S. Chand Private Ltd., 2011.
2. Glyn James, “Advanced Modern Engineering Mathematics”, 3<sup>rd</sup> Edition, Pearson Education, 2012.
3. Peter V. O’Neil, “Advanced Engineering Mathematics”, 7th Edition, Cengage learning, 2012.
4. Ramana B.V, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., “Engineering Mathematics”, Volume I, Second Edition, PEARSON Publishing, 2011.

**PH6151 ENGINEERING PHYSICS – I L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

**UNIT I CRYSTAL PHYSICS 9**  
Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment) - Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)



**OBJECTIVES:**

- To make the students conversant with basics of polymer chemistry.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- To acquaint the students with the basics of nano materials, their properties and applications.

**UNIT I POLYMER CHEMISTRY****9**

Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: T<sub>g</sub>, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Preparation, properties and uses of Nylon 6,6, and Epoxy resin.

**UNIT II CHEMICAL THERMODYNAMICS****9**

Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions (problems); Criteria of spontaneity; Gibbs-Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore(problems).

**UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY****9**

Photochemistry: Laws of photochemistry - Grotthuss-Draper law, Stark-Einstein law and Lambert-Beer Law. Quantum efficiency – determination- Photo processes - Internal Conversion, Inter-system crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitization. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram only).

**UNIT IV PHASE RULE AND ALLOYS****9**

Phase rule: Introduction, definition of terms with examples, One Component System- water system - Reduced phase rule - Two Component Systems- classification – lead-silver system, zinc-magnesium system. Alloys: Introduction- Definition- Properties of alloys- Significance of alloying, Functions and effect of alloying elements- Ferrous alloys- Nichrome and Stainless steel – heat treatment of steel; Non-ferrous alloys – brass and bronze.

**UNIT V NANOCHEMISTRY****9**

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: nano cluster, nano rod, nanotube(CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrode position, chemical vapour deposition, laser ablation; Properties and applications

**TOTAL :45 PERIODS****OUTCOMES:**

- The knowledge gained on polymer chemistry, thermodynamics. spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these subjects for further learning.

**TEXT BOOKS:**

1. Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010
2. Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009

**REFERENCES:**

1. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.
3. Gowariker V.R. , Viswanathan N.V. and JayadevSreedhar, "Polymer Science", New Age International P (Ltd.), Chennai, 2006.
4. Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.

**GE6151****COMPUTER PROGRAMMING****L T P C  
3 0 0 3****OBJECTIVES:****The students should be made to:**

- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

**UNIT I INTRODUCTION****8**

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

**UNIT II C PROGRAMMING BASICS****10**

Problem formulation – Problem Solving - Introduction to 'C' programming –fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

**UNIT III ARRAYS AND STRINGS****9**

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

**UNIT IV FUNCTIONS AND POINTERS****9**

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

## UNIT V STRUCTURES AND UNIONS

9

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

**TOTAL: 45 PERIODS**

### OUTCOMES:

**At the end of the course, the student should be able to:**

- Design C Programs for problems.
- Write and execute C programs for simple applications.

### TEXTBOOKS:

1. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009
3. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.

### REFERENCES:

1. Byron S Gottfried, "Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.
2. Dromey R.G., "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007.
3. Kernighan, B.W and Ritchie, D.M, "The C Programming language", Second Edition, Pearson Education, 2006.

**GE6152**

**ENGINEERING GRAPHICS**

**L T P C**  
**2 0 3 4**

### OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

### CONCEPTS AND CONVENTIONS (Not for Examination)

1

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

## UNIT I PLANE CURVES AND FREE HAND SKETCHING

5+9

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

## UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES

5+9

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

**UNIT III PROJECTION OF SOLIDS****5+9**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

**UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES****5+9**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

**UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS****6+9**

Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

**COMPUTER AIDED DRAFTING (Demonstration Only)****3**

Introduction to drafting packages and demonstration of their use.

**TOTAL: 75 PERIODS****OUTCOMES:**

On Completion of the course the student will be able to

- perform free hand sketching of basic geometrical constructions and multiple views of objects.
- do orthographic projection of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- prepare isometric and perspective sections of simple solids.
- demonstrate computer aided drafting.

**TEXT BOOK:**

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50<sup>th</sup> Edition, 2010.

**REFERENCES:**

1. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
2. Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2<sup>nd</sup> Edition, 2009.
4. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.
5. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

**Publication of Bureau of Indian Standards:**

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.

4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

**Special points applicable to University Examinations on Engineering Graphics:**

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

**GE6161**

**COMPUTER PRACTICES LABORATORY**

**L T P C**  
**0 0 3 2**

**OBJECTIVES:**

**The student should be made to:**

- Be familiar with the use of Office software.
- Be exposed to presentation and visualization tools.
- Be exposed to problem solving techniques and flow charts.
- Be familiar with programming in C.
- Learn to use Arrays, strings, functions, structures and unions.

**LIST OF EXPERIMENTS:**

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions – Includes Parameter Passing
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.
- Develop recursive programs.

**LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:**

Standalone desktops with C compiler      30 Nos.

(or)

Server with C compiler supporting 30 terminals or more.

**OBJECTIVES:**

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

**GROUP A (CIVIL & MECHANICAL)****I CIVIL ENGINEERING PRACTICE****9****Buildings:**

- Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

**Plumbing Works:**

- Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- Study of pipe connections requirements for pumps and turbines.
- Preparation of plumbing line sketches for water supply and sewage works.
- Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

- Demonstration of plumbing requirements of high-rise buildings.

**Carpentry using Power Tools only:**

- Study of the joints in roofs, doors, windows and furniture.
- Hands-on-exercise:

Wood work, joints by sawing, planing and cutting.

**II MECHANICAL ENGINEERING PRACTICE****13****Welding:**

- Preparation of arc welding of butt joints, lap joints and tee joints.
- Gas welding practice

**Basic Machining:**

- Simple Turning and Taper turning
- Drilling Practice

**Sheet Metal Work:**

- Forming & Bending:
- Model making – Trays, funnels, etc.
- Different type of joints.

**Machine assembly practice:**

- Study of centrifugal pump
- Study of air conditioner

**Demonstration on:**

- Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.

- (b) Foundry operations like mould preparation for gear and step cone pulley.
- (c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

### GROUP B (ELECTRICAL & ELECTRONICS)

- |            |  |           |
|------------|--|-----------|
| <b>III</b> | <b>ELECTRICAL ENGINEERING PRACTICE</b>   | <b>10</b> |
|            | 1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.  |           |
|            | 2. Fluorescent lamp wiring.  |           |
|            | 3. Stair case wiring   |           |
|            | 4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.   |           |
|            | 5. Measurement of energy using single phase energy meter.  |           |
|            | 6. Measurement of resistance to earth of an electrical equipment.  |           |
| <b>IV</b>  | <b>ELECTRONICS ENGINEERING PRACTICE</b>  | <b>13</b> |
|            | 1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR. |           |
|            | 2. Study of logic gates AND, OR, EOR and NOT.  |           |
|            | 3. Generation of Clock Signal.   |           |
|            | 4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.   |           |
|            | 5. Measurement of ripple factor of HWR and FWR.  |           |

**TOTAL: 45 PERIODS**

#### OUTCOMES:

- ability to fabricate carpentry components and pipe connections including plumbing works.
- ability to use welding equipments to join the structures.
- ability to fabricate electrical and electronics circuits.

#### REFERENCES:

1. Jeyachandran K., Natarajan S. & Balasubramanian S., “A Primer on Engineering Practices Laboratory”, Anuradha Publications, 2007.
2. Jeyapooan T., Saravanapandian M. & Pranitha S., “Engineering Practices Lab Manual”, Vikas PUBLISHING House Pvt.Ltd, 2006.
3. Bawa H.S., “Workshop Practice”, Tata McGraw – Hill Publishing Company Limited, 2007.
4. Rajendra Prasad A. & Sarma P.M.M.S., “Workshop Practice”, Sree Sai Publication, 2002.
5. Kannaiah P. & Narayana K.L., “Manual on Workshop Practice”, Scitech Publications, 1999.

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

#### CIVIL

- |   |          |
|---|----------|
| 1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. | 15 Sets. |
| 2. Carpentry vice (fitted to work bench)  | 15 Nos.  |
| 3. Standard woodworking tools   | 15 Sets. |
| 4. Models of industrial trusses, door joints, furniture joints  | 5 each   |
| 5. Power Tools: (a) Rotary Hammer   | 2 Nos    |
| (b) Demolition Hammer   | 2 Nos    |
| (c) Circular Saw  | 2 Nos    |
| (d) Planer  | 2 Nos    |
| (e) Hand Drilling Machine   | 2 Nos    |
| (f) Jigsaw  | 2 Nos    |

## MECHANICAL

- |   |           |
|---|-----------|
| 1. Arc welding transformer with cables and holders                            | 5 Nos.    |
| 2. Welding booth with exhaust facility  | 5 Nos.    |
| 3. Welding accessories like welding shield, chipping hammer, wire brush, etc. | 5 Sets.   |
| 4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.    | 2 Nos.    |
| 5. Centre lathe   | 2 Nos.    |
| 6. Hearth furnace, anvil and smithy tools                                     | 2 Sets.   |
| 7. Moulding table, foundry tools  | 2 Sets.   |
| 8. Power Tool: Angle Grinder  | 2 Nos     |
| 9. Study-purpose items: centrifugal pump, air-conditioner                     | One each. |

## ELECTRICAL

- |  |         |
|--|---------|
| 1. Assorted electrical components for house wiring                         | 15 Sets |
| 2. Electrical measuring instruments  | 10 Sets |
| 3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each |         |
| 4. Megger (250V/500V)  | 1 No.   |
| 5. Power Tools: (a) Range Finder   | 2 Nos   |
| (b) Digital Live-wire detector   | 2 Nos   |

## ELECTRONICS

- |   |         |
|---|---------|
| 1. Soldering guns   | 10 Nos. |
| 2. Assorted electronic components for making circuits                 | 50 Nos. |
| 3. Small PCBs   | 10 Nos. |
| 4. Multimeters  | 10 Nos. |
| 5. Study purpose items: Telephone, FM radio, low-voltage power supply |         |

**GE6163**

**PHYSICS AND CHEMISTRY LABORATORY – I**

**L T P C**  
**0 0 2 1**

**PHYSICS LABORATORY – I**

### OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

### LIST OF EXPERIMENTS

(Any FIVE Experiments)

1. (a) Determination of Wavelength, and particle size using Laser  
(b) Determination of acceptance angle in an optical fiber.
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
3. Determination of wavelength of mercury spectrum – spectrometer grating
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of Young's modulus by Non uniform bending method
6. Determination of specific resistance of a given coil of wire – Carey Foster's Bridge

**OUTCOMES:**

- The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Diode laser, lycopodium powder, glass plate, optical fiber.
2. Ultrasonic interferometer
3. Spectrometer, mercury lamp, grating
4. Lee's Disc experimental set up
5. Traveling microscope, meter scale, knife edge, weights
6. Carey foster's bridge set up  
(vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

**CHEMISTRY LABORATORY- I****OBJECTIVES:**

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by vacometry.

**LIST OF EXPERIMENTS**

(Any FIVE Experiments)

- 1 Determination of DO content of water sample by Winkler's method.
- 2 Determination of chloride content of water sample by argentometric method.
- 3 Determination of strength of given hydrochloric acid using pH meter.
- 4 Determination of strength of acids in a mixture using conductivity meter.
- 5 Estimation of iron content of the water sample using spectrophotometer.  
(1,10- phenanthroline / thiocyanate method).
- 6 Determination of molecular weight of polyvinylalcohol using Ostwald viscometer.
- 7 Conductometric titration of strong acid vs strong base.

**TOTAL: 30 PERIODS**

**OUTCOMES:**

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

**REFERENCES:**

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York 2001.
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry", LBS Singapore 1994.
3. Jeffery G.H., Bassett J., Mendham J. and Denny vogel's R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

- |                       |   |        |
|-----------------------|---|--------|
| 1. Iodine flask       | - | 30 Nos |
| 2. pH meter           | - | 5 Nos  |
| 3. Conductivity meter | - | 5 Nos  |
| 4. Spectrophotometer  | - | 5 Nos  |
| 5. Ostwald Viscometer | - | 10 Nos |

**Common Apparatus : Pipette, Burette, conical flask, porcelain tile, dropper (each 30 Nos.)**

**OBJECTIVES:**

- To make learners acquire listening and speaking skills in both formal and informal contexts.
- To help them develop their reading skills by familiarizing them with different types of reading strategies.
- To equip them with writing skills needed for academic as well as workplace contexts.
- To make them acquire language skills at their own pace by using e-materials and language lab components.

**UNIT I****9+3**

Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on topics like weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; Writing - Effective use of SMS for sending short notes and messages - Using 'emojicons' as symbols in email messages; Grammar - Regular and irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. 'can') - Homophones (e.g. 'some', 'sum'); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

**UNIT II****9+3**

Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercises on Grammar and vocabulary, Extensive reading activity (reading stories / novels), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students' dialogues.

**UNIT III****9+3**

Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret, etc.); Reading - Speed reading – reading passages with time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading articles from journals - Format for journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. 'rock', 'train', 'ring'); E-materials - Interactive exercise on Grammar and vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU and RIE materials – Attending a meeting and writing minutes.

**UNIT IV****9+3**

Listening - Listening to a telephone conversation, Viewing model interviews (face-to-face, telephonic and video conferencing); Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary - Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on

Grammar and Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

## **UNIT V**

**9+3**

Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading; Writing – Checklist - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; E-materials - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises; Language Lab - Different models of group discussion.

**TOTAL (L:45+T:15): 60 PERIODS**

### **OUTCOMES:**

Learners should be able to

- Speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies.
- Write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
- Read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
- Listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

### **TEXTBOOKS:**

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

### **REFERENCES:**

1. Anderson, Paul V. Technical Communication: A Reader-Centered Approach. Cengage. New Delhi. 2008
2. Muralikrishna, & Sunita Mishra. Communication Skills for Engineers. Pearson, New Delhi. 2011
3. Riordan, Daniel. G. Technical Communication. Cengage Learning, New Delhi. 2005
4. Sharma, Sangeetha & Binod Mishra. Communication Skills for Engineers and Scientists. PHI Learning, New Delhi. 2009
5. Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA. 2007

### **EXTENSIVE Reading (Not for Examination)**

1. Khera, Shiv. You can Win. Macmillan, Delhi. 1998.

### **Websites**

1. <http://www.englishclub.com>
2. <http://owl.english.purdue.edu>

**TEACHING METHODS:**

- Lectures
- Activities conducted individually, in pairs and in groups like individual writing and presentations, group discussions, interviews, reporting, etc
- Long presentations using visual aids
- Listening and viewing activities with follow up activities like discussions, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc
- Projects like group reports, mock interviews etc using a combination of two or more of the language skills

**EVALUATION PATTERN:****Internal assessment: 20%**

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Report
- Creative writing, etc.

All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual presentations, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded following Bloom's taxonomy
- ✓ Writing assessment: Writing essays, CVs, reports etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content graded following Bloom's taxonomy.

**End Semester Examination: 80%****MA6251****MATHEMATICS – II****L T P C**  
**3 1 0 4****OBJECTIVES:**

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

**UNIT I VECTOR CALCULUS****9+3**

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

**UNIT II ORDINARY DIFFERENTIAL EQUATIONS****9+3**

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

**UNIT III LAPLACE TRANSFORM****9+3**

Laplace transform – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Transforms of unit step function and impulse functions – Transform of periodic functions. Inverse Laplace transform -Statement of Convolution theorem – Initial and final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

**UNIT IV ANALYTIC FUNCTIONS****9+3**

Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping:  $w = z+k$ ,  $kz$ ,  $1/z$ ,  $z^2$ ,  $e^z$  and bilinear transformation.

**UNIT V COMPLEX INTEGRATION****9+3**

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor's and Laurent's series expansions – Singular points – Residues – Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES:**

- The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.

**TEXT BOOKS:**

1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd.,2011.
2. Grewal. B.S, "Higher Engineering Mathematics", 41<sup>st</sup> Edition, Khanna Publications, Delhi, 2011.

**REFERENCES:**

1. Dass, H.K., and Er. Rajnish Verma," Higher Engineering Mathematics", S. Chand Private Ltd., 2011
2. Glyn James, "Advanced Modern Engineering Mathematics", 3<sup>rd</sup> Edition, Pearson Education, 2012.
3. Peter V. O'Neil," Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.
4. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., "Engineering Mathematics" Volume II, Second Edition, PEARSON Publishing, 2011.

**OBJECTIVES:**

- To enrich the understanding of various types of materials and their applications in engineering and technology.

**UNIT I CONDUCTING MATERIALS****9**

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

**UNIT II SEMICONDUCTING MATERIALS****9**

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

**UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS****9**

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications

Superconductivity: properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High  $T_c$  superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

**UNIT IV DIELECTRIC MATERIALS****9**

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

**UNIT V ADVANCED ENGINEERING MATERIALS****9**

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications

**TOTAL: 45 PERIODS****OUTCOMES:**

- The students will have the knowledge on physics of materials and that knowledge will be used by them in different engineering and technology applications.

**TEXT BOOKS:**

- Arumugam M., Materials Science. Anuradha publishers, 2010
- Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009

**REFERENCES:**

- Palanisamy P.K. Materials Science. SCITECH Publishers, 2011
- Senthilkumar G. Engineering Physics II. VRB Publishers, 2011
- Mani P. Engineering Physics II. Dhanam Publications, 2011
- Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009

**OBJECTIVES:**

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- Principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.

**UNIT I WATER TECHNOLOGY****9**

Introduction to boiler feed water-requirements-formation of deposits in steam boilers and heat exchangers- disadvantages (wastage of fuels, decrease in efficiency, boiler explosion) prevention of scale formation -softening of hard water -external treatment zeolite and demineralization - internal treatment- boiler compounds (phosphate, calgon, carbonate, colloidal) - caustic embrittlement -boiler corrosion-priming and foaming- desalination of brackish water –reverse osmosis.

**UNIT II ELECTROCHEMISTRY AND CORROSION****9**

Electrochemical cell - redox reaction, electrode potential- origin of electrode potential- oxidation potential- reduction potential, measurement and applications - electrochemical series and its significance - Nernst equation (derivation and problems). Corrosion- causes- factors- types- chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Paints- constituents and function. Electroplating of Copper and electroless plating of nickel.

**UNIT III ENERGY SOURCES****9**

Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion- differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells:Types of batteries- alkaline battery- lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H<sub>2</sub> -O<sub>2</sub> fuel cell- applications.

**UNIT IV ENGINEERING MATERIALS****9**

Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties – refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Portland cement- manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement–properties and uses. Glass - manufacture, types, properties and uses.

**UNIT V FUELS AND COMBUSTION****9**

Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- coal-analysis of coal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) - petroleum- manufacture of synthetic petrol (Bergius process)- knocking-octane number - diesel oil- cetane number - natural gas- compressed natural gas(CNG)- liquefied petroleum gases(LPG)- producer gas- water gas. Power alcohol and bio diesel. Combustion of fuels: introduction- theoretical calculation of calorific value- calculation of stoichiometry of fuel and air ratio- ignition temperature- explosive range - flue gas analysis (ORSAT Method).

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

**TEXT BOOKS:**

1. Vairam S, Kalyani P and SubaRamesh., "Engineering Chemistry"., Wiley India PvtLtd., New Delhi., 2011
2. DaraS.S, UmareS.S. "Engineering Chemistry", S. Chand & Company Ltd., New Delhi , 2010

**REFERENCES:**

- 1 Kannan P. and Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009
2. AshimaSrivastava and Janhavi N N., "Concepts of Engineering Chemistry", ACME Learning Private Limited., New Delhi., 2010.
3. RenuBapna and Renu Gupta., "Engineering Chemistry", Macmillan India Publisher Ltd., 2010.
4. Pahari A and Chauhan B., "Engineering Chemistry"., Firewall Media., New Delhi., 2010

**GE6252****BASIC ELECTRICAL AND ELECTRONICS ENGINEERING****L T P C  
4 0 0 4****OBJECTIVES:**

- To explain the basic theorems used in Electrical circuits and the different components and function of electrical machines.
- To explain the fundamentals of semiconductor and applications.
- To explain the principles of digital electronics
- To impart knowledge of communication.

**UNIT I ELECTRICAL CIRCUITS & MEASUREMENTS****12**

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits.

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

**UNIT II ELECTRICAL MECHANICS****12**

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

**UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS****12**

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation.

Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

**UNIT IV DIGITAL ELECTRONICS****12**

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

**UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING****12**

Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations.

Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

**TOTAL: 60 PERIODS****OUTCOMES:**

- ability to identify the electrical components explain the characteristics of electrical machines.
- ability to identify electronics components and use of them to design circuits.

**TEXT BOOKS:**

1. Mittle N., "Basic Electrical Engineering", Tata McGraw Hill Edition, New Delhi, 1990.
2. Sedha R.S., "Applied Electronics", S. Chand & Co., 2006.

**REFERENCES:**

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering", Tata McGraw Hill, Second Edition, 2006.
2. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press 2005.
3. Mehta V K, "Principles of Electronics", S.Chand & Company Ltd, 1994.
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.
5. Premkumar N, "Basic Electrical Engineering", Anuradha Publishers, 2003.

**GE6253****ENGINEERING MECHANICS****L T P C****3 1 0 4****OBJECTIVES:**

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

**UNIT I BASICS AND STATICS OF PARTICLES****12**

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces — Vectorial representation of forces – Vector operations of forces -additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

**UNIT II EQUILIBRIUM OF RIGID BODIES****12**

Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

**UNIT III PROPERTIES OF SURFACES AND SOLIDS****12**

Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula –

Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem –Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

#### **UNIT IV DYNAMICS OF PARTICLES**

**12**

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton's laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

#### **UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS**

**12**

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

**TOTAL : 60 PERIODS**

#### **OUTCOMES:**

- ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
- ability to analyse the forces in any structures.
- ability to solve rigid body subjected to dynamic forces.

#### **TEXT BOOKS:**

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8<sup>th</sup> Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

#### **REFERENCES:**

1. Hibbeler, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11<sup>th</sup> Edition, Pearson Education 2010.
2. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4<sup>th</sup> Edition, Pearson Education 2006.
3. Meriam J.L. and Kraige L.G., "Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", Third Edition, John Wiley & Sons,1993.
4. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3<sup>rd</sup> Edition, Vikas Publishing House Pvt. Ltd., 2005.
5. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 1998.
6. Kumar, K.L., "Engineering Mechanics", 3<sup>rd</sup> Revised Edition, Tata McGraw-Hill Publishing company, New Delhi 2008.

#### **GE6261 COMPUTER AIDED DRAFTING AND MODELING LABORATORY**

**L T P C**  
**0 1 2 2**

#### **OBJECTIVES:**

- To develop skill to use software to create 2D and 3D models.

#### **LIST OF EXERCISES USING SOFTWARE CAPABLE OF DRAFTING AND MODELING**

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.

3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building ( Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- ability to use the software packers for drafting and modeling
- ability to create 2D and 3D models of Engineering Components

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

Sl.No	Description of Equipment	Quantity
1.	Pentium IV computer or better hardware, with suitable graphics facility	30 No.
2.	Licensed software for Drafting and Modeling.	30 Licenses
3.	Laser Printer or Plotter to print / plot drawings	2 No.

**GE6262**

**PHYSICS AND CHEMISTRY LABORATORY – II**

**L T P C**  
**0 0 2 1**

**PHYSICS LABORATORY – II**

**OBJECTIVES:**

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

**LIST OF EXPERIMENTS**

**(Any FIVE Experiments)**

1. Determination of Young's modulus by uniform bending method
2. Determination of band gap of a semiconductor
3. Determination of Coefficient of viscosity of a liquid –Poiseuille's method
4. Determination of Dispersive power of a prism - Spectrometer
5. Determination of thickness of a thin wire – Air wedge method
6. Determination of Rigidity modulus – Torsion pendulum

**OUTCOMES:**

- The students will have the ability to test materials by using their knowledge of applied physics principles in optics and properties of matter.

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Traveling microscope, meter scale, Knife edge, weights
  2. Band gap experimental set up
  3. Burette, Capillary tube, rubber tube, stop clock, beaker and weighing balance
  4. spectrometer, prism, sodium vapour lamp.
  5. Air-wedge experimental set up.
  6. Torsion pendulum set up.
- (vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

## CHEMISTRY LABORATORY - II

### OBJECTIVES:

- To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

### LIST OF EXPERIMENTS

#### (Any FIVE Experiments)

- 1 Determination of alkalinity in water sample
- 2 Determination of total, temporary & permanent hardness of water by EDTA method
- 3 Estimation of copper content of the given solution by EDTA method
- 4 Estimation of iron content of the given solution using potentiometer
- 5 Estimation of sodium present in water using flame photometer
- 6 Corrosion experiment – weight loss method
- 7 Conductometric precipitation titration using  $\text{BaCl}_2$  and  $\text{Na}_2\text{SO}_4$
- 8 Determination of CaO in Cement.

**TOTAL: 30 PERIODS**

### OUTCOMES:

- The students will be conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis.

### REFERENCES:

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York, 2001.
  2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry, LBS Singapore ,1994.
  3. Jeffery G.H, Bassett J., Mendham J. and Denny R.C., "Vogel's Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
  4. Kolthoff I.M. and Sandell E.B. et al. Quantitative chemical analysis, McMillan, Madras 1980
- **Laboratory classes on alternate weeks for Physics and Chemistry.**

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

- |                       |   |       |
|-----------------------|---|-------|
| 1. Potentiometer      | - | 5 Nos |
| 2. Flame photo meter  | - | 5 Nos |
| 3. Weighing Balance   | - | 5 Nos |
| 4. Conductivity meter | - | 5 Nos |

**Common Apparatus : Pipette, Burette, conical flask, porcelain tile, dropper (30 Nos each)**

**OBJECTIVES**

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

**UNIT I PARTIAL DIFFERENTIAL EQUATIONS****9 + 3**

Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order partial differential equations - Lagrange's linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

**UNIT II FOURIER SERIES****9 + 3**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

**UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS****9 + 3**

Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

**UNIT IV FOURIER TRANSFORMS****9 + 3**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

**UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS****9 + 3**

Z- transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES**

- The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

**TEXT BOOKS**

1. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., Second reprint, New Delhi, 2012.
2. Grewal. B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.
3. Narayanan.S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.

**REFERENCES**

1. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7<sup>th</sup> Edition, Laxmi Publications Pvt Ltd, 2007.

2. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-Graw Hill Publishing Company Limited, New Delhi, 2008.
3. Glyn James, "Advanced Modern Engineering Mathematics", 3<sup>rd</sup> Edition, Pearson Education, 2007.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8<sup>th</sup> Edition, Wiley India, 2007.
5. Ray Wylie. C and Barrett.L.C, "Advanced Engineering Mathematics", Sixth Edition, Tata McGraw Hill Education Pvt Ltd, New Delhi, 2012.
6. Datta.K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.

**CE6306**

**STRENGTH OF MATERIALS**

**L T P C**  
**3 1 0 4**

**OBJECTIVES:**

To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.

**UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9**

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains –Stresses on inclined planes – principal stresses and principal planes – Mohr’s circle of stress.

**UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9**

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending– bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

**UNIT III TORSION 9**

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

**UNIT IV DEFLECTION OF BEAMS 9**

Double Integration method – Macaulay’s method – Area moment method for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell’s reciprocal theorems.

**UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS 9**

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure –Deformation in spherical shells – Lamé’s theorem.

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behavior of simple structures.
- Critically analyse problem and solve the problems related to mechanical elements and analyse the deformation behavior for different types of loads.

**TEXT BOOKS:**

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2007
2. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2007

**REFERENCES:**

1. Egor. P.Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2001
2. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2007.
3. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2007
4. Ferdinand P. Beer, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing 'co. Ltd., New Delhi, 2005.

**ME6301****ENGINEERING THERMODYNAMICS****L T P C  
3 0 0 3****OBJECTIVES:**

- To familiarize the students to understand the fundamentals of thermodynamics and to perform thermal analysis on their behavior and performance.

(Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychrometric Chart permitted)

**UNIT I BASIC CONCEPTS AND FIRST LAW****9**

Basic concepts - concept of continuum, comparison of microscopic and macroscopic approach. Path and point functions. Intensive and extensive, total and specific quantities. System and their types. Thermodynamic Equilibrium State, path and process. Quasi-static, reversible and irreversible processes. Heat and work transfer, definition and comparison, sign convention. Displacement work and other modes of work .P-V diagram. Zeroth law of thermodynamics – concept of temperature and thermal equilibrium– relationship between temperature scales –new temperature scales. First law of thermodynamics –application to closed and open systems – steady and unsteady flow processes.

**UNIT II SECOND LAW AND AVAILABILITY ANALYSIS****9**

Heat Reservoir, source and sink. Heat Engine, Refrigerator, Heat pump. Statements of second law and its corollaries. Carnot cycle Reversed Carnot cycle, Performance. Clausius inequality. Concept of entropy, T-s diagram, Tds Equations, entropy change for - pure substance, ideal gases - different processes, principle of increase in entropy. Applications of II Law. High and low grade energy. Available and non-available energy of a source and finite body. Energy and irreversibility. Expressions for the energy of a closed system and open systems. Energy balance and entropy generation. Irreversibility. I and II law Efficiency.

**UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE****9**

Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface. Use of Steam Table and Mollier Chart. Determination of dryness fraction. Application of I and II law for pure substances. Ideal and actual Rankine cycles, Cycle Improvement Methods - Reheat and Regenerative cycles, Economiser, preheater, Binary and Combined cycles.

**UNIT IV IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS****9**

Properties of Ideal gas- Ideal and real gas comparison- Equations of state for ideal and real gases- Reduced properties-.Compressibility factor-.Principle of Corresponding states. -Generalised Compressibility Chart and its use-. Maxwell relations, Tds Equations, Difference and ratio of heat



**UNIT II FLOW THROUGH CIRCULAR CONDUITS 8**

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

**UNIT III DIMENSIONAL ANALYSIS 9**

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

**UNIT IV PUMPS 10**

Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps –classification.

**UNIT V TURBINES 10**

Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students can able to apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Can critically analyse the performance of pumps and turbines.

**TEXT BOOK:**

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2004.

**REFERENCES:**

1. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2004
3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", 2011.
4. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011

**ME6302**

**MANUFACTURING TECHNOLOGY – I**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To introduce the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and manufacture of plastic components.

**UNIT I METAL CASTING PROCESSES 9**

**Sand Casting** : Sand Mould – Type of patterns - Pattern Materials – Pattern allowances –Moulding sand Properties and testing – Cores –Types and applications – Moulding machines– Types and applications; **Melting furnaces** : Blast and Cupola Furnaces; **Principle of special casting processes** : Shell - investment – Ceramic mould – Pressure die casting - Centrifugal Casting - CO<sub>2</sub> process – Stir casting; **Defects in Sand casting**

## **UNIT II JOINING PROCESSES**

**9**

**Operating principle, basic equipment, merits and applications of :** Fusion welding processes : Gas welding - Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding - Gas metal arc welding – Submerged arc welding – Electro slag welding; **Operating principle and applications of :** Resistance welding - Plasma arc welding – Thermit welding – Electron beam welding – Friction welding and Friction Stir Welding; Brazing and soldering; **Weld defects:** types, causes and cure.

## **UNIT III METAL FORMING PROCESSES**

**9**

Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – forging operations. Rolling of metals– Types of Rolling – Flat strip rolling – shape rolling operations – Defects in rolled parts. Principle of rod and wire drawing – Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion.

## **UNIT IV SHEET METAL PROCESSES**

**9**

Sheet metal characteristics – shearing, bending and drawing operations – Stretch forming operations – Formability of sheet metal – Test methods –special forming processes-Working principle and applications – Hydro forming – Rubber pad forming – Metal spinning– Introduction of Explosive forming, magnetic pulse forming, peen forming, Super plastic forming – Micro forming

## **UNIT V MANUFACTURE OF PLASTIC COMPONENTS**

**9**

Types and characteristics of plastics – Moulding of thermoplastics – working principles and typical applications – injection moulding – Plunger and screw machines – Compression moulding, Transfer Moulding – Typical industrial applications – introduction to blow moulding –Rotational moulding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics.

**TOTAL: 45 PERIODS**

### **OUTCOMES:**

- Upon completion of this course, the students can able to apply the different manufacturing process and use this in industry for component production

### **TEXT BOOKS:**

1. Hajra Chouldhary S.K and Hajra Choudhury. AK., "Elements of workshop Technology", volume I and II, Media promoters and Publishers Private Limited, Mumbai, 1997
2. Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India Edition, 2006

### **REFERENCES:**

1. Gowri P. Hariharan, A.Suresh Babu, "Manufacturing Technology I", Pearson Education, 2008
2. Roy. A. Lindberg, "Processes and Materials of Manufacture", PHI / Pearson education, 2006
3. Paul Degarma E, Black J.T and Ronald A. Kosher, "Materials and Processes, in Manufacturing" Eight Edition, Prentice – Hall of India, 1997.
4. Sharma, P.C., "A Text book of production Technology", S.Chand and Co. Ltd., 2004.
5. Rao, P.N. "Manufacturing Technology Foundry, Forming and Welding", 2<sup>nd</sup>Edition, TMH-2003; 2003

**OBJECTIVES:**

- To understand the basic concepts of different types of electrical machines and their performance.
- To study the different methods of starting D.C motors and induction motors.
- To study the conventional and solid-state drives

**UNIT I INTRODUCTION****8**

Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors

**UNIT II DRIVE MOTOR CHARACTERISTICS****9**

Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors: Shunt, series and compound - single phase and three phase induction motors.

**UNIT III STARTING METHODS****8**

Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors.

**UNIT IV CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES****10**

Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system - Using controlled rectifiers and DC choppers –applications.

**UNIT V CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C. DRIVES****10**

Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon Completion of this subject, the students can able to explain different types of electrical machines and their performance

**TEXT BOOKS:**

1. Vedam Subrahmaniam, "Electric Drives (Concepts and Applications)", Tata McGraw-Hill, 2001
2. Nagrath .I.J. & Kothari .D.P, "Electrical Machines", Tata McGraw-Hill, 1998

**REFERENCES:**

1. Pillai.S.K "A First Course on Electric Drives", Wiley Eastern Limited, 1998
2. Singh. M.D., K.B.Khanchandani, "Power Electronics", Tata McGraw-Hill, 1998
3. Partab. H., "Art and Science and Utilisation of Electrical Energy", Dhanpat Rai and Sons, 1994

**ME6311****MANUFACTURING TECHNOLOGY LABORATORY – I****L T P C  
0 0 3 2****OBJECTIVES:**

- To Study and practice the various operations that can be performed in lathe, shaper, drilling, milling machines etc. and to equip with the practical knowledge required in the core industries.

**LIST OF EXPERIMENTS**

Machining and Machining time estimations for :

- Taper Turning
- External Thread cutting
- Internal Thread Cutting
- Eccentric Turning
- Knurling
- Square Head Shaping
- Hexagonal Head Shaping

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students can able to demonstrate and fabricate different types of components using the machine tools

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S. NO.	NAME OF THE EQUIPMENT	Qty.
1	Centre Lathes	7 Nos.
2	Horizontal Milling Machine	1 No
3	Vertical Milling Machine	1 No
4	Shaper	1 Nos.

**CE6461****FLUID MECHANICS AND MACHINERY LABORATORY****L T P C  
0 0 3 2****OBJECTIVES:**

- Upon Completion of this subject, the students can able to have hands on experience in flow measurements using different devices and also perform calculation related to losses in pipes and also perform characteristic study of pumps, turbines etc.,

**LIST OF EXPERIMENTS**

- Determination of the Coefficient of discharge of given Orifice meter.
- Determination of the Coefficient of discharge of given Venturi meter.
- Calculation of the rate of flow using Rota meter.
- Determination of friction factor for a given set of pipes.
- Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
- Conducting experiments and drawing the characteristic curves of reciprocating pump.
- Conducting experiments and drawing the characteristic curves of Gear pump.
- Conducting experiments and drawing the characteristic curves of Pelton wheel.
- Conducting experiments and drawing the characteristics curves of Francis turbine.
- Conducting experiments and drawing the characteristic curves of Kaplan turbine.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Ability to use the measurement equipments for flow measurement
- Ability to do performance trust on different fluid machinery

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S. NO.	NAME OF THE EQUIPMENT	Qty.
1	Orifice meter setup	1
2	Venturi meter setup	1
3	Rotameter setup	1
4	Pipe Flow analysis setup	1
5	Centrifugal pump/submersible pump setup	1
6	Reciprocating pump setup	1
7	Gear pump setup	1
8	Pelton wheel setup	1
9	Francis turbine setup	1
10	Kaplan turbine setup	1

**EE6365****ELECTRICAL ENGINEERING LABORATORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

**OBJECTIVES:**

- To validate the principles studied in theory by performing experiments in the laboratory

**LIST OF EXPERIMENTS**

1. Load test on DC Shunt & DC Series motor
2. O.C.C & Load characteristics of DC Shunt and DC Series generator
3. Speed control of DC shunt motor (Armature, Field control)
4. Load test on single phase transformer
5. O.C & S.C Test on a single phase transformer
6. Regulation of an alternator by EMF & MMF methods.
7. V curves and inverted V curves of synchronous Motor
8. Load test on three phase squirrel cage Induction motor
9. Speed control of three phase slip ring Induction Motor
10. Load test on single phase Induction Motor.
11. Study of DC & AC Starters

**TOTAL: 45 PERIODS****OUTCOMES**

- Ability to perform speed characteristic of different electrical machine

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S.No.	NAME OF THE EQUIPMENT	Qty.
1	DC Shunt motor	2
2	DC Series motor	1
3	DC shunt motor-DC Shunt Generator set	1
4	DC Shunt motor-DC Series Generator set	1

5	Single phase transformer	2
6	Three phase alternator	2
7	Three phase synchronous motor	1
8	Three phase Squirrel cage Induction motor	1
9	Three phase Slip ring Induction motor	1
10	Single phase Induction motor	1

**MA6452**

**STATISTICS AND NUMERICAL METHODS**

**L T P C**  
**3 1 0 4**

**OBJECTIVES:**

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.

**UNIT I TESTING OF HYPOTHESIS**

**9+3**

Large sample test based on Normal distribution for single mean and difference of means - Tests based on  $t$ ,  $t^2$  and  $F$  distributions for testing means and variances – Contingency table (Test for Independency) – Goodness of fit.

**UNIT II DESIGN OF EXPERIMENTS**

**9+3**

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design -  $2^2$  factorial design.

**UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS**

**9+3**

Newton Raphson method – Gauss elimination method – pivoting – Gauss Jordan methods – Iterative methods of Gauss Jacobi and Gauss Seidel – Matrix inversion by Gauss Jordan method – Eigen values of a matrix by power method.

**UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION**

**9+3**

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

**UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**

**9+3**

Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations – Milne's predictor corrector methods for solving first order equations – Finite difference methods for solving second order equations.

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES**

- It helps the students to have a clear perception of the power of statistical and numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

**TEXT BOOKS**

1. Johnson. R.A., and Gupta. C.B., "Miller and Freund's Probability and Statistics for Engineers", 11<sup>th</sup> Edition, Pearson Education, , Asia, 2011.
2. Grewal. B.S., and Grewal. J.S., "Numerical Methods in Engineering and Science", 9<sup>th</sup> Edition, Khanna Publishers, New Delhi, 2007.

## REFERENCES

1. Walpole. R.E., Myers. R.H., Myers. S.L., and Ye. K., "Probability and Statistics for Engineers and Scientists", 8<sup>th</sup> Edition, Pearson Education, Asia, 2007.
2. Spiegel. M.R., Schiller. J., and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics", Tata McGraw Hill Edition, 2004.
3. Chapra. S.C., and Canale. R.P, "Numerical Methods for Engineers", 5<sup>th</sup> Edition, Tata McGraw Hill, New Delhi, 2007.
4. Gerald. C.F., and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 2006.

**ME6401**

**KINEMATICS OF MACHINERY**

**L T P C**  
**3 0 0 3**

### OBJECTIVES:

- To understand the basic components and layout of linkages in the assembly of a system / machine.
- To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.

### **UNIT I           BASICS OF MECHANISMS**

**9**

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler's criterion – Grashof's Law – Kinematic inversions of four-bar chain and slider crank chains – Limit positions – Mechanical advantage – Transmission Angle – Description of some common mechanisms – Quick return mechanisms, Straight line generators, Universal Joint – rocker mechanisms.

### **UNIT II           KINEMATICS OF LINKAGE MECHANISMS**

**9**

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration polygons – Velocity analysis using instantaneous centres – kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration – Introduction to linkage synthesis problem.

### **UNIT III         KINEMATICS OF CAM MECHANISMS**

**9**

Classification of cams and followers – Terminology and definitions – Displacement diagrams –Uniform velocity, parabolic, simple harmonic and cycloidal motions – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams.

### **UNIT IV         GEARS AND GEAR TRAINS**

**9**

Law of toothed gearing – Involute and cycloidal tooth profiles –Spur Gear terminology and definitions –Gear tooth action – contact ratio – Interference and undercutting. Helical, Bevel, Worm, Rack and Pinion gears [Basics only]. Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains.

**UNIT V            FRICTION IN MACHINE ELEMENTS****9**

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads –Bearings and lubrication – Friction clutches – Belt and rope drives – Friction in brakes- Band and Block brakes.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students can able to apply fundamentals of mechanism for the design of new mechanisms and analyse them for optimum design.

**TEXT BOOKS:**

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 3<sup>rd</sup> Edition, Oxford University Press, 2009.
2. Rattan, S.S, "Theory of Machines", 3<sup>rd</sup> Edition, Tata McGraw-Hill, 2009.

**REFERENCES:**

1. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.
2. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2005
3. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.
4. Allen S. Hall Jr., "Kinematics and Linkage Design", Prentice Hall, 1961
5. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi, 1988.
6. Rao.J.S. and Dukkipati.R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
7. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
8. Ramamurthi. V, "Mechanics of Machines", Narosa Publishing House, 2002.
9. Khurmi, R.S., "Theory of Machines", 14<sup>th</sup> Edition, S Chand Publications, 2005
10. Sadhu Sigh : Theory of Machines, "Kinematics of Machine", Third Edition, Pearson Education, 2012

**ME6402****MANUFACTURING TECHNOLOGY – II****L T P C  
3 0 0 3****OBJECTIVES:**

- To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching.
- To understand the basic concepts of Computer Numerical Control (CNC) of machine tools and CNC Programming

**UNIT I            THEORY OF METAL CUTTING****9**

Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools – nomenclature, orthogonal metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

**UNIT II            TURNING MACHINES****9**

Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes- tool layout – automatic lathes: semi automatic – single spindle : Swiss type, automatic screw type – multi spindle:

**UNIT III SHAPER, MILLING AND GEAR CUTTING MACHINES 9**

Shaper - Types of operations. Drilling ,reaming, boring, Tapping. Milling operations-types of milling cutter. Gear cutting – forming and generation principle and construction of gear milling ,hobbing and gear shaping processes –finishing of gears.

**UNIT IV ABRASIVE PROCESS AND BROACHING 9**

Abrasive processes: grinding wheel – specifications and selection, types of grinding process–cylindrical grinding, surface grinding, centreless grinding and internal grinding- Typical applications – concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines

**UNIT V CNC MACHINING 9**

Numerical Control (NC) machine tools – CNC types, constructional details, special features, machining centre, part programming fundamentals CNC – manual part programming – micromachining – wafer machining

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students can able to understand and compare the functions and applications of different metal cutting tools and also demonstrate the programming in CNC machining.

**TEXT BOOKS:**

1. Hajra Choudhury, "Elements of Workshop Technology", Vol.II., Media Promoters
2. Rao. P.N "Manufacturing Technology - Metal Cutting and Machine Tools", Tata McGraw-Hill, New Delhi, 2003.

**REFERENCES:**

1. Richerd R Kibbe, John E. Neely, Roland O. Merges and Warren J.White "Machine Tool Practices", Prentice Hall of India, 1998
2. HMT, "Production Technology", Tata McGraw Hill, 1998.
3. Geoffrey Boothroyd, "Fundamentals of Metal Machining and Machine Tools", Mc Graw Hill, 1984
4. Roy. A.Lindberg, "Process and Materials of Manufacture," Fourth Edition, PHI/Pearson Education 2006.

**ME6403 ENGINEERING MATERIALS AND METALLURGY L T P C  
3 0 0 3**

**OBJECTIVES:**

- To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

**UNIT I ALLOYS AND PHASE DIAGRAMS 9**

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron – carbon equilibrium diagram. Classification of steel and cast Iron microstructure, properties and application.

**UNIT II HEAT TREATMENT 10**

Definition – Full annealing, stress relief, recrystallisation and spheroidising – normalising, hardening and Tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T.

diagram CCR – Hardenability, Jominy end quench test - Austempering, martempering – case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening. .

**UNIT III FERROUS AND NON-FERROUS METALS 9**

Effect of alloying additions on steel- and stabilisers– stainless and tool steels – HSLA, Maraging steels – Cast Iron - Grey, white, malleable, spheroidal – alloy cast irons, Copper and copper alloys – Brass, Bronze and Cupronickel – Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys, Mg-alloys, Ni-based super alloys and Titanium alloys.

**UNIT IV NON-METALLIC MATERIALS 9**

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes)- Engineering Ceramics – Properties and applications of  $Al_2O_3$ , SiC,  $Si_3N_4$ , PSZ and SIALON –Composites-Classifications- Metal Matrix and FRP - Applications of Composites.

**UNIT V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS 8**

Mechanisms of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), hardness tests, Impact test Izod and charpy, fatigue and creep failure mechanisms.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students can able to apply the different materials, their processing, heat treatments in suitable application in mechanical engineering fields.

**TEXT BOOKS:**

1. Avner, S.H., "Introduction to Physical Metallurgy", McGraw Hill Book Company, 1994.
2. Williams D Callister, "Material Science and Engineering" Wiley India Pvt Ltd, Revised Indian Edition 2007

**REFERENCES:**

1. Raghavan.V, "Materials Science and Engineering", Prentice Hall of India Pvt. Ltd., 1999.
2. Kenneth G.Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 4th Indian Reprint 2002.
3. Upadhyay. G.S. and Anish Upadhyay, "Materials Science and Engineering", Viva Books Pvt. Ltd., New Delhi, 2006.
4. U.C.Jindal : Material Science and Metallurgy, "Engineering Materials and Metallurgy", First Edition, Dorling Kindersley, 2012

**GE6351 ENVIRONMENTAL SCIENCE AND ENGINEERING**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

To the study of nature and the facts about environment.

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.

- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

### **UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 12**

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds Field study of simple ecosystems – pond, river, hill slopes, etc.

### **UNIT II ENVIRONMENTAL POLLUTION 10**

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry-Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO<sub>2</sub>, NO<sub>x</sub>, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies – Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

### **UNIT III NATURAL RESOURCES 10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins –Biochemical degradation of pollutants, Bioconversion of pollutants. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

### **UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization-environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- nuclear

accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides. Public awareness.

#### **UNIT V HUMAN POPULATION AND THE ENVIRONMENT**

**6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

**TOTAL : 45 PERIODS**

#### **OUTCOMES:**

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

#### **TEXT BOOKS :**

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education, 2004.
2. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.

#### **REFERENCES :**

1. Trivedi.R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media, 3<sup>rd</sup> edition, BPB publications, 2010.
2. Cunningham, W.P. Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.

**ME6404**

**THERMAL ENGINEERING**

**L T P C  
3 0 0 3**

#### **OBJECTIVES:**

- To integrate the concepts, laws and methodologies from the first course in thermodynamics into analysis of cyclic processes
- To apply the thermodynamic concepts into various thermal application like IC engines, Steam Turbines, Compressors and Refrigeration and Air conditioning systems

(Use of standard refrigerant property data book, Steam Tables, Mollier diagram and Psychrometric chart permitted)

#### **UNIT I GAS POWER CYCLES**

**8**

Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure, and air standard efficiency - Comparison of cycles.

**UNIT II INTERNAL COMBUSTION ENGINES 10**

Classification - Components and their function. Valve timing diagram and port timing diagram - actual and theoretical p-V diagram of four stroke and two stroke engines. Simple and complete Carburettor. MPFI, Diesel pump and injector system. Battery and Magneto Ignition System - Principles of Combustion and knocking in SI and CI Engines. Lubrication and Cooling systems. Performance calculation.

**UNIT III STEAM NOZZLES AND TURBINES 9**

Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow. Impulse and Reaction principles, compounding, velocity diagram for simple and multi-stage turbines, speed regulations –Governors.

**UNIT IV AIR COMPRESSOR 9**

Classification and working principle of various types of compressors, work of compression with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency of reciprocating compressors, Multistage air compressor and inter cooling –work of multistage air compressor

**UNIT V REFRIGERATION AND AIR CONDITIONING 9**

Refrigerants - Vapour compression refrigeration cycle- super heat, sub cooling – Performance calculations - working principle of vapour absorption system, Ammonia –Water, Lithium bromide – water systems (Description only) . Air conditioning system - Processes, Types and Working Principles. - Concept of RSHP, GSHP, ESHP- Cooling Load calculations.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students can able to apply the different gas power cycles and use of them in IC and R&AC applications.

**TEXT BOOKS:**

1. Rajput. R. K., "Thermal Engineering" S.Chand Publishers, 2000
2. Kothandaraman.C.P., Domkundwar. S,Domkundwar. A.V., "A course in thermal Engineering", Fifth Edition, "Dhanpat Rai & sons , 2002

**REFERENCES:**

1. Sarkar, B.K,"Thermal Engineering" Tata McGraw-Hill Publishers, 2007
2. Arora.C.P, "Refrigeration and Air Conditioning ," Tata McGraw-Hill Publishers 1994
3. Ganesan V.." Internal Combustion Engines" , Third Edition, Tata Mcgraw-Hill 2007
4. Rudramoorthy, R, "Thermal Engineering ",Tata McGraw-Hill, New Delhi,2003
5. Ramalingam. K.K., "Thermal Engineering", SCITECH Publications (India) Pvt. Ltd., 2009.

**ME6411 MANUFACTURING TECHNOLOGY LABORATORY – II**

**L T P C  
0 0 3 2**

**OBJECTIVES:**

- To Study and acquire knowledge on various basic machining operations in special purpose machines and its applications in real life manufacture of components in the industry

**LIST OF EXPERIMENTS:**

1. Contour milling using vertical milling machine
2. Spur gear cutting in milling machine
3. Helical Gear Cutting in milling machine

4. Gear generation in hobbing machine
5. Gear generation in gear shaping machine
6. Plain Surface grinding
7. Cylindrical grinding
8. Tool angle grinding with tool and Cutter Grinder
9. Measurement of cutting forces in Milling / Turning Process
10. CNC Part Programming.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to use different machine tools to manufacturing gears.
- Ability to use different machine tools for finishing operations
- Ability to manufacture tools using cutter grinder
- Develop CNC part programming

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Turret and Capstan Lathes	1 No each
2	Horizontal Milling Machine	2 No
3	Vertical Milling Machine	1 No
4	Surface Grinding Machine	1 No.
5	Cylindrical Grinding Machine	1 No.
6	Radial Drilling Machine	1 No.
7	lathe Tool Dynamometer	1 No
8	Milling Tool Dynamometer	1 No
9	Gear Hobbing Machine	1 No
10	Tool Makers Microscope	1 No
11	CNC Lathe	1 No
12	CNC Milling machine	1 No
13	Gear Shaping machine	1 No
14	Centerless grinding machine	1 No
15	Tool and cutter grinder	1 No

**ME6412**

**THERMAL ENGINEERING LABORATORY – I**

**L T P C  
0 0 3 2**

**OBJECTIVES:**

- To study the value timing-V diagram and performance of IC Engines
- To Study the characteristics of fuels/Lubricates used in IC Engines
- To study the Performance of steam generator/ turbine

**LIST OF EXPERIMENTS**

**I.C. ENGINE LAB**

**30**

1. Valve Timing and Port Timing diagrams.
2. Actual p-v diagrams of IC engines.
3. Performance Test on 4 – stroke Diesel Engine.
4. Heat Balance Test on 4 – stroke Diesel Engine.

5. Morse Test on Multi-cylinder Petrol Engine.
7. Retardation Test on a Diesel Engine.
8. Determination of Flash Point and Fire Point of various fuels / lubricants.

### STEAM LAB

15

1. Study on Steam Generators and Turbines.
2. Performance and Energy Balance Test on a Steam Generator.
3. Performance and Energy Balance Test on Steam Turbine.

**TOTAL: 45 PERIODS**

### OUTCOMES:

- Ability to conduct experiment on IC engine to study the characteristic and performance of IC design/ steam turbines.

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	I.C Engine – 2 stroke and 4 stroke model	1 set
2	Apparatus for Flash and Fire Point	1 No.
3	4-stroke Diesel Engine with mechanical loading.	1 No
4	4-stroke Diesel Engine with hydraulic loading.	1 No.
5	4-stroke Diesel Engine with electrical loading.	1 No.
6	Multi-cylinder Petrol Engine	1 No.
7	Single cylinder Petrol Engine	1 No.
8	Data Acquisition system with any one of the above engines	1 No.
9	Steam Boiler with turbine setup	1 No.

**CE6315**

### STRENGTH OF MATERIALS LABORATORY

**L T P C**  
**0 0 3 2**

### OBJECTIVES

To supplement the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads. This would enable the student to have a clear understanding of the design for strength and stiffness

### LIST OF EXPERIMENTS

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
  - (i) Unhardened specimen
  - (ii) Quenched Specimen and
  - (iii) Quenched and tempered specimen.
11. Microscopic Examination of
  - (i) Hardened samples and
  - (ii) Hardened and tempered samples.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Ability to perform different destructive testing
- Ability to characteristic materials

**LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS**

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity	1
2	Torsion Testing Machine (60 NM Capacity)	1
3	Impact Testing Machine (300 J Capacity)	1
4	Brinell Hardness Testing Machine	1
5	Rockwell Hardness Testing Machine	1
6	Spring Testing Machine for tensile and compressive loads (2500 N)	1
7	Metallurgical Microscopes	3
8	Muffle Furnace (800 C)	1

**ME6501****COMPUTER AIDED DESIGN****L T P C  
3 0 0 3****OBJECTIVES:**

- To provide an overview of how computers are being used in mechanical component design

**UNIT I FUNDAMENTALS OF COMPUTER GRAPHICS 9**

Product cycle- Design process- sequential and concurrent engineering- Computer aided design – CAD system architecture- Computer graphics – co-ordinate systems- 2D and 3D transformations- homogeneous coordinates - Line drawing -Clipping- viewing transformation

**UNIT II GEOMETRIC MODELING 9**

Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves-Techniques for surface modeling – surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG and B-rep

**UNIT III VISUAL REALISM 9**

Hidden – Line-Surface-Solid removal algorithms – shading – colouring – computer animation.

**UNIT IV ASSEMBLY OF PARTS 9**

Assembly modelling – interferences of positions and orientation – tolerance analysis-massproperty calculations – mechanism simulation and interference checking.

**UNIT V CAD STANDARDS 9**

Standards for computer graphics- **Graphical Kernel System (GKS)** - standards for exchange images- **Open Graphics Library (OpenGL)** - Data exchange standards - IGES, STEP, CALSetc. - communication standards.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students can able to use computer and CAD software's for modeling of mechanical components

**TEXT BOOKS:**

1. Ibrahim Zeid "Mastering CAD CAM" Tata McGraw-Hill Publishing Co.2007

**REFERENCES:**

1. Chris McMahon and Jimmie Browne "CAD/CAM Principles", "Practice and Manufacturing management " Second Edition, Pearson Education, 1999.
2. William M Neumann and Robert F.Sproul "Principles of Computer Graphics", McGraw Hill Book Co. Singapore, 1989.
3. Donald Hearn and M. Pauline Baker "Computer Graphics". Prentice Hall, Inc, 1992.
4. Foley, Wan Dam, Feiner and Hughes - "Computer graphics principles & practice" Pearson Education - 2003.

**ME6502****HEAT AND MASS TRANSFER****L T P C  
3 0 0 3****OBJECTIVES:**

- To understand the mechanisms of heat transfer under steady and transient conditions.
- To understand the concepts of heat transfer through extended surfaces.
- To learn the thermal analysis and sizing of heat exchangers and to understand the basic concepts of mass transfer.

(Use of standard HMT data book permitted)

**UNIT I CONDUCTION****9**

General Differential equation of Heat Conduction– Cartesian and Polar Coordinates – One Dimensional Steady State Heat Conduction — plane and Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Semi Infinite and Infinite Solids –Use of Heisler’s charts.

**UNIT II CONVECTION****9**

Free and Forced Convection - Hydrodynamic and Thermal Boundary Layer. Free and Forced Convection during external flow over Plates and Cylinders and Internal flow through tubes .

**UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS****9**

Nusselt’s theory of condensation - Regimes of Pool boiling and Flow boiling. Correlations in boiling and condensation. Heat Exchanger Types - Overall Heat Transfer Coefficient – Fouling Factors - Analysis – LMTD method - NTU method.

**UNIT IV RADIATION****9**

Black Body Radiation – Grey body radiation - Shape Factor – Electrical Analogy – Radiation Shields. Radiation through gases.

**UNIT V MASS TRANSFER****9**

Basic Concepts – Diffusion Mass Transfer – Fick’s Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy –Convective Mass Transfer Correlations.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students can able to understand and apply different heat and mass transfer principles of different applications.

**TEXT BOOK:**

1. Yunus A. Cengel, "Heat Transfer A Practical Approach", Tata McGraw Hill, 2010

## REFERENCE BOOKS:

1. Frank P. Incropera and David P. Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley & Sons, 1998.
2. Venkateshan. S.P., "Heat Transfer", Ane Books, New Delhi, 2004.
3. Ghoshdastidar, P.S, "Heat Transfer", Oxford, 2004,
4. Nag, P.K., "Heat Transfer", Tata McGraw Hill, New Delhi, 2002
5. Holman, J.P., "Heat and Mass Transfer", Tata McGraw Hill, 2000
6. Ozisik, M.N., "Heat Transfer", McGraw Hill Book Co., 1994.
7. Kothandaraman, C.P., "Fundamentals of Heat and Mass Transfer", New Age International, New Delhi, 1998.
8. Yadav, R., "Heat and Mass Transfer", Central Publishing House, 1995.
9. M.Thirumaleshwar : Fundamentals of Heat and Mass Transfer, "Heat and Mass Transfer", First Edition, Dorling Kindersley, 2009

**ME6503**

**DESIGN OF MACHINE ELEMENTS**

**L T P C**  
**3 0 0 3**

## OBJECTIVES

- To familiarize the various steps involved in the Design Process
  - To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
  - To learn to use standard practices and standard data
  - To learn to use catalogues and standard machine components
- (Use of P S G Design Data Book is permitted)

## **UNIT I            STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS            10**

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – curved beams – crane hook and ‘C’ frame- Factor of safety - theories of failure – Design based on strength and stiffness – stress concentration – Design for variable loading.

## **UNIT II            SHAFTS AND COUPLINGS            8**

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines - Rigid and flexible couplings.

## **UNIT III            TEMPORARY AND PERMANENT JOINTS            9**

Threaded fasteners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints, riveted joints for structures - theory of bonded joints.

## **UNIT IV            ENERGY STORING ELEMENTS AND ENGINE COMPONENTS            9**

Various types of springs, optimization of helical springs - rubber springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

## **UNIT V            BEARINGS            9**

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs, -- Selection of Rolling Contact bearings.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students can able to successfully design machine components

**TEXT BOOK:**

1. Bhandari V, "Design of Machine Elements", 3<sup>rd</sup> Edition, Tata McGraw-Hill Book Co, 2010.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8<sup>th</sup> Edition, Tata McGraw-Hill, 2008.

**REFERENCES:**

1. Sundararamoorthy T. V. Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.
2. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design", 4<sup>th</sup> Edition, Wiley, 2005
3. Alfred Hall, Halowenko, A and Laughlin, H., "Machine Design", Tata McGraw-Hill BookCo.(Schaum's Outline), 2010
4. Bernard Hamrock, Steven Schmid,Bo Jacobson, "Fundamentals of Machine Elements",2<sup>nd</sup> Edition, Tata McGraw-Hill Book Co., 2006.
5. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
6. Ansel Ugural, "Mechanical Design – An Integral Approach", 1<sup>st</sup> Edition, Tata McGraw-Hill Book Co, 2003.
7. Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, "Design of Machine Elements" 8th Edition, Printice Hall, 2003.

**ME6504****METROLOGY AND MEASUREMENTS****L T P C  
3 0 0 3****OBJECTIVES:**

- To provide knowledge on various Metrological equipments available to measure the dimension of the components.
- To provide knowledge on the correct procedure to be adopted to measure the dimension of the components.

**UNIT I .BASICS OF METROLOGY****5**

Introduction to Metrology – Need – Elements – Work piece, Instruments – Persons – Environment – their effect on Precision and Accuracy – Errors – Errors in Measurements – Types – Control – Types of standards.

**UNIT II LINEAR AND ANGULAR MEASUREMENTS****10**

Linear Measuring Instruments – Evolution – Types – Classification – Limit gauges – gauge design – terminology – procedure – concepts of interchange ability and selective assembly – Angular measuring instruments – Types – Bevel protractor clinometers angle gauges, spirit levels sine bar – Angle alignment telescope – Autocollimator – Applications.

**UNIT III ADVANCES IN METROLOGY****12**

Basic concept of lasers Advantages of lasers – laser Interferometers – types – DC and AC Lasers interferometer – Applications – Straightness – Alignment. Basic concept of CMM – Types of CMM – Constructional features – Probes – Accessories – Software – Applications – Basic concepts of Machine Vision System – Element – Applications.

**UNIT IV FORM MEASUREMENT 10**  
Principles and Methods of straightness – Flatness measurement – Thread measurement, gear measurement, surface finish measurement, Roundness measurement – Applications.

**UNIT V MEASUREMENT OF POWER, FLOW AND TEMPERATURE 8**  
Force, torque, power - mechanical , Pneumatic, Hydraulic and Electrical type. Flow measurement: Venturimeter, Orifice meter, rotameter, pitot tube – Temperature: bimetallic strip, thermocouples, electrical resistance thermometer – Reliability and Calibration – Readability and Reliability.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the Students can demonstrate different measurement technologies and use of them in Industrial Components

**TEXT BOOKS:**

1. Jain R.K. “Engineering Metrology”, Khanna Publishers, 2005.
2. Gupta. I.C., “Engineering Metrology”, Dhanpatrai Publications, 2005.

**REFERENCES:**

1. Charles Reginald Shotbolt, “Metrology for Engineers”, 5<sup>th</sup> edition, Cengage Learning EMEA,1990.
2. Backwith, Marangoni, Lienhard, “Mechanical Measurements”, Pearson Education , 2006.

**ME6505 DYNAMICS OF MACHINES L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
- To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
- To understand the effect of Dynamics of undesirable vibrations.
- To understand the principles in mechanisms used for speed control and stability control.

**UNIT I FORCE ANALYSIS 9**  
Dynamic force analysis – Inertia force and Inertia torque– D Alembert’s principle –Dynamic Analysis in reciprocating engines – Gas forces – Inertia effect of connecting rod– Bearing loads – Crank shaft torque – Turning moment diagrams –Fly Wheels – Flywheels of punching presses- Dynamics of Cam-follower mechanism.

**UNIT II BALANCING 9**  
Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder engine – Balancing of Multi-cylinder inline, V-engines – Partial balancing in engines – Balancing of linkages – Balancing machines-Field balancing of discs and rotors.

**UNIT III SINGLE DEGREE FREE VIBRATION 9**  
Basic features of vibratory systems – Degrees of freedom – single degree of freedom – Free vibration – Equations of motion – Natural frequency – Types of Damping – Damped vibration– Torsional vibration of shaft – Critical speeds of shafts – Torsional vibration – Two and three rotor torsional systems.

**UNIT IV FORCED VIBRATION****9**

Response of one degree freedom systems to periodic forcing – Harmonic disturbances –Disturbance caused by unbalance – Support motion –transmissibility – Vibration isolation vibration measurement.

**UNIT V MECHANISM FOR CONTROL****9**

Governors – Types – Centrifugal governors – Gravity controlled and spring controlled centrifugal governors – Characteristics – Effect of friction – Controlling force curves. Gyroscopes –Gyroscopic forces and torques – Gyroscopic stabilization – Gyroscopic effects in Automobiles, ships and airplanes.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the Students can able to predict the force analysis in mechanical system and related vibration issues and can able to solve the problem

**TEXT BOOK:**

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms" ,3<sup>rd</sup> Edition, Oxford University Press, 2009.
2. Rattan, S.S, "Theory of Machines", 3<sup>rd</sup> Edition, Tata McGraw-Hill, 2009

**REFERENCES:**

1. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.
2. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2005
3. Benson H. Tongue, "Principles of Vibrations", Oxford University Press, 2<sup>nd</sup> Edition, 2007
4. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.
5. Allen S. Hall Jr., "Kinematics and Linkage Design", Prentice Hall, 1961
6. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi, 1988.
7. Rao.J.S. and Dukupati.R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
8. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
9. Grover. G.T., "Mechanical Vibrations", Nem Chand and Bros., 1996
10. William T. Thomson, Marie Dillon Dahleh, Chandramouli Padmanabhan, "Theory of Vibration with Application", 5th edition, Pearson Education, 2011
11. V.Ramamurthi, "Mechanics of Machines", Narosa Publishing House, 2002.
12. Khurmi, R.S., "Theory of Machines", 14<sup>th</sup> Edition, S Chand Publications, 2005.

**GE6075****PROFESSIONAL ETHICS IN ENGINEERING****L T P C  
3 0 0 3****OBJECTIVES:**

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

**UNIT I HUMAN VALUES****10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.



**OBJECTIVES:**

- To supplement the principles learnt in kinematics and Dynamics of Machinery.
- To understand how certain measuring devices are used for dynamic testing.

**LIST OF EXPERIMENTS**

- a) Study of gear parameters.  
b) Experimental study of velocity ratios of simple, compound, Epicyclic and differential gear trains.
- a) Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinder Mechanisms.  
b) Kinematics of single and double universal joints.
- a) Determination of Mass moment of inertia of Fly wheel and Axle system.  
b) Determination of Mass Moment of Inertia of axisymmetric bodies using Turn Table apparatus.  
c) Determination of Mass Moment of Inertia using bifilar suspension and compound pendulum.
- Motorized gyroscope – Study of gyroscopic effect and couple.
- Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.
- Cams – Cam profile drawing, Motion curves and study of jump phenomenon
- a) Single degree of freedom Spring Mass System – Determination of natural Frequency and verification of Laws of springs – Damping coefficient determination.  
b) Multi degree freedom suspension system – Determination of influence coefficient.
- a) Determination of torsional natural frequency of single and Double Rotor systems.- Undamped and Damped Natural frequencies.  
b) Vibration Absorber – Tuned vibration absorber.
- Vibration of Equivalent Spring mass system – undamped and damped vibration.
- Whirling of shafts – Determination of critical speeds of shafts with concentrated loads.
- a) Balancing of rotating masses. (b) Balancing of reciprocating masses.
- a) Transverse vibration of Free-Free beam – with and without concentrated masses.  
b) Forced Vibration of Cantilever beam – Mode shapes and natural frequencies.  
c) Determination of transmissibility ratio using vibrating table.

**TOTAL : 45 PERIODS****OUTCOME**

- Ability to demonstrate the principles of kinematics and dynamics of machinery
- Ability to use the measuring devices for dynamic testing.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Cam follower setup.	1 No.
2	Motorised gyroscope.	1 No.
3	Governor apparatus - Watt, Porter, Proell and Hartnell governors.	1 No.
4	Whirling of shaft apparatus.	1 No.
5	Dynamic balancing machine.	1 No.
6	Two rotor vibration setup.	1 No.
7	Spring mass vibration system.	1 No.
8	Torsional Vibration of single rotor system setup.	1 No.
9	Gear Models	1 No.
10	Kinematic Models to study various mechanisms.	1 No.
11	Turn table apparatus.	1 No.
12	Transverse vibration setup of a) cantilever	1 No.

	b) Free-Free beam c) Simply supported beam.	
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ME6512

THERMAL ENGINEERING LABORATORY – II

L T P C  
0 0 3 2

**OBJECTIVES**

- To study the heat transfer phenomena predict the relevant coefficient using implementation
- To study the performance of refrigeration cycle / components

**LIST OF EXPERIMENTS:**

**HEAT TRANSFER LAB:**

30

1. Thermal conductivity measurement using guarded plate apparatus.
2. Thermal conductivity measurement of pipe insulation using lagged pipe apparatus.
3. Determination of heat transfer coefficient under natural convection from a vertical cylinder.
4. Determination of heat transfer coefficient under forced convection from a tube.
5. Determination of Thermal conductivity of composite wall.
6. Determination of Thermal conductivity of insulating powder.
7. Heat transfer from pin-fin apparatus (natural & forced convection modes)
8. Determination of Stefan – Boltzmann constant.
9. Determination of emissivity of a grey surface.
10. Effectiveness of Parallel / counter flow heat exchanger.

**REFRIGERATION AND AIR CONDITIONING LAB**

15

1. Determination of COP of a refrigeration system
2. Experiments on Psychrometric processes
3. Performance test on a reciprocating air compressor
4. Performance test in a HC Refrigeration System
5. Performance test in a fluidized Bed Cooling Tower

**TOTAL: 45 PERIODS**

**OUTCOMES**

- Ability to demonstrate the fundamentals of heat and predict the coefficient used in that transfer application and also design refrigeration cycle.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Guarded plate apparatus	1 No.
2	Lagged pipe apparatus	1 No.
3	Natural convection-vertical cylinder apparatus	1 No.
4	Forced convection inside tube apparatus	1 No.
5	Composite wall apparatus	1 No.
6	Thermal conductivity of insulating powder apparatus	1 No.
7	Pin-fin apparatus	1 No.
8	Stefan-Boltzmann apparatus	1 No.
9	Emissivity measurement apparatus	1 No.
10	Parallel/counter flow heat exchanger apparatus	1 No.

11	Single/two stage reciprocating air compressor	1 No.
12	Refrigeration test rig	1 No.
13	Air-conditioning test rig	1 No.
14	HC Refrigeration System	1 No.
15.	Fluidized Bed Cooling Tower	1 No.

**ME6513**

**METROLOGY AND MEASUREMENTS LABORATORY**

**L T P C**  
**0 0 3 2**

**OBJECTIVES**

- To familiar with different measurement equipments and use of this industry for quality inspection

**LIST OF EXPERIMENTS**

1. Tool Maker's Microscope
2. Comparator
3. Sine Bar
4. Gear Tooth Vernier Caliper
5. Floating gauge Micrometer
6. Co ordinate Measuring Machine
7. Surface Finish Measuring Equipment
8. Vernier Height Gauge
9. Bore diameter measurement using telescope gauge
10. Bore diameter measurement using micrometer
11. Force Measurement
12. Torque Measurement
13. Temperature measurement
14. Autocollimator

**TOTAL: 45 PERIODS**

**OUTCOMES**

- Ability to handle different measurement tools and perform measurements in quality impulsion

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

<b>S.No.</b>	<b>NAME OF THE EQUIPMENT</b>	<b>Qty.</b>
1	Micrometer	5
2	Vernier Caliper	5
3	Vernier Height Gauge	2
4	Vernier depth Gauge	2
5	Slip Gauge Set	1
6	Gear Tooth Vernier	1
7	Sine Bar	1
8	Floating Carriage Micrometer	1
9	Profile Projector / Tool Makers Microscope	1
10	Parallel / counter flow heat exchanger apparatus	1
11	Mechanical / Electrical / Pneumatic Comparator	1
12	Autocollimator	1
13	Temperature Measuring Setup	1
14	Force Measuring Setup	1

15	Torque Measuring Setup	1
16	Coordinate measuring machine	1
17	Surface finish measuring equipment	1
18	Bore gauge	1
19	Telescope gauge	1

**ME6601**

**DESIGN OF TRANSMISSION SYSTEMS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To gain knowledge on the principles and procedure for the design of Mechanical power Transmission components.
- To understand the standard procedure available for Design of Transmission of Mechanical elements
- To learn to use standard data and catalogues  
(Use of P S G Design Data Book permitted)

**UNIT I DESIGN OF FLEXIBLE ELEMENTS 9**

Design of Flat belts and pulleys - Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.

**UNIT II SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 9**

Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects – Fatigue strength - Factor of safety - Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations – Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces for helical gears.

**UNIT III BEVEL, WORM AND CROSS HELICAL GEARS 9**

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits-terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair. Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

**UNIT IV GEAR BOXES 9**

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box - Design of multi speed gear box for machine tool applications - Constant mesh gear box - Speed reducer unit. – Variable speed gear box, Fluid Couplings, Torque Converters for automotive applications.

**UNIT V CAMS, CLUTCHES AND BRAKES 9**

Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses. Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches-Electromagnetic clutches. Band and Block brakes - external shoe brakes – Internal expanding shoe brake.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students can able to successfully design transmission components used in Engine and machines

### TEXT BOOKS:

1. Bhandari V, "Design of Machine Elements", 3rd Edition, Tata McGraw-Hill Book Co, 2010.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8th Edition, Tata McGraw-Hill, 2008.

### REFERENCES:

1. Sundararamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.
2. Gitin Maitra, L. Prasad "Hand book of Mechanical Design", 2nd Edition, Tata McGraw-Hill, 2001.
3. Prabhu. T.J., "Design of Transmission Elements", Mani Offset, Chennai, 2000.
4. C.S.Sharma, Kamlesh Purohit, "Design of Machine Elements", Prentice Hall of India, Pvt. Ltd., 2003.
5. Bernard Hamrock, Steven Schmid, Bo Jacobson, "Fundamentals of Machine Elements", 2nd Edition, Tata McGraw-Hill Book Co., 2006.
6. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design", 4<sup>th</sup> Edition, Wiley, 2005
7. Alfred Hall, Halowenko, A and Laughlin, H., "Machine Design", Tata McGraw-Hill BookCo.(Schaum's Outline), 2010
8. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
9. Ansel Ugural, "Mechanical Design – An Integral Approach", 1st Edition, Tata McGraw-Hill Book Co, 2003.
10. Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, "Design of Machine Elements" 8<sup>th</sup> Edition, Printice Hall, 2003.
11. U.C.Jindal : Machine Design, "Design of Transmission System", Dorling Kindersley, 2010

**MG6851**

**PRINCIPLES OF MANAGEMENT**

**L T P C**  
**3 0 0 3**

### OBJECTIVES:

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization .

### **UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS**

**9**

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

### **UNIT II PLANNING**

**9**

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

### **UNIT III ORGANISING**

**9**

Nature and purpose – Formal and informal organization – organization chart – organization structure

– types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

#### **UNIT IV DIRECTING**

**9**

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

#### **UNIT V CONTROLLING**

**9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

#### **TEXTBOOKS:**

1. Stephen P. Robbins & Mary Coulter, “Management”, Prentice Hall (India) Pvt. Ltd., 10<sup>th</sup> Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, 6th Edition, Pearson Education, 2004.

#### **REFERENCES:**

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, “Fundamentals of Management” 7<sup>th</sup> Edition, Pearson Education, 2011.
2. Robert Kreitner & Mamata Mohapatra, “ Management”, Biztantra, 2008.
3. Harold Koontz & Heinz Wehrich, “Essentials of Management”, Tata McGraw Hill, 1998.
4. Tripathy PC & Reddy PN, “Principles of Management”, Tata Mcgraw Hill, 1999

**ME6602**

**AUTOMOBILE ENGINEERING**

**L T P C**  
**3 0 0 3**

#### **OBJECTIVES:**

- To understand the construction and working principle of various parts of an automobile.
- To have the practice for assembling and dismantling of engine parts and transmission system

#### **UNIT I VEHICLE STRUCTURE AND ENGINES**

**9**

Types of automobiles, vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines –components-functions and materials, variable valve timing (VVT).

#### **UNIT II ENGINE AUXILIARY SYSTEMS**

**9**

Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

**UNIT III TRANSMISSION SYSTEMS****9**

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints ,Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

**UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS****9**

Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control.

**UNIT V ALTERNATIVE ENERGY SOURCES****9**

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell  
Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students will be able to identify the different components in automobile engineering.
- Have clear understanding on different auxiliary and transmission systems usual.

**TEXT BOOKS:**

1. Kirpal Singh, "Automobile Engineering", Vol 1 & 2, Seventh Edition, Standard Publishers, New Delhi, 1997.
2. Jain K.K. and Asthana .R.B, "Automobile Engineering" Tata McGraw Hill Publishers, New Delhi, 2002.

**REFERENCES:**

1. Newton ,Steeds and Garet, "Motor Vehicles", Butterworth Publishers,1989.
2. Joseph Heitner, "Automotive Mechanics," Second Edition, East-West Press, 1999.
3. Martin W, Stockel and Martin T Stockle , "Automotive Mechanics Fundamentals," The Good heart –Will Cox Company Inc, USA ,1978.
4. Heinz Heisler, "Advanced Engine Technology," SAE International Publications USA, 1998.
5. Ganesan V. "Internal Combustion Engines", Third Edition, Tata McGraw-Hill, 2007.

**ME6603****FINITE ELEMENT ANALYSIS****L T P C  
3 0 0 3****OBJECTIVES:**

- To introduce the concepts of Mathematical Modeling of Engineering Problems.
- To appreciate the use of FEM to a range of Engineering Problems.

**UNIT I INTRODUCTION****9**

Historical Background – Mathematical Modeling of field problems in Engineering – Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – RitzTechnique – Basic concepts of the Finite Element Method.

**UNIT II ONE-DIMENSIONAL PROBLEMS 9**

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors- Assembly of Matrices - Solution of problems from solid mechanics and heat transfer. Longitudinal vibration frequencies and mode shapes. Fourth Order Beam Equation –Transverse deflections and Natural frequencies of beams.

**UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS 9**

Second Order 2D Equations involving Scalar Variable Functions – Variational formulation –Finite Element formulation – Triangular elements – Shape functions and element matrices and vectors. Application to Field Problems - Thermal problems – Torsion of Non circular shafts –Quadrilateral elements – Higher Order Elements.

**UNIT IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS 9**

Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements.

**UNIT V ISOPARAMETRIC FORMULATION 9**

Natural co-ordinate systems – Isoparametric elements – Shape functions for iso parametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems - Matrix solution techniques – Solutions Techniques to Dynamic problems – Introduction to Analysis Software.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students can able to understand different mathematical Techniques used in FEM analysis and use of them in Structural and thermal problem

**TEXT BOOK:**

1. Reddy. J.N., “An Introduction to the Finite Element Method”, 3rd Edition, Tata McGraw-Hill, 2005
2. Seshu, P, “Text Book of Finite Element Analysis”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.

**REFERENCES:**

1. Rao, S.S., “The Finite Element Method in Engineering”, 3rd Edition, Butterworth Heinemann, 2004
2. Logan, D.L., “A first course in Finite Element Method”, Thomson Asia Pvt. Ltd., 2002
3. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, “Concepts and Applications of Finite Element Analysis”, 4th Edition, Wiley Student Edition, 2002.
4. Chandrupatla & Belagundu, “Introduction to Finite Elements in Engineering”, 3rd Edition, Prentice Hall College Div, 1990
5. Bhatti Asghar M, "Fundamental Finite Element Analysis and Applications", John Wiley & Sons, 2005 (Indian Reprint 2013)\*

**ME6604**

**GAS DYNAMICS AND JET PROPULSION**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To understand the basic difference between incompressible and compressible flow.
- To understand the phenomenon of shock waves and its effect on flow. To gain some basic knowledge about jet propulsion and Rocket Propulsion.  
(Use of Standard Gas Tables permitted)

**UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS 6**

Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers

**UNIT II FLOW THROUGH DUCTS 9**

Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties.

**UNIT III NORMAL AND OBLIQUE SHOCKS 10**

Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Applications.

**UNIT IV JET PROPULSION 10**

Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operating principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines.

**UNIT V SPACE PROPULSION 10**

Types of rocket engines – Propellants-feeding systems – Ignition and combustion – Theory of rocket propulsion – Performance study – Staging – Terminal and characteristic velocity – Applications – space flights.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students can able to successfully apply gas dynamics principles in the Jet and Space Propulsion

**TEXT BOOKS:**

1. Anderson, J.D., "Modern Compressible flow", 3<sup>rd</sup> Edition, McGraw Hill, 2003.
2. Yahya, S.M. "Fundamentals of Compressible Flow", New Age International (P) Limited, New Delhi, 1996.

**REFERENCES:**

1. Hill. P. and C. Peterson, "Mechanics and Thermodynamics of Propulsion", Addison – Wesley Publishing company, 1992.
2. Zucrow. N.J., "Aircraft and Missile Propulsion", Vol.1 & II, John Wiley, 1975.
3. Zucrow. N.J., "Principles of Jet Propulsion and Gas Turbines", John Wiley, New York, 1970.
4. Sutton. G.P., "Rocket Propulsion Elements", John wiley, New York, 1986,.
5. Shapiro. A.H., " Dynamics and Thermodynamics of Compressible fluid Flow", John wiley, New York, 1953.
6. Ganesan. V., "Gas Turbines", Tata McGraw Hill Publishing Co., New Delhi, 1999.
7. Somasundaram. PR.S.L., "Gas Dynamics and Jet Propulsions", New Age International Publishers, 1996.
8. Babu. V., "Fundamentals of Gas Dynamics", ANE Books India, 2008.
9. Cohen. H., G.E.C. Rogers and Saravanamutto, "Gas Turbine Theory", Longman Group Ltd., 1980.

**OBJECTIVES:**

- To gain practical experience in handling 2D drafting and 3D modelling software systems.
- To study the features of CNC Machine Tool.
- To expose students to modern control systems (Fanuc, Siemens etc.,)
- To know the application of various CNC machines like CNC lathe, CNC Vertical Machining centre, CNC EDM and CNC wire-cut and studying of Rapid prototyping.

**LIST OF EXPERIMENTS****1. 3D GEOMETRIC MODELLING****24 PERIODS****List of Experiments**

1. Introduction of 3D Modelling software

**Creation of 3D assembly model of following machine elements using 3D Modelling software**

2. Flange Coupling
3. Plummer Block
4. Screw Jack
5. Lathe Tailstock
6. Universal Joint
7. Machine Vice
8. Stuffing box
9. Crosshead
10. Safety Valves
11. Non-return valves
12. Connecting rod
13. Piston
14. Crankshaft

\* Students may also be trained in manual drawing of some of the above components

**2. Manual Part Programming.****21 PERIODS**

- (i) Part Programming - CNC Machining Centre
  - a) Linear Cutting.
  - b) Circular cutting.
  - c) Cutter Radius Compensation.
  - d) Canned Cycle Operations.
- (ii) Part Programming - CNC Turning Centre
  - a) Straight, Taper and Radius Turning.
  - b) Thread Cutting.
  - c) Rough and Finish Turning Cycle.
  - d) Drilling and Tapping Cycle.

**3. Computer Aided Part Programming**

- e) CL Data and Post process generation using CAM packages.
- f) Application of CAPP in Machining and Turning Centre.

**TOTAL: 45 PERIODS**

**OUTCOMES**

- Ability to develop 2D and 3D models using modeling softwares.
- Ability to understand the CNC control in modern manufacturing system.
- Ability to prepare CNC part programming and perform manufacturing.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S.No.	Description of Equipment	Qty
<b>HARDWARE</b>		
1.	Computer Server	1
2.	Computer nodes or systems (High end CPU with atleast 1 GB main memory) networked to the server	30
3.	A3 size plotter	1
4.	Laser Printer	1
5.	CNC Lathe	1
6.	CNC milling machine	1
<b>SOFTWARE</b>		
7.	Any High end integrated modeling and manufacturing CAD / CAM software	15 licenses
8.	CAM Software for machining centre and turning centre (CNC Programming and tool path simulation for FANUC / Sinumeric and Heidenhain controller)	15 licenses
9.	Licensed operating system	Adequate
10.	Support for CAPP	Adequate

**ME6612**

**DESIGN AND FABRICATION PROJECT**

**L T P C  
0 0 4 2**

**OBJECTIVES:**

- The main objective is to give an opportunity to the student to get hands on training in the fabrication of one or more components of a complete working model, which is designed by them.

**GUIDELINE FOR REVIEW AND EVALUATION**

The students may be grouped into 2 to 4 and work under a project supervisor. The device/system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL : 60 PERIODS**

**OUTCOMES:**

- Use of design principles and develop conceptual and engineering design of any components.
- Ability to fabricate any components using different manufacturing tools.

**OBJECTIVES:**

To enable learners to,

- Develop their communicative competence in English with specific reference to speaking and listening
- Enhance their ability to communicate effectively in interviews.
- Strengthen their prospects of success in competitive examinations.

**UNIT I LISTENING AND SPEAKING SKILLS 12**

Conversational skills (formal and informal)- group discussion- making effective presentations using computers, listening/watching interviews conversations, documentaries. Listening to lectures, discussions from TV/ Radio/ Podcast.

**UNIT II READING AND WRITING SKILLS 12**

Reading different genres of texts ranging from newspapers to creative writing. Writing job applications- cover letter- resume- emails- letters- memos- reports. Writing abstracts- summaries- interpreting visual texts.

**UNIT III ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS AND PLACEMENTS 12**

International English Language Testing System (IELTS) - Test of English as a Foreign Language (TOEFL) - Civil Service(Language related)- Verbal Ability.

**UNIT IV INTERVIEW SKILLS 12**

Different types of Interview format- answering questions- offering information- mock interviews-body language( paralinguistic features)- articulation of sounds- intonation.

**UNIT V SOFT SKILLS 12**

**Motivation- emotional intelligence-**Multiple intelligences- emotional intelligence- managing changes-time management-stress management-leadership traits-team work- career planning - intercultural communication- creative and critical thinking

**TOTAL: 60 PERIODS**

**TEACHING METHODS:**

1. To be totally learner-centric with minimum teacher intervention as the course revolves around practice.
2. Suitable audio/video samples from Podcast/YouTube to be used for illustrative purposes.
3. Portfolio approach for writing to be followed. Learners are to be encouraged to blog, tweet, text and email employing appropriate language.
4. GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.
5. Learners are to be assigned to read/write/listen/view materials outside the classroom as well for gaining proficiency and better participation in the class.

**Lab Infrastructure:**

S. No.	Description of Equipment (minimum configuration)	Qty Required
1	<b>Server</b>	1 No.
	• PIV System	
	• 1 GB RAM / 40 GB HDD	

	<ul style="list-style-type: none"> <li>• OS: Win 2000 server</li> <li>• Audio card with headphones</li> <li>• JRE 1.3</li> </ul>	
2	<b>Client Systems</b> <ul style="list-style-type: none"> <li>• PIII or above</li> <li>• 256 or 512 MB RAM / 40 GB HDD</li> <li>• OS: Win 2000</li> <li>• Audio card with headphones</li> <li>• JRE 1.3</li> </ul>	60 Nos.
3	Handicam	1 No.
4	Television 46"	1 No.
5	Collar mike	1 No.
6	Cordless mike	1 No.
7	Audio Mixer	1 No.
8	DVD recorder/player	1 No.
9	LCD Projector with MP3/CD/DVD provision for Audio/video facility	1 No.

### Evaluation:

#### Internal: 20 marks

Record maintenance: Students should write a report on a regular basis on the activities conducted, focusing on the details such as the description of the activity, ideas emerged, learning outcomes and so on. At the end of the semester records can be evaluated out of 20 marks.

#### External: 80 marks

Online Test	- 35 marks
Interview	- 15 marks
Presentation	- 15 marks
Group Discussion	- 15 marks

#### Note on Internal and External Evaluation:

1. Interview – mock interview can be conducted on one-on-one basis.
2. Speaking – example for role play:
  - a. Marketing engineer convincing a customer to buy his product.
  - b. Telephonic conversation- fixing an official appointment / placing an order / enquiring and so on.
3. Presentation – should be extempore on simple topics.
4. Discussion – topics of different kinds; general topics, and case studies.

### OUTCOMES:

#### At the end of the course, learners should be able to

- Take international examination such as IELTS and TOEFL
- Make presentations and Participate in Group Discussions.
- Successfully answer questions in interviews.

### REFERENCES:

1. **Business English Certificate Materials**, Cambridge University Press.
2. **Graded Examinations in Spoken English and Spoken English for Work** downloadable materials from Trinity College, London.
3. **International English Language Testing System** Practice Tests, Cambridge University Press.
4. Interactive Multimedia Programs on **Managing Time and Stress**.
5. **Personality Development** (CD-ROM), Times Multimedia, Mumbai.

6. Robert M Sherfield and et al. “**Developing Soft Skills**” 4th edition, New Delhi: Pearson Education, 2009.

**Web Sources:**

<http://www.slideshare.net/rohitjsh/presentation-on-group-discussion>

[http://www.washington.edu/doi/TeamN/present\\_tips.html](http://www.washington.edu/doi/TeamN/present_tips.html)

<http://www.oxforddictionaries.com/words/writing-job-applications>

<http://www.kent.ac.uk/careers/cv/coveringletters.htm>

[http://www.mindtools.com/pages/article/newCDV\\_34.htm](http://www.mindtools.com/pages/article/newCDV_34.htm)

**ME6701**

**POWER PLANT ENGINEERING**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

- Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

**UNIT I COAL BASED THERMAL POWER PLANTS 10**

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

**UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 10**

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

**UNIT III NUCLEAR POWER PLANTS 7**

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : *Boiling Water Reactor* (BWR), *Pressurized Water Reactor* (PWR), CANada Deuterium-Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

**UNIT IV POWER FROM RENEWABLE ENERGY 10**

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, *Solar Photo Voltaic* (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

**UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS 8**

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students can able to understand different types of power plant, and its functions and their flow lines and issues related to them.
- Analyse and solve energy and economic related issues in power sectors.

**TEXT BOOK:**

1. Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008.

**REFERENCES:**

1. El-Wakil. M.M., "Power Plant Technology", Tata McGraw – Hill Publishing Company Ltd., 2010.
2. Black & Veatch, Springer, "Power Plant Engineering", 1996.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, "Power Plant Engineering", Second Edition, Standard Handbook of McGraw – Hill, 1998.
4. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.

**ME6702**

**MECHATRONICS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To impart knowledge about the elements and techniques involved in Mechatronics systems which are very much essential to understand the emerging field of automation.

**UNIT I INTRODUCTION**

**12**

Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers: Static and dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor – Temperature sensors – Light sensors

**UNIT II 8085 MICROPROCESSOR AND 8051 MICROCONTROLLER**

**10**

Introduction – Architecture of 8085 – Pin Configuration – Addressing Modes –Instruction set, Timing diagram of 8085 – Concepts of 8051 microcontroller – Block diagram,.

**UNIT III PROGRAMMABLE PERIPHERAL INTERFACE**

**8**

Introduction – Architecture of 8255, Keyboard interfacing, LED display –interfacing, ADC and DAC interface, Temperature Control – Stepper Motor Control – Traffic Control interface.

**UNIT IV PROGRAMMABLE LOGIC CONTROLLER**

**7**

Introduction – Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters and internal relays – Data handling – Selection of PLC.

**UNIT V ACTUATORS AND MECHATRONIC SYSTEM DESIGN**

**8**

Types of Stepper and Servo motors – Construction – Working Principle – Advantages and Disadvantages. Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Engine Management system – Automatic car park barrier.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students can able to design mechatronics system with the help of Microprocessor, PLC and other electrical and Electronics Circuits.

**TEXT BOOKS:**

1. Bolton, "Mechatronics", Printice Hall, 2008
2. Ramesh S Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 5th Edition, Prentice Hall, 2008.

#### REFERENCES:

1. Michael B.Histand and Davis G.Alciatore, "Introduction to Mechatronics and Measurement systems", McGraw Hill International edition, 2007.
2. Bradley D.A, Dawson D, Buru N.C and Loader A.J, "Mechatronics", Chapman and Hall, 1993.
3. Smaili.A and Mrad.F , "Mechatronics Integrated Technologies for Intelligent Machines", Oxford University Press, 2007.
4. Devadas Shetty and Richard A. Kolk, "Mechatronics Systems Design", PWS publishing company, 2007.
5. Krishna Kant, "Microprocessors & Microcontrollers", Prentice Hall of India, 2007.
6. Clarence W, de Silva, "Mechatronics" CRC Press, First Indian Re-print, 2013

**ME6703**

**COMPUTER INTEGRATED MANUFACTURING SYSTEMS**

**L T P C**

**3 0 0 3**

#### OBJECTIVES:

- To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

#### **UNIT I INTRODUCTION**

**10**

Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM – Concurrent Engineering-CIM concepts – Computerised elements of CIM system –Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance – Simple problems – Manufacturing Control – Simple Problems – Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In-Time Production.

#### **UNIT II PRODUCTION PLANNING AND CONTROL AND COMPUTERISED PROCESS PLANNING**

**10**

Process planning – Computer Aided Process Planning (CAPP) – Logical steps in Computer Aided Process Planning – Aggregate Production Planning and the Master Production Schedule – Material Requirement planning – Capacity Planning- Control Systems-Shop Floor Control-Inventory Control – Brief on Manufacturing Resource Planning-II (MRP-II) & Enterprise Resource Planning (ERP) - Simple Problems.

#### **UNIT III CELLULAR MANUFACTURING**

**9**

Group Technology(GT), Part Families – Parts Classification and coding – Simple Problems in Opitz Part Coding system – Production flow Analysis – Cellular Manufacturing – Composite part concept – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing – Rank Order Clustering Method - Arranging Machines in a GT cell – Hollier Method – Simple Problems.

#### **UNIT IV FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED**

**GUIDED VEHICLE SYSTEM (AGVS)****8**

Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control– Quantitative analysis in FMS – Simple Problems. Automated Guided Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety.

**UNIT V INDUSTRIAL ROBOTICS****8**

Robot Anatomy and Related Attributes – Classification of Robots- Robot Control systems – End Effectors – Sensors in Robotics – Robot Accuracy and Repeatability - Industrial Robot Applications – Robot Part Programming – Robot Accuracy and Repeatability – Simple Problems.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the student can able to understand the use of computers in process planning and use of FMS and Robotics in CIM

**TEXT BOOK:**

1. Mikell.P.Groover “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India, 2008.
2. Radhakrishnan P, Subramanyan S.and Raju V., “CAD/CAM/CIM”, 2nd Edition, New Age International (P) Ltd, New Delhi, 2000.

**REFERENCES:**

1. Kant Vajpayee S, “Principles of Computer Integrated Manufacturing”, Prentice Hall India, 2003.
2. Gideon Halevi and Roland Weill, “Principles of Process Planning – A Logical Approach” Chapman & Hall, London, 1995.
3. Rao. P, N Tewari &T.K. Kundra, “Computer Aided Manufacturing”, Tata McGraw Hill Publishing Company, 2000.

**GE6757****TOTAL QUALITY MANAGEMENT****L T P C  
3 0 0 3****OBJECTIVES:**

- To facilitate the understanding of Quality Management principles and process.

**UNIT I INTRODUCTION****9**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

**UNIT II TQM PRINCIPLES****9**

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

**UNIT III TQM TOOLS AND TECHNIQUES I****9**

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

**UNIT IV TQM TOOLS AND TECHNIQUES II****9**

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

## **UNIT V            QUALITY SYSTEMS**

**9**

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors..

**TOTAL: 45 PERIODS**

### **OUTCOMES:**

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

### **TEXT BOOK:**

1. Dale H. Besterfield, et al., "Total quality Management", Third Edition, Pearson Education Asia, Indian Reprint, 2006.

### **REFERENCES:**

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8<sup>th</sup> Edition, First Indian Edition, Cengage Learning, 2012.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

**ME6711**

## **SIMULATION AND ANALYSIS LABORATORY**

**L T P C**  
**0 0 3 2**

### **OBJECTIVES:**

- To give exposure to software tools needed to analyze engineering problems.
- To expose the students to different applications of simulation and analysis tools.

### **LIST OF EXPERIMENTS**

#### **A. SIMULATION**

1. MATLAB basics, Dealing with matrices, Graphing-Functions of one variable and two variables
2. Use of Matlab to solve simple problems in vibration
3. Mechanism Simulation using Multibody Dynamic software

#### **B. ANALYSIS**

1. Force and Stress analysis using link elements in Trusses, cables etc.
2. Stress and deflection analysis in beams with different support conditions.
3. Stress analysis of flat plates and simple shells.
4. Stress analysis of axi – symmetric components.
5. Thermal stress and heat transfer analysis of plates.
6. Thermal stress analysis of cylindrical shells.
7. Vibration analysis of spring-mass systems.
8. Model analysis of Beams.
9. Harmonic, transient and spectrum analysis of simple systems.

**TOTAL: 45 PERIODS**

### **OUTCOMES:**

- Upon completion of this course, the Students can model, analyse and simulate experiments to meet real world system and evaluate the performance.

#### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO.	NAME OF THE EQUIPMENT	Qty.
1	Computer Work Station	15
2	Color Desk Jet Printer	01
3	Multibody Dynamic Software Suitable for Mechanism simulation and analysis	15 licenses
4	C / MATLAB	5 licenses

**ME6712**

**MECHATRONICS LABORATORY**

**L T P C**  
**0 0 3 2**

#### OBJECTIVES:

- To know the method of programming the microprocessor and also the design, modeling & analysis of basic electrical, hydraulic & pneumatic Systems which enable the students to understand the concept of mechatronics.

#### LIST OF EXPERIMENTS:

1. Assembly language programming of 8085 – Addition – Subtraction – Multiplication – Division – Sorting – Code Conversion.
2. Stepper motor interface.
3. Traffic light interface.
4. Speed control of DC motor.
5. Study of various types of transducers.
6. Study of hydraulic, pneumatic and electro-pneumatic circuits.
7. Modelling and analysis of basic hydraulic, pneumatic and electrical circuits using Software.
8. Study of PLC and its applications.
9. Study of image processing technique.

**TOTAL : 45 PERIODS**

#### OUTCOMES:

- Upon completion of this course, the students can able to design mechatronics system with the help of Microprocessor, PLC and other electrical and Electronics Circuits.

#### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl. No.	NAME OF THE EQUIPMENT	Qty.
1	Basic Pneumatic Trainer Kit with manual and electrical controls/ PLC Control each	1 No.
2	Basic Hydraulic Trainer Kit	1 No
3	Hydraulics and Pneumatics Systems Simulation Software	10 No
4	8051 - Microcontroller kit with stepper motor and drive circuit sets	2 No
	Image processing system with hardware & software	1 No.

**ME6713**

**COMPREHENSION**

**L T P C**

**OBJECTIVES:**

- To encourage the students to comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E Degree Course through periodic exercise.

**METHOD OF EVALUATION:**

The students will be assessed 100% internally through weekly test with objective type questions on all the subject related topics

**TOTAL : 30 PERIODS****OUTCOMES:**

- ability to understand and comprehend any given problem related to mechanical engineering field.

**MG6863****ENGINEERING ECONOMICS****L T P C  
3 0 0 3****OBJECTIVES:**

- To enable students to understand the fundamental economic concepts applicable to engineering and to learn the techniques of incorporating inflation factor in economic decision making.

**UNIT I INTRODUCTION TO ECONOMICS****8**

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics - Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis - V ratio, Elementary economic Analysis – Material selection for product Design selection for a product, Process planning.

**UNIT II VALUE ENGINEERING****10**

Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor - Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

**UNIT III CASH FLOW****9**

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

**UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS****9**

Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

**UNIT V DEPRECIATION****9**

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

**TOTAL: 45 PERIODS**

**OUTCOMES :**

- Upon successful completion of this course, students will acquire the skills to apply the basics of economics and cost analysis to engineering and take economically sound decisions.

**TEXT BOOKS:**

1. Panneer Selvam, R, “Engineering Economics”, Prentice Hall of India Ltd, New Delhi, 2001.

**REFERENCES:**

1. Chan S.Park, “Contemporary Engineering Economics”, Prentice Hall of India, 2011.
2. Donald.G. Newman, Jerome.P.Lavelle, “Engineering Economics and analysis” Engg. Press, Texas, 2010.
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, “Engineering Economy”, Macmillan, New York, 2011.
4. Zahid A khan: Engineering Economy, "Engineering Economy", Dorling Kindersley, 2012

**ME6811**

**PROJECT WORK**

**L T P C**  
**0 0 12 6**

**OBJECTIVES:**

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL: 180 PERIODS**

**OUTCOMES:**

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

**MG6072**

**MARKETING MANAGEMENT**

**L T P C**



**OBJECTIVES:**

- To introduce the concept of SQC
- To understand process control and acceptance sampling procedure and their application.
- To learn the concept of reliability.

**UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES 10**

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality control: Quality cost-Variation in process causes of variation –Theory of control chart- uses of control chart – Control chart for variables – X chart, R chart and chart-process capability – process capability studies and simple problems. Six sigma concepts

**UNIT II PROCESS CONTROL FOR ATTRIBUTES 8**

Control chart for attributes –control chart for non conformings– p chart and np chart – control chart for nonconformities– C and U charts, State of control and process out of control identification in charts, pattern study.

**UNIT III ACCEPTANCE SAMPLING 9**

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD- uses of standard sampling plans.

**UNIT IV LIFE TESTING – RELIABILITY 9**

Life testing – Objective – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate – Weibull model, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems. Acceptance sampling based on reliability test – O.C Curves.

**UNIT V QUALITY AND RELIABILITY 9**

Reliability improvements – techniques- use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

**TOTAL: 45 PERIODS**

**Note:** Use of approved statistical table permitted in the examination.

**OUTCOMES:**

- Upon successful completion of this course, the students can able to apply the concept of SQC in process control for reliable component production

**TEXT BOOKS:**

1. Douglas.C. Montgomery, “ Introduction to Statistical quality control”, 4<sup>th</sup> edition, John Wiley 2001.
2. Srinath. L.S., “Reliability Engineering”, Affiliated East west press, 1991.

**REFERENCES:**

1. John.S. Oakland. "Statistical process control", 5th edition, Elsevier, 2005
2. Connor, P.D.T.O., "Practical Reliability Engineering", John Wiley, 1993
3. Grant, Eugene .L "Statistical Quality Control", McGraw-Hill, 1996
4. Monohar Mahajan, "Statistical Quality Control", Dhanpat Rai & Sons, 2001.
- 5.. Gupta. R.C, "Statistical Quality control", Khanna Publishers, 1997.
6. Besterfield D.H., "Quality Control", Prentice Hall, 1993.
7. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publishers, 1998.
8. Danny Samson, "Manufacturing & Operations Strategy", Prentice Hall, 1991

**OBJECTIVES:**

- To understand the underlying principles of operations in different Refrigeration & Air conditioning systems and components.
- To provide knowledge on design aspects of Refrigeration & Air conditioning systems

**UNIT I INTRODUCTION****5**

Introduction to Refrigeration - Unit of Refrigeration and C.O.P.– Ideal cycles- Refrigerants Desirable properties – Classification - Nomenclature - ODP & GWP.

**UNIT II VAPOUR COMPRESSION REFRIGERATION SYSTEM****10**

Vapor compression cycle : p-h and T-s diagrams - deviations from theoretical cycle – subcooling and super heating- effects of condenser and evaporator pressure on COP- multipressure system - low temperature refrigeration - Cascade systems – problems. Equipments: Type of Compressors, Condensers, Expansion devices, Evaporators.

**UNIT III OTHER REFRIGERATION SYSTEMS****8**

Working principles of Vapour absorption systems and adsorption cooling systems – Steam jet refrigeration- Ejector refrigeration systems- Thermoelectric refrigeration- Air refrigeration - Magnetic - Vortex and Pulse tube refrigeration systems.

**UNIT IV PSYCHROMETRIC PROPERTIES AND PROCESSES****10**

Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temperature Thermodynamic wet bulb temperature, Psychrometric chart; Psychrometric of air-conditioning processes, mixing of air streams.

**UNIT V AIR CONDITIONING SYSTEMS AND LOAD ESTIMATION****12**

Air conditioning loads: Outside and inside design conditions; Heat transfer through structure, Solar radiation, Electrical appliances, Infiltration and ventilation, internal heat load; Apparatus selection; fresh air load, human comfort & IAQ principles, effective temperature & chart, calculation of summer & winter air conditioning load; Classifications, Layout of plants; Air distribution system; Filters; Air Conditioning Systems with Controls: Temperature, Pressure and Humidity sensors, Actuators & Safety controls.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students can able to demonstrate the operations in different Refrigeration & Air conditioning systems and also able to design Refrigeration & Air conditioning systems .

**TEXT BOOK:**

1. Arora, C.P., "Refrigeration and Air Conditioning", 3<sup>rd</sup> edition, McGraw Hill, New Delhi, 2010.

**REFERENCES:**

1. Roy J. Dossat, "Principles of Refrigeration", 4<sup>th</sup> edition, Pearson Education Asia, 2009.
2. Stoecker, W.F. and Jones J. W., "Refrigeration and Air Conditioning", McGraw Hill, New Delhi, 1986.
3. ASHRAE Hand book, Fundamentals, 2010
4. Jones W.P., "Air conditioning engineering", 5<sup>th</sup> edition, Elsevier Butterworth-Heinemann, 2001

**OBJECTIVES:**

- At the end of the course, the students are expected to identify the new methodologies / technologies for effective utilization of renewable energy sources.

**UNIT I INTRODUCTION****9**

World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilisation – Renewable Energy Scenario in Tamil nadu, India and around the World – Potentials - Achievements / Applications – Economics of renewable energy systems.

**UNIT II SOLAR ENERGY****9**

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

**UNIT III WIND ENERGY****9**

Wind Data and Energy Estimation – Types of Wind Energy Systems – Performance – Site Selection – Details of Wind Turbine Generator – Safety and Environmental Aspects

**UNIT IV BIO - ENERGY****9**

Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production – Bio diesel – Cogeneration - Biomass Applications

**UNIT V OTHER RENEWABLE ENERGY SOURCES****9**

Tidal energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro-Geothermal Energy – Hydrogen and Storage - Fuel Cell Systems – Hybrid Systems.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students can able to identify the new methodologies / technologies for effective utilization of renewable energy sources.

**TEXT BOOKS:**

1. Rai. G.D., "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 2011.
2. Twidell, J.W. & Weir, A., "Renewable Energy Sources", EFN Spon Ltd., UK, 2006.

**REFERENCES:**

1. Sukhatme. S.P., "Solar Energy", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
2. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 1996.
3. Tiwari. G.N., Solar Energy – "Fundamentals Design, Modelling & Applications", Narosa Publishing House, New Delhi, 2002.
4. Freris. L.L., "Wind Energy Conversion Systems", Prentice Hall, UK, 1990.
5. Johnson Gary, L. "Wind Energy Systems", Prentice Hall, New York, 1985
6. David M. Mousdale – "Introduction to Biofuels", CRC Press, Taylor & Francis Group, USA 2010
7. Chetan Singh Solanki, Solar Photovoltaics, "Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi, 2009.

**OBJECTIVES:**

- To learn about various unconventional machining processes, the various process parameters and their influence on performance and their applications

**UNIT I INTRODUCTION**

6

Unconventional machining Process – Need – classification – Brief overview .

**UNIT II MECHANICAL ENERGY BASED PROCESSES**

9

Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining - Ultrasonic Machining.(AJM, WJM, AWJM and USM). Working Principles – equipment used – Process parameters – MRR- Applications.

**UNIT III ELECTRICAL ENERGY BASED PROCESSES**

9

Electric Discharge Machining (EDM)- working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications.

**UNIT IV CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES**

11

Chemical machining and Electro-Chemical machining (CHM and ECM)-Etchants – Maskant - techniques of applying maskants - Process Parameters – Surface finish and MRR-Applications. Principles of ECM- equipments-Surface Roughness and MRR Electrical circuit-Process Parameters-ECG and ECH - Applications.

**UNIT V THERMAL ENERGY BASED PROCESSES**

10

Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students can able to demonstrate different unconventional machining processes and know the influence of difference process parameters on the performance and their applications.

**TEXT BOOKS:**

- Vijay.K. Jain “Advanced Machining Processes” Allied Publishers Pvt. Ltd., New Delhi, 2007
- Pandey P.C. and Shan H.S. “Modern Machining Processes” Tata McGraw-Hill, New Delhi, 2007.

**REFERENCES:**

- Benedict. G.F. “Nontraditional Manufacturing Processes”, Marcel Dekker Inc., New York, 1987.
- Mc Geough, “Advanced Methods of Machining”, Chapman and Hall, London, 1998.
- Paul De Garmo, J.T.Black, and Ronald.A.Kohser, “Material and Processes in Manufacturing” Prentice Hall of India Pvt. Ltd., 8thEdition, New Delhi , 2001.

**ME6005**

**PROCESS PLANNING AND COST ESTIMATION**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To introduce the process planning concepts to make cost estimation for various products after process planning

**UNIT I INTRODUCTION TO PROCESS PLANNING 10**

Introduction- methods of process planning-Drawing interpretation-Material evaluation – steps in process selection-.Production equipment and tooling selection

**UNIT II PROCESS PLANNING ACTIVITIES 10**

Process parameters calculation for various production processes-Selection jigs and fixtures election of quality assurance methods - Set of documents for process planning-Economics of process planning- case studies

**UNIT III INTRODUCTION TO COST ESTIMATION 8**

Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of over head charges- Calculation of depreciation cost

**UNIT IV PRODUCTION COST ESTIMATION 8**

Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop

**UNIT V MACHINING TIME CALCULATION 9**

Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations ,Drilling and Boring - Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students can able to use the concepts of process planning and cost estimation for various products.

**TEXT BOOKS:**

1. Peter scalon, “Process planning, Design/Manufacture Interface”, Elsevier science technology Books, Dec 2002.

**REFERENCES:**

1. Ostwalal P.F. and Munez J., “Manufacturing Processes and systems”, 9<sup>th</sup> Edition, John Wiley, 1998.
2. Russell R.S and Tailor B.W, “Operations Management”, 4th Edition, PHI, 2003.
3. Chitale A.V. and Gupta R.C., “Product Design and Manufacturing”, 2nd Edition, PHI, 2002.

**ME6006**

**DESIGN OF JIGS, FIXTURES AND PRESS TOOLS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To understand the functions and design principles of Jigs, fixtures and press tools
- To gain proficiency in the development of required views of the final design.

**UNIT I LOCATING AND CLAMPING PRINCIPLES: 8**

Objectives of tool design- Function and advantages of Jigs and fixtures – Basic elements – principles of location – Locating methods and devices – Redundant Location – Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and Jig buttons – Tolerances and materials used.

**UNIT II JIGS AND FIXTURES 10**

Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

**UNIT III PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES 10**

Press Working Terminologies - operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material Utilization – Shearing action – Clearances – Press Work Materials – Center of pressure- Design of various elements of dies – Die Block – Punch holder, Die set, guide plates – Stops – Strippers – Pilots – Selection of Standard parts – Design and preparation of four standard views of simple blanking, piercing, compound and progressive dies.

**UNIT IV BENDING AND DRAWING DIES 10**

Difference between bending and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back – knockouts – direct and indirect – pressure pads – Ejectors – Variables affecting Metal flow in drawing operations – draw die inserts – draw beads-ironing – Design and development of bending, forming, drawing, reverse redrawing and combination dies – Blank development for axisymmetric, rectangular and elliptic parts – Single and double action dies.

**UNIT V OTHER FORMING TECHNIQUES 7**

Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction - tooling for numerically controlled machines- setup reduction for work holding – Single minute exchange of dies – Poka Yoke.

**TOTAL: 45 PERIODS**

**Note:** (Use of P S G Design Data Book is permitted in the University examination)

**OUTCOMES:**

- Upon completion of this course, the students can able to design jigs, fixtures and press tools.

**TEXT BOOKS:**

1. Joshi, P.H. “Jigs and Fixtures”, Second Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2004.
2. Joshi P.H “Press tools - Design and Construction”, wheels publishing, 1996

**REFERENCES:**

1. Venkataraman. K., “Design of Jigs Fixtures & Press Tools”, Tata McGraw Hill, New Delhi, 2005.
2. Donaldson, Lecain and Goold “Tool Design”, 3<sup>rd</sup> Edition, Tata McGraw Hill, 2000.
3. Kempster, “Jigs and Fixture Design”, Third Edition, Hoddes and Stoughton, 1974.
4. Hoffman “Jigs and Fixture Design”, Thomson Delmar Learning, Singapore, 2004.
5. ASTME Fundamentals of Tool Design Prentice Hall of India.
6. Design Data Hand Book, PSG College of Technology, Coimbatore.

**OBJECTIVES:**

- To understand the fundamentals of composite material strength and its mechanical behavior Understanding the analysis of fiber reinforced Laminate design for different
- combinations of plies with different orientations of the fiber.
- Thermo-mechanical behavior and study of residual stresses in Laminates during processing. Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronic chips.

**UNIT I INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS & MANUFACTURING 12**

Definition –Need – General Characteristics, Applications. Fibers – Glass, Carbon, Ceramic and Aramid fibers. Matrices – Polymer, Graphite, Ceramic and Metal Matrices – Characteristics of fibers and matrices. Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix ( $Q_{ij}$ ), Typical Commercial material properties, Rule of Mixtures. Generally Orthotropic Lamina –Transformation Matrix, Transformed Stiffness. Manufacturing: Bag Moulding Compression Moulding – Pultrusion – Filament Winding – Other Manufacturing Processes

**UNIT II FLAT PLATE LAMINATE CONSTITUTE EQUATIONS 10**

Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

**UNIT III LAMINA STRENGTH ANALYSIS 5**

Introduction - Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure

**UNIT IV THERMAL ANALYSIS 8**

Assumption of Constant C.T.E's. Modification of Hooke's Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E's. C.T.E's for special Laminate Configurations – Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates

**UNIT V ANALYSIS OF LAMINATED FLAT PLATES 10**

Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students can able to analyse the fiber reinforced Laminate for optimum design
- Apply classical laminate theory to study and analyse the residual stresses in Laminate.

**TEXT BOOKS:**

1. Gibson, R.F., "Principles of Composite Material Mechanics", Second Edition, McGraw-Hill, CRC press in progress, 1994, -.
2. Hyer, M.W., "Stress Analysis of Fiber – Reinforced Composite Materials", McGraw Hill, 1998

## REFERENCES:

1. Issac M. Daniel and Ori Ishai, "Engineering Mechanics of Composite Materials", Oxford University Press-2006, First Indian Edition - 2007
2. Mallick, P.K., Fiber, "Reinforced Composites: Materials, Manufacturing and Design", Manel Dekker Inc, 1993.
3. Halpin, J.C., "Primer on Composite Materials, Analysis", Technomic Publishing Co., 1984.
4. Agarwal, B.D., and Broutman L.J., "Analysis and Performance of Fiber Composites", John Wiley and Sons, New York, 1990.
5. Mallick, P.K. and Newman, S., (edition), "Composite Materials Technology: Processes and Properties", Hansen Publisher, Munish, 1990.

**ME6008**

**WELDING TECHNOLOGY**

**L T P C**  
**3 0 0 3**

## OBJECTIVES

- To understand the basics of welding and to know about the various types of welding processes

### **UNIT I GAS AND ARC WELDING PROCESSES: 9**

Fundamental principles – Air Acetylene welding, Oxyacetylene welding, Carbon arc welding, Shielded metal arc welding, Submerged arc welding, TIG & MIG welding, Plasma arc welding and Electroslag welding processes - advantages, limitations and applications.

### **UNIT II RESISTANCE WELDING PROCESSES: 9**

Spot welding, Seam welding, Projection welding, Resistance Butt welding, Flash Butt welding, Percussion welding and High frequency resistance welding processes - advantages, limitations and applications.

### **UNIT III SOLID STATE WELDING PROCESSES: 9**

Cold welding, Diffusion bonding, Explosive welding, Ultrasonic welding, Friction welding, Forge welding, Roll welding and Hot pressure welding processes - advantages, limitations and applications.

### **UNIT IV OTHER WELDING PROCESSES: 9**

Thermit welding, Atomic hydrogen welding, Electron beam welding, Laser Beam welding, Friction stir welding, Under Water welding, Welding automation in aerospace, nuclear and surface transport vehicles.

### **UNIT V DESIGN OF WELD JOINTS, WELDABILITY AND TESTING OF WELDMENTS 9**

Various weld joint designs – Weldability of Aluminium, Copper, and Stainless steels. Destructive and non destructive testing of weldments.

**TOTAL : 45 HOURS**

## OUTCOMES:

- Upon completion of this course, the students can able to compare different types of Welding process for effective Welding of Structural components.

## TEXT BOOKS:

1. Parmer R.S., "Welding Engineering and Technology", 1<sup>st</sup> edition, Khanna Publishers, New Delhi, 2008.
2. Parmer R.S., "Welding Processes and Technology", Khanna Publishers, New Delhi, 1992.

- Little R.L., "Welding and welding Technology", Tata McGraw Hill Publishing Co., Ltd., New Delhi, 34<sup>th</sup> reprint, 2008.

#### REFERENCES:

- Schwartz M.M. "Metals Joining Manual". McGraw Hill Books, 1979.
- Tylecote R.F. "The Solid Phase Welding of Metals". Edward Arnold Publishers Ltd. London, 1968.
- AWS- Welding Hand Book. 8th Edition. Vol- 2. "Welding Process"
- Nadkarni S.V. "Modern Arc Welding Technology", 1st edition, Oxford IBH Publishers, 2005.
- Christopher Davis. "Laser Welding- Practical Guide". Jaico Publishing House, 1994.
- Davis A.C., "The Science and Practice of Welding", Cambridge University Press, Cambridge, 1993

**ME6009**

**ENERGY CONSERVATION AND MANAGEMENT**

**L T P C**  
**3 0 0 3**

#### OBJECTIVES:

At the end of the course, the student is expected to

- understand and analyse the energy data of industries
- carryout energy accounting and balancing
- conduct energy audit and suggest methodologies for energy savings and
- utilise the available resources in optimal ways

#### UNIT I INTRODUCTION

**8**

Energy - Power – Past & Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization –Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.

#### UNIT II ELECTRICAL SYSTEMS

**12**

Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.

#### UNIT III THERMAL SYSTEMS

**12**

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and encon measures. Steam: Distribution &U sage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractories

#### UNIT IV ENERGY CONSERVATION IN MAJOR UTILITIES

**8**

Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets

#### UNIT V ECONOMICS

**5**

Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept

**TOTAL: 45 PERIODS**

#### OUTCOMES:

Upon completion of this course, the students can able to analyse the energy data of industries.

- Can carryout energy accounting and balancing

- Can suggest methodologies for energy savings

#### **TEXT BOOKS:**

1. Energy Manager Training Manual (4 Volumes) available at [www.energymanagertraining.com](http://www.energymanagertraining.com), a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India, 2004.

#### **REFERENCES:**

1. Witte. L.C., P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilisation" Hemisphere Publ, Washington, 1988.
2. Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford, 1981.
3. Dryden. I.G.C., "The Efficient Use of Energy" Butterworths, London, 1982
4. Turner. W.C., "Energy Management Hand book", Wiley, New York, 1982.
5. Murphy. W.R. and G. Mc KAY, "Energy Management", Butterworths, London 1987.

**GE6083**

**DISASTER MANAGEMENT**

**L T P C**  
**3 0 0 3**

#### **OBJECTIVES:**

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

#### **UNIT I INTRODUCTION TO DISASTERS**

**9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

#### **UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)**

**9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

#### **UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT**

**9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

#### **UNIT IV DISASTER RISK MANAGEMENT IN INDIA**

**9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and





- To learn about basis of nanomaterial science, preparation method, types and application

**UNIT I INTRODUCTION 8**

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering- Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

**UNIT II GENERAL METHODS OF PREPARATION 9**

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

**UNIT III NANOMATERIALS 12**

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO<sub>2</sub>, MgO, ZrO<sub>2</sub>, NiO, nanoalumina, CaO, AgTiO<sub>2</sub>, Ferrites, Nanoclays- functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications

**UNIT IV CHARACTERIZATION TECHNIQUES 9**

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

**UNIT V APPLICATIONS 7**

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery

**TOTAL : 45 PERIODS**

**OUTCOMES**

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

**TEXT BOOKS**

1. Edelstein. A.S. and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. John Dinardo. N, "Nanoscale charecterisation of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000

**REFERENCES**

1. Timp .G, "Nanotechnology", AIP press/Springer, 1999.
2. Akhlesh Lakhtakia (Editor),"The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

**OBJECTIVES:**

- To understand the various systems, principles, operations and applications of different types of turbo machinery components.

**UNIT I PRINCIPLES 9**

Energy transfer between fluid and rotor-classification of fluid machinery,-dimensionless parameters-specific speed-applications-stage velocity triangles-work and efficiency.

**UNIT II CENTRIFUGAL FANS AND BLOWERS 9**

Types- stage and design parameters-flow analysis in impeller blades-volute and diffusers, losses, characteristic curves and selection, fan drives and fan noise.

**UNIT III CENTRIFUGAL COMPRESSOR 9**

Construction details, impeller flow losses, slip factor, diffuser analysis, losses and performance curves.

**UNIT IV AXIAL FLOW COMPRESSOR 9**

Stage velocity diagrams, enthalpy-entropy diagrams, stage losses and efficiency, work done simple stage design problems and performance characteristics.

**UNIT V AXIAL AND RADIAL FLOW TURBINES 9**

Stage velocity diagrams, reaction stages, losses and coefficients, blade design principles, testing and performance characteristics.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students can able to explain the various systems, principles and applications and different types of turbo machinery components.

**TEXT BOOKS:**

- Yahya, S.H., Turbines, Compressor and Fans, Tata McGraw Hill Publishing Company, 1996.

**REFERENCES:**

- Bruneck, Fans, Pergamom Press, 1973.
- Earl Logan, Jr., Hand book of Turbomachinery, Marcel Dekker Inc., 1992.
- Dixon, S.I., "Fluid Mechanics and Thermodynamics of Turbomachinery", Pergamon Press, 1990.
- Shepherd, D.G., "Principles of Turbomachinery", Macmillan, 1969.
- Ganesan, V., "Gas Turbines", Tata McGraw Hill Pub. Co., 1999.
- Gopalakrishnan .G and Prithvi Raj .D, "A Treatise on Turbo machines", Scifech Publications (India) Pvt. Ltd., 2002.

**OBJECTIVES:**

- To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
- To explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.
- To illustrate some of the simple instruments used for condition monitoring in industry.

**UNIT I PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING 9**

Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and benefits of sound Maintenance systems – Reliability and machine availability – MTBF, MTTR and MWT – Factors of availability – Maintenance organization – Maintenance economics.

**UNIT II MAINTENANCE POLICIES – PREVENTIVE MAINTENANCE 9**

Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repair cycle - Principles and methods of lubrication – TPM.

**UNIT III CONDITION MONITORING 9**

Condition Monitoring – Cost comparison with and without CM – On-load testing and offload testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis

**UNIT IV REPAIR METHODS FOR BASIC MACHINE ELEMENTS 10**

Repair methods for beds, slide ways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location.

**UNIT V REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT 8**

Repair methods for Material handling equipment - Equipment records –Job order systems -Use of computers in maintenance.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of the programme, the students can able to implement the maintenance function and different practices in industries for the successful management of maintenance activities
- To identify the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.

**TEXT BOOKS:**

1. Srivastava S.K., "Industrial Maintenance Management", S. Chand and Co., 1981
2. Venkataraman .K "Maintancence Engineering and Management", PHI Learning, Pvt. Ltd., 2007

**REFERENCES:**

1. Bhattacharya S.N., "Installation, Servicing and Maintenance", S. Chand and Co., 1995
2. White E.N., "Maintenance Planning", I Documentation, Gower Press, 1979.
2. Garg M.R., "Industrial Maintenance", S. Chand & Co., 1986.
3. Higgins L.R., "Maintenance Engineering Hand book", 5th Edition, McGraw Hill, 1988.
4. Armstrong, "Condition Monitoring", BSIRSA, 1988.
5. Davies, "Handbook of Condition Monitoring", Chapman & Hall, 1996.
6. "Advances in Plant Engineering and Management", Seminar Proceedings - IPE, 1996.

**OBJECTIVES**

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

**UNIT I INTRODUCTION****9**

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

**UNIT II SENSORS AND ACTUATORS-I****9**

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys

**UNIT III SENSORS AND ACTUATORS-II****9**

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

**UNIT IV MICROMACHINING****9**

Silicon Anisotropic Etching – Anisotropic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

**UNIT V POLYMER AND OPTICAL MEMS****9**

Polymers in MEMS– Polyimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

**TOTAL : 45 PERIODS****OUTCOMES**

- Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.
- Ability to understand and analyse, linear and digital electronic circuits.

**TEXT BOOKS:**

1. Chang Liu, "Foundations of MEMS", Pearson Education Inc., 2006.
2. Stephen D Senturia, "Microsystem Design", Springer Publication, 2000.
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

**REFERENCES:**

1. Nadim Maluf, " An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Boca Raton, 2000
3. Julian w. Gardner, Vijay K. Varadan, Osama O. Awadelkarim, "Micro Sensors MEMS and Smart Devices", John Wiley & Son LTD,2002
4. James J.Allen, "Micro Electro Mechanical System Design", CRC Press Publisher, 2010
5. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer 2012.

**OBJECTIVES:**

- This course will give an appreciation of the fundamental principles, design and operation of hydraulic and pneumatic machines, components and systems and their application in recent automation revolution.

**UNIT I FLUID POWER PRINCIPLES AND FUNDAMENTALS (REVIEW)****3**

Introduction to Fluid power- Advantages and Applications- Fluid power systems – Types of fluids- Properties of fluids Basics of Hydraulics – Pascal’s Law- Principles of flow – Work, Power and Torque. Properties of air– Perfect Gas Laws.

**UNIT II HYDRAULIC SYSTEM AND COMPONENTS****13**

Sources of Hydraulic power: Pumping Theory – Pump Classification- Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criterion of Linear, Rotary- Fixed and Variable displacement pumps, Hydraulic Actuators: Cylinders – Types and construction, Hydraulic motors Control Components: Direction control, Flow control and Pressure control valves- Types, Construction and Operation- Applications – Types of actuation. Accessories: Reservoirs, Accumulators, Intensifiers, Pressure Switches- Applications- Fluid Power ANSI Symbol.

**UNIT III HYDRAULIC CIRCUITS****9**

Industrial hydraulic circuits- Regenerative, Pump Unloading, Double-pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-safe, Speed control, Hydrostatic transmission, Accumulators, Electro hydraulic circuits, Mechanical Hydraulic servo systems.

**UNIT IV PNEUMATIC SYSTEM****8**

Compressors- Filter, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust valves, Pneumatic actuators, Servo systems. Introduction to Fluidics, Pneumatic logic circuits.

**UNIT V DESIGN OF HYDRALIC AND PNEMATIC CIRCUITS****12**

Design of circuits using the components of hydraulic system for Drilling, Planning, Shaping, Punching, Press. – Selection, fault finding and maintenance of hydraulic components- Sequential circuit design for simple application using cascade method, Electro pneumatic circuits. Selection criteria of pneumatic components – Installation fault finding and maintenance of pneumatic components. Microprocessor and PLC- Applications in Hydraulic and Pneumatics- Low cost Automation – Hydraulic and Pneumatic power packs.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Identify hydraulic and pneumatics components.
- Ability to design hydraulic and pneumatic circuits.

**TEXT BOOK**

- Anthony Esposito, "Fluid Power with Applications", PHI / Pearson Education, 2005.

**REFERENCES**

- Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co, 2006.
- Majumdar, S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGraw Hill, 2001
- Majumdar, S.R., "Pneumatic Systems – Principles and Maintenance", Tata McGraw Hill, 2007.
- Micheal J, Pinches and Ashby, J.G., "Power Hydraulics", Prentice Hall, 1989.
- Dudelyt, A Pease and John J Pippenger, "Basic Fluid Power", Prentice Hall, 1987.
- Srinivasan. R, "Hydraulic and Pneumatic Control", II<sup>nd</sup> Edition, Tata McGraw - Hill Education, 2012.

**OBJECTIVES:**

- To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.
- To know the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

**UNIT I INTRODUCTION****9**

Objectives and benefits of planning and control-Functions of production control-Types of production-job- batch and continuous-Product development and design-Marketing aspect - Functional aspects-Operational aspect-Durability and dependability aspect aesthetic aspect. Profit consideration-Standardization, Simplification & specialization- Break even analysis-Economics of a new design.

**UNIT II WORK STUDY****9**

Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

**UNIT III PRODUCT PLANNING AND PROCESS PLANNING****9**

Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning-Steps in process planning-Quantity determination in batch production-Machine capacity, balancing-Analysis of process capabilities in a multi product system.

**UNIT IV PRODUCTION SCHEDULING****9**

Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems - Line of balance – Flow production scheduling-Batch production scheduling-Product sequencing – Production Control systems-Periodic batch control-Material requirement planning kanban – Dispatching-Progress reporting and expediting-Manufacturing lead time-Techniques for aligning completion times and due dates.

**UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC****9**

Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system -Ordering cycle system-Determination of Economic order quantity and economic lot size-ABC analysis-Recorder procedure-Introduction to computer integrated production planning systems-elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students can able to prepare production planning and control activities such as work study, product planning, production scheduling, Inventory Control.
- They can plan manufacturing requirements manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

**TEXT BOOKS:**

1. Martand Telsang, "Industrial Engineering and Production Management", First edition, S. Chand and Company, 2000.
2. James.B.Dilworth,"Operations management – Design, Planning and Control for manufacturing and services" Mcgraw Hill International edition 1992.

**REFERENCES:**

1. Samson Eilon, "Elements of Production Planning and Control", Universal Book Corpn.1984
2. Elwood S.Buffa, and Rakesh K.Sarin, "Modern Production / Operations Management", 8<sup>th</sup> Edition, John Wiley and Sons, 2000.
3. Kanishka Bedi, " Production and Operations management", 2<sup>nd</sup> Edition, Oxford university press, 2007.
4. Melynk, Denzler, " Operations management – A value driven approach" Irwin Mcgraw hill.
5. Norman Gaither, G. Frazier, "Operations Management", 9th edition, Thomson learning IE, 2007
6. Jain. K.C & L.N. Aggarwal, "Production Planning Control and Industrial Management", Khanna Publishers, 1990.
7. Chary. S.N. "Theory and Problems in Production & Operations Management", Tata McGraw Hill, 1995.
8. Upendra Kachru, "Production and Operations Management – Text and cases", 1<sup>st</sup> Edition, Excel books 2007.

**MG6071**

**ENTREPRENEURSHIP DEVELOPMENT**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

**UNIT I ENTREPRENEURSHIP**

**9**

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur  
Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

**UNIT II MOTIVATION**

**9**

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

**UNIT III BUSINESS**

**9**

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

**UNIT IV FINANCING AND ACCOUNTING**

**9**

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.

**UNIT V SUPPORT TO ENTREPRENEURS**

**9**

Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures - Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

**TOTAL : 45 PERIODS**

**OUTCOMES :**

- Upon completion of the course, students will be able to gain knowledge and skills needed to run a business successfully.

**TEXT BOOKS :**

1. Khanka. S.S., "Entrepreneurial Development" S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.

- Donald F Kuratko, "Entrepreneurship – Theory, Process and Practice", 9<sup>th</sup> Edition, Cengage Learning, 2014.

**REFERENCES :**

- Hisrich R D, Peters M P, "Entrepreneurship" 8<sup>th</sup> Edition, Tata McGraw-Hill, 2013.
- Mathew J Manimala, "Entrepreneurship theory at cross roads: paradigms and praxis" 2<sup>nd</sup> Edition Dream tech, 2005.
- Rajeev Roy, "Entrepreneurship" 2<sup>nd</sup> Edition, Oxford University Press, 2011.
- EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development", Institute of India, Ahmadabad, 1986.

**ME6013**

**DESIGN OF PRESSURE VESSELS AND PIPING**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To understand the Mathematical knowledge to design pressure vessels and piping
- To understand the ability to carry of stress analysis in pressure vessels and piping

**UNIT I INTRODUCTION**

**3**

Methods for determining stresses – Terminology and Ligament Efficiency – Applications.

**UNIT II STRESSES IN PRESSURE VESSELS**

**15**

Introduction – Stresses in a circular ring, cylinder –Dilation of pressure vessels, Membrane stress Analysis of Vessel – Cylindrical, spherical and, conical heads – Thermal Stresses – Discontinuity stresses in pressure vessels.

**UNIT III DESIGN OF VESSELS**

**15**

Design of Tall cylindrical self supporting process columns – Supports for short vertical vessels – Stress concentration at a variable Thickness transition section in a cylindrical vessel, about a circular hole, elliptical openings. Theory of Reinforcement – Pressure Vessel Design.

**UNIT IV BUCKLING AND FRACTURE ANALYSIS IN VESSELS**

**8**

Buckling phenomenon – Elastic Buckling of circular ring and cylinders under external pressure – collapse of thick walled cylinders or tubes under external pressure – Effect of supports on Elastic Buckling of Cylinders – Buckling under combined External pressure and axial loading.

**UNIT V PIPING**

**4**

Introduction – Flow diagram – piping layout and piping stress Analysis.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students can able to apply the mathematical fundamental for the design of pressure vessels and pipes. Further they can able to analyse and design of pressure vessels and piping.

**TEXT BOOKS:**

- John F. Harvey, "Theory and Design of Pressure Vessels", CBS Publishers and Distributors, 1987.

**REFERENCES:**

1. Henry H. Bedner, "Pressure Vessels, Design Hand Book", CBS publishers and Distributors, 1987.
2. Stanley, M. Wales, "Chemical process equipment, selection and Design". Buterworths series in Chemical Engineering, 1988.
3. William. J., Bees, "Approximate Methods in the Design and Analysis of Pressure Vessels and Piping", Pre ASME Pressure Vessels and Piping Conference, 1997.
4. Sam Kannapan, "Introduction to Pipe Stress Analysis". John Wiley and Sons, 1985.

**ME6014**

**COMPUTATIONAL FLUID DYNAMICS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To introduce Governing Equations of viscous fluid flows
- To introduce numerical modeling and its role in the field of fluid flow and heat transfer
- To enable the students to understand the various discretization methods, solution procedures and turbulence modeling.
- To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers.

**UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 8**

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behaviour of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

**UNIT II FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION 9**

Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – Finite volume formulation for steady state One, Two and Three -dimensional diffusion problems –Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations – Use of Finite Difference and Finite Volume methods.

**UNIT III FINITE VOLUME METHOD FOR CONVECTION DIFFUSION 10**

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes properties of discretization schemes – Conservativeness, Boundedness, Transportiveness, Hybrid, Power-law, QUICK Schemes.

**UNIT IV FLOW FIELD ANALYSIS 9**

Finite volume methods -Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants – PISO Algorithms.

**UNIT V TURBULENCE MODELS AND MESH GENERATION 9**

Turbulence models, mixing length model, Two equation (k- ) models – High and low Reynolds number models – Structured Grid generation – Unstructured Grid generation – Mesh refinement – Adaptive mesh – Software tools.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon completion of this course, the students can able

- To create numerical modeling and its role in the field of fluid flow and heat transfer
- To use the various discretization methods, solution procedures and turbulence modeling to solve flow and heat transfer problems.

**TEXT BOOKS:**

1. Versteeg, H.K., and Malalasekera, W., "An Introduction to Computational Fluid Dynamics: The finite volume Method", Pearson Education Ltd. Second Edition, 2007.
2. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw Hill Publishing Company Ltd., 1998.

**REFERENCES:**

1. Patankar, S.V. "Numerical Heat Transfer and Fluid Flow", Hemisphere Publishing Corporation, 2004.
2. Chung, T.J. "Computational Fluid Dynamics", Cambridge University, Press, 2002.
3. Ghoshdastidar P.S., "Heat Transfer", Oxford University Press, 2005
4. Muralidhar, K., and Sundararajan, T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi, 1995.
5. ProdipNiyogi, Chakrabarty, S.K., Laha, M.K. "Introduction to Computational Fluid Dynamics", Pearson Education, 2005.
6. Anil W. Date "Introduction to Computational Fluid Dynamics" Cambridge University Press, 2005.

**ME6015****OPERATIONS RESEARCH****L T P C  
3 0 0 3****OBJECTIVES:**

- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

**UNIT I LINEAR MODELS****15**

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

**UNIT II TRANSPORTATION MODELS AND NETWORK MODELS****8**

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

**UNIT III INVENTORY MODELS****6**

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

**UNIT IV QUEUEING MODELS****6**

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

**UNIT V DECISION MODELS****10**

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students can able to use the optimization techniques for use engineering and Business problems

**TEXT BOOK:**

1. Taha H.A., "Operations Research", Sixth Edition, Prentice Hall of India, 2003.

**REFERENCES:**

1. Shennoy G.V. and Srivastava U.K., "Operation Research for Management", Wiley Eastern, 1994.
2. Bazara M.J., Jarvis and Sherali H., "Linear Programming and Network Flows", John Wiley, 1990.
3. Philip D.T. and Ravindran A., "Operations Research", John Wiley, 1992.
4. Hillier and Libeberman, "Operations Research", Holden Day, 1986
5. Budnick F.S., "Principles of Operations Research for Management", Richard D Irwin, 1990.
6. Tulsian and Pasdey V., "Quantitative Techniques", Pearson Asia, 2002.

**GE6084****HUMAN RIGHTS****L T P C  
3 0 0 3****OBJECTIVES :**

- To sensitize the Engineering students to various aspects of Human Rights.

**UNIT I****9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

**UNIT II****9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

**UNIT III****9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

**UNIT IV****9**

Human Rights in India – Constitutional Provisions / Guarantees.

**UNIT V****9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

**TOTAL : 45 PERIODS**

**OUTCOME :**

- Engineering students will acquire the basic knowledge of human rights.

**REFERENCES:**

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

**ME6016****ADVANCED I.C ENGINES****L T P C**  
**3 0 0 3****OBJECTIVES:**

- To understand the underlying principles of operation of different IC Engines and components.
- To provide knowledge on pollutant formation, control, alternate fuel etc.

**UNIT I SPARK IGNITION ENGINES****9**

Mixture requirements – Fuel injection systems – Monopoint, Multipoint & Direct injection - Stages of combustion – Normal and Abnormal combustion – Knock - Factors affecting knock – Combustion chambers.

**UNIT II COMPRESSION IGNITION ENGINES****9**

Diesel Fuel Injection Systems - Stages of combustion – Knocking – Factors affecting knock – Direct and Indirect injection systems – Combustion chambers – Fuel Spray behaviour – Spray structure and spray penetration – Air motion - Introduction to Turbocharging.

**UNIT III POLLUTANT FORMATION AND CONTROL****9**

Pollutant – Sources – Formation of Carbon Monoxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters, Selective Catalytic Reduction and Particulate Traps – Methods of measurement – Emission norms and Driving cycles.

**UNIT IV ALTERNATIVE FUELS****9**

Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - Properties, Suitability, Merits and Demerits - Engine Modifications.

**UNIT V RECENT TRENDS****9**

Air assisted Combustion, Homogeneous charge compression ignition engines – Variable Geometry turbochargers – Common Rail Direct Injection Systems - Hybrid Electric Vehicles – NOx Adsorbers - Onboard Diagnostics.

**TOTAL : 45 PERIODS****OUTCOME:**

- Upon completion of this course, the students can able to compare the operations of different IC Engine and components and can evaluate the pollutant formation, control, alternate fuel

**TEXT BOOKS:**

1. Ramalingam. K.K., "Internal Combustion Engine Fundamentals", Scitech Publications, 2002.
2. Ganesan, "Internal Combustion Engines", II Edition, TMH, 2002.

**REFERENCES:**

1. Mathur. R.B. and R.P. Sharma, "Internal Combustion Engines"., Dhanpat Rai & Sons 2007.
2. Duffy Smith, "Auto Fuel Systems", The Good Heart Willcox Company, Inc., 1987.
3. Eric Chowenitz, "Automobile Electronics", SAE Publications, 1995

**ME6017**

**DESIGN OF HEAT EXCHANGERS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To learn the thermal and stress analysis on various parts of the heat exchangers
- To analyze the sizing and rating of the heat exchangers for various applications

**UNIT I INTRODUCTION**

**9**

Types of heat exchangers, shell and tube heat exchangers – regenerators and recuperators - Temperature distribution and its implications - Parts description, Classification as per Tubular Exchanger Manufacturers Association (TEMA)

**UNIT II PROCESS DESIGN OF HEAT EXCHANGERS**

**9**

Heat transfer correlations, Overall heat transfer coefficient, analysis of heat exchangers – LMTD and effectiveness method. Sizing of finned tube heat exchangers, U tube heat exchangers, Design of shell and tube heat exchangers, fouling factors, pressure drop calculations.

**UNIT III STRESS ANALYSIS**

**9**

Stress in tubes – header sheets and pressure vessels – thermal stresses, shear stresses - types of failures, buckling of tubes, flow induced vibration.

**UNIT IV COMPACT AND PLATE HEAT EXCHANGER**

**9**

Types- Merits and Demerits- Design of compact heat exchangers, plate heat exchangers, performance influencing parameters, limitations.

**UNIT V CONDENSERS AND COOLING TOWERS**

**9**

Design of surface and evaporative condensers – cooling tower – performance characteristics.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students can able to apply the mathematical knowledge for thermal and stress analysis on various parts of the heat exchangers components.

**TEXT BOOKS:**

1. SadikKakac and Hongtan Liu, "Heat Exchangers Selection", Rating and Thermal Design, CRC Press, 2002.
2. Shah,R. K., Dušan P. Sekuli , "Fundamentals of heat exchanger design", John Wiley & Sons, 2003.

**REFERENCES:**

1. Robert W. Serth, "Process heat transfer principles and applications", Academic press, Elsevier, 2007.
2. Sarit Kumar Das, "Process heat transfer", Alpha Science International, 2005
3. John E. Hesselgreaves, "Compact heat exchangers: selection, design, and operation", Elsevier science Ltd, 2001.
4. Kuppam. T., "Heat exchanger design hand book", New York : Marcel Dekker, 2000.

5. Eric M. Smith, "Advances in thermal design of heat exchangers: a numerical approach: direct-sizing, step-wise rating, and transients", John Wiley & Sons, 1999.

**ME6018**

**ADDITIVE MANUFACTURING**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To know the principle methods, areas of usage, possibilities and limitations as well as environmental effects of the Additive Manufacturing technologies
- To be familiar with the characteristics of the different materials those are used in Additive Manufacturing.

**UNIT I INTRODUCTION**

**10**

Overview – History - Need-Classification -Additive Manufacturing Technology in product development- Materials for Additive Manufacturing Technology – Tooling - Applications.

**UNIT II CAD & REVERSE ENGINEERING**

**10**

Basic Concept – Digitization techniques – Model Reconstruction – Data Processing for Additive Manufacturing Technology: CAD model preparation – Part Orientation and support generation – Model Slicing –Tool path Generation – Softwares for Additive Manufacturing Technology: MIMICS, MAGICS.

**UNIT III LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS**

**10**

Classification – Liquid based system – Stereolithography Apparatus (SLA)- Principle, process, advantages and applications - Solid based system –Fused Deposition Modeling - Principle, process, advantages and applications, Laminated Object Manufacturing

**UNIT IV POWDER BASED ADDITIVE MANUFACTURING SYSTEMS**

**10**

Selective Laser Sintering – Principles of SLS process - Process, advantages and applications, Three Dimensional Printing - Principle, process, advantages and applications- Laser Engineered Net Shaping (LENS), Electron Beam Melting.

**UNIT V MEDICAL AND BIO-ADDITIVE MANUFACTURING**

**5**

Customized implants and prosthesis: Design and production. Bio-Additive Manufacturing- Computer Aided Tissue Engineering (CATE) – Case studies

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students can able to compare different method and discuss the effects of the Additive Manufacturing technologies and analyse the characteristics of the different materials in Additive Manufacturing.

**TEXT BOOKS:**

1. Chua C.K., Leong K.F., and Lim C.S., "Rapid prototyping: Principles and applications", Third Edition, World Scientific Publishers, 2010.
2. Gebhardt A., "Rapid prototyping", Hanser Gardener Publications, 2003.

**REFERENCES:**

1. Liou L.W. and Liou F.W., "Rapid Prototyping and Engineering applications : A tool box for prototype development", CRC Press, 2007.



2. Ravi Prakash, "Non-Destructive Testing Techniques", 1st revised edition, New Age International Publishers, 2010

**REFERENCES:**

1. ASM Metals Handbook,"Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17.
2. Paul E Mix, "Introduction to Non-destructive testing: a training guide", Wiley, 2<sup>nd</sup> Edition New Jersey, 2005
3. Charles, J. Hellier," Handbook of Nondestructive evaluation", McGraw Hill, New York 2001.
4. ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NDT Handbook,Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing, Vol. 5, Electromagnetic Testing, Vol. 6, Acoustic Emission Testing, Vol. 7, Ultrasonic Testing

**ME6020**

**VIBRATION AND NOISE CONTROL**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- The student will be able to understand the sources of vibration and noise in automobiles and make design modifications to reduce the vibration and noise and improve the life of the components

**UNIT I BASICS OF VIBRATION**

**9**

Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies.

**UNIT II BASICS OF NOISE**

**9**

Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis.

**UNIT III AUTOMOTIVE NOISE SOURCES**

**9**

Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine necessary contributed noise, transmission noise, aerodynamic noise, tire noise, brake noise.

**UNIT IV CONTROL TECHNIQUES**

**9**

Vibration isolation, tuned absorbers, un-tuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

**UNIT V SOURCE OF NOISE AND CONTROL**

**9**

Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Understanding causes, source and types of vibrations in machineries
- Gaining knowledge in sources and measurement standard of noise
- Ability to design and develop vibrations and noise control systems.

**TEXT BOOKS:**

1. Singiresu S.Rao, "Mechanical Vibrations", 5<sup>th</sup> Edition, Pearson Education, 2010

**REFERENCES:**

1. Benson H. Tongue, "Principles of Vibrations", 2<sup>nd</sup> Edition, Oxford University, 2007
2. David Bies and Colin Hansen, "Engineering Noise Control – Theory and Practice", 4<sup>th</sup> Edition, E and FN Spon, Taylore & Francise e-Library, 2009
3. William T. Thomson, Marie Dillon Dahleh, Chandramouli Padmanabhan, "**Theory of Vibration with Application**", 5<sup>th</sup> Edition Pearson Education, 2011
4. Grover. G.T., "Mechanical Vibrations", Nem Chand and Bros., 1996
5. Bernard Challen and Rodica Baranescu - "Diesel Engine Reference Book", Second Edition, SAE International, 1999.
6. Julian Happian-Smith - "An Introduction to Modern Vehicle Design"- Butterworth-Heinemann, 2004
7. Rao, J.S and Gupta, K., "Introductory course on Theory and Practice of Mechanical Vibration", 2<sup>nd</sup> Edition, New Age International Publications, 2010
8. Shabana. A.A., "Theory of vibrations – An introduction", 2<sup>nd</sup> Edition, Springer, 2010
9. Balakumar Balachandran and Edward B. Magrab, "Fundamentals of Vibrations", 1<sup>st</sup> Editon, Cengage Learning, 2009
10. John Fenton, "Handbook of Automotive body Construction and Design Analysis – Professional Engineering Publishing, 1998

**ANNA UNIVERSITY, CHENNAI**  
**AFFILIATED INSTITUTIONS**  
**R - 2013**  
**B.E. MECHATRONICS ENGINEERING**  
**I – VIII SEMESTERS CURRICULUM AND SYLLABUS**

**SEMESTER I**

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	HS6151	<u>Technical English – I</u>	3	1	0	4
2.	MA6151	<u>Mathematics – I</u>	3	1	0	4
3.	PH6151	<u>Engineering Physics – I</u>	3	0	0	3
4.	CY6151	<u>Engineering Chemistry – I</u>	3	0	0	3
5.	GE6151	<u>Computer Programming</u>	3	0	0	3
6.	GE6152	<u>Engineering Graphics</u>	2	0	3	4
<b>PRACTICALS</b>						
7.	GE6161	<u>Computer Practices Laboratory</u>	0	0	3	2
8.	GE6162	<u>Engineering Practices Laboratory</u>	0	0	3	2
9.	GE6163	<u>Physics and Chemistry Laboratory - I</u>	0	0	2	1
<b>TOTAL</b>			<b>17</b>	<b>2</b>	<b>11</b>	<b>26</b>

**SEMESTER II**

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	HS6251	<u>Technical English – II</u>	3	1	0	4
2.	MA6251	<u>Mathematics – II</u>	3	1	0	4
3.	PH6251	<u>Engineering Physics – II</u>	3	0	0	3
4.	CY6251	<u>Engineering Chemistry – II</u>	3	0	0	3
5.	GE6252	<u>Basic Electrical and Electronics Engineering</u>	4	0	0	4
6.	GE6253	<u>Engineering Mechanics</u>	3	1	0	4
<b>PRACTICALS</b>						
7.	GE6261	<u>Computer Aided Drafting and Modeling Laboratory</u>	0	1	2	2
8.	GE6262	<u>Physics and Chemistry Laboratory - II</u>	0	0	2	1
<b>TOTAL</b>			<b>19</b>	<b>4</b>	<b>4</b>	<b>25</b>

### SEMESTER III

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MA6351	<u>Transforms and Partial Differential Equations</u>	3	1	0	4
2.	CE6306	<u>Strength of Materials</u>	3	1	0	4
3.	CE6451	<u>Fluid Mechanics and Machinery</u>	3	0	0	3
4.	EC6302	<u>Digital Electronics</u>	3	0	0	3
5.	EE6358	<u>Electrical Machines and Drives</u>	3	0	0	3
6.	ME6401	<u>Kinematics of Machinery</u>	3	0	0	3
<b>PRACTICALS</b>						
7.	CE6461	<u>Fluid Mechanics and Machinery Laboratory</u>	0	0	3	2
8.	EE6362	<u>Electrical Machines and Drives Laboratory</u>	0	0	3	2
9.	MT6311	<u>Computer Aided Machine Drawing</u>	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>2</b>	<b>9</b>	<b>26</b>

### SEMESTER IV

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MA6452	<u>Statistics and Numerical Methods</u>	3	1	0	4
2.	ME6505	<u>Dynamics of Machines</u>	3	0	0	3
3.	EC6405	<u>Control System Engineering</u>	3	0	0	3
4.	ME6352	<u>Manufacturing Technology</u>	3	0	0	3
5.	ME6504	<u>Metrology and Measurements</u>	3	0	0	3
6.	MT6401	<u>Microprocessors and Applications</u>	3	0	0	3
<b>PRACTICALS</b>						
7.	MT6411	<u>Microprocessor Laboratory</u>	0	0	3	2
8.	ME6465	<u>Manufacturing Technology Laboratory</u>	0	0	3	2
9.	ME6511	<u>Dynamics Laboratory</u>	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>1</b>	<b>9</b>	<b>25</b>

**SEMESTER V**

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	ME6503	<u>Design of Machine Elements</u>	3	0	0	3
2.	EE6503	<u>Power Electronics</u>	3	0	0	3
3.	MT6501	<u>Sensors and Signal Processing</u>	3	0	0	3
4.	GE6351	<u>Environmental Science and Engineering</u>	3	0	0	3
5.	MF6505	<u>CNC Machining Technology</u>	3	0	0	3
6.	MT6502	<u>Thermodynamics Principles and Applications</u>	3	0	0	3
<b>PRACTICALS</b>						
7.	MT6511	<u>Power Electronics Laboratory</u>	0	0	3	2
8.	MT6512	<u>Sensors and Signal Processing Laboratory</u>	0	0	3	2
9.	MT6513	<u>CNC Laboratory</u>	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>0</b>	<b>9</b>	<b>24</b>

**SEMESTER VI**

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MG6851	<u>Principles of Management</u>	3	0	0	3
2.	MT6601	<u>Micro Controller and PLC</u>	3	0	0	3
3.	MT6602	<u>Applied Hydraulics and Pneumatics</u>	3	0	0	3
4.	MT6603	<u>Design of Mechatronics System</u>	3	0	0	3
5.	MT6604	<u>Object Oriented Programming in C++</u>	3	0	0	3
6.		Elective – I	3	0	0	3
<b>PRACTICALS</b>						
7.	MT6611	<u>Micro Controller and PLC Laboratory</u>	0	0	3	2
8.	MT6612	<u>Object Oriented Programming Laboratory</u>	0	0	3	2
9.	MT6613	<u>Applied Hydraulics and Pneumatics Laboratory</u>	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>0</b>	<b>9</b>	<b>24</b>

**SEMESTER VII**

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MT6701	<u>Medical Mechatronics</u>	3	0	0	3
2.	MT6702	<u>Modeling and Simulation</u>	3	0	0	3
3.	MT6703	<u>Robotics and Machine Vision System</u>	3	0	0	3
4.	ME6602	<u>Automobile Engineering</u>	3	0	0	3
5.		Elective – II	3	0	0	3
6.		Elective - III	3	0	0	3
<b>PRACTICALS</b>						
7.	MT6711	<u>Computer Aided Design and Computer Aided Manufacturing Laboratory</u>	0	0	3	2
8.	MT6712	<u>Robotics Laboratory</u>	0	0	3	2
9.	MT6713	<u>Design and Fabrication Project</u>	0	0	4	2
<b>TOTAL</b>			<b>18</b>	<b>0</b>	<b>10</b>	<b>24</b>

### SEMESTER VIII

SL. No.	COURSE CODE.	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MT6801	<u>Automotive Electronics</u>	3	0	0	3
2.		Elective - IV	3	0	0	3
3.		Elective – V	3	0	0	3
<b>PRACTICAL</b>						
4.	MT6811	<u>Project Work</u>	0	0	12	6
<b>TOTAL</b>			<b>9</b>	<b>0</b>	<b>12</b>	<b>15</b>

**TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE : 189**

### LIST OF ELECTIVES FOR B.E. MECHATRONICS ENGINEERING

#### SEMESTER VI Elective I

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	MT6001	<u>Advanced Manufacturing Technology</u>	3	0	0	3
2.	GE6757	<u>Total Quality Management</u>	3	0	0	3
3.	IT6502	<u>Digital Signal Processing</u>	3	1	0	4
4.	IE6011	<u>Product Design and Development</u>	3	0	0	3

#### SEMESTER VII Elective II

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	MT6002	<u>Diagnostic Techniques</u>	3	0	0	3
2.	MG6072	<u>Marketing Management</u>	3	0	0	3
3.	MT6003	<u>Engineering Economics and Cost Analysis</u>	3	0	0	3
4.	GE6084	Human Rights	3	0	0	3

#### Elective III

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	MT6004	<u>Industrial Electronics and Applications</u>	3	0	0	3
2.	ME6501	<u>Computer Aided Design</u>	3	0	0	3
3.	IT6005	<u>Digital Image Processing</u>	3	0	0	3
4.	EE6007	<u>Micro Electro Mechanical Systems</u>	3	0	0	3

**SEMESTER VIII**

**Elective IV**

<b>SL. No.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1.	MF6009	<u>Rapid Prototyping</u>	3	0	0	3
2.	MT6005	<u>Virtual Instrumentation</u>	3	0	0	3
3.	ME6015	<u>Operations Research</u>	3	0	0	3
4.	MG6071	<u>Entrepreneurship Development</u>	3	0	0	3

**Elective V**

<b>SL. No.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1.	GE6075	<u>Professional Ethics in Engineering</u>	3	0	0	3
2.	MG6088	<u>Software Project Management</u>	3	0	0	3
3.	CS6302	<u>Database Management Systems</u>	3	0	0	3
4.	CS6551	<u>Computer Networks</u>	3	0	0	3
5.	GE6083	<u>Disaster Management</u>	3	0	0	3

**OBJECTIVES:**

- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.

**UNIT I****9+3**

Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one's place, important festivals etc. – Introducing oneself, one's family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one's leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words - Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

**UNIT II****9+3**

Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking and answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Process descriptions (general/specific) - Definitions - Recommendations – Instructions; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association (connotation); E-materials - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

**UNIT III****9+3**

Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading - Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause and effect / compare and contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

**UNIT IV****9+3**

Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations and acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.

## UNIT V

9+3

Listening - Listening to different accents, Listening to Speeches/Presentations, Listening to broadcast and telecast from Radio and TV; Speaking - Giving impromptu talks, Making presentations on given topics; Reading - Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email; Writing - Creative writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items (fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar and Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents - Interpreting posters.

**TOTAL (L:45+T:15): 60 PERIODS**

### OUTCOMES:

Learners should be able to

- Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- Read different genres of texts adopting various reading strategies.
- Listen/view and comprehend different spoken discourses/excerpts in different accents

### TEXTBOOKS:

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

### REFERENCES:

1. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice. Oxford University Press, New Delhi. 2011.
2. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi. 2006.
3. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005
4. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi. 2001.
5. Viswamohan, Aysha. English for Technical Communication. Tata McGraw-Hill, New Delhi. 2008.

### EXTENSIVE Reading (Not for Examination)

1. Kalam, Abdul. Wings of Fire. Universities Press, Hyderabad. 1999.

### WEBSITES:

1. <http://www.usingenglish.com>
2. <http://www.uefap.com>

### TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like self introduction, peer introduction, group poster making, grammar and vocabulary games, etc.
- Discussions
- Role play activities
- Short presentations
- Listening and viewing activities with follow up activities like discussion, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc.

## EVALUATION PATTERN:

### Internal assessment: 20%

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Reviews
- Creative writing
- Poster making, etc.

All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual speaking activities, Pair work activities like role play, Interview, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded from simple to complex, from direct to inferential
- ✓ Writing assessment: Writing paragraphs, essays etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content.

### End Semester Examination: 80%

MA6151

MATHEMATICS – I

L T P C  
3 1 0 4

### OBJECTIVES:

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

### UNIT I MATRICES

9+3

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

### UNIT II SEQUENCES AND SERIES

9+3

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test, Integral test and D'Alembert's ratio test – Alternating series – Leibnitz's test – Series of positive and negative terms – Absolute and conditional convergence.

**UNIT III APPLICATIONS OF DIFFERENTIAL CALCULUS 9+3**  
Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals.

**UNIT IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES 9+3**  
Limits and Continuity – Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor’s series for functions of two variables – Maxima and minima of functions of two variables – Lagrange’s method of undetermined multipliers.

**UNIT V MULTIPLE INTEGRALS 9+3**  
Double integrals in cartesian and polar coordinates – Change of order of integration – Area enclosed by plane curves – Change of variables in double integrals – Area of a curved surface - Triple integrals – Volume of Solids.

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES:**

- This course equips students to have basic knowledge and understanding in one fields of materials, integral and differential calculus.

**TEXT BOOKS:**

1. Bali N. P and Manish Goyal, “A Text book of Engineering Mathematics”, Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
2. Grewal. B.S, “Higher Engineering Mathematics”, 41<sup>st</sup> Edition, Khanna Publications, Delhi, 2011.

**REFERENCES:**

1. Dass, H.K., and Er. Rajnish Verma, “Higher Engineering Mathematics”, S. Chand Private Ltd., 2011.
2. Glyn James, “Advanced Modern Engineering Mathematics”, 3<sup>rd</sup> Edition, Pearson Education, 2012.
3. Peter V. O’Neil, “Advanced Engineering Mathematics”, 7th Edition, Cengage learning, 2012.
4. Ramana B.V, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., “Engineering Mathematics”, Volume I, Second Edition, PEARSON Publishing, 2011.

**PH6151 ENGINEERING PHYSICS – I L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

**UNIT I CRYSTAL PHYSICS 9**  
Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment) - Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)



**OBJECTIVES:**

- To make the students conversant with basics of polymer chemistry.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- To acquaint the students with the basics of nano materials, their properties and applications.

**UNIT I POLYMER CHEMISTRY 9**

Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: T<sub>g</sub>, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Preparation, properties and uses of Nylon 6,6, and Epoxy resin.

**UNIT II CHEMICAL THERMODYNAMICS 9**

Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions (problems); Criteria of spontaneity; Gibbs-Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore(problems).

**UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY 9**

Photochemistry: Laws of photochemistry - Grotthuss-Draper law, Stark-Einstein law and Lambert-Beer Law. Quantum efficiency – determination- Photo processes - Internal Conversion, Inter-system crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitization. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram only).

**UNIT IV PHASE RULE AND ALLOYS 9**

Phase rule: Introduction, definition of terms with examples, One Component System- water system - Reduced phase rule - Two Component Systems- classification – lead-silver system, zinc-magnesium system. Alloys: Introduction- Definition- Properties of alloys- Significance of alloying, Functions and effect of alloying elements- Ferrous alloys- Nichrome and Stainless steel – heat treatment of steel; Non-ferrous alloys – brass and bronze.

**UNIT V NANO CHEMISTRY 9**

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: nano cluster, nano rod, nanotube(CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrode position, chemical vapour deposition, laser ablation; Properties and applications

**TOTAL :45 PERIODS****OUTCOMES:**

- The knowledge gained on polymer chemistry, thermodynamics. spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these subjects for further learning.

**TEXT BOOKS:**

1. Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010
2. Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009

**REFERENCES:**

1. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.
3. Gowariker V.R. , Viswanathan N.V. and JayadevSreedhar, "Polymer Science", New Age International P (Ltd.), Chennai, 2006.
4. Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.

**GE6151****COMPUTER PROGRAMMING****L T P C  
3 0 0 3****OBJECTIVES:****The students should be made to:**

- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

**UNIT I INTRODUCTION****8**

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

**UNIT II C PROGRAMMING BASICS****10**

Problem formulation – Problem Solving - Introduction to 'C' programming –fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

**UNIT III ARRAYS AND STRINGS****9**

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

**UNIT IV FUNCTIONS AND POINTERS****9**

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

## UNIT V STRUCTURES AND UNIONS

9

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

**TOTAL: 45 PERIODS**

### OUTCOMES:

**At the end of the course, the student should be able to:**

- Design C Programs for problems.
- Write and execute C programs for simple applications.

### TEXTBOOKS:

1. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009
3. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.

### REFERENCES:

1. Byron S Gottfried, "Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.
2. Dromey R.G., "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007.
3. Kernighan, B.W and Ritchie, D.M, "The C Programming language", Second Edition, Pearson Education, 2006.

**GE6152**

**ENGINEERING GRAPHICS**

**L T P C**  
**2 0 3 4**

### OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

### CONCEPTS AND CONVENTIONS (Not for Examination)

**1**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

### UNIT I PLANE CURVES AND FREE HAND SKETCHING

**5+9**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

### UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES

**5+9**

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

**UNIT III PROJECTION OF SOLIDS****5+9**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

**UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES****5+9**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

**UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS****6+9**

Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

**COMPUTER AIDED DRAFTING (Demonstration Only)****3**

Introduction to drafting packages and demonstration of their use.

**TOTAL: 75 PERIODS****OUTCOMES:**

On Completion of the course the student will be able to

- perform free hand sketching of basic geometrical constructions and multiple views of objects.
- do orthographic projection of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- prepare isometric and perspective sections of simple solids.
- demonstrate computer aided drafting.

**TEXT BOOK:**

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50<sup>th</sup> Edition, 2010.

**REFERENCES:**

1. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
2. Luzzader, Warren.J. and Duff, John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2<sup>nd</sup> Edition, 2009.
4. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.
5. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

**Publication of Bureau of Indian Standards:**

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

**Special points applicable to University Examinations on Engineering Graphics:**

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

**GE6161**

**COMPUTER PRACTICES LABORATORY**

**L T P C**  
**0 0 3 2**

**OBJECTIVES:**

**The student should be made to:**

- Be familiar with the use of Office software.
- Be exposed to presentation and visualization tools.
- Be exposed to problem solving techniques and flow charts.
- Be familiar with programming in C.
- Learn to use Arrays, strings, functions, structures and unions.

**LIST OF EXPERIMENTS:**

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions – Includes Parameter Passing
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.
- Develop recursive programs.

**LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:**

Standalone desktops with C compiler      30 Nos.

(or)

Server with C compiler supporting 30 terminals or more.

**OBJECTIVES:**

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

**GROUP A (CIVIL & MECHANICAL)****I CIVIL ENGINEERING PRACTICE****9****Buildings:**

- (a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

**Plumbing Works:**

- (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- (b) Study of pipe connections requirements for pumps and turbines.
- (c) Preparation of plumbing line sketches for water supply and sewage works.
- (d) Hands-on-exercise:  
Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
- (e) Demonstration of plumbing requirements of high-rise buildings.

**Carpentry using Power Tools only:**

- (a) Study of the joints in roofs, doors, windows and furniture.
- (b) Hands-on-exercise:

Wood work, joints by sawing, planing and cutting.

**II MECHANICAL ENGINEERING PRACTICE****13****Welding:**

- (a) Preparation of arc welding of butt joints, lap joints and tee joints.
- (b) Gas welding practice

**Basic Machining:**

- (a) Simple Turning and Taper turning
- (b) Drilling Practice

**Sheet Metal Work:**

- (a) Forming & Bending:
- (b) Model making – Trays, funnels, etc.
- (c) Different type of joints.

**Machine assembly practice:**

- (a) Study of centrifugal pump
- (b) Study of air conditioner

**Demonstration on:**

- (a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
- (b) Foundry operations like mould preparation for gear and step cone pulley.
- (c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

## GROUP B (ELECTRICAL & ELECTRONICS)

- III ELECTRICAL ENGINEERING PRACTICE** **10**
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
  2. Fluorescent lamp wiring.
  3. Stair case wiring
  4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
  5. Measurement of energy using single phase energy meter.
  6. Measurement of resistance to earth of an electrical equipment.
- IV ELECTRONICS ENGINEERING PRACTICE** **13**
1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
  2. Study of logic gates AND, OR, EOR and NOT.
  3. Generation of Clock Signal.
  4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
  5. Measurement of ripple factor of HWR and FWR.

**TOTAL: 45 PERIODS**

### **OUTCOMES:**

- ability to fabricate carpentry components and pipe connections including plumbing works.
- ability to use welding equipments to join the structures.
- ability to fabricate electrical and electronics circuits.

### **REFERENCES:**

1. Jeyachandran K., Natarajan S. & Balasubramanian S., “A Primer on Engineering Practices Laboratory”, Anuradha Publications, 2007.
2. Jeyapooan T., Saravanapandian M. & Pranitha S., “Engineering Practices Lab Manual”, Vikas PUBLISHING House Pvt.Ltd, 2006.
3. Bawa H.S., “Workshop Practice”, Tata McGraw – Hill Publishing Company Limited, 2007.
4. Rajendra Prasad A. & Sarma P.M.M.S., “Workshop Practice”, Sree Sai Publication, 2002.
5. Kannaiah P. & Narayana K.L., “Manual on Workshop Practice”, Scitech Publications, 1999.

### **LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

#### **CIVIL**

- |   |          |
|---|----------|
| 1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. | 15 Sets. |
| 2. Carpentry vice (fitted to work bench)  | 15 Nos.  |
| 3. Standard woodworking tools   | 15 Sets. |
| 4. Models of industrial trusses, door joints, furniture joints  | 5 each   |
| 5. Power Tools: (a) Rotary Hammer   | 2 Nos    |
| (b) Demolition Hammer   | 2 Nos    |
| (c) Circular Saw  | 2 Nos    |
| (d) Planer  | 2 Nos    |
| (e) Hand Drilling Machine   | 2 Nos    |
| (f) Jigsaw  | 2 Nos    |

## MECHANICAL

- |   |           |
|---|-----------|
| 1. Arc welding transformer with cables and holders                            | 5 Nos.    |
| 2. Welding booth with exhaust facility  | 5 Nos.    |
| 3. Welding accessories like welding shield, chipping hammer, wire brush, etc. | 5 Sets.   |
| 4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.    | 2 Nos.    |
| 5. Centre lathe   | 2 Nos.    |
| 6. Hearth furnace, anvil and smithy tools                                     | 2 Sets.   |
| 7. Moulding table, foundry tools  | 2 Sets.   |
| 8. Power Tool: Angle Grinder  | 2 Nos     |
| 9. Study-purpose items: centrifugal pump, air-conditioner                     | One each. |

## ELECTRICAL

- |  |         |
|--|---------|
| 1. Assorted electrical components for house wiring                         | 15 Sets |
| 2. Electrical measuring instruments  | 10 Sets |
| 3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each |         |
| 4. Megger (250V/500V)  | 1 No.   |
| 5. Power Tools: (a) Range Finder   | 2 Nos   |
| (b) Digital Live-wire detector   | 2 Nos   |

## ELECTRONICS

- |   |         |
|---|---------|
| 1. Soldering guns   | 10 Nos. |
| 2. Assorted electronic components for making circuits                 | 50 Nos. |
| 3. Small PCBs   | 10 Nos. |
| 4. Multimeters  | 10 Nos. |
| 5. Study purpose items: Telephone, FM radio, low-voltage power supply |         |

**GE6163**

**PHYSICS AND CHEMISTRY LABORATORY – I**

**L T P C**  
**0 0 2 1**

**PHYSICS LABORATORY – I**

### OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

### LIST OF EXPERIMENTS

(Any FIVE Experiments)

- (a) Determination of Wavelength, and particle size using Laser  
(b) Determination of acceptance angle in an optical fiber.
- Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
- Determination of wavelength of mercury spectrum – spectrometer grating
- Determination of thermal conductivity of a bad conductor – Lee's Disc method.
- Determination of Young's modulus by Non uniform bending method
- Determination of specific resistance of a given coil of wire – Carey Foster's Bridge

**OUTCOMES:**

- The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Diode laser, lycopodium powder, glass plate, optical fiber.
2. Ultrasonic interferometer
3. Spectrometer, mercury lamp, grating
4. Lee's Disc experimental set up
5. Traveling microscope, meter scale, knife edge, weights
6. Carey foster's bridge set up  
(vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

**CHEMISTRY LABORATORY- I****OBJECTIVES:**

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by vacometry.

**LIST OF EXPERIMENTS**

(Any FIVE Experiments)

- 1 Determination of DO content of water sample by Winkler's method.
- 2 Determination of chloride content of water sample by argentometric method.
- 3 Determination of strength of given hydrochloric acid using pH meter.
- 4 Determination of strength of acids in a mixture using conductivity meter.
- 5 Estimation of iron content of the water sample using spectrophotometer.  
(1,10- phenanthroline / thiocyanate method).
- 6 Determination of molecular weight of polyvinylalcohol using Ostwald viscometer.
- 7 Conductometric titration of strong acid vs strong base.

**TOTAL: 30 PERIODS**

**OUTCOMES:**

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

**REFERENCES:**

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York 2001.
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry", LBS Singapore 1994.
3. Jeffery G.H., Bassett J., Mendham J. and Denny vogel's R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Iodine flask	-	30 Nos
2. pH meter	-	5 Nos
3. Conductivity meter	-	5 Nos
4. Spectrophotometer	-	5 Nos
5. Ostwald Viscometer	-	10 Nos

**Common Apparatus : Pipette, Burette, conical flask, porcelain tile, dropper (each 30 Nos.)**

**OBJECTIVES:**

- To make learners acquire listening and speaking skills in both formal and informal contexts.
- To help them develop their reading skills by familiarizing them with different types of reading strategies.
- To equip them with writing skills needed for academic as well as workplace contexts.
- To make them acquire language skills at their own pace by using e-materials and language lab components.

**UNIT I****9+3**

Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on topics like weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; Writing - Effective use of SMS for sending short notes and messages - Using 'emojicons' as symbols in email messages; Grammar - Regular and irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. 'can') - Homophones (e.g. 'some', 'sum'); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

**UNIT II****9+3**

Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercises on Grammar and vocabulary, Extensive reading activity (reading stories / novels), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students' dialogues.

**UNIT III****9+3**

Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret, etc.); Reading - Speed reading – reading passages with time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading articles from journals - Format for journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. 'rock', 'train', 'ring'); E-materials - Interactive exercise on Grammar and vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU and RIE materials – Attending a meeting and writing minutes.

**UNIT IV****9+3**

Listening - Listening to a telephone conversation, Viewing model interviews (face-to-face, telephonic and video conferencing); Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary - Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on

Grammar and Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

## **UNIT V**

**9+3**

Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading; Writing – Checklist - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; E-materials - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises; Language Lab - Different models of group discussion.

**TOTAL (L:45+T:15): 60 PERIODS**

### **OUTCOMES:**

Learners should be able to

- Speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies.
- Write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
- Read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
- Listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

### **TEXTBOOKS:**

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

### **REFERENCES:**

1. Anderson, Paul V. Technical Communication: A Reader-Centered Approach. Cengage. New Delhi. 2008
2. Muralikrishna, & Sunita Mishra. Communication Skills for Engineers. Pearson, New Delhi. 2011
3. Riordan, Daniel. G. Technical Communication. Cengage Learning, New Delhi. 2005
4. Sharma, Sangeetha & Binod Mishra. Communication Skills for Engineers and Scientists. PHI Learning, New Delhi. 2009
5. Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA. 2007

### **EXTENSIVE Reading (Not for Examination)**

1. Khera, Shiv. You can Win. Macmillan, Delhi. 1998.

### **Websites**

1. <http://www.englishclub.com>
2. <http://owl.english.purdue.edu>

## TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like individual writing and presentations, group discussions, interviews, reporting, etc
- Long presentations using visual aids
- Listening and viewing activities with follow up activities like discussions, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc
- Projects like group reports, mock interviews etc using a combination of two or more of the language skills

## EVALUATION PATTERN:

### Internal assessment: 20%

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Report
- Creative writing, etc.

All the four skills are to be tested with equal weightage given to each.

- ✓ Speaking assessment: Individual presentations, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded following Bloom's taxonomy
- ✓ Writing assessment: Writing essays, CVs, reports etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content graded following Bloom's taxonomy.

### End Semester Examination: 80%

MA6251

MATHEMATICS – II

L T P C  
3 1 0 4

## OBJECTIVES:

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

## UNIT I VECTOR CALCULUS

9+3

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

**UNIT II ORDINARY DIFFERENTIAL EQUATIONS****9+3**

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

**UNIT III LAPLACE TRANSFORM****9+3**

Laplace transform – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Transforms of unit step function and impulse functions – Transform of periodic functions. Inverse Laplace transform -Statement of Convolution theorem – Initial and final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

**UNIT IV ANALYTIC FUNCTIONS****9+3**

Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping:  $w = z+k$ ,  $kz$ ,  $1/z$ ,  $z^2$ ,  $e^z$  and bilinear transformation.

**UNIT V COMPLEX INTEGRATION****9+3**

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor's and Laurent's series expansions – Singular points – Residues – Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES:**

- The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.

**TEXT BOOKS:**

1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd.,2011.
2. Grewal. B.S, "Higher Engineering Mathematics", 41<sup>st</sup> Edition, Khanna Publications, Delhi, 2011.

**REFERENCES:**

1. Dass, H.K., and Er. Rajnish Verma," Higher Engineering Mathematics", S. Chand Private Ltd., 2011
2. Glyn James, "Advanced Modern Engineering Mathematics", 3<sup>rd</sup> Edition, Pearson Education, 2012.
3. Peter V. O'Neil," Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.
4. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., "Engineering Mathematics" Volume II, Second Edition, PEARSON Publishing, 2011.

**OBJECTIVES:**

- To enrich the understanding of various types of materials and their applications in engineering and technology.

**UNIT I CONDUCTING MATERIALS****9**

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

**UNIT II SEMICONDUCTING MATERIALS****9**

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

**UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS****9**

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications

Superconductivity: properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High  $T_c$  superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

**UNIT IV DIELECTRIC MATERIALS****9**

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Clausius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

**UNIT V ADVANCED ENGINEERING MATERIALS****9**

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications

**TOTAL: 45 PERIODS****OUTCOMES:**

- The students will have the knowledge on physics of materials and that knowledge will be used by them in different engineering and technology applications.

**TEXT BOOKS:**

- Arumugam M., Materials Science. Anuradha publishers, 2010
- Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009

**REFERENCES:**

- Palanisamy P.K. Materials Science. SCITECH Publishers, 2011
- Senthilkumar G. Engineering Physics II. VRB Publishers, 2011
- Mani P. Engineering Physics II. Dhanam Publications, 2011
- Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009

**OBJECTIVES:**

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- Principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.

**UNIT I WATER TECHNOLOGY****9**

Introduction to boiler feed water-requirements-formation of deposits in steam boilers and heat exchangers- disadvantages (wastage of fuels, decrease in efficiency, boiler explosion) prevention of scale formation -softening of hard water -external treatment zeolite and demineralization - internal treatment- boiler compounds (phosphate, calgon, carbonate, colloidal) - caustic embrittlement -boiler corrosion-priming and foaming- desalination of brackish water –reverse osmosis.

**UNIT II ELECTROCHEMISTRY AND CORROSION****9**

Electrochemical cell - redox reaction, electrode potential- origin of electrode potential- oxidation potential- reduction potential, measurement and applications - electrochemical series and its significance - Nernst equation (derivation and problems). Corrosion- causes- factors- types- chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Paints- constituents and function. Electroplating of Copper and electroless plating of nickel.

**UNIT III ENERGY SOURCES****9**

Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion- differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells:Types of batteries- alkaline battery- lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H<sub>2</sub> -O<sub>2</sub> fuel cell- applications.

**UNIT IV ENGINEERING MATERIALS****9**

Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties – refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Portland cement- manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement–properties and uses. Glass - manufacture, types, properties and uses.

**UNIT V FUELS AND COMBUSTION****9**

Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- coal-analysis of coal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) - petroleum- manufacture of synthetic petrol (Bergius process)- knocking-octane number - diesel oil- cetane number - natural gas- compressed natural gas(CNG)- liquefied petroleum gases(LPG)- producer gas- water gas. Power alcohol and bio diesel. Combustion of fuels: introduction- theoretical calculation of calorific value- calculation of stoichiometry of fuel and air ratio- ignition temperature- explosive range - flue gas analysis (ORSAT Method).

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

**TEXT BOOKS:**

1. Vairam S, Kalyani P and SubaRamesh., "Engineering Chemistry"., Wiley India PvtLtd., New Delhi., 2011
2. DaraS.S, UmareS.S. "Engineering Chemistry", S. Chand & Company Ltd., New Delhi , 2010

**REFERENCES:**

- 1 Kannan P. and Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009
2. AshimaSrivastava and Janhavi N N., "Concepts of Engineering Chemistry", ACME Learning Private Limited., New Delhi., 2010.
3. RenuBapna and Renu Gupta., "Engineering Chemistry", Macmillan India Publisher Ltd., 2010.
4. Pahari A and Chauhan B., "Engineering Chemistry"., Firewall Media., New Delhi., 2010

**GE6252 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING****L T P C**  
**4 0 0 4****OBJECTIVES:**

- To explain the basic theorems used in Electrical circuits and the different components and function of electrical machines.
- To explain the fundamentals of semiconductor and applications.
- To explain the principles of digital electronics
- To impart knowledge of communication.

**UNIT I ELECTRICAL CIRCUITS & MEASUREMENTS****12**

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits.

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

**UNIT II ELECTRICAL MECHANICS****12**

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

**UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS****12**

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation.

Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

**UNIT IV DIGITAL ELECTRONICS****12**

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

**UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING****12**

Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations.

Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

**TOTAL: 60 PERIODS****OUTCOMES:**

- ability to identify the electrical components explain the characteristics of electrical machines.
- ability to identify electronics components and use of them to design circuits.

**TEXT BOOKS:**

1. Mittle N., “Basic Electrical Engineering”, Tata McGraw Hill Edition, New Delhi, 1990.
2. Sedha R.S., “Applied Electronics”, S. Chand & Co., 2006.

**REFERENCES:**

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical, Electronics and Computer Engineering”, Tata McGraw Hill, Second Edition, 2006.
2. Nagsarkar T K and Sukhija M S, “Basics of Electrical Engineering”, Oxford press 2005.
3. Mehta V K, “Principles of Electronics”, S.Chand & Company Ltd, 1994.
4. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill, 2002.
5. Premkumar N, “Basic Electrical Engineering”, Anuradha Publishers, 2003.

**GE6253****ENGINEERING MECHANICS****L T P C  
3 1 0 4****OBJECTIVES:**

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

**UNIT I BASICS AND STATICS OF PARTICLES****12**

Introduction – Units and Dimensions – Laws of Mechanics – Lami’s theorem, Parallelogram and triangular Law of forces — Vectorial representation of forces – Vector operations of forces -additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

**UNIT II EQUILIBRIUM OF RIGID BODIES****12**

Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon’s theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

**UNIT III PROPERTIES OF SURFACES AND SOLIDS****12**

Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula – Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem –Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

**UNIT IV DYNAMICS OF PARTICLES****12**

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton's laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

**UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS****12**

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

**TOTAL : 60 PERIODS****OUTCOMES:**

- ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
- ability to analyse the forces in any structures.
- ability to solve rigid body subjected to dynamic forces.

**TEXT BOOKS:**

1. Beer, F.P and Johnston Jr. E.R., “Vector Mechanics for Engineers (In SI Units): Statics and Dynamics”, 8<sup>th</sup> Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Vela Murali, “Engineering Mechanics”, Oxford University Press (2010)

**REFERENCES:**

1. Hibbeler, R.C and Ashok Gupta, “Engineering Mechanics: Statics and Dynamics”, 11<sup>th</sup> Edition, Pearson Education 2010.
2. Irving H. Shames and Krishna Mohana Rao. G., “Engineering Mechanics – Statics and Dynamics”, 4<sup>th</sup> Edition, Pearson Education 2006.
3. Meriam J.L. and Kraige L.G., “ Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2”, Third Edition, John Wiley & Sons,1993.
4. Rajasekaran S and Sankarasubramanian G., “Engineering Mechanics Statics and Dynamics”, 3<sup>rd</sup> Edition, Vikas Publishing House Pvt. Ltd., 2005.
5. Bhavikatti, S.S and Rajashekarappa, K.G., “Engineering Mechanics”, New Age International (P) Limited Publishers, 1998.
6. Kumar, K.L., “Engineering Mechanics”, 3<sup>rd</sup> Revised Edition, Tata McGraw-Hill Publishing company, New Delhi 2008.

**GE6261 COMPUTER AIDED DRAFTING AND MODELING LABORATORY****L T P C  
0 1 2 2****OBJECTIVES:**

- To develop skill to use software to create 2D and 3D models.

**LIST OF EXERCISES USING SOFTWARE CAPABLE OF DRAFTING AND MODELING**

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building ( Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.

8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- ability to use the software packers for drafting and modeling
- ability to create 2D and 3D models of Engineering Components

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

Sl.No	Description of Equipment	Quantity
1.	Pentium IV computer or better hardware, with suitable graphics facility	30 No.
2.	Licensed software for Drafting and Modeling.	30 Licenses
3.	Laser Printer or Plotter to print / plot drawings	2 No.

**GE6262**

**PHYSICS AND CHEMISTRY LABORATORY – II**

**L T P C  
0 0 2 1**

**PHYSICS LABORATORY – II**

**OBJECTIVES:**

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

**LIST OF EXPERIMENTS  
(Any FIVE Experiments)**

1. Determination of Young's modulus by uniform bending method
2. Determination of band gap of a semiconductor
3. Determination of Coefficient of viscosity of a liquid –Poiseuille's method
4. Determination of Dispersive power of a prism - Spectrometer
5. Determination of thickness of a thin wire – Air wedge method
6. Determination of Rigidity modulus – Torsion pendulum

**OUTCOMES:**

- The students will have the ability to test materials by using their knowledge of applied physics principles in optics and properties of matter.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Traveling microscope, meter scale, Knife edge, weights
2. Band gap experimental set up
3. Burette, Capillary tube, rubber tube, stop clock, beaker and weighing balance
4. spectrometer, prism, sodium vapour lamp.
5. Air-wedge experimental set up.
6. Torsion pendulum set up.  
(vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

## CHEMISTRY LABORATORY - II

### OBJECTIVES:

- To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

### LIST OF EXPERIMENTS

#### (Any FIVE Experiments)

- 1 Determination of alkalinity in water sample
- 2 Determination of total, temporary & permanent hardness of water by EDTA method
- 3 Estimation of copper content of the given solution by EDTA method
- 4 Estimation of iron content of the given solution using potentiometer
- 5 Estimation of sodium present in water using flame photometer
- 6 Corrosion experiment – weight loss method
- 7 Conductometric precipitation titration using  $\text{BaCl}_2$  and  $\text{Na}_2\text{SO}_4$
- 8 Determination of CaO in Cement.

**TOTAL: 30 PERIODS**

### OUTCOMES:

- The students will be conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis.

### REFERENCES:

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York, 2001.
  2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry, LBS Singapore ,1994.
  3. Jeffery G.H, Bassett J., Mendham J. and Denny R.C., "Vogel's Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
  4. Kolthoff I.M. and Sandell E.B. et al. Quantitative chemical analysis, McMillan, Madras 1980
- **Laboratory classes on alternate weeks for Physics and Chemistry.**

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

- |                       |   |       |
|-----------------------|---|-------|
| 1. Potentiometer      | - | 5 Nos |
| 2. Flame photo meter  | - | 5 Nos |
| 3. Weighing Balance   | - | 5 Nos |
| 4. Conductivity meter | - | 5 Nos |

**Common Apparatus : Pipette, Burette, conical flask, porcelain tile, dropper (30 Nos each)**

**OBJECTIVES:**

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

**UNIT I PARTIAL DIFFERENTIAL EQUATIONS****9 + 3**

Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order partial differential equations - Lagrange's linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

**UNIT II FOURIER SERIES****9 + 3**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

**UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS****9 + 3**

Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

**UNIT IV FOURIER TRANSFORMS****9 + 3**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

**UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS****9 + 3**

Z- transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES:**

- The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

**TEXT BOOKS:**

1. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal. B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.
3. Narayanan.S., Manicavachagom Pillay. T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.

**REFERENCES:**

1. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7<sup>th</sup> Edition, Laxmi Publications Pvt Ltd , 2007.
2. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company Limited, NewDelhi, 2008.

3. Glyn James, "Advanced Modern Engineering Mathematics", 3<sup>rd</sup> Edition, Pearson Education, 2007.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8<sup>th</sup> Edition, Wiley India, 2007.
5. Ray Wylie. C and Barrett.L.C, "Advanced Engineering Mathematics" Tata Mc Graw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.
6. Datta.K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.

**CE6306**

**STRENGTH OF MATERIALS**

**L T P C**  
**3 1 0 4**

**OBJECTIVES:**

To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.

**UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9**

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains –Stresses on inclined planes – principal stresses and principal planes – Mohr’s circle of stress.

**UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9**

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending– bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

**UNIT III TORSION 9**

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

**UNIT IV DEFLECTION OF BEAMS 9**

Double Integration method – Macaulay’s method – Area moment method for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell’s reciprocal theorems.

**UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS 9**

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure –Deformation in spherical shells – Lamé’s theorem.

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behavior of simple structures.
- Critically analyse problem and solve the problems related to mechanical elements and analyse the deformation behavior for different types of loads.

**TEXT BOOKS:**

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2007
2. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2007

**REFERENCES:**

1. Egor. P.Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2001
2. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2007.
3. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2007
4. Ferdinand P. Beer, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing 'co. Ltd., New Delhi, 2005.

**CE6451****FLUID MECHANICS AND MACHINERY****L T P C****3 0 0 3****OBJECTIVES:**

- The applications of the conservation laws to flow through pipes and hydraulic machines are studied
- To understand the importance of dimensional analysis.
- To understand the importance of various types of flow in pumps and turbines.

**UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 8**

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

**UNIT II FLOW THROUGH CIRCULAR CONDUITS 8**

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

**UNIT III DIMENSIONAL ANALYSIS 9**

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

**UNIT IV PUMPS 10**

Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps –classification.

**UNIT V TURBINES 10**

Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students can able to apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Can critically analyse the performance of pumps and turbines.

**TEXT BOOK:**

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2004.

**REFERENCES:**

1. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2004
3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", 2011.
4. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011

**EC6302****DIGITAL ELECTRONICS****L T P C  
3 0 0 3****OBJECTIVES:**

- To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
- To introduce the methods for simplifying Boolean expressions
- To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits
- To introduce the concept of memories and programmable logic devices.
- To illustrate the concept of synchronous and asynchronous sequential circuits

**UNIT I MINIMIZATION TECHNIQUES AND LOGIC GATES 9**

**Minimization Techniques:** Boolean postulates and laws – De-Morgan's Theorem - Principle of Duality - Boolean expression - Minimization of Boolean expressions — Minterm – Maxterm - Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map Minimization – Don't care conditions – Quine - Mc Cluskey method of minimization.

**Logic Gates:** AND, OR, NOT, NAND, NOR, Exclusive–OR and Exclusive–NOR Implementations of Logic Functions using gates, NAND–NOR implementations – Multi level gate implementations- Multi output gate implementations. TTL and CMOS Logic and their characteristics – Tristate gates

**UNIT II COMBINATIONAL CIRCUITS 9**

Design procedure – Half adder – Full Adder – Half subtractor – Full subtractor – Parallel binary adder, parallel binary Subtractor – Fast Adder - Carry Look Ahead adder – Serial Adder/Subtractor - BCD adder – Binary Multiplier – Binary Divider - Multiplexer/ Demultiplexer – decoder - encoder – parity checker – parity generators – code converters - Magnitude Comparator.

**UNIT III SEQUENTIAL CIRCUITS 9**

Latches, Flip-flops - SR, JK, D, T, and Master-Slave – Characteristic table and equation –Application table – Edge triggering – Level Triggering – Realization of one flip flop using other flip flops – serial adder/subtractor- Asynchronous Ripple or serial counter – Asynchronous Up/Down counter - Synchronous counters – Synchronous Up/Down counters – Programmable counters – Design of Synchronous counters: state diagram- State table –State minimization –State assignment - Excitation table and maps-Circuit implementation - Modulo–n counter, Registers – shift registers - Universal shift registers – Shift register counters – Ring counter – Shift counters - Sequence generators.

**UNIT IV MEMORY DEVICES****9**

Classification of memories – ROM - ROM organization - PROM – EPROM – EEPROM –EAPROM, RAM – RAM organization – Write operation – Read operation – Memory cycle - Timing wave forms – Memory decoding – memory expansion – Static RAM Cell- Bipolar RAM cell – MOSFET RAM cell – Dynamic RAM cell –Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using ROM, PLA, PAL

**UNIT V SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS****9**

**Synchronous Sequential Circuits:** General Model – Classification – Design – Use of Algorithmic State Machine – Analysis of Synchronous Sequential Circuits

**Asynchronous Sequential Circuits:** Design of fundamental mode and pulse mode circuits – Incompletely specified State Machines – Problems in Asynchronous Circuits – Design of Hazard Free Switching circuits. Design of Combinational and Sequential circuits using VERILOG.

**TOTAL: 45 PERIODS****OUTCOMES:****Students will be able to:**

- Analyze different methods used for simplification of Boolean expressions.
- Design and implement Combinational circuits.
- Design and implement synchronous and asynchronous sequential circuits.
- Write simple HDL codes for the circuits.

**TEXT BOOK:**

1. M. Morris Mano, "Digital Design", 4<sup>th</sup> Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.

**REFERENCES:**

1. John F.Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 2008
2. John.M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.
3. Charles H.Roth. "Fundamentals of Logic Design", 6<sup>th</sup> Edition, Thomson Learning, 2013.
4. Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", 6<sup>th</sup> Edition, TMH, 2006.
5. Thomas L. Floyd, "Digital Fundamentals", 10<sup>th</sup> Edition, Pearson Education Inc, 2011
6. Donald D.Givone, "Digital Principles and Design", TMH, 2003.

**EE6358****ELECTRICAL MACHINES AND DRIVES****L T P C  
3 0 0 3****OBJECTIVES:**

- The students will learn basic principle ,A.C , D.C Circuits, Transformers, Characteristics , starting methods, of D.C. and A.C. motors ,induction motor. and controlling the speed of D.C. and A.C. motors using solid state devices.

**UNIT I ELECTRICAL CIRCUITS AND TRANSFORMERS****6**

D.C. Voltage, current, power – Ohms law – series, parallel circuits – Kirchhoff's laws – mesh analysis – A.C. voltage – sinusoidal waves, – power factor – complex power – basic operation of transformers – simple problems.

<b>UNIT II</b>	<b>ELECTRICAL MOTORS</b>	<b>12</b>
Constructional details, principle of operation and performance characteristics of D.C. motors, single phase induction motor, three phase induction motor, synchronous motors, universal motors, stepper motors and reluctance motor.		
<b>UNIT III</b>	<b>SPEED CONTROL AND STRATING</b>	<b>9</b>
Speed control of D.C. motors – three phase induction motors – starting methods of D.C. motor and three phase induction motor – electrical braking – simple problems.		
<b>UNIT IV</b>	<b>ELECTRICAL DRIVES</b>	<b>9</b>
Type of Electrical Drives – Selection & factors influencing the selection – heating and cooling curves – loading condition and classes of duty – determination of power rating – simple problems.		
<b>UNIT V</b>	<b>SOLID STATE DRIVES(QUALITATIVE TREATMENT ONLY)</b>	<b>9</b>
Advantages of solid state drives – D.C. motor control using rectifiers and choppers – control of induction motor by V, V/f and slip power recovery scheme using inverters and A.C. power regulators.		
		<b>TOTAL: 45 PERIODS</b>

**OUTCOMES:**

- Upon Completion of this subject, the students can able to explain different types of electrical machines and their performance

**TEXT BOOKS:**

1. Vukosavic, "Digital Control of Electrical Drives", Springer, Indian Reprint, 2010.
2. Vedam Subramaniam. "Electric Drives", Tata McGraw Hill , New Delhi , 2007.
3. De. N.K., & Sen. P.K "Electric Drives", Prentice Hall India Pvt Limited 2002.

**REFERENCES:**

1. Crowder, "Electric Drives and Electromechanical Systems", Elsevier, Indian Reprint, 2009
2. Metha. V.K. & Rohit Metha, "Principle of Electrical Engineering", S.Chand & Co .2006.
3. Dubey.G.K. "Fundamental Electrical Drives" 2<sup>nd</sup> Edition, Narosa Publications, 2002
4. Bhattacharya S.K. & Brinjinder Singh , "Control of Electrical Machines", New Age International Publishers, 2002.

<b>ME6401</b>	<b>KINEMATICS OF MACHINERY</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

**OBJECTIVES:**

- To understand the basic components and layout of linkages in the assembly of a system/ machine.
- To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.

<b>UNIT I</b>	<b>BASICS OF MECHANISMS</b>	<b>9</b>
Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler’s criterion – Grashof’s Law – Kinematic inversions of four-bar chain and slider crank chains – Limit positions – Mechanical advantage – Transmission Angle –		

Description of some common mechanisms – Quick return mechanisms, Straight line generators, Universal Joint – rocker mechanisms.

## **UNIT II KINEMATICS OF LINKAGE MECHANISMS 9**

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration polygons – Velocity analysis using instantaneous centres – kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration – Introduction to linkage synthesis problem.

## **UNIT III KINEMATICS OF CAM MECHANISMS 9**

Classification of cams and followers – Terminology and definitions – Displacement diagrams –Uniform velocity, parabolic, simple harmonic and cycloidal motions – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams.

## **UNIT IV GEARS AND GEAR TRAINS 9**

Law of toothed gearing – Involute and cycloidal tooth profiles –Spur Gear terminology and definitions –Gear tooth action – contact ratio – Interference and undercutting. Helical, Bevel, Worm, Rack and Pinion gears [Basics only]. Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains.

## **UNIT V FRICTION IN MACHINE ELEMENTS 9**

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads –Bearings and lubrication – Friction clutches – Belt and rope drives – Friction in brakes- Band and Block brakes.

**TOTAL : 45 PERIODS**

### **OUTCOMES:**

- Upon completion of this course, the students can able to apply fundamentals of mechanism for the design of new mechanisms and analyse them for optimum design.

### **TEXT BOOKS:**

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 3<sup>rd</sup>Edition, Oxford University Press, 2009.
2. Rattan, S.S, "Theory of Machines", 3<sup>rd</sup> Edition, Tata McGraw-Hill, 2009.

### **REFERENCES:**

1. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.
2. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2005
3. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.
4. Allen S. Hall Jr., "Kinematics and Linkage Design", Prentice Hall, 1961
5. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi, 1988.
6. Rao.J.S. and Dukkupati.R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
7. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
8. Ramamurthi. V, "Mechanics of Machines", Narosa Publishing House, 2002.
9. Khurmi, R.S., "Theory of Machines", 14<sup>th</sup> Edition, S Chand Publications, 2005
10. Sadhu Singh : Theory of Machines, "Kinematics of Machine", Third Edition, Pearson Education, 2012

**OBJECTIVES:**

- Upon Completion of this subject, the students can able to have hands on experience in flow measurements using different devices and also perform calculation related to losses in pipes and also perform characteristic study of pumps, turbines etc.,

**LIST OF EXPERIMENTS**

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Ability to use the measurement equipments for flow measurement
- Ability to do performance trust on different fluid machinery

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S. No.	NAME OF THE EQUIPMENT	Qty.
1	Orifice meter setup	1
2	Venturi meter setup	1
3	Rotameter setup	1
4	Pipe Flow analysis setup	1
5	Centrifugal pump/submergible pump setup	1
6	Reciprocating pump setup	1
7	Gear pump setup	1
8	Pelton wheel setup	1
9	Francis turbine setup	1
10	Kaplan turbine setup	1

**OBJECTIVES:**

- To expose the students the operation of electric drives to gain hands on experience.

**LIST OF EXPERIMENTS**

1. Load test on D.C. shunt motor.
2. Speed control of D.C. shunt motor.
3. Swinburne's test.

4. Load test on three phase induction motor.
5. No load and blocked rotor tests on three – phase induction motor.
6. Load test on single phase induction motor.
7. No load and blocked rotor tests on single phase induction motor.
8. Load test on Synchronous motors.
9. Performance characteristics of Stepper motor.
10. Performance characteristics of single phase transformer.

**TOTAL: 45 PERIODS**

### OUTCOMES

- Ability to perform load test on D.C. shunt motor
- Ability to perform speed control test
- Ability to do characteristics of different electrical motors

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	NAME OF THE EQUIPMENT	Qty
1	Shunt motor 5HP	3
2	Single phase Induction Motor 2HP	2
3	Three phase induction Motor 5HP	2
4	Single phase transformer 2KVA	1
5	Three phase auto transformer	2
6	Single phase auto transformer	2
7	3 point starter	3
8	DPST, TPST Each	2
9	DC source 300v, 100A	1
10	Ammeter(0-5A),(0-10A)MC Each	2
11	Ammeter(0-5A),(0-10A)MI Each	2
12	Voltmeter(0-300V) MC	3
13	Voltmeter(0-150V),(0-300V),(0-600V)MI Each	2
14	Wattmeter 150/300V, 5/10A UPF	2
15	Wattmeter 300/600V,5/10A UPF	2
16	Wattmeter 150/300V,5/10A LPF	2
17	Wattmeter 300/600V,5/10A LPF	2
18	Stepper motor 5Kg	1
19	Synchronous motor 5KW	1
20	Rheostat 360 ohm/1.2A	3
21	Tachometer	5
22	Rheostat 50 ohm/5A	3

**MT6311**

**COMPUTER AIDED MACHINE DRAWING**

**L T P C  
0 0 3 2**

### OBJECTIVES

- To introduce the students the Indian standard code of practice for engineering drawing and general symbols and abbreviation used on the drawing.
- To provide hands on experience to develop 2D and 3D models of engineering components.
- To provide knowledge to use Drawing/Modeling software.

**UNIT I** **9**  
Indian standard code of practice for engineering drawing – general principles of Presentation. Conventional representations of threaded parts, springs, gear and Common features. Abbreviations and symbols for use on technical drawings. Conventions for sectioning and dimensioning.

**UNIT II** **9**  
Tolerances – types – representation of tolerances on drawing, fits – types – selection of Fits – allowance. Geometric tolerances – form and positional tolerances – datum, datum Features. Maximum material principle – symbols and methods of indicating it on drawing Surface finish symbols – welding symbols and methods of indicating it on drawing.

**UNIT III DRAFTING WORK USING MINI DRAFTER** **9**  
Preparation of part and assembly drawings of Plummer block, screw jack, machine vice, lathe tailstock, tool head of the shaper, stuffing box, piston & connecting rod universal joint)

**UNIT IV** **9**  
Introduction to the use of any drafting software – creation of simple geometric bodies using primitives (line, arc, circle etc.) and editing for the drawing, Dimensioning and text writing, concept of layer creation and setting, line types.

**UNIT V** **9**  
Preparation of 2-D drawings using CAD software for components and assemblies of Plummer block, screw jack, machine vice, lathe tailstock, tool head of the shaper. Introduction to 3-D modeling solid and frame modeling.

**TOTAL: 45 PERIODS**

**OUTCOMES**

- Ability to develop engineering drawing for the industrial component using Indian Standard code of practice.
- Ability to develop 2D and 3D models of the component using manual/software.

**TEXT BOOKS:**

1. Sadhu Singh & P.L. Sah, "Fundamentals of Machine Dynamics", Prentice Hall of India 2003
2. Rao. P.N., "CAD/CAM Principles and Applications", Tata McGraw – Hill 2003.

**REFERNCE:**

1. Venugopal. K., "Engineering Graphics AutoCAD", John Wiley& Sons, 2002

**MA6452 STATISTICS AND NUMERICAL METHODS** **L T P C**  
**3 1 0 4**

**OBJECTIVES:**

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.

**UNIT I TESTING OF HYPOTHESIS** **9+3**  
Large sample test based on Normal distribution for single mean and difference of means - Tests based on  $t$ ,  $t^2$  and F distributions for testing means and variances – Contingency table (Test for Independency) – Goodness of fit.

**UNIT II DESIGN OF EXPERIMENTS****9+3**

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design -  $2^2$  factorial design.

**UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS****9+3**

Newton Raphson method – Gauss elimination method – pivoting – Gauss Jordan methods – Iterative methods of Gauss Jacobi and Gauss Seidel – Matrix inversion by Gauss Jordan method – Eigen values of a matrix by power method.

**UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION****9+3**

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

**UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS****9+3**

Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations – Milne's predictor corrector methods for solving first order equations – Finite difference methods for solving second order equations.

**TOTAL (L:45+T:15): 60 PERIODS****OUTCOMES:**

- It helps the students to have a clear perception of the power of statistical and numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

**TEXT BOOKS**

1. Johnson. R.A., and Gupta. C.B., "Miller and Freund's "Probability and Statistics for Engineers", 11<sup>th</sup> Edition, Pearson Education, Asia, 2011.
2. Grewal. B.S., and Grewal. J.S., "Numerical Methods in Engineering and Science", 9<sup>th</sup> Edition, Khanna Publishers, New Delhi, 2007.

**REFERENCES**

1. Walpole. R.E., Myers. R.H., Myers. S.L., and Ye. K., "Probability and Statistics for Engineers and Scientists", 8<sup>th</sup> Edition, Pearson Education, Asia, 2007.
2. Spiegel. M.R., Schiller. J., and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics", Tata McGraw Hill Edition, 2004.
3. Chapra. S.C., and Canale. R.P, "Numerical Methods for Engineers", 5<sup>th</sup> Edition, Tata McGraw Hill, New Delhi, 2007.
4. Gerald. C.F., and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 2006.

**ME6505****DYNAMICS OF MACHINES****L T P C  
3 0 0 3****OBJECTIVES:**

- To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
- To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
- To understand the effect of Dynamics of undesirable vibrations.
- To understand the principles in mechanisms used for speed control and stability control.



**OBJECTIVES:**

- To introduce the elements of control system and their modeling using various Techniques.
- To introduce methods for analyzing the time response, the frequency response and the stability of systems
- To introduce the state variable analysis method

**UNIT I CONTROL SYSTEM MODELING****9**

Basic Elements of Control System – Open loop and Closed loop systems - Differential equation - Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems - Block diagram reduction Techniques - Signal flow graph

**UNIT II TIME RESPONSE ANALYSIS****9**

Time response analysis - First Order Systems - Impulse and Step Response analysis of second order systems - Steady state errors – P, PI, PD and PID Compensation, Analysis using MATLAB

**UNIT III FREQUENCY RESPONSE ANALYSIS****9**

Frequency Response - Bode Plot, Polar Plot, Nyquist Plot - Frequency Domain specifications from the plots - Constant M and N Circles - Nichol's Chart - Use of Nichol's Chart in Control System Analysis. Series, Parallel, series-parallel Compensators - Lead, Lag, and Lead Lag Compensators, Analysis using MATLAB.

**UNIT IV STABILITY ANALYSIS****9**

Stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, Stability, Dominant Poles, Application of Root Locus Diagram - Nyquist Stability Criterion - Relative Stability, Analysis using MATLAB

**UNIT V STATE VARIABLE ANALYSIS****9**

State space representation of Continuous Time systems – State equations – Transfer function from State Variable Representation – Solutions of the state equations - Concepts of Controllability and Observability – State space representation for Discrete time systems. Sampled Data control systems – Sampling Theorem – Sampler & Hold – Open loop & Closed loop sampled data systems.

**TOTAL: 45 PERIODS****OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Perform time domain and frequency domain analysis of control systems required for stability analysis.
- Design the compensation technique that can be used to stabilize control systems.

**TEXTBOOK:**

1. J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5<sup>th</sup> Edition, 2007.

**REFERENCES:**

1. Benjamin.C.Kuo, "Automatic control systems", Prentice Hall of India, 7<sup>th</sup> Edition,1995.
2. M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 2<sup>nd</sup> Edition, 2002.
3. Schaum's Outline Series, "Feed back and Control Systems" Tata Mc Graw-Hill, 2007.
4. John J.D'Azzo & Constantine H.Houpis, "Linear Control System Analysis and Design", Tata Mc Graw-Hill, Inc., 1995.
5. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Addison – Wesley, 1999.

**OBJECTIVES:**

- The automobile components such as piston, connecting rod, crankshaft, engine block, front axle, frame, body etc., are manufactured by various types of production processes involving casting, welding, machining, metal forming, power metallurgy etc. Hence B.E. Automobile Engineering students must study this course Production Technology.

**UNIT I CASTING****8**

Casting types, procedure to make sand mould, types of core making, moulding tools, machine moulding, special moulding processes – CO<sub>2</sub> moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

**UNIT II WELDING****8**

Classification of welding processes. Principles of Oxy-acetylene gas welding. A.C metal arc welding, resistance welding, submerged arc welding, tungsten inert gas welding, metal inert gas welding, plasma arc welding, thermit welding, electron beam welding, laser beam welding, defects in welding, soldering and brazing.

**UNIT III MACHINING****13**

General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines. General principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining and Laser beam machining.

**UNIT IV FORMING AND SHAPING OF PLASTICS****7**

Types of plastics - Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of - Injection moulding – Plunger and screw machines – Blow moulding – Rotational moulding – Film blowing – Extrusion - Typical industrial applications – Thermoforming – Processing of Thermosets – Working principles and typical applications - Compression moulding – Transfer moulding – Bonding of Thermoplastics – Fusion and solvent methods – Induction and Ultrasonic methods

**UNIT V METAL FORMING AND POWDER METALLURGY****9**

Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing and Spinning, Powder metallurgy – Principal steps involved advantages, disadvantages and limitations of powder metallurgy.

**TOTAL: 45 PERIODS****OUTCOMES:**

- The Students can able to use different manufacturing process and use this in industry for component production

**TEXT BOOKS:**

- Hajra Choudhury, "Elements of Workshop Technology", Vol. I and II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2005.
- Nagendra Parashar B.S. and Mittal R.K., "Elements of Manufacturing Processes", Prentice-Hall of India Private Limited, 2007.

## REFERENCES:

1. Serope Kalpajian, Steven R.Schmid, "Manufacturing Processes for Engineering Materials", 4<sup>th</sup> Edition, Pearson Education, Inc. 2007.
2. Jain. R.K. and S.C. Gupta, "Production Technology", Khanna Publishers. 16<sup>th</sup> Edition, 2001.
3. "H.M.T. Production Technology – Handbook", Tata McGraw-Hill, 2000.
4. Roy. A. Linberg, "Process and Materials of Manufacture", PHI, 2000.
5. Adithan. M and A.B. Gupta, "Manufacturing Technology", New Age, 2006.

**ME6504**

**METROLOGY AND MEASUREMENTS**

**L T P C**  
**3 0 0 3**

## OBJETCTIVES:

- To provide knowledge on various Metrological equipments available to measure the dimension of the components.
- To provide knowledge on the correct procedure to be adopted to measure the dimension of the components.

### **UNIT I .BASICS OF METROLOGY**

**5**

Introduction to Metrology – Need – Elements – Work piece, Instruments – Persons – Environment – their effect on Precision and Accuracy – Errors – Errors in Measurements – Types – Control – Types of standards.

### **UNIT II LINEAR AND ANGULAR MEASUREMENTS**

**10**

Linear Measuring Instruments – Evolution – Types – Classification – Limit gauges – gauge design – terminology – procedure – concepts of interchange ability and selective assembly – Angular measuring instruments – Types – Bevel protractor clinometers angle gauges, spirit levels sine bar – Angle alignment telescope – Autocollimator – Applications.

### **UNIT III ADVANCES IN METROLOGY**

**12**

Basic concept of lasers Advantages of lasers – laser Interferometers – types – DC and AC Lasers interferometer – Applications – Straightness – Alignment. Basic concept of CMM – Types of CMM – Constructional features – Probes – Accessories – Software – Applications – Basic concepts of Machine Vision System – Element – Applications.

### **UNIT IV FORM MEASUREMENT**

**10**

Principles and Methods of straightness – Flatness measurement – Thread measurement, gear measurement, surface finish measurement, Roundness measurement – Applications.

### **UNIT V MEASUREMENT OF POWER, FLOW AND TEMPERATURE**

**8**

Force, torque, power - mechanical , Pneumatic, Hydraulic and Electrical type. Flow measurement: Venturimeter, Orifice meter, rotameter, pitot tube – Temperature: bimetallic strip, thermocouples, electrical resistance thermometer – Reliability and Calibration – Readability and Reliability.

**TOTAL : 45 PERIODS**

## OUTCOMES:

- Upon completion of this course, the Students can demonstrate different measurement technologies and use of them in Industrial Components

**TEXT BOOKS:**

1. Jain R.K. "Engineering Metrology", Khanna Publishers, 2005.
2. Gupta. I.C., "Engineering Metrology", Dhanpatrai Publications, 2005.

**REFERENCES:**

1. Shot bolt, "Metrology for Engineers", McGraw Hill, 1990.
2. Backwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education , 2006.

**MT6401****MICROPROCESSORS AND APPLICATIONS****L T P C  
3 0 0 3****OBJECTIVES:**

- Most of the Mechatronics systems control is based on Microprocessor or Microcontroller. The students will be exposed to the knowledge of Microprocessor , Microcontrollers and design of mechatronics using them.systems.

**UNIT I INTRODUCTION****10**

Organization of 8085: Architecture, Internal Register Organization and Pin Configuration – Instruction Set of 8085 – addressing modes – instruction machine cycles with states and timing diagram.- 8085 assembly language programming- Examples.

**UNIT II INTERFACING TECHNIQUES****9**

Need for Interfacing - Memory Interfacing, address space partitioning – address map – Address decoding – Designing decoders circuit. I/O Interfacing: Data transfer schemes – programmed Synchronous and asynchronous – Interrupt driven Transfer – Multiple devices and multiple interrupt levels – enabling disabling and masking of interrupts. DMA transfer: Cycle stealing – Burst mode – Multiple DMA devices – DMA transfer in 8085 system – serial data transfer.

**UNIT III INTERFACING DEVICES****9**

Programmable peripheral device (8255) – programmable interval timer (8353) – Programmable communication interface (8251) (USART) – Programmable interrupt controller – Programmable DMA Controller (8257)- Programmable Keyboard/display controllers.(8279)

**UNIT IV DESIGN USING PERIPHERAL DEVICES****9**

Interfacing A/D and D/A converters – Matrix Keyboard design using 8255 with 8085 programs. Designing real time clock, detecting power failure, detecting presence of objects using 8253 - Design of Keyboard and display interfacing using 8279 – Design of digital transmission with modems and telephone lines using 8251 A.

**UNIT V MICROPROCESSOR APPLICATIONS****8**

Temperature monitoring system – Automotive applications – Closed loop process control – Stepper motor control.

**TOTAL: 45 PERIODS****OUTCOMES:**

- At the end of the course the students will be able to design microprocessor based systems.

**TEXT BOOKS:**

1. Rafiquzzaman, "Microprocessors and Microcomputer-Based System Design" 2<sup>nd</sup> Edition, Taylor & Francis, Indian Reprint, 2009
2. Ramesh Gonakar, "Microprocessor Architecture. Programming and Applications with the 8085" 5<sup>th</sup> edition – Penram International Publishing (India) Private Limited. 2005.

**REFERENCES:**

1. Aditya P Mathur , "Introduction to Microprocessor" 3<sup>rd</sup> Edition, Tata McGraw Hill Publishing Co Ltd., New Delhi, 2003.
2. Douglas V. Hall. "Microprocessors and Interfacing, Programming and Hardware" Tata McGraw – Hill Publishing Company Ltd., New Delhi, 1997.

**MT6411****MICROPROCESSOR LABORATORY****L T P C  
0 0 3 2****OBJECTIVES:**

- To expose the students to microprocessor and trvia them to perform simple programming
- To provide knowledge on interfacing

**LIST OF EXPERIMENTS.****I PROGRAMMING****30**

1. Addition of two 8 – bit numbers, sum of 8 – bits and 16 bits.
2. Decimal addition of two 8 – bit numbers Sum: 16 bits.
3. 8 - bit subtraction.
4. 8 – bit decimal subtraction.
5. Additional of two 16 – bit numbers, Sum: 16 bits or more.
6. Multibyte subtraction.
7. To arrange a series of numbers in Ascending order.
8. To arrange a series of numbers in Descending order.
9. 8 – bit Multiplication.
10. 8 – bit Division.
11. Decimal to hexadecimal conversion and hexadecimal to decimal number conversion.

**II. INTERFACING****15**

1. Analog to digital conversion.
2. Digital to analog conversion.
3. Steeper motor controller.
4. Temperature controller.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Ability to use the microprocessor to perform simple programmes like addition, subtraction, multiplication, division etc.,
- Ability to use the microprocessor for interfacing for conversion of signals.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

<b>S.No</b>	<b>Name of the Equipment</b>	<b>Qty</b>
1	8085 Microprocessor trainer kits	15
2	ADC interface card	3
3	DAC interface card	3
4	Stepper motor interfacing card with stepper motor	3
5	Temperature controller with sensors(thermocouple)	3

**OBJECTIVES:**

- Demonstration and study of the VARIOUS machines. The Main emphasis will be on a complete understanding of the machine capabilities and processes.

**LIST OF EXPERIMENTS****UNIT I LATHE PRACTICE**

- Plain Turning
- Taper Turning
- Thread Cutting

Estimation of machining time for the above turning processes.

**UNIT II DRILLING PRACTICE**

- Drilling
- Tapping
- Reaming.

**UNIT III MILLING**

- Surface Milling.
- Gear Cutting.
- Contour Milling.

**UNIT IV PLANNING AND SHAPING**

- Cutting Key Ways.
- Dove tail machining.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Ability to use different machine tools to manufacturing gears.
- Ability to use different machine tools for finishing operations
- Ability to manufacture tools using cutter grinder
- Develop CNC part programming

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S.No.	NAME OF THE EQUIPMENT	Qty.
1	. Lathe -	15 Nos.
2	Drilling Machine -	1 No
3	Milling Machine -	2 Nos.
4	Planning Machine -	1 No
5	Shaping Machine -	2 Nos.

**OBJECTIVES:**

- To supplement the principles learnt in kinematics and Dynamics of Machinery.
- To understand how certain measuring devices are used for dynamic testing.

## LIST OF EXPERIMENTS

1. a) Study of gear parameters.  
b) Experimental study of velocity ratios of simple, compound, Epicyclic and differential gear trains.
2. a) Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinder Mechanisms.  
b) Kinematics of single and double universal joints.
3. a) Determination of Mass moment of inertia of Fly wheel and Axle system.  
b) Determination of Mass Moment of Inertia of axisymmetric bodies using Turn Table apparatus.  
c) Determination of Mass Moment of Inertia using bifilar suspension and compound pendulum.
4. Motorized gyroscope – Study of gyroscopic effect and couple.
5. Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.
6. Cams – Cam profile drawing, Motion curves and study of jump phenomenon
7. a) Single degree of freedom Spring Mass System – Determination of natural Frequency and verification of Laws of springs – Damping coefficient determination.  
b) Multi degree freedom suspension system – Determination of influence coefficient.
8. a) Determination of torsional natural frequency of single and Double Rotor systems.- Undamped and Damped Natural frequencies.  
b) Vibration Absorber – Tuned vibration absorber.
9. Vibration of Equivalent Spring mass system – undamped and damped vibration.
10. Whirling of shafts – Determination of critical speeds of shafts with concentrated loads.
11. a) Balancing of rotating masses. (b) Balancing of reciprocating masses.
12. a) Transverse vibration of Free-Free beam – with and without concentrated masses.  
b) Forced Vibration of Cantilever beam – Mode shapes and natural frequencies.  
c) Determination of transmissibility ratio using vibrating table.

**TOTAL : 45 PERIODS**

## OUTCOME

- Ability to demonstrate the principles of kinematics and dynamics of machinery
- Ability to use the measuring devices for dynamic testing.

## LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Cam follower setup.	1 No.
2	Motorised gyroscope.	1 No.
3	Governor apparatus - Watt, Porter, Proell and Hartnell governors.	1 No.
4	Whirling of shaft apparatus.	1 No.
5	Dynamic balancing machine.	1 No.
6	Two rotor vibration setup.	1 No.
7	Spring mass vibration system.	1 No.
8	Torsional Vibration of single rotor system setup.	1 No.
9	Gear Models	1 No.
10	Kinematic Models to study various mechanisms.	1 No.
11	Turn table apparatus.	1 No.
12	Transverse vibration setup of a) cantilever b) Free-Free beam c) Simply supported beam.	1 No.

**OBJECTIVES:**

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components  
(Use of P S G Design Data Book is permitted)

**UNIT I            STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS****10**

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – curved beams – crane hook and ‘C’ frame- Factor of safety - theories of failure – Design based on strength and stiffness – stress concentration – Design for variable loading.

**UNIT II            SHAFTS AND COUPLINGS****8**

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines – crankshafts - Rigid and flexible couplings

**UNIT III            TEMPORARY AND PERMANENT JOINTS****9**

Threaded fasteners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints, riveted joints for structures - theory of bonded joints.

**UNIT IV            ENERGY STORING ELEMENTS AND ENGINE COMPONENTS****9**

Various types of springs, optimization of helical springs - rubber springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

**UNIT V            BEARINGS****9**

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs, -- Selection of Rolling Contact bearings.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students can able to successfully design engine components

**TEXT BOOKS:**

1. Bhandari V, “Design of Machine Elements”, 3<sup>rd</sup> Edition, Tata McGraw-Hill Book Co, 2010.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett “Mechanical Engineering Design”, 8<sup>th</sup> Edition, Tata McGraw-Hill, 2008.

**REFERENCES:**

1. Sundararajamoorthy T. V. Shanmugam .N, “Machine Design”, Anuradha Publications, Chennai, 2003.
2. Robert C. Juvinall and Kurt M. Marshek, “Fundamentals of Machine Design”, 4<sup>th</sup> Edition, Wiley, 2005
3. Alfred Hall, Halowenko, A and Laughlin, H., “Machine Design”, Tata McGraw-Hill BookCo.(Schaum’s Outline), 2010

4. Bernard Hamrock, Steven Schmid, Bo Jacobson, "Fundamentals of Machine Elements", 2<sup>nd</sup> Edition, Tata McGraw-Hill Book Co., 2006.
5. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
6. Ansel Ugural, "Mechanical Design – An Integral Approach", 1<sup>st</sup> Edition, Tata McGraw-Hill Book Co, 2003.
7. Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, "Design of Machine Elements" 8<sup>th</sup> Edition, Prentice Hall, 2003.

**EE6503**

**POWER ELECTRONICS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To get an overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers
- To study the operation, switching techniques and basic topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and various configurations.

**UNIT I POWER SEMI-CONDUCTOR DEVICES**

**9**

Study of switching devices, Diode, SCR, TRIAC, GTO, BJT, MOSFET, IGBT-Static and Dynamic characteristics - Triggering and commutation circuit for SCR- Design of Driver and snubber circuit.

**UNIT II PHASE-CONTROLLED CONVERTERS**

**9**

2-pulse, 3-pulse and 6-pulse converters – performance parameters – Effect of source inductance – Gate Circuit Schemes for Phase Control – Dual converters.

**UNIT III DC TO DC CONVERTER**

**9**

Step-down and step-up chopper-control strategy – Forced commutated chopper – Voltage commutated, Current commutated, Load commutated, Switched mode regulators- Buck, boost, buck-boost converter, Introduction to Resonant Converters.

**UNIT IV INVERTERS**

**9**

Single phase and three phase voltage source inverters (both 120° mode and 180° mode) – Voltage & harmonic control – PWM techniques: Sinusoidal PWM, modified sinusoidal PWM - multiple PWM – Introduction to space vector modulation – Current source inverter.

**UNIT V AC TO AC CONVERTERS**

**9**

Single phase and Three phase AC voltage controllers – Control strategy- Power Factor Control – Multistage sequence control - single phase and three phase cyclo converters – Introduction to Matrix converters.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Ability to understand and analyse, linear and digital electronic circuits.

**TEXT BOOKS:**

1. M.H. Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, PHI Third Edition, New Delhi, 2004.
2. P.S. Bimbra "Power Electronics" Khanna Publishers, third Edition, 2003.

3. L. Umanand, "Power Electronics Essentials and Applications", Wiley, 2010.

#### REFERENCES:

1. Joseph Vithayathil, 'Power Electronics, Principles and Applications', McGraw Hill Series, 6<sup>th</sup> Reprint, 2013.
2. Ashfaq Ahmed Power Electronics for Technology Pearson Education, Indian reprint, 2003.
3. Philip T. Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.
4. Ned Mohan, Tore. M. Undel and, William. P. Robbins, 'Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition, 2003.
5. Daniel.W.Hart, "Power Electronics", Indian Edition, Mc Graw Hill, 3<sup>rd</sup> Print, 2013.
6. M.D. Singh and K.B. Khanchandani, "Power Electronics," Mc Graw Hill India, 2013.

MT6501

### SENSORS AND SIGNAL PROCESSING

L T P C  
3 0 0 3

#### OBJECTIVES:

- Students will be exposed to basics of sensors and the methods of processing their signals.

#### UNIT I SCIENCE OF MEASUREMENT

9

Units and Standards – Calibration techniques –Errors in Measurements – Generalized Measurement System – Static and dynamic characteristics of transducers – Generalized Performance of Zero Order and First Order Systems - Response of transducers to different time varying inputs – Classification of transducers

#### UNIT II MECHANICAL MEASUREMENTS

9

Temperature: Filled thermometer – Bimetallic thermometer – monometers – elastic transducers – bourdon gauge – bellows – diaphragm. Vacuum: McLeod gauge, thermal conductivity gauge – Ionization gauge, flow measurement: orifice, venture, nozzle, pilot tube, turbine flow meter, hot wire anemometer.'

#### UNIT III ELECTRICAL MEASUREMENTS

9

Resistive transducers – Potentiometer– RTD – Thermistor – Thermocouple – Strain gauges – use in displacement, temperature, force measurement – Inductive transducer – LVDT – RVDT – use in displacement – Capacitive transducer – Piezo electric transducer – Digital displacement transducers.

#### UNIT IV SMART SENSORS

9

Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors – applications - Automobile, Aerospace, Home appliances, Manufacturing, Medical diagnostics, Environmental monitoring.

#### UNIT V SIGNAL CONDITIONING AND DATA ACQUISITION

9

Amplification – Filtering – Sample and Hold circuits –Data Acquisition: Single channel and multi channel data acquisition – Data logging.

**TOTAL: 45 PERIODS**

#### OUTCOMES:

- The students will be able to use Sensors, various electrical and mechanical instruments in industries.

**TEXT BOOKS:**

1. Doebelin. E. O., "Measurement Systems – Applications and Design", Tata McGraw Hill, 1992
2. Patranabis. D, "Sensors and Transducers", 2<sup>nd</sup> Edition PHI, New Delhi, 2003.

**REFERENCES:**

1. Ian Sinclair .R "Sensors and transducers", Newnes ,Elavier Indian print 2011.
2. Beckwith, Marangoni and Lienhard, "Mechanical Measurements", Addison Wesley, 2000..
3. Venkatesan. S.P, "Mechanical Measurements", Ane Books Pvt Ltd, India 2008.

**GE6351****ENVIRONMENTAL SCIENCE AND ENGINEERING****L T P C  
3 0 0 3****OBJECTIVES:**

To the study of nature and the facts about environment.

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY****12**

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds  
Field study of simple ecosystems – pond, river, hill slopes, etc.

**UNIT II ENVIRONMENTAL POLLUTION****10**

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry-Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO<sub>2</sub>, NO<sub>x</sub>, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies –  
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

### **UNIT III NATURAL RESOURCES**

**10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins –Biochemical degradation of pollutants, Bioconversion of pollutants.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

### **UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT**

**7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides. Public awareness.

### **UNIT V HUMAN POPULATION AND THE ENVIRONMENT**

**6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

**TOTAL : 45 PERIODS**

#### **OUTCOMES:**

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

#### **TEXT BOOKS :**

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2<sup>nd</sup> Edition, Pearson Education, 2004.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.

#### **REFERENCES :**

1. Trivedi R.K., 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India Pvt Ltd, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

**OBJECTIVES:**

Upon completion of this subject, student will be able to:

- Understand evolution and principle of CNC machine tools
- Describe constructional features of CNC machine tools
- Explain drives and positional transducers used in CNC machine tools
- Write simple programs for CNC turning and machining centres
- Generate CNC programs for popular CNC controllers
- Describe tooling and work holding devices for CNC machine tools

**UNIT I INTRODUCTION TO CNC MACHINE TOOLS****6**

Evolution of CNC Technology, principles, features, advantages, applications, CNC and DNC concept, classification of CNC Machines – turning centre, machining centre, grinding machine, EDM, types of control systems, CNC controllers, characteristics, interpolators– Computer Aided Inspection

**UNIT II STRUCTURE OF CNC MACHINE TOOL****10**

CNC Machine building, structural details, configuration and design, guide ways – Friction, Anti friction and other types of guide ways, elements used to convert the rotary motion to a linear motion – Screw and nut, recirculating ball screw, planetary roller screw, recirculating roller screw, rack and pinion, spindle assembly, torque transmission elements – gears, timing belts, flexible couplings, Bearings.

**UNIT III DRIVES AND CONTROLS****9**

Spindle drives – DC shunt motor, 3 phase AC induction motor, feed drives –stepper motor, servo principle, DC and AC servomotors, Open loop and closed loop control, Axis measuring system – synchro, synchro-resolver, gratings, moiré fringe gratings, encoders, inductosyn, laser interferometer.

**UNIT IV CNC PROGRAMMING****11**

Coordinate system, structure of a part program, G & M Codes, tool length compensation, cutter radius and tool nose radius compensation, do loops, subroutines, canned cycles, mirror image, parametric programming, machining cycles, programming for machining centre and turning centre for well known controllers such as Fanuc, Heidenhain, Sinumerik etc., generation of CNC codes from CAM packages.

**UNIT V TOOLING AND WORK HOLDING DEVICES****9**

Introduction to cutting tool materials – Carbides, Ceramics, CBN, PCD–inserts classification- PMK, NSH, qualified, semi qualified and preset tooling, tooling system for Machining centre and Turning centre, work holding devices for rotating and fixed work parts, economics of CNC, maintenance of CNC machines.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Upon completion of this course the student and can to provide knowledge on principle, constructional features, programming, tooling and workholding devices in CNC machine tools

**TEXT BOOKS:**

1. HMT, "Mechatronics", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
2. Warren S.Seamers, "Computer Numeric Control", Fourth Edition – Thomson Delmar, 2002.

**REFERENCES:**

1. James Madison, "CNC Machining Hand Book", Industrial Press Inc., 1996.
2. Ken Evans, John Polywka & Stanley Gabrel, "Programming of CNC Machines", Second Edition – Industrial Press Inc, New York, 2002
3. Peter Smid, "CNC Programming Hand book", Industrial Press Inc., 2000

4. Berry Leathan – Jones, "Introduction to Computer Numerical Control", Pitman, London, 1987.
5. Radhakrishnan P "Computer Numerical Control Machines", New Central Book Agency, 2002.
6. Rao P.N., "CAD/CAM", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2002.

**MT6502**

**THERMODYNAMICS PRINCIPLES AND APPLICATIONS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- The laws of thermodynamics are introduced. Types of I.C engines ,air conditioning and refrigeration techniques and heat transfer methods are introduced.

**UNIT I FIRST LAW OF THERMODYNAMICS**

**8**

Thermodynamics – microscopic and macroscopic point of view – systems, properties, process, path, cycle. Units – pressure, temperature – Zeroth law. First law – application to closed and open systems, internal energy, specific heat capacities CV and CP – enthalpy

**UNIT II SECOND LAW OF THERMODYNAMICS**

**8**

Second Law of thermodynamics – statements – equivalents of Kelvin Plank and Clausius statements. Reversibility – Irreversibility, reversible cycle – Carnot cycle and theorem

**UNIT III INTERNAL COMBUSTION ENGINES**

**12**

Classification of IC engine - IC engine components and functions. Valve timing diagram and port timing diagram - Comparison of two stroke and four stroke engines, Comparison of petrol & diesel engine, Fuel supply systems, total fuel consumption, specific fuel consumption, mechanical efficiency, BHP, IHP, FP - Ignition Systems, Lubrication system, Cooling system, MPFI, DTSI, CRDI.

**UNIT IV REFRIGERATION AND AIR-CONDITIONING**

**8**

Principles of refrigeration, refrigerator& heat pump cycle, refrigerants, refrigerant properties, refrigerant selection, vapour compression refrigeration cycle, vapour absorption cycle, dry bulb temperature, wet bulb temperature, relative humidity, comfort air-conditioning, Psychrometric chart, humidification, de-humidification, air coolers, cooling towers.

**UNIT V HEAT TRANSFER (Qualitative Treatment Only)**

**9**

Heat transfer through conduction and convection, Fourier's law of conduction - Problems on one dimensional heat conduction through plain walls, composite walls, cylinder walls, spheres. Extended surfaces: Fins. Problems on heat transfer through rectangular fin, triangular fin, circumferential fin, pin fin, fin efficiency, fin effectiveness. Heat transfer through radiation, Stefan Boltzman Law, black body, grey body, shape factor. Types of Heat Exchangers.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- The students will be able to apply the thermodynamics laws in the design of I.C engines , air conditioning and refrigeration equipments.

**TEXT BOOK:**

1. Nag P. K, 'Engineering Thermodynamics' Tata McGraw-Hill, 2005.

**REFERENCES:**

1. Michael A. Boles, Yunus A. Cengel, YunusCengel, "Thermodynamics", 2<sup>nd</sup> Edition, Mc Graw-Hill India, 2006.
2. Kothandaraman. C.P., Domkundwar. S. & Domkundwar. A.V., "A course in Thermal Engineering" Dhanpatrai & Co (P) Ltd, Fifth edition, 2000.
3. Kothandaraman. C.P., "Heat and Mass Transfer", New Age International (P) Publishers, 2002.
4. Holman.J.P., "Thermodynamics", 3<sup>rd</sup> Ed. McGraw-Hill, 2000.

**MT6511****POWER ELECTRONICS LABORATORY****L T P C**  
**0 0 3 2****OBJECTIVES:**

- To introduce the students different power electronics components and use of them in electronic circuits.
- To study characteristic of different power electronics components.

**LIST OF EXPERIMENTS**

1. Study of SCR, MOSFET & IGBT characteristics
2. UJT, R, RC firing circuits for SCR
3. Voltage & current commutated chopper
4. SCR phase control circuit
5. TRIAC phase control circuit
6. Study of half controlled & fully controller converters
7. Study of three phase AC regulator
8. Speed control of DC shunt motor using three phase fully controlled converter.
9. SCR single-phase cyclo converter
10. SCR series and parallel inverters
11. IGBT Chopper
12. IGBT based PWM inverter (single phase)

**TOTAL : 45 PERIODS****OUTCOMES:**

- Ability to use SCR, MOSFET, TRIAC in electronic circuit
- Ability to perform characteristic study on the electronics components.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

Sl.No	Name of the Equipment	Qty
1	Study of SCR, MOSFET & IGBT characteristics module	1
2	UJT, R, RC firing circuits for SCR module	1
3	Voltage & current commutated chopper module	1
4	SCR phase control circuit module	1
5	TRIAC phase control circuit module	1
6	Study of half controlled & fully controller converters module	1
7	Study of three phase AC regulator module	1
8	Speed control of DC shunt motor using three phase fully controlled converter module	1
9	SCR single phase cyclo converter module	1
10	SCR series and parallel inverters module	1
11	IGBT chopper module	1
12	IGBT based PWM inverter (single phase) module	1

13	Ammeter (0-5A) MC, (0-2A) MC, (0-2A) MI, (0-5V) MI	15
14	Voltmeter (0-300V) MC, (0-600V) MC, (0-300V) MI, (0-600V) MI, Multimeter	16
15	CRO ,Transformer 1KVA, 1:1, 230V	Each 3

MT6512

**SENSORS AND SIGNAL PROCESSING LABORATORY**

**L T P C**  
**0 0 3 2**

**OBJECTIVES:**

- To provide knowledge sensors and signal processing
- To provide hand experience to measure different signal using sensor and processing them in required form.

**LIST OF EXPERIMENTS**

1. Measurement of temperature using thermocouple, thermistor and RTD
2. Measurement of displacement using POT, LVDT & Capacitive transducer
3. Torque measurement using torque measuring devices
4. Strain Measurement using strain gauge
5. Servomotor position control using photo electric pickup
6. Wave Shaping circuit
7. Analog to Digital Converters
8. Digital Comparator
9. Voltage to frequency converter
10. Frequency to Voltage Converter
11. Position and velocity measurement using encoders
12. Study on the application of data acquisition system for industrial purposes.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Ability to use the sensors for the measurement of different signals and use of signal processing techniques to convert them to useful signal.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S.No	Name of the Equipment	Qty
1	Cathode Ray Oscilloscope	5
2	Function Generator	5
3	Regulated power supply	7
4	Displacement Measurement Trainer using LVDT	1
5	Capacitive pickup trainer module	1
6	Position and Velocity measurement using encoder kit	1
7	Servomotor Position control kit	1
8	Speed measurement and closed loop control of DC	1
9	Motor using photo electric pickup kit	1
10	RTD module	1
11	Thermistor module	1
12	Thermocouple module	1
13	Absolute encoder	1
14	Potentiometer trainer pickup	1
15	Strain gauge module	1
16	Load cell module	1

**MT6513**

**CNC LABORATORY**

**L T P C**  
**0 0 3 2**

**OBJECTIVES:**

- To train the students in manual and computer assisted part programming, tool path generation and control, operation and control of CNC machines tools.

**LIST OF EXPERIMENTS**

1. Manual part programming using G and M codes for Turning, step turning, Taper turning, thread cutting and radius turning on cylindrical components.
2. Programming and Simulation of machining using the following features.
  - (i) Linear and Circular interpolation
  - (ii) Pocket milling, slotting, peck drilling and other fixed canned cycles.
3. Given a component drawing to write the manual part programming and execute on CNC Lathe and Milling Machine.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to write manual part programming using G code and M code for simple components
- Ability to operate CNC controlled machine tools

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

1. CNC Lathe with Fanuc control
2. CNC Milling Machine with Fanuc control
3. Master CAM software
4. Computer nodes

**MG6851**

**PRINCIPLES OF MANAGEMENT**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization .

**UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS**

**9**

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

**UNIT II PLANNING**

**9**

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

**UNIT III ORGANISING**

**9**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

**UNIT IV DIRECTING****9**

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

**UNIT V CONTROLLING****9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

**TEXTBOOKS:**

1. Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall (India) Pvt. Ltd., 10<sup>th</sup> Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", Pearson Education, 6<sup>th</sup> Edition, 2004.

**REFERENCES:**

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" 7<sup>th</sup> Edition, Pearson Education, , 2011.
2. Robert Kreitner & Mamata Mohapatra, " Management", Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich "Essentials of management" Tata McGraw Hill, 1998.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999

**MT6601****MICROCONTROLLER AND PLC****L T P C  
3 0 0 3****OBJECTIVES:**

- To introduce the basic features, programming methods and applications of Micro controllers .The design of systems using PLC is introduced in detail.

**UNIT I INTRODUCTION TO MICROCONTROLLER****9**

8051 Architecture:– Memory map - Addressing modes, I/O Ports –Counters and Timers – Serial data - I/O – Interrupts –Instruction set,, Data transfer instructions, Arithmetic and Logical Instructions, Jump and Call Instructions , Assembly Language Programming tools.

**UNIT II MICROCONTROLLER PROGRAMMING****9**

8051 Assembly Language Programming- Block transfer, arithmetic operations, Code conversion, Time delay generation, Interrupt programming, Lookup table techniques

**UNIT III MICROCONTROLLER APPLICATIONS****8**

Interfacing of Keyboards – Interfacing of Display Devices – Pulse measurement – Analog to Digital and Digital to Analog Converter – Interfacing Hardware Circuit – Serial Data Communication – Network Configuration.

**UNIT IV PROGRAMMABLE LOGIC CONTROLLERS 9**

Introduction — Principles of operation – PLC Architecture and specifications – PLC hardware components Analog & digital I/O modules , CPU & memory module – Programming devices – PLC ladder diagram, Converting simple relay ladder diagram in to PLC relay ladder diagram. PLC programming Simple instructions – Manually operated switches – Mechanically operated a Proximity switches - Latching relays,

**UNIT V APPLICATIONS OF PROGRAMMABLE LOGIC CONTROLLERS. 9**

Timer instructions - On delay, Off delay, Cyclic and Retentive timers, Up /Down Counters, control instructions – Data manipulating instructions, math instructions; Applications of PLC – Simple materials handling applications, Automatic control of warehouse door, Automatic lubrication of supplier Conveyor belt, motor control, Automatic car washing machine, Bottle label detection and process control application.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- The students will learn the theory, programming and application of microcontroller And design of systems using Programmable Logic Controllers

**TEXT BOOKS:**

1. Muhammad Ali Mazdi ,J.G.Mazdi & R.D.McKinlay “The 8051 Microcontroller& Embedded systems Using assembly & C “ 2<sup>nd</sup> Edition Pearson Education , Inc ,2006
2. Udayasankara.v & Mallikarjunaswamy .M.S ,’8051 Microcontroller, Hardware, Software & Applications ,Tata McGraw Hill Education Pvt Limited. New Delhi ,2009.
3. Gary Dunning , ‘Introduction to Programmable Logic Controllers“ Thomson Learning, 2001.

**REFERENCES:**

1. Singh. B.P., "Microprocessors and Microcontrollers", Galcotia Publications (P) Ltd, First edition, New Delhi, 1997.
2. Parr, "Programmable Controllers: An Engineers Guide", 3<sup>rd</sup> Edition, Elsevier, Indian Reprint, 2013
3. Valdes-Perez, Microcontrollers: Fundamentals and Applications with PIC, Taylor & Francis, Indian Reprint, 2013.
4. Bolton , "Programmable Logic Controllers" 5<sup>th</sup> Edition Newnes, ,2009

**MT6602**

**APPLIED HYDRAULICS AND PNEUMATICS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- This course will give an appreciation of the fundamental principles, design and operation of hydraulic and pneumatic components and systems and their application in manufacturing and mechanical systems.

**UNIT I FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS 9**

Introduction to Fluid power- Advantages and Applications- Fluid power systems – Types of fluids- Properties of fluids – Basics of Hydraulics – Pascal’s Law- Principles of flow – Friction loss- Work, Power and Torque. Problems Sources of Hydraulic power: Pumping Theory – Pump Classification- Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criterion of Linear, Rotary- Fixed and Variable displacement pumps-Problems



**UNIT II SYSTEM MODELLING 9**  
Introduction-model categories-fields of application-model development-model verification-model validation-model simulation-design of mixed systems-electro mechanics design-model transformation-domain-independent description forms-simulator coupling.

**UNIT III REAL TIME INTERFACING 9**  
Introduction-selection of interfacing standards Elements of Data Acquisition & control Systems- Over view of I/O process, General purpose I/O card and its installation, Data conversion process, Application Software- Lab view Environment and its applications, Vim-Sim Environment & its applications -Man machine interface.

**UNIT IV CASE STUDIES ON MECHATRONIC SYSTEM 9**  
Introduction –Fuzzy based Washing machine – pH control system – Autofocus Camera, exposure control– Motion control using D.C.Motor& Solenoids – Engine management systems.– Controlling temperature of a hot/cold reservoir using PID- Control of pick and place robot – Part identification and tracking using RFID – Online surface measurement using image processing

**UNIT V MICRO MECHATRONIC SYSTEM 9**  
Introduction- System principle - Component design – System design – Scaling laws – Micro actuation – Micro robot – Micro pump – Applications of micro mechatronic components.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- The students will be able to design systems in mechatronics approach using modern software packages.

**TEXT BOOKS:**

1. Devdas shetty, Richard A. Kolk, "Mechatronics System Design", 2<sup>nd</sup> Edition ,Cengage Learning 2011.
2. Georg pelz, "Mechatronic Systems: Modeling and simulation" with HDL's, John wiley and sons Ltd, 2003

**REFERENCES:**

1. Bishop, Robert H, "Mechatronics Hand book", CRC Press, 2002.
2. Bradley, D.Dawson, N.C. Burd and A.J. Loader, "Mechatronics: Electronics in Products and Processes", CRC Press 1991 , First Indian print 2010.
3. De Silva, "Mechatronics: A Foundation Course", Taylor & Francis, Indian Reprint, 2013

**MT6604 OBJECT ORIENTED PROGRAMMING IN C++ L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To introduce the C++ programming and its use in object oriented environment.

**UNIT I OOP PARADIGM : 9**  
Software crisis – Software evolution – A look at procedure oriented programming – Object oriented programming paradigm – Basic concepts of object oriented programming – Benefits of OOP – Reusability – Security – Object oriented programming fundamental – Abstraction – Encapsulation – Derivation – Object oriented languages and packages–Applications of OOP – A simple C++ program – More C++ statements – Structure of C++ Program.

**UNIT II INTRODUCTION TO C++: 10**

Tokens – Keywords – Identifiers and constants – Basic data types – User defined data types – Derived data types – Symbolic constants – Declaration of variables – Dynamic initialization of variables – Reference variables – Operators in C++ – Scope resolution operator – Manipulators– Type cast operator – Expressions and their types – Special assignment expressions – Control structures - The main function – Function prototyping – Call by reference – Return by reference – Inline functions – Default arguments – Function overloading.

**UNIT III CLASSES AND OBJECTS : 9**

Specifying a class – Defining member functions – Private member functions –Arrays within a class – Memory allocation for objects – Static data members – Static member functions – Arrays of objects – Objects as function arguments –Friendly functions – Returning objects. Constructors: Parameterized constructors – Multiple constructors in a class – Constructors with default arguments – Dynamic initialization of objects – Copy constructor – Dynamic constructors– Destructors.

**UNIT IV OPERATOR OVERLOADING, INHERITANCE AND POLYMORPHISM 10**

Defining operator overloading: Overloading unary, binary operators. Manipulation of strings using operators – Rules for overloading operators – Type Conversions - Defining derived classes – Single inheritance – Multilevel inheritance – Multiple inheritance – Hierarchical inheritance – Hybrid inheritance – Virtual base classes – Abstract classes - Introduction to pointers to objects: This pointer – Pointers to derived classes – Virtual functions – Pure virtual functions.

**UNIT V CASE STUDIES 7**

Over view of typical object oriented systems – Case studies- Applications

**TOTAL:45 PERIODS**

**OUTCOMES:**

- The students will be able to develop C++ programs for object oriented systems and test the systems

**TEXT BOOK:**

1. Balagurusamy. E., "Object Oriented Programing wih C++", Tata McGraw Hill,1997.

**REFERENCES:**

1. Herbert Schildt,"C++ The Complete Reference", Tata Mc Graw Hill Edition, 2003
2. Bjanne Stroustrup, "The C++ Programming Language",3<sup>rd</sup> Edition, Addison Wesley, 2000
3. Stanley, B.Lippman,JoveLagrie,"C++Primer",3<sup>rd</sup> Edition, Addison Wesley,1998
4. Baarkakati. N., 'Object Oriented Programming in C++', Prentice Hall of India, 1997.

**MT6611 MICRO CONTROLLER AND PLC LABORATORY L T P C  
0 0 3 2**

**OBJECTIVES:**

- To introduce and train the students to use microcontroller and PLC for actuation, control of speed.

**LIST OF EXPERIMENTS**

1. Study of Microcontroller Kits.
2. 8051 / 8031 Programming Exercises.
3. Stepper Motor interface.
4. D.C. motor controller interface.
5. Study of interrupt structure of 8051.

6. Interfacing high power devices to microcomputer port lines, LED relays and LCD displays.
7. Linear actuation of hydraulic cylinder with counter and speed control.
8. Hydraulic rotation with timer and speed control.
9. Sequential operation of pneumatic cylinders.
10. Traffic light controller.
11. Speed control of DC motor using PLC.
12. Testing of Relays using PLC.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to use microcontroller and PLC to control different motor/equipment.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S.No	Name of the Equipment	Qty
1	Regulated power supply	7
2	Pulse generator	1
3	Function generator	5
4	Cathode ray oscilloscope	5
5	8051 MicroController Kit	5
6	stepper Motor	2
7	stepper motor interfacing board	2
8	PLC trainer kit and related software	2
9	Hydraulic cylinder	1
10	Pneumatic cylinder	1
11	LED/LCD interface units	1
12	SCR/Triac/Power MOSFET interface unit	1

**MT6612**

**OBJECT ORIENTED PROGRAMMING LABORATORY**

**L T P C**  
**0 0 3 2**

**OBJECTIVES:**

- To get a clear understanding of object-oriented concepts.
- To understand object oriented programming through C++ & JAVA.

**LIST OF EXPERIMENTS:**

**C++:**

1. program using functions
  - functions with default arguments
  - implementation of call by value, address, reference
2. simple classes for understanding objects, member functions & constructors
  - classes with primitive data members,
  - classes with arrays as data members
  - classes with pointers as data members
  - classes with constant data members
  - classes with static member functions
3. compile time polymorphism

- operator overloading
  - function overloading
4. run time polymorphism
- inheritance
  - virtual functions
  - virtual base classes
  - templates
5. file handling
- sequential access
  - random access

**TOTAL :45 PERIODS**

### OUTCOMES

- Gain the basic knowledge on Object Oriented concepts.
- Ability to develop applications using Object Oriented Programming Concepts.
- Ability to implement features of object oriented programming to solve real world problems

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No	Name of the Equipment	Qty
1	Standalone desktops with C++ compiler (or) Server with C++ compiler supporting 30 terminals or more.	30 Nos.

**MT6613**

**APPLIED HYDRAULICS AND PNEUMATIC LABORATORY**

**L T P C**  
**0 0 3 2**

### OBJECTIVES:

- To introduce and provide hand on experience to students to design and test hydraulic circuit to control press, flow etc.,
- To provide hands on experience to design and test the pneumatic circuit to perform basic operations
- To introduce the MAT Lan/ LABVIEW software to simulate hydraulic, pneumatic and electrical circuit.

### LIST OF EXPERIMENTS

#### 1. Design and testing of hydraulic circuits such as

- i) Pressure control
- ii) Flow control
- iii) Direction control
- iv) Design of circuit with programmed logic sequence, using an optional PLC in hydraulic Electro hydraulic Trainer.

#### 2. Design and testing of pneumatic circuits such as

- i. Pressure control
- ii. Flow control
- iii. Direction control
- iv. Circuits with logic controls

- v. Circuits with timers
- vi. Circuits with multiple cylinder sequences in Pneumatic Electro pneumatic Trainer.

Modeling and analysis of basic electrical, hydraulic, and pneumatic systems using

**MATLAB/LABVIEW** software.

3. Simulation of basic hydraulic, pneumatic and electrical circuits using Automation studio software.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to design and test hydraulic, pneumatic circuits
- Use of MATLAB/LABVIEW software for simulation of hydraulic, pneumatic and electrical circuits.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S.No	NAME OF THE EQUIPMENT	Qty
<b>Hydraulic equipment</b>		
1	Pressure relief valve	4
2	Pressure reducing valves	2
3	Flow control valves	2
4	Pressure switch	1
5	Limit switches	2
6	Linear actuator	1
7	Rotary actuator	1
8	Double solenoid actuated DCV	2
9	Single solenoid actuated DCV	1
10	Hydraulic power pack with 2 pumps & 2 pressure relief valve	1
11	PLC	1
<b>Pneumatics equipment</b>		
1	Pneumatic trainer kit with FRL Unit, Single acting cylinder, push buttons	1
2	Pneumatic trainer kit with FRL unit, Double acting cylinder, manually actuated DCV	1
3	Pneumatic training kit with FRL unit, Double acting cylinder, pilot actuated DCV	1
4	Pneumatic trainer kit with FRL unit, Double acting cylinder, Double solenoid actuated DCV, DCV with sensors/ magnetic reed switches	1
5	PLC with Interface card	1
6	LABVIEW Software	1
7	Automation studio software	1

**MT6701**

**MEDICAL MECHATRONICS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- The students will be exposed to sensors and actuators used in biomedical system design

**UNIT I INTRODUCTION**

**9**

Cell structure – electrode – electrolyte interface, electrode potential, resting and action potential – electrodes for their measurement, ECG, EEG, EMG – machine description – methods of measurement – three equipment failures and trouble shooting.





**UNIT IV MACHINE VISION FUNDAMENTALS 9**  
Machine vision: image acquisition, digital images-sampling and quantization-levels of computation  
Feature extraction-windowing technique- segmentation- Thresholding- edge detection- binary morphology - grey morphology

**UNIT V ROBOT PROGRAMMING 8**  
Robot programming: Robot Languages- Classification of robot language-Computer control and robot software-Val system and Languages- application of robots.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students can able to apply the basic engineering knowledge for the design of robotics

**TEXT BOOKS:**

1. M.P.Groover, M.Weiss ,R.N. Nagal, N.G.Odrey, "Industrial Robotics - Technology, programming and Applications" Tata , McGraw-Hill Education Pvt Limited, 2008

**REFERENCES:**

1. Sathya Ranjan Deb, "Robotics Technology & flexible Automation" Sixth edition, Tata McGraw-Hill Publication, 2003.
2. K.S.Fu, R.C.Gonzalez, C.S.G.Lee, "Robotics: Sensing, Vision & Intelligence", Tata McGraw-Hill Publication, 1987.
3. John.J.Craig, "Introduction to Robotics: Mechanics & control", Second edition, 2002.
4. Jazar, "Theory of Applied Robotics: Kinematics, Dynamics and Control", Springer, Indian Reprint, 2010

**ME6602 AUTOMOBILE ENGINEERING L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To understand the construction and working principle of various parts of an automobile.
- To have the practice for assembling and dismantling of engine parts and transmission system

**UNIT I VEHICLE STRUCTURE AND ENGINES 9**  
Types of automobiles, vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines –components-functions and materials, variable valve timing (VVT).

**UNIT II ENGINE AUXILIARY SYSTEMS 9**  
Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

**UNIT III TRANSMISSION SYSTEMS 9**  
Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints ,Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

**UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS 9**

Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control.

**UNIT V ALTERNATIVE ENERGY SOURCES 9**

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance ,Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell

Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students will be able to identify the different components in automobile engineering.
- Have clear understanding on different auxiliary and transmission systems usual.

**TEXT BOOKS:**

1. Kirpal Singh, "Automobile Engineering", Vol 1 & 2, Standard Publishers, Seventh Edition, New Delhi, 1997.
2. Jain K.K. and Asthana .R.B, "Automobile Engineering" Tata McGraw Hill Publishers, New Delhi, 2002.

**REFERENCES:**

1. Newton ,Steeds and Garet, "Motor Vehicles", Butterworth Publishers,1989.
2. Joseph Heitner, "Automotive Mechanics," Second Edition, East-West Press, 1999.
3. Martin W, Stockel and Martin T Stockle , "Automotive Mechanics Fundamentals," The Good heart –Will Cox Company Inc, USA ,1978.
4. Heinz Heisler , "Advanced Engine Technology," SAE International Publications USA,1998.
5. Ganesan V. "Internal Combustion Engines", Third Edition, Tata Mcgraw-Hill, 2007.

**MT6711 COMPUTER AIDED DESIGN AND COMPUTER AIDED MANUFACTURING LABORATORY L T P C  
0 0 3 2**

**OBJECTIVES:**

- To provide an overview of how computers are being used in design

**LIST OF EXPERIMENTS:**

1. Modelling of a part using Pro-E / CATIA / UNIGRAPHICS.
2. Modelling of a component using Pro-E / CATIA / UNIGRAPHICS.
3. Modelling and assembling of the mechanical assembly using Pro-E / CATIA / UNIGRAPHICS.
4. Structural analysis using FEA software – ANSYS / SOLIDWORKS / CATIA.
5. Beam deflection analysis using FEA software – ANSYS / SOLIDWORKS / CATIA.
6. Thermal analysis using FEA software – ANSYS / SOLIDWORKS / CATIA.
7. Vibration or modal analysis using FEA software – ANSYS / SOLIDWORKS / CATIA.
8. Modelling and tool path simulation using Master CAM (MILL) or any CAM package.
9. Modelling and tool path simulation using Master CAM (Lathe) or any CAM package.
10. NC code generation for milling using Master CAM (MILL) or any CAM package.
11. NC code generation for turning using Master CAM (Lathe) or any CAM package.

**TOTAL : 45 PERIODS**

## EQUIPMENTS FOR A BATCH OF 30 STUDENTS

**NOTE - Any solid modelling or suitable software packages can be used for exercise.**

### OUTCOMES:

- The students can able to apply the students can able to apply mathematical knowledge in modeling and assembly of parts

**MT6712**

**ROBOTICS LABORATORY**

**L T P C**  
**0 0 3 2**

### OBJECTIVES:

- To introduce different types of robotics and demonstrate them to identify differnt parts and components.
- To write programming for simple operations like pick and place, rotoxim etc.,

### LIST OF EXPERIMENTS:

1. Study of different types of robots based on configuration and application.
2. Study of different type of links and joints used in robots
3. Study of components of robots with drive system and end effectors.
4. Determination of maximum and minimum position of links.
5. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
6. Estimation of accuracy, repeatability and resolution.
7. Robot programming exercises

**TOTAL: 45 PERIODS**

### OUTCOMES:

- Use of Adam's software and MAT Lab software to model the different types of robots and calculate work volume for different robots.

## EQUIPMENTS FOR A BATCH OF 30 STUDENTS

Adam's software and Mat lab software packages are to be used to carry out the listed experiments

**MT6713**

**DESIGN AND FABRICATION PROJECT**

**L T P C**  
**0 0 4 2**

### OBJECTIVES:

- The main objective is to give an opportunity to the student to get hands on training in the fabrication of one or more components of a complete working model, which is designed by them.

### GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped into 2 to 4 and work under a project supervisor. The device/system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based

on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL : 60 PERIODS**

**OUTCOMES:**

- Use of design principles and develop conceptual and engineering design of any components.
- Ability to fabricate any components using different manufacturing tools.

**MT6801**

**AUTOMOTIVE ELECTRONICS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- Students will be exposed to application of electronics in automotives systems

**UNIT I INTRODUCTION**

**8**

Evolution of electronics in automobiles – emission laws – introduction to Euro I, Euro II, Euro III, Euro IV, Euro V standards – Equivalent Bharat Standards. Charging systems: Working and design of charging circuit diagram – Alternators – Requirements of starting system - Starter motors and starter circuits.

**UNIT II IGNITION AND INJECTION. SYSTEMS**

**10**

Ignition systems: Ignition fundamentals - Electronic ignition systems - Programmed Ignition – Distribution less ignition - Direct ignition – Spark Plugs. Electronic fuel Control: Basics of combustion – Engine fuelling and exhaust emissions – Electronic control of carburetion – Petrol fuel injection – Diesel fuel injection.

**UNIT III SENSOR AND ACTUATORS**

**7**

Working principle and characteristics of Airflow rate, Engine crankshaft angular position, Hall effect, Throttle angle, temperature, exhaust gas oxygen sensors – study of fuel injector, exhaust gas recirculation actuators, stepper motor actuator, vacuum operated actuator.

**UNIT IV ENGINE CONTROL SYSTEMS**

**10**

Control modes for fuel control-engine control subsystems – ignition control methodologies – different ECU's used in the engine management – block diagram of the engine management system. In vehicle networks: CAN standard, format of CAN standard – diagnostics systems in modern automobiles.

**UNIT V CHASSIS AND SAFETY SYSTEMS**

**10**

Traction control system – Cruise control system – electronic control of automatic transmission – antilock braking system – electronic suspension system – working of airbag and role of MEMS in airbag systems – centralized door locking system – climate control of cars.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- The students will be able to use advanced sensors and actuators in the upgradation of automobiles.

**TEXT BOOKS:**

1. Ribbens, "Understanding Automotive Electronics", 7<sup>th</sup> Edition, Elsevier, Indian Reprint, 2013

**REFERENCES:**

1. Tom Denton, "Automobile Electrical and Electronics Systems", Edward Arnold Publishers, 2000.

2. Barry Hollembeak, "Automotive Electricity, Electronics & Computer Controls", Delmar Publishers, 2001.
3. Richard K. Dupuy "Fuel System and Emission controls", Check Chart Publication, 2000.
4. Ronald. K. Jurgon, "Automotive Electronics Handbook", McGraw-Hill, 1999.

**MT6811**

**PROJECT WORK**

**L T P C**  
**0 0 12 6**

**OBJECTIVES:**

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL: 180 PERIODS**

**OUTCOMES:**

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

**MT6001**

**ADVANCED MANUFACTURING TECHNOLOGY**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To introduce the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and manufacture of plastic components.

**UNIT I SHEET METAL WORKING OF METALS**

**8**

Hot and Cold Working- rolling, forging, wire drawing, extrusion-types-forward, backward & tube extrusion. Blanking-blank size calculation, draw ratio, drawing force, piercing, punching, trimming, stretch forming, tube bending, tube forming -embossing & coining-explosive forming electro hydraulic forming-electromagnetic forming

**UNIT II NON TRADITIONAL MACHINING**

**9**

Ultrasonic machining (USM) – process and description of USM-applications and limitations- Electron Beam Machining (EBM)-Process principles of EBM-applications-process principles- Laser Beam Machining (LBM)-Laser beam production-applications-laser beam welding-Plasma Arc Machining (PAM)-Generation of plasma arc-process parameters-applications and limitations.

**UNIT III SURFACE FINISHING AND SURFACE HARDENING PROCESS 10**

Grinding process, various types of grinding machine-grinding wheel-types-selection of grinding wheel for different applications-selection of cutting speed and work speed- mounting of grinding wheel-galvanizing, electroplating, anodising. Surface hardening- carburizing, carbonitriding, cyaniding, nitriding, ion nitriding, boronizing, laser hardening, thin film coating(PVD, CVD).

**UNIT IV EDM AND ECM 10**

Electrical Discharge Machining (EDM) - Description of EDM equipment-electrical circuits - electrolyte-metal removal rate-applications-EDWC - process principles – equipments - applications.Electro Chemical Machining (ECM) - Description of the equipment-electrolyte-metal removal rate -accuracy and surface finish obtained. Electro Chemical grinding (ECG) – Chemical machining-electro chemical grinding equipment-application-electro chemical deburring-honingapplications

**UNIT V JIGS AND FIXTURES 8**

Jigs-Locating and Clamping devices-principles-elements-mechanical-pneumatic and hydraulicactuation-types of Jigs-general consideration in Jig design-jig bushing, types- methods of construction. Fixtures-types of fixtures- fixture for machine tools –lathe, milling, boring, broaching, grinding-assembly inspection of welding fixture design.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students can able to use different manufacturing process and use this in industry for component production

**TEXTBOOKS:**

1. Rao P.N., "Manufacturing Technology, Metal cutting and Machine Tools", Tata McGraw Hill, 2000.
2. Sharma .P.C., "A text book of Production Technology- vol I &II ", S.Chand & Company Ltd, New Delhi, 1996.

**REFERENCES:**

1. HajraChoudhary.S.K. and Hajra Choudhary.A.K, "workshop Technology", Vol-I &Vol-II", Media Publishers 1986.
2. Donaldson. C. "Tool design", Tata McGraw Hill Co. Ltd.,1985.
3. H.M.T Bangalore "Production Technology" Tata McGraw Hill, 2001

**GE6757 TOTAL QUALITY MANAGEMENT L T P C  
3 0 0 3**

**OBJECTIVES :**

- The principles and techniques used in TQM and various quality control systems are introduced.

**UNIT I INTRODUCTION 9**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

**UNIT II TQM PRINCIPLES 9**

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal- Continuous process improvement - PDSA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

**UNIT III TQM TOOLS AND TECHNIQUES I 9**

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

**UNIT IV TQM TOOLS AND TECHNIQUES II 9**

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

**UNIT V QUALITY SYSTEMS 9**

Need for ISO 9000 - ISO 9000-2000 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - Case studies of TQM Implementation in manufacturing and service sectors including IT.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- The students will be able to implement various quality control procedures in manufacturing and service sectors including IT.

**TEXT BOOK:**

1. Dale H. Besterfield, et al., "Total quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2006).

**REFERENCES:**

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8<sup>th</sup> Edition, First Indian Edition, Cengage Learning, 2012.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

**IT6502**

**DIGITAL SIGNAL PROCESSING**

**L T P C  
3 1 0 4**

**OBJECTIVES:**

- To introduce discrete Fourier transform and its applications.
- To teach the design of infinite and finite impulse response filters for filtering undesired signals.
- To introduce signal processing concepts in systems having more than one sampling frequency.

**UNIT I SIGNALS AND SYSTEMS 9**

Basic elements of DSP – concepts of frequency in Analog and Digital Signals – sampling theorem – Discrete – time signals, systems – Analysis of discrete time LTI systems – Z transform – Convolution – Correlation.

**UNIT II FREQUENCY TRANSFORMATIONS 9**

Introduction to DFT – Properties of DFT – Circular Convolution - Filtering methods based on DFT – FFT Algorithms - Decimation – in – time Algorithms, Decimation – in – frequency Algorithms – Use of FFT in Linear Filtering – DCT – Use and Application of DCT.

**UNIT III IIR FILTER DESIGN 9**

Structures of IIR – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives – (LPF, HPF, BPF, BRF) filter design using frequency translation.

**UNIT IV FIR FILTER DESIGN 9**

Structures of FIR – Linear phase FIR filter – Fourier Series - Filter design using windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques

**UNIT V FINITE WORD LENGTH EFFECTS IN DIGITAL FILTERS 9**

Binary fixed point and floating point number representations – Comparison - Quantization noise – truncation and rounding – quantization noise power- input quantization error- coefficient quantization error – limit cycle oscillations-dead band- Overflow error-signal scaling.

**TOTAL (L:45+T:15): 60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Perform frequency transforms for the signals.
- Design IIR and FIR filters.
- Finite word length effects in digital filters

**TEXT BOOK:**

1. John G. Proakis and Dimitris G.Manolakis, “Digital Signal Processing – Principles, Algorithms & Applications”, Fourth Edition, Pearson Education, Prentice Hall, 2007.

**REFERENCES:**

1. Emmanuel C.Ifeachor, and Barrie.W.Jervis, “Digital Signal Processing”, Second Edition, Pearson Education, Prentice Hall, 2002.
2. Sanjit K. Mitra, “Digital Signal Processing – A Computer Based Approach”, Third Edition, Tata Mc Graw Hill, 2007.
3. A.V.Oppenheim, R.W. Schafer and J.R. Buck, Discrete-Time Signal Processing, 8<sup>th</sup> Indian Reprint, Pearson, 2004.
4. Andreas Antoniou, “Digital Signal Processing”, Tata McGraw Hill, 2006.

<b>IE6011</b>	<b>PRODUCT DESIGN AND DEVELOPMENT</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

**OBJECTIVES:**

- The course aims at providing the basic concepts of product design, product features and its architecture so that student can have a basic knowledge in the common features a product has and how to incorporate them suitably in product.

**UNIT I INTRODUCTION 5**

Need for IPPD – Strategic importance of Product development – integration of customer, designer, material supplier and process planner, Competitor and customer – Behaviour analysis. Understanding customer – prompting customer understanding – involve customer in development and managing requirements – Organization – process management and improvement – Plan and establish product specifications.

**UNIT II CONCEPT GENERATION AND SELECTION 5**  
Task – Structured approaches – clarification – search – externally and internally – explore systematically – reflect on the solutions and processes – concept selection – methodology – benefits.

**UNIT III PRODUCT ARCHITECTURE 10**  
Implications – Product change – variety – component standardization – product performance – manufacturability – product development management – establishing the architecture – creation – clustering – geometric layout development – fundamental and incidental interactions – related system level design issues – secondary systems – architecture of the chunks – creating detailed interface specifications.

**UNIT IV INDUSTRIAL DESIGN 10**  
Integrate process design – Managing costs – Robust design – Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically – Need for industrial design – impact – design process – investigation of for industrial design – impact – design process – investigation of customer needs – conceptualization – refinement – management of the industrial design process – technology driven products – user – driven products – assessing the quality of industrial design.

**UNIT V DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT 15**  
Definition – Estimation of Manufacturing cost – reducing the component costs and assembly costs – Minimize system complexity – Prototype basics – principles of prototyping – planning for prototypes – Economic Analysis – Understanding and representing tasks – baseline project planning – accelerating the project – project execution.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- The student will be able to design some products for the given set of applications; also the knowledge gained through prototyping technology will help the student to make a prototype of a problem and hence product design and development can be achieved.

**TEXT BOOK:**

1. Kari T.Ulrich and Steven D.Eppinger, "Product Design and Development", McGraw-Hill International Edns. 1999.

**REFERENCES:**

1. Kemnneth Crow, "Concurrent Engg./Integrated Product Development", DRM Associates,26/3, Via Olivera, Palos Verdes, CA 90274(310) 377-569, Workshop Book.
2. Stephen Rosenthal,"Effective Product Design and Development", Business One Orwin, Homewood, 1992, ISBN 1-55623-603-4.
3. Staurt Pugh, "Tool Design –Integrated Methods for Successful Product Engineering", Addison Wesley Publishing, New york, NY.

**MT6002**

**DIAGNOSTIC TECHNIQUES**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- The basics of various diagnostics techniques for proper maintance and monitoring the equipment are introduced.

**UNIT I DEFECTS AND FAILURE ANALYSIS 9**  
Maintenance Concept, Maintenance objective, Challenges in maintenance. Defect generation - Types of failures - Defect reporting and recording - Defect analysis -Failure analysis -Equipment down time analysis - Breakdown analysis - FTA - FMEA - FMECA.

**UNIT II MAINTENANCE SYSTEMS 9**  
Planned and unplanned maintenance - Breakdown maintenance - corrective maintenance- Opportunistic maintenance - Routine maintenance - Preventive maintenance – Predictive Maintenance - Condition based maintenance system - Design out maintenance – Maintenance by objectives – Selection of maintenance system

**UNIT III SYSTEMATIC MAINTENANCE 9**  
Codification and Cataloguing - instruction manual and operating manual - Maintenance manual and departmental manual - Maintenance time standard - Maintenance work order and work permit - job monitoring – Feedback and control – Maintenance records and documentation. Introduction to Total Productive Maintenance (TPM).

**UNIT IV COMPUTER MANAGED MAINTENANCE SYSTEM 9**  
Selection and scope of computerization – Equipment classification – Codification of breakdown,material and facilities - Job sequencing - Material management module – Captive engineering module. Decision making in maintenance.Economic aspects of maintenance.

**UNIT V CONDITION MONITORING 9**  
Condition monitoring techniques – Visual monitoring – Temperature monitoring – Vibration monitoring – Lubricant monitoring – Cracks monitoring – Thickness monitoring - Noise and sound monitoring – Condition monitoring of hydraulic system. Machine diagnostics – Objectives - Monitoring strategies – Examples of monitoring and diagnostics - Control structures for machine diagnosis.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- The students will be able to analyze the defects and rectify the faults. Also they will be able to monitor and maintain the equipment..

**TEXTBOOK:**

1. Sushil Kumar Srivastava, “Industrial Maintenance Management”, S.Chand & Company Ltd, New Delhi, 1998.

**REFERENCES:**

1. Manfred, H. "Bibring, Handbook of Machine Tools", Vol.3, John Wiley & Sons
2. Mishra R.C., Pathak K. "Maintenance Engineering and Management", Prentice Hall of India Private Ltd., New Delhi, 2002

**MG6072**

**MARKETING MANAGEMENT**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To enable students to deal with newer concepts of marketing concepts like strategic marketing segmentation, pricing, advertisement and strategic formulation. The course will enable a student to take up marketing as a professional career.

<b>UNIT I</b>	<b>MARKETING PROCESS</b>	<b>9</b>
Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy.		
<b>UNIT II</b>	<b>BUYING BEHAVIOUR AND MARKET SEGMENTATION</b>	<b>9</b>
Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic - Psycho graphic and geographic segmentation, process, patterns.		
<b>UNIT III</b>	<b>PRODUCT PRICING AND MARKETING RESEARCH</b>	<b>9</b>
Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.		
<b>UNIT IV</b>	<b>MARKETING PLANNING AND STRATEGY FORMULATION</b>	<b>9</b>
Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.		
<b>UNIT V</b>	<b>ADVERTISING, SALES PROMOTION AND DISTRIBUTION</b>	<b>9</b>
Characteristics, impact, goals, types, and sales promotions - point of purchase - unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing, Modern Trends, e-Marketing.		

**TOTAL: 45 PERIODS**

**OUTCOMES :**

- The learning skills of Marketing will enhance the knowledge about Marketer's Practices and create insights on Advertising, Branding, Retailing and Marketing Research.

**TEXTBOOKS:**

1. Philip Kotler & Keller, "Marketing Management", 14<sup>th</sup> edition, Prentice Hall of India, 2012.
2. Chandrasekar. K.S., "Marketing Management Text and Cases", 1<sup>st</sup> Edition, Tata McGraw Hill – Vijaynicole, 2010.

**REFERENCES:**

1. Ramasamy and Nama kumari, "Marketing Environment: Planning, implementation and control the Indian context", 1990.
2. Czinkota & Kotabe, "Marketing management", Thomson learning, Indian edition 2007
3. Adrain palmer, " Introduction to Marketing Theory and Practice", Oxford university press IE 2004.
4. Donald S. Tull and Hawkins, "Marketing Reasearch", Prentice Hall of Inida-1997.
5. Philip Kotler and Gary Armstrong "Principles of Marketing" Prentice Hall of India, 2000.
6. Steven J.Skinner, "Marketing", All India Publishers and Distributes Ltd. 1998.
7. Graeme Drummond and John Ensor, "Introduction to marketing concepts", Elsevier, Indian Reprint, 2007.

<b>MT6003</b>	<b>ENGINEERING ECONOMICS AND COST ANALYSIS</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

**OBJECTIVES:**

- Basics of economic analysis and cost analysis are introduced. Method adopted For capital budgeting and depreciation estimation are introduced.

**UNIT I DEMAND AND SUPPLY ANALYSIS 9**

Nature and scope of engineering economics – definition and scope of study- importance of economic analysis in business. Demand and supply analysis – demand determinants- Law of demand – elasticity of demand – demand forecasting. Law of supply – elasticity of supply – market price

**UNIT II COST ANALYSIS 9**

Types of cost - Fixed cost, variable cost, marginal cost. Cost output relationship in short and long run. Pricing decisions – situations demanding pricing decisions, pricing techniques in practice – full cost pricing, marginal cost pricing, going rate pricing, bid pricing, price fixing for a rate of return. Statutory requirements.

**UNIT III MONEY AND BANKING 9**

Value of money – inflation – deflation, banking- commercial bank and its functions, central bank and its functions. New economic environment – globalization, liberalization and privatization.

**UNIT IV CAPITAL BUDGETING 9**

Need for capital budgeting – method of appraising project profitability – rate of return method, payback period method, present value comparisons method, cost benefit analysis. Preparation of feasibility report, appraisal process, economic and commercial feasibility, financial feasibility, technical feasibility.

**UNIT V DEPRECIATION AND COST ANALYSIS 9**

Causes of depreciation, objectives, methods of computing depreciation, simple problems. Breakeven analysis, breakeven point – assumptions, breakeven chart, uses of breakeven analysis, simple problems. Financial statements – cash flow statement, profit and loss account, balance sheet and evaluation of projected financial statements.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- The students will be able to carryout cost analysis for capital subjecting based on depreciation, money available , supply of material and demand of products.in their management profession.

**TEXTBOOK:**

1. James L Riggs, David D. Bedworth, "Engineering Economics", Tata McGraw Hill, 1998

**REFERENCES:**

1. Varshney R Lnd Maheswari K L, "Managerial Economics", S.Chand& Co, 1993
2. Samuelson P A and Nordhaus W D, "Economics", Tata McGraw Hill, 2001
3. Prasanna Chandra, "Projects", Tata McGraw Hill, 2003
4. Patel Bhavesh . M, "Project Management, Strategic Financial Planning Evaluation and Control", Vikas Publishing House, New Delhi, 2000

**GE6084**

**HUMAN RIGHTS**

**L T P C  
3 0 0 3**

**OBJECTIVES :**

- To sensitize the Engineering students to various aspects of Human Rights.

**UNIT I**

**9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

**UNIT II** **9**  
Evolution of the concept of Human Rights Magna carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

**UNIT III** **9**  
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

**UNIT IV** **9**  
Human Rights in India – Constitutional Provisions / Guarantees.

**UNIT V** **9**  
Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

**TOTAL : 45 PERIODS**

**OUTCOME :**

- Engineering students will acquire the basic knowledge of human rights.

**REFERENCES:**

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

**MT6004** **INDUSTRIAL ELECTRONICS AND APPLICATIONS** **L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- Students will be exposed to electronics devices and their controls used in industrial environment

**UNIT I INTRODUCTION** **9**  
Industrial control classification- motion and process control- feed forward control-interfacing devices- Operational Amplifier-review of thyristor- SCR- TRIAC-Phototransistor

**UNIT II CONVERTERS AND INVERTERS** **9**  
Analysis of controlled and fully controlled converters-Dual converters-Analysis of voltage source and current source- current source and series converters

**UNIT III INDUSTRIAL MOTOR CONTROL** **9**  
Method of controlling speed- Basic control circuit-DC motor control- AC motor control- Servo motor control- Stepper motor control- micro controller based speed control – solid state motor control-PLL control of a DC motor control

**UNIT IV RELAYS, HEATING & WELDING CONTROL** **9**  
Introduction- principle of relays- electromechanical relay- solid state relays- Latching relays timing relays- Induction heating- dielectric heating- resistance welding.



## TEXT BOOKS:

1. Ibrahim Zeid "Mastering CAD CAM" Tata McGraw-Hill Publishing Co.2007

## REFERENCES:

1. Chris McMahon and Jimmie Browne "CAD/CAM Principles", "Practice and Manufacturing management " Second Edition, Pearson Education, 1999.
2. William M Neumann and Robert F.Sproul "Principles of Computer Graphics", McGraw Hill Book Co. Singapore, 1989.
3. Donald Hearn and M. Pauline Baker "Computer Graphics". Prentice Hall, Inc, 1992.
4. Foley, Wan Dam, Feiner and Hughes - "Computer graphics principles & practice" Pearson Education - 2003.

IT6005

DIGITAL IMAGE PROCESSING

L T P C  
3 0 0 3

## OBJECTIVES:

The student should be made to:

- Learn digital image fundamentals.
- Be exposed to simple image processing techniques.
- Be familiar with image compression and segmentation techniques.
- Learn to represent image in form of features.

### UNIT I DIGITAL IMAGE FUNDAMENTALS

8

Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - color models.

### UNIT II IMAGE ENHANCEMENT

10

**Spatial Domain:** Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering – **Frequency Domain:** Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.

### UNIT III IMAGE RESTORATION AND SEGMENTATION

9

**Noise models** – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering **Segmentation:** Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation- Morphological processing- erosion and dilation.

### UNIT IV WAVELETS AND IMAGE COMPRESSION

9

Wavelets – Subband coding - Multiresolution expansions - **Compression:** Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards.

### UNIT V IMAGE REPRESENTATION AND RECOGNITION

9

Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments – Boundary description – Shape number – Fourier Descriptor, moments- Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

**TOTAL: 45 PERIODS**

## OUTCOMES:

Upon successful completion of this course, students will be able to:

- Discuss digital image fundamentals.
- Apply image enhancement and restoration techniques.
- Use image compression and segmentation Techniques.
- Represent features of images.

#### TEXT BOOK

1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2010.

#### REFERENCES:

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
2. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.
3. William K Pratt, "Digital Image Processing", John Willey, 2002.
4. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.
5. <http://eeweb.poly.edu/~onur/lectures/lectures.html>.
6. <http://www.caen.uiowa.edu/~dip/LECTURE/lecture.html>

EE6007

MICRO ELECTRO MECHANICAL SYSTEMS

L T P C  
3 0 0 3

#### OBJECTIVES:

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

#### UNIT I INTRODUCTION

9

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

#### UNIT II SENSORS AND ACTUATORS-I

9

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys

#### UNIT III SENSORS AND ACTUATORS-II

9

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

**UNIT IV MICROMACHINING****9**

Silicon Anisotropic Etching – Anisotropic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

**UNIT V POLYMER AND OPTICAL MEMS****9**

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Ability to understand the operation of micro devices, micro systems and their applications.
- Ability to design the micro devices, micro systems using the MEMS fabrication process.

**TEXT BOOKS:**

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012.
2. Stephen D Senturia, 'Microsystem Design', Springer Publication, 2000.
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

**REFERENCES:**

1. Nadim Maluf, " An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2001.
3. Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002.
4. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
5. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer, 2010.

**MF6009****RAPID PROTOTYPING****L T P C  
3 0 0 3****OBJECTIVES:**

- Generating a good understanding of RP history, its development and applications.. To expose the students to different types of Rapid prototyping processes, materials used in RP systems and reverse engineering.

**UNIT I INTRODUCTION****8**

History – Development of RP systems – Applications in Product Development, Reverse Engineering, Rapid Tooling, Rapid Manufacturing- Principle – Fundamental – File format – Other translators – medical applications of RP - On demand manufacturing – Direct material deposition - Shape Deposition Manufacturing.

**UNIT II LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS 10**

Classification – Liquid based system - Stereolithography Apparatus (SLA), details of SL process, products, Advantages, Limitations, Applications and Uses. Solid based system - Fused Deposition Modeling, principle, process, products, advantages, applications and uses - Laminated Object Manufacturing

**UNIT III POWDER BASED RAPID PROTOTYPING SYSTEMS 10**

Selective Laser Sintering – principles of SLS process, principle of sinter bonding process, Laser sintering materials, products, advantages, limitations, applications and uses. Three Dimensional Printing – process, major applications, research and development. Direct shell production casting – key strengths, process, applications and uses, case studies, research and development. Laser Sintering System, e-manufacturing using Laser sintering, customized plastic parts, customized metal parts, e-manufacturing - Laser Engineered Net Shaping (LENS).

**UNIT IV MATERIALS FOR RAPID PROTOTYPING SYSTEMS 10**

Nature of material – type of material – polymers, metals, ceramics and composites- liquid based materials, photo polymer development – solid based materials, powder based materials - case study.

**UNIT V REVERSE ENGINEERING and NEW TECHNOLOGIES 7**

Introduction, measuring device- contact type and non-contact type, CAD model creation from point clouds-preprocessing, point clouds to surface model creation, medical data processing - types of medical imaging, software for making medical models, medical materials, other applications - Case study.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- To provide knowledge on different types of Rapid Prototyping systems and its applications in various fields

**TEXT BOOKS:**

1. Rafiq I. Noorani, "Rapid Prototyping – Principles and Applications", Wiley & Sons, 2006.
2. Chua C.K, Leong K.F and Lim C.S, "Rapid Prototyping: Principles and Applications", Second Edition, World Scientific, 2003.

**REFERENCES:**

1. Hopkinson N., R.J.M, Hauge, P M, Dickens, “Rapid Manufacturing – An Industrial revolution for the digital age”, Wiley, 2006
2. Ian Gibson, “Advanced Manufacturing Technology for Medical applications: Reverse Engineering, Software conversion and Rapid Prototyping”, Wiley, 2006
3. Paul F.Jacobs, Rapid Prototyping and Manufacturing, “Fundamentals of Stereolithography”, McGraw Hill 1993.
4. D.t.Pham and S.S. Dimov, “Rapid Manufacturing”, Springer Verlag 2001.

**MT6005**

**VIRTUAL INSTRUMENTATION**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- The principle and applications of virtual instruments are introduced in mechatronics systems.

**UNIT I REVIEW OF VIRTUAL INSTRUMENTATION 9**

Historical perspectives, advantages, block diagram and architecture of a virtual instrument, data -flow techniques, graphical programming in data flow, comparison with conventional programming.

**UNIT II VI PROGRAMMING TECHNIQUES 9**

VIS and sub-VIS loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O.

**UNIT III DATA ACQUISITION BASICS 9**  
AOC.OAC. 010. Counters & timers. PC Hardware structure, timing. Interrupts OMA, software and hardware installation.

**UNIT IV COMMON INSTRUMENT INTERFACES 9**  
Current loop, RS.232C/RS.485, GPIB, System buses, interface buses: USB, PCMCIA, VXI, SCXI, PXI, etc., networking basics for office & Industrial applications, Visa and IVI, image acquisition and processing. Motion control.

**UNIT V USE OF ANALYSIS TOOLS 9**  
Fourier transforms, power spectrum correlation methods, windowing & filtering, VI application in various fields.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- The students will be able to use virtual instruments to design various mechatronics systems

**TEXT BOOK:**

1. Gupta ,” Virtual Instrumentation Using Lab view” 2<sup>nd</sup> Edition, Tata McGraw-Hill Education, 2010

**REFERENCES:**

- 1 Gary Jonson, "Labview Graphical Programming", Second Edition, McGraw Hill, New York, 1997
2. Sokoloff; "Basic concepts of Labview 4", Prentice Hall Inc., New Jersey 1998.
3. Gupta.S., Gupta.J.P., "PC interfacing for Data Acquisition & Process Control", Second Edition, Instrument Society of America, 1994.

**ME6015**

**OPERATIONS RESEARCH**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

**UNIT I LINEAR MODELS 15**  
The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

**UNIT II TRANSPORTATION MODELS AND NETWORK MODELS 8**  
Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

**UNIT III INVENTORY MODELS 6**  
Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

**UNIT IV QUEUEING MODELS****6**

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

**UNIT V DECISION MODELS****10**

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students can able to use the optimization techniques for use engineering and Business problems

**TEXT BOOK:**

1. Taha H.A., "Operations Research", Prentice Hall of India, Sixth Edition, 2003,

**REFERENCES:**

1. Shennoy G.V. and Srivastava U.K., "Operation Research for Management", Wiley Eastern, 1994.
2. Bazara M.J., Jarvis and Sherali H., "Linear Programming and Network Flows", John Wiley, 1990.
3. Philip D.T. and Ravindran A., "Operations Research", John Wiley, 1992.
4. Hillier and Libebberman, "Operations Research", Holden Day, 1986
5. Budnick F.S., "Principles of Operations Research for Management", Richard D Irwin, 1990.
6. Tulsian and Pasdey V., "Quantitative Techniques", Pearson – Asia 2002.

**MG6071****ENTREPRENEURSHIP DEVELOPMENT****L T P C  
3 0 0 3****OBJECTIVES :**

- To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

**UNIT I ENTREPRENEURSHIP****9**

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

**UNIT II MOTIVATION****9**

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

**UNIT III BUSINESS****9**

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

**UNIT IV FINANCING AND ACCOUNTING****9**

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.

**UNIT V SUPPORT TO ENTREPRENEURS 9**

Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures - Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Upon completion of the course, students will be able to gain knowledge and skills needed to run a business successfully.

**TEXTBOOKS :**

1. Khanka. S.S., “Entrepreneurial Development” S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.
2. Donald F Kuratko, “ Entrepreneurship – Theory, Process and Practice”, 9th edition, Cengage Learning, 2014.

**REFERENCES :**

1. Hisrich R D, Peters M P, “Entrepreneurship” 8<sup>th</sup> Edition, Tata McGraw-Hill, 2013.
2. Mathew J Manimala, Entrepreneurship theory at cross roads: paradigms and praxis” Dream tech, 2nd edition 2005.
3. Rajeev Roy, ‘Entrepreneurship’ 2<sup>nd</sup> edition, Oxford University Press, 2011.
4. EDII “Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development”, Institute of India, Ahmadabad, 1986.

**GE6075 PROFESSIONAL ETHICS IN ENGINEERING L T P C  
3 0 0 3**

**OBJECTIVES:**

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

**UNIT I HUMAN VALUES 10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

**UNIT II ENGINEERING ETHICS 9**

Senses of ‘Engineering Ethics’ – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg’s theory – Gilligan’s theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

**UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

**UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk -

Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

## **UNIT V GLOBAL ISSUES**

**8**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility

**TOTAL: 45 PERIODS**

### **OUTCOME :**

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society

### **TEXTBOOKS:**

1. Mike W. Martin and Roland Schinzinger, “Ethics in Engineering”, Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

### **REFERENCES:**

1. Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics – Concepts and Cases”, Cengage Learning, 2009
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001
5. Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for Personal Integrity and Social Responsibility” Mc Graw Hill education, India Pvt. Ltd., New Delhi 2013.
6. World Community Service Centre, ‘ Value Education’, Vethathiri publications, Erode, 2011

### **Web sources:**

1. [www.onlineethics.org](http://www.onlineethics.org)
2. [www.nspe.org](http://www.nspe.org)
3. [www.globalethics.org](http://www.globalethics.org)
4. [www.ethics.org](http://www.ethics.org)

**MG6088**

**SOFTWARE PROJECT MANAGEMENT**

**L T P C**  
**3 0 0 3**

### **OBJECTIVES:**

- To outline the need for Software Project Management
- To highlight different techniques for software cost estimation and activity planning.

## **UNIT I PROJECT EVALUATION AND PROJECT PLANNING**

**9**

Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

**UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9**  
Software process and Process Models – Choice of Process models - mental delivery – Rapid Application development – Agile methods – Extreme Programming – SCRUM – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II A Parametric Productivity Model - Staffing Pattern.

**UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 9**  
Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Monitoring – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical patterns – Cost schedules.

**UNIT IV PROJECT MANAGEMENT AND CONTROL 9**  
Framework for Management and control – Collection of data Project termination – Visualizing progress – Cost monitoring – Earned Value Analysis- Project tracking – Change control- Software Configuration Management – Managing contracts – Contract Management.

**UNIT V STAFFING IN SOFTWARE PROJECTS 9**  
Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham-Hackman job characteristic model – Ethical and Programmed concerns – Working in teams – Decision making – Team structures – Virtual teams – Communications genres – Communication plans.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- At the end of the course the students will be able to practice Project Management principles while developing a software.

**TEXTBOOK:**

1. Bob Hughes, Mike Cotterell and Rajib Mall: "Software Project Management", Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

**REFERENCES:**

1. Robert K. Wysocki "Effective Software Project Management", Wiley Publication,2011.
2. Walker Royce: "Software Project Management"- Addison-Wesley , 1998.
3. Gopalaswamy Ramesh, "Managing Global Software Projects", McGraw Hill Education (India), Fourteenth Reprint 2013.

**CS6302**

**DATABASE MANAGEMENT SYSTEMS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To expose the students to the fundamentals of Database Management Systems.
- To make the students understand the relational model.
- To familiarize the students with ER diagrams.
- To expose the students to SQL.
- To make the students to understand the fundamentals of Transaction Processing and Query Processing.
- To familiarize the students with the different types of databases.
- To make the students understand the Security Issues in Databases.

**UNIT I INTRODUCTION TO DBMS 10**

File Systems Organization - Sequential, Pointer, Indexed, Direct - Purpose of Database System- Database System Terminologies-Database characteristics- Data models – Types of data models – Components of DBMS- Relational Algebra. LOGICAL DATABASE DESIGN: Relational DBMS - Codd's Rule - Entity-Relationship model - Extended ER Normalization – Functional Dependencies, Anomaly- 1NF to 5NF- Domain Key Normal Form – Denormalization

**UNIT II SQL & QUERY OPTIMIZATION 8**

SQL Standards - Data types - Database Objects- DDL-DML-DCL-TCL-Embedded SQL-Static Vs Dynamic SQL - QUERY OPTIMIZATION: Query Processing and Optimization - Heuristics and Cost Estimates in Query Optimization.

**UNIT III TRANSACTION PROCESSING AND CONCURRENCY CONTROL 8**

Introduction-Properties of Transaction- Serializability- Concurrency Control – Locking Mechanisms- Two Phase Commit Protocol-Dead lock.

**UNIT IV TRENDS IN DATABASE TECHNOLOGY 10**

Overview of Physical Storage Media – Magnetic Disks – RAID – Tertiary storage – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing - Introduction to Distributed Databases- Client server technology- Multidimensional and Parallel databases- Spatial and multimedia databases- Mobile and web databases- Data Warehouse-Mining- Data marts.

**UNIT V ADVANCED TOPICS 9**

DATABASE SECURITY: Data Classification-Threats and risks – Database access Control – Types of Privileges –Cryptography- Statistical Databases.- Distributed Databases-Architecture-Transaction Processing-Data Warehousing and Mining-Classification-Association rules-Clustering-Information Retrieval- Relevance ranking-Crawling and Indexing the Web- Object Oriented Databases-XML Databases.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design Databases for applications.
- Use the Relational model, ER diagrams.
- Apply concurrency control and recovery mechanisms for practical problems.
- Design the Query Processor and Transaction Processor.
- Apply security concepts to databases.

**TEXT BOOK:**

1. Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", Fifth Edition, Pearson Education, 2008.

**REFERENCES:**

1. Abraham Silberschatz, Henry F. Korth and S. Sudharshan, "Database System Concepts", Sixth Edition, Tata Mc Graw Hill, 2011.
2. C.J.Date, A.Kannan and S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
3. Atul Kahate, "Introduction to Database Management Systems", Pearson Education, New Delhi, 2006.

4. Alexis Leon and Mathews Leon, "Database Management Systems", Vikas Publishing House Private Limited, New Delhi, 2003.
5. Raghu Ramakrishnan, "Database Management Systems", Fourth Edition, Tata Mc Graw Hill, 2010.
6. G.K.Gupta, "Database Management Systems", Tata Mc Graw Hill, 2011.
7. Rob Cornell, "Database Systems Design and Implementation", Cengage Learning, 2011.

**CS6551**

**COMPUTER NETWORKS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Understand the division of network functionalities into layers.
- Be familiar with the components required to build different types of networks
- Be exposed to the required functionality at each layer
- Learn the flow control and congestion control algorithms

**UNIT I FUNDAMENTALS & LINK LAYER**

**9**

Building a network – Requirements - Layering and protocols - Internet Architecture – Network software – Performance ; Link layer Services - Framing - Error Detection - Flow control

**UNIT II MEDIA ACCESS & INTERNETWORKING**

**9**

Media access control - Ethernet (802.3) - Wireless LANs – 802.11 – Bluetooth - Switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP, ICMP )

**UNIT III ROUTING**

**9**

Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Multicast – addresses – multicast routing (DVMRP, PIM)

**UNIT IV TRANSPORT LAYER**

**9**

Overview of Transport layer - UDP - Reliable byte stream (TCP) - Connection management - Flow control - Retransmission – TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements

**UNIT V APPLICATION LAYER**

**9**

Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS - SNMP

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Identify the components required to build different types of networks
- Choose the required functionality at each layer for given application
- Identify solution for each functionality at each layer
- Trace the flow of information from one node to another node in the network

**TEXT BOOK:**

1. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers, 2011.

## REFERENCES:

1. James F. Kurose, Keith W. Ross, "Computer Networking - A Top-Down Approach Featuring the Internet", Fifth Edition, Pearson Education, 2009.
2. Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2010.
3. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", Mc Graw Hill Publisher, 2011.
4. Behrouz A. Forouzan, "Data communication and Networking", Fourth Edition, Tata McGraw – Hill, 2011.

**GE6083**

**DISASTER MANAGEMENT**

**L T P C**  
**3 0 0 3**

## OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

## **UNIT I INTRODUCTION TO DISASTERS**

**9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

## **UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)**

**9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

## **UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT**

**9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenious knowledge, appropriate technology and local resources.

## **UNIT IV DISASTER RISK MANAGEMENT IN INDIA**

**9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

## **UNIT V            DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS**

**9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

**TOTAL: 45 PERIODS**

### **OUTCOMES:**

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management.

### **TEXTBOOK:**

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IAS and Sage Publishers, New Delhi, 2010.

### **REFERENCES**

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

# ANNA UNIVERSITY, CHENNAI

## REGULATIONS 2013

### CREDIT SYSTEM

#### AFFILIATED COLLEGES

#### POST-GRADUATE PROGRAMMES

The following Regulations is applicable to the students admitted to M.E / M.Tech., M.C.A and M.B.A. Programmes at all Engineering Colleges affiliated to Anna University, Chennai (other than Autonomous Colleges) and to all the University Colleges of Engineering of Anna University, Chennai from the academic year 2013-2014.

#### 1 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires:

- i. **“Programme”** means Post graduate Degree Programme e.g. M.E., M.Tech. Degree Programme.
- ii. **“Branch”** means specialization or discipline of M.E. / M.Tech. Degree Programme like “Structural Engineering”, “Engineering Design”, etc.
- iii. **“Course”** means Theory or Practical subject that is normally studied in a semester, like Applied Mathematics, Advanced Thermodynamics, etc.
- iv. **“Director, Academic Courses”** means the authority of the University who is responsible for all academic activities of the University for implementation of relevant Rules and Regulations.
- v. **“Chairman”** means the Head of the Faculty.
- vi. **“Head of the Department”** means Head of the Department concerned.
- vii. **“Head of the Institution”** means the Principal of a College / Institution who is responsible for all academic activities of that College / Institution and for implementation of relevant Rules and Regulations.
- viii. **“Controller of Examinations”** means the Authority of the University who is responsible for all activities of the University Examinations.
- ix. **“University”** means ANNA UNIVERSITY, CHENNAI.

## **2 PROGRAMMES OFFERED, MODES OF STUDY AND ADMISSION REQUIREMENTS**

### **2.1 P.G. PROGRAMMES OFFERED:**

1. M.E
2. M.Tech.
3. M.B.A.
4. M.C.A.

### **2.2 MODES OF STUDY:**

#### **2.2.1 Full-Time:**

Candidates admitted under 'Full-Time' should be available in the College / Institution during the entire duration of working hours (From Morning to Evening on Full-Time basis) for the curricular, co-curricular and extra-curricular activities assigned to them.

The Full-Time candidates should not attend any other Full-Time programme(s) / course(s) or take up any Full-Time job / Part-Time job in any Institution or Company during the period of the Full-Time programme. Violation of the above rules will result in cancellation of admission to the PG programme.

#### **2.2.2 Part-Time – Day Time Mode:**

This mode of study is applicable to those candidates admitted under sponsored category (Teacher candidates only). In this mode of study, the candidates are required to attend classes along with Full-Time students for the required number of courses and complete the programme in three years.

**2.2.3** Conversion from one mode of study to the other is not permitted.

### **2.3 ADMISSION REQUIREMENTS:**

**2.3.1** Candidates for admission to the first semester of the Post-Graduate Degree Programme shall be required to have passed an appropriate Under-Graduate Degree **Examination of Anna University** or equivalent as specified under qualification for admission as per the Tamil Nadu Common Admission (TANCA) criteria.

**Note:** TANCA releases the updated criteria during the admissions every academic year. Admission shall be offered only to the candidates who possess the qualification prescribed against each programme. Any other relevant qualification which is not prescribed against each programme shall be considered for equivalence by the committee constituted for the purpose. Admission to such degrees shall be offered only after obtaining equivalence to such degrees.

**2.3.2** However, the Syndicate of the University may decide to restrict admission in any particular year to candidates having a subset of qualifications prescribed at the time of admission.

- 2.3.3** Notwithstanding the qualifying examination the candidate might have passed, he/she shall have a minimum level of proficiency in the appropriate programme / courses as prescribed by the Syndicate of the University from time to time.
- 2.3.4** Eligibility conditions for admission such as the class obtained, the number of attempts in qualifying examination and physical fitness will be as prescribed by the Syndicate of the University from time to time.
- 2.3.5** All Part-Time (Day-Time mode) candidates should satisfy other conditions regarding Experience, Sponsorship etc. that may be prescribed by the Syndicate from time to time.

### **3 DURATION AND STRUCTURE OF THE PROGRAMMES:**

- 3.1** The minimum and maximum period for completion of the P.G. Programmes are given below:

<b>Programme</b>	<b>Min. No. of Semesters</b>	<b>Max. No. of Semesters</b>
M.E. / M.Tech. (Full-Time)	4	8
M.E. / M.Tech. (Part Time)	6	12
M.C.A. (Full Time)	6	12
M.B.A. (Full Time)	4	8
M.B.A. (Part Time)	6	12

- 3.2** Every **Programme** will have a curriculum and syllabus consisting of core courses, elective courses and project work.  
The Programme may also include seminar, practical, practical / Industrial training, Summer project if they are specified in the curriculum.
- 3.3** The Curriculum and Syllabi of all the P.G. Programmes shall be approved by the Academic Council of Anna University. The number of Credits to be earned for the successful completion of the programme shall be as specified in the Curriculum of the respective specialization of the P.G. Programme
- 3.4** Each semester shall normally consist of 90 working days or 350 periods of each 50 minutes duration, for full-time mode of study (400 Periods for M.B.A.) or 200 periods for part-time mode of study. The Head of the Institution shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course being taught. For the purpose of calculation of attendance requirement for writing the end semester examinations (as per clause 9) by students, following method shall be used.

$$\text{Percentage of Attendance} = \frac{\text{Total no. of periods attended in all the courses per semester}}{(\text{No.of periods / week as prescribed in the curriculum}) \times 15 \text{ taken together for all courses of the semester}} \times 100$$

End Semester Examinations conducted by the University will be scheduled after the last working day of the semester.

- 3.5** The minimum prescribed credits required for the award of the degree shall be within the limits specified below:

<b>PROGRAMME</b>	<b>PRESCRIBED CREDIT RANGE</b>
M.E. / M.Tech.	65 to 75

<b>Programme</b>	<b>Prescribed Credits</b>
M.C.A.	119
M.B.A.	96

- 3.6** Credits will be assigned to the courses for different modes of study as given below:

- 3.6.1** The following will apply to all modes of P.G. Programmes.

- One credit for each lecture period allotted per week
- One credit for each tutorial period allotted per week
- One credit for each seminar/practical session/project work of two periods designed per week (2 credits for 3 or 4 periods of practical).

- 3.6.2** Two weeks of practical training in any industrial / research laboratory correspond to one credit, and is applicable to all modes of study.

- 3.6.3** Practical training or Industrial Training if specified in the Curriculum should be organized by the Head of the Department / Institution for a duration not exceeding 4 weeks.

- 3.6.4** Summer project if specified in the Curriculum, should be organized by the Head of the Department / Institution for a duration not exceeding 6 weeks.

- 3.7** The electives from the curriculum are to be chosen with the approval of the Head of the Department. A candidate may be permitted by the Head of the Department to choose a maximum of two electives from other P.G. Programmes offered in the Department /any other Department of the Institutions during the period of his/her study, provided the Head of the Department offering such course also approves such requests subject to no clash in the time-table for the lecture classes of both departments.

- 3.8** The medium of instruction shall be English for all courses, examinations, seminar presentations and project thesis/dissertation reports.

#### **4. PROJECT WORK**

- 4.1** The project work for M.E. / M.Tech. Programmes consist of Phase-I and Phase-II. The Phase-I is to be undertaken during III semester and Phase-II, which is a continuation of Phase-I is to be undertaken during IV semester.

- 4.2** In case of candidates of M.E. / M.Tech. Programmes not completing Phase-I of project work successfully, the candidates can undertake Phase-I again in the subsequent semester. In such cases the candidates can enroll for Phase-II, only after successful completion of Phase-I.

- 4.3** Project work shall be carried out under the supervision of a “qualified teacher” in the Department concerned. In this context “qualified teacher” means the faculty member possessing (i) PG degree with a minimum of 3 years experience in teaching or (ii) Ph.D. degree.
- 4.4** A candidate may, however, in certain cases, be permitted to work on projects in an Industrial/Research Organization, on the recommendations of the Head of the Department Concerned. In such cases, the Project work shall be jointly supervised by a supervisor of the department and an expert, as a joint supervisor from the organization and the student shall be instructed to meet the supervisor periodically and to attend the review committee meetings for evaluating the progress.
- 4.5** The Project work (Phase II in the case of M.E/M.Tech.) shall be pursued for a minimum of 16 weeks during the final semester.
- 4.6** The deadline for submission of final Project Report is 60 calendar days from the last working day of the semester in which project / thesis / dissertation is done. However, the Phase-I of the Project work in the case M.E. / M.Tech. Programmes shall be submitted within a maximum period of 30 calendar days from the last working day of the semester as per the academic calendar published by the University.

## **5 EVALUATION OF PROJECT WORK**

The evaluation of Project Work for Phase-I & Phase-II in the case of M.E. / M.Tech. and project work of M.B.A and M.C.A shall be done independently in the respective semesters and marks shall be allotted as per the weightages given in Clause 5.1.

- 5.1** There shall be three assessments (each 100 marks) during the Semester by a review committee. The Student shall make presentation on the progress made before the Committee. The Head of the Institution shall constitute the review committee for each branch of study. The total marks obtained in the three assessments shall be reduced to 20 marks and rounded to the nearest integer (as per the Table given below). There will be a vice-voce Examination during End Semester Examinations conducted by a Committee consisting of the supervisor, one internal examiner and one external examiner. The internal examiner and the external examiner shall be appointed by the Controller of Examination. The distribution of marks for the internal assessment and End semester examination is given below:

<b>Internal Assessment (20 Marks)</b>			<b>End Semester Examination (80 Marks)</b>			
<b>Review - I</b>	<b>Review - II</b>	<b>Review - III</b>	<b>Thesis Submission (30 Marks)</b>	<b>Viva – Voce (Rounded to 50 Marks)</b>		
			External Examiner	Internal Examiner	External Examiner	Supervisor Examiner
5	7.5	7.5	30	15	20	15

- 5.2** The Project Report prepared according to approved guidelines as given by Director, Academic Courses and duly signed by the supervisor(s) and the Head of the Department concerned shall be submitted to the Head of the Institution.
- 5.3** If the candidate fails to obtain 50% of the internal assessment marks in the Phase–I and Phase–II / final project, he/she will not be permitted to submit the report for that particular semester and has to re-enroll for the same in the subsequent semester.

If a candidate fails to submit the project report on or before the specified deadline, he/she is deemed to have failed in the Project Work and shall re-enroll for the same in a subsequent semester. This applies to both Phase–I and Phase–II in the case of M.E. / M.Tech. Project Work and the Final Project work of M.B.A. / M.C.A.

If a candidate fails in the end semester examinations of Phase–I, he/she has to resubmit the Project Report within 30 days from the date of declaration of the results. If he / she fails in the End semester examination of Phase–II of Project work of M.E. / M.Tech. or the Final Project work of M.B.A. / M.C.A, he/she shall resubmit the Project Report within 60 days from the date of declaration of the results. The resubmission of a project report and subsequent viva-voce examination will be considered as reappearance with payment of exam fee. For this purpose the same Internal and External examiners shall evaluate the resubmitted report.

- 5.3.1** A copy of the approved Project Report after the successful completion of viva-voce examinations shall be kept in the library of the college / institution.
- 5.3.2** Practical / Industrial Training, Summer Project if specified in the Curriculum shall not exceed the maximum duration of 4 weeks and should be organized by the Head of the Department for every student.
- 5.3.3** At the end of Practical / Industrial Training, Summer Project the candidate shall submit a certificate from the organization where he/she has undergone training and also a brief report. The evaluation for 100 marks will be carried out internally based on this report and a Viva-Voce Examination will be conducted by a Departmental Committee constituted by the Head of the Institution. Certificates submitted by the students shall be attached to the mark list sent by the Head of the Institution to the Controller of Examination.

## **6 CLASS ADVISER**

There shall be a class advisor for each class. The class advisor will be one among the (course-instructors) of the class. He / She will be appointed by the Head of the department concerned. The class advisor is the ex-officio member and the Convener of the class committee. The responsibilities for the class advisor shall be:

- To act as the channel of communication between the HoD and the students of the respective class.
- To collect and maintain various statistical details of students.
- To help the chairperson of the class committee in planning and conduct of the class committee meetings.

- To monitor the academic performance of the students including attendance and to inform the class committee.
- To attend to the students' welfare activities like awards, medals, scholarships and industrial visits.

## **7 CLASS COMMITTEE**

**7.1** A Class Committee consists of teachers of the concerned class, student representatives and a chairperson who is not teaching the class. It is like the 'Quality Circle' (more commonly used in industries) with the overall goal of improving the teaching-learning process. The functions of the class committee include:

- Solving problems experienced by students in the class room and in the laboratories.
- Clarifying the regulations of the programme and the details of rules therein.
- Informing the student representatives, the "academic schedule" including the dates of assessments and the syllabus coverage for each assessment period.
- Informing the student representatives, the details of regulations regarding the weightage used for each assessment. In the case of practical courses (laboratory / project work / seminar etc.) the breakup of marks for each experiment/ exercise/ module of work, should be clearly discussed in the class committee meeting and informed to the students.
- Analyzing the performance of the students of the class after each test and finding the ways and means of improving the Students Performance
- Identifying the weak students, if any, in any specific subject and requesting the teachers concerned to provide some additional help or guidance or coaching to such weak students as frequently as possible.

**7.2** The class committee for a class under a particular programme is normally constituted by the Head of the Department. However, if the students of different programmes are mixed in a class, the class committee is to be constituted by the Head of the Institution.

**7.3** The class committee shall be constituted on the first working day of any semester or earlier.

**7.4** At least 2 student representatives (usually 1 boy and 1 girl) shall be included in the class committee.

**7.5** The chairperson of the class committee shall invite the Class adviser(s) and the Head of the Department to the meeting of the class committee.

**7.6** The Head of the Institution may participate in any class committee of the institution.

**7.7** The Chairperson of the Class Committee is required to prepare the minutes of every meeting, submit the same to the Head of the Institution within two days of the meeting and arrange to circulate among the concerned students and teachers. If there are some points in the minutes requiring action by the management, the same shall be brought to the notice of the management by the Head of the Institution.

- 7.8 The first meeting of the class committee shall be held within one week from the date of commencement of the semester in order to inform the students about the nature and weightage of assessments within the framework of the Regulations. Two or three subsequent meetings may be held at suitable intervals. During these meetings the student members, representing the entire class, shall meaningfully interact and express the opinions and suggestions of the class students to improve the effectiveness of the teaching-learning process.

## 8 COURSE COMMITTEE FOR COMMON COURSES

Each common course offered to more than one group of students shall have a "Course Committee" comprising all the teachers teaching the common course with one of them nominated as Course Coordinator. The nomination of the course Coordinator shall be made by the Head of the Department / Head of the Institution depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The 'Course committee' shall meet as often as possible and ensure uniform evaluation of the tests and arrive at a common scheme of evaluation for the tests. Wherever it is feasible, the course committee may also prepare a common question paper for the Assessment Test(s).

## 9 ATTENDANCE REQUIREMENTS FOR COMPLETION OF A SEMESTER

- 9.1 A candidate who has fulfilled the following conditions shall be deemed to have satisfied the attendance requirements for completion of a semester.

Ideally every student is expected to attend all classes and earn 100% attendance. However in order to allow provision for certain unavoidable reasons such as prolonged hospitalization / accident / specific illness the student is expected to earn a minimum of 75% attendance to become eligible to write the End-Semester Examinations.

Therefore, every student shall secure not less than 75% of overall attendance in that semester as per clause 3.4.

- 9.2 However, a candidate who secures overall attendance between 65% and 74% in that current semester due to medical reasons (prolonged hospitalization / accident / specific illness / participation in sports events) may be permitted to appear for the current semester examinations subject to the condition that the candidate shall submit the medical certificate / sports participation certificate to the Head of the Institution. The same shall be forwarded to the Controller of Examinations for record purposes.

- 9.3 Candidates who could secure less than 65% overall attendance and **Candidates who do not satisfy the clauses 9.1 & 9.2** will not be permitted to write the end-semester examination of that current semester and are not permitted to go to next semester. They are required to repeat the incomplete semester in the next academic year.

## **10 PROCEDURES FOR AWARDING MARKS FOR INTERNAL ASSESSMENT(IA)**

The maximum marks assigned to different courses shall be as given below:  
Each of the theory and practical courses (including project work) shall carry a maximum of 100 marks of which 20 marks will be through internal assessment and the End Semester Examination (ESE) will carry 80 marks.

**10.1** The marks for the continuous assessment shall be awarded as per the procedure given below:

### **(i) Theory Courses:**

Three tests each carrying 100 marks shall be conducted during the semester by the Department / College concerned. The total marks obtained in all tests put together out of 300, shall be proportionately reduced for 20 marks and rounded to the nearest integer (This also implies equal weightage to all the three tests).

### **(ii) Practical Courses:**

The maximum marks for Internal Assessment shall be 20 in case of practical courses. Every practical exercise / experiment shall be evaluated based on conduct of experiment / exercise and records maintained. There shall be at least one test. The criteria for arriving at the Internal Assessment marks of 20 is as follows: 75 marks shall be awarded for successful completion of all the prescribed experiments done in the Laboratory and 25 marks for the test. The total mark shall be reduced to 20 and rounded to the nearest integer.

### **(iii) Theory Courses with Laboratory component:**

The maximum marks for Internal Assessment shall be 20 in case of theory courses with Laboratory component. For a theory course with Laboratory component, there shall be three assessments: the first two assessments (each with a maximum of 100 marks) will be from theory portions and the third assessment (maximum marks 100) will be for laboratory component. The sum of marks of all three assessments shall be reduced to 20 marks and rounded to the nearest integer.

### **(iv) Seminar / Professional Practices / Case Study:**

The seminar / Case study is to be considered as purely INTERNAL (with 100% internal marks only). Every student is expected to present a minimum of 2 seminars per semester before the evaluation committee and for each seminar marks can be equally apportioned. The three member committee appointed by Head of the Institution will evaluate the seminar and at the end of the semester the marks can be consolidated and taken as the final mark. The evaluation shall be based on the seminar paper (40%), presentation (40%) and response to the questions asked during presentation (20%).

**(v)**The Industrial / Practical Training shall carry 100 marks and shall be evaluated through internal assessment only. At the end of Industrial / Practical training / internship / Summer Project, the candidate shall submit a certificate from the organization where he / she has undergone training and a brief report. The evaluation will be made based on this report and a Viva-Voce Examination, conducted internally by a three member Departmental Committee constituted by the Head of the Institution. Certificates submitted by the candidate shall be attached to the mark list sent by the Head of the Department.

- 10.2** Internal marks approved by the Head of the Institution shall be displayed by the respective HODs within 5 days from the last working day.
- 10.3** Every teacher is required to maintain an 'ATTENDANCE AND ASSESSMENT RECORD' which consists of attendance marked in each lecture or practical or project work class, the test marks and the record of class work (topics covered), separately for each course. This should be submitted to the Head of the Department periodically (at least three times in a semester) for checking the syllabus coverage and the records of test marks and attendance. The Head of the department will put his signature and date after due verification. At the end the semester, the record should be verified by the Head of the institution who will keep this document in safe custody (for five years). The university or any inspection team appointed by the University may inspect the records of attendance and assessments of both current and previous semesters.

## **11 REQUIREMENTS FOR APPEARING FOR SEMESTER EXAMINATION**

- 11.1** A candidate shall normally be permitted to appear for the University examinations of the current semester if he/she has satisfied the semester completion requirements as per clause 9.1 & 9.2 and has registered for examination in all courses of the current semester.
- 11.2** Further, registration is mandatory for all the courses in the current semester as well as for arrear(s) course(s) for the university examinations failing which, the candidate will not be permitted to move to the higher semester.
- 11.3** A student who has passed all the courses prescribed in the curriculum for the award of the degree shall not be permitted to re-enroll to improve his/her marks in a course or the aggregate marks / CGPA.

## **12 UNIVERSITY EXAMINATIONS**

- 12.1** There shall be an End- Semester Examination of 3 hours duration in each lecture based course.

The examinations shall ordinarily be conducted between October and December during the odd semesters and between April and June in the even semesters.

For the practical examinations (including project work), both internal and external examiners shall be appointed by the University.

### **12.2 WEIGHTAGE**

The following will be the weightage for different courses.

- i) Lecture or Lecture cum Tutorial based course:
- |                          |   |     |
|--------------------------|---|-----|
| Internal Assessment      | - | 20% |
| End Semester Examination | - | 80% |
- ii) Laboratory based courses
- |                          |   |     |
|--------------------------|---|-----|
| Internal Assessment      | - | 20% |
| End Semester Examination | - | 80% |

iii) Project work		
Internal Assessment	-	20%
Evaluation of Project Report by external examiner	-	30%
Viva-Voce Examination	-	50%
iv) Practical training / summer project / seminar		
Internal Assessment	-	100%

### **13 PASSING REQUIREMENTS**

- 13.1** A candidate who secures not less than 50% of total marks prescribed for the course with a minimum of 50% of the marks prescribed for each of the course of the End-Semester University Examination in both theory and practical courses shall be declared to have passed in the course and acquired the relevant number of credits.
- 13.2** If the candidate fails to secure a pass in a particular course as per clause 13.1, it is mandatory that the candidate shall register and re-appear for the examination in that course during the subsequent semester when examination is conducted for that course. Further, the candidate should continue to enroll and reappear for the examination till a **pass** is secured in such arrear course.
- 13.3** The internal assessment marks obtained by the candidate in the first appearance shall be retained and considered valid for all subsequent attempts till the candidate secure a pass. However, from the third attempt onwards if a candidate fails to obtain pass marks (IA + End Semester Examination) as per clause 13.1, then the candidate shall be declared to have passed the examination if he/she secure a minimum of 50% marks prescribed for the university end semester examinations alone.

### **14 ELIGIBILITY FOR THE AWARD OF THE DEGREE**

- 14.1** A student shall be declared eligible for the award of the degree if he/she has:
- (i) Successfully passed all the courses as specified in the curriculum corresponding to his/her programme within the stipulated period. (as per clause 3.1)
  - (ii) No disciplinary action is pending against him/her.
  - (iii) The award of the degree must have been approved by the syndicate.
  - (iv) Successfully completed any additional courses prescribed by the Director, Academic Courses

### **15 AWARD OF LETTER GRADES**

- 15.1** All assessments of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain points specified, will be awarded as per the range of total marks (out of 100) obtained by the candidate (Regular or Arrear), as detailed below:

Letter grade	Grade Points	Marks Range
S	10	91 – 100
A	9	81 – 90
B	8	71 – 80
C	7	61 – 70
D	6	57 – 60
E	5	50 – 56
U	0	< 50
	(or 50, but not satisfying clause 13.1)	
W	0	

A student is deemed to have passed and acquired the corresponding credits in a particular course if he / she **obtained** any one of the following grades: “S”, “A”, “B”, “C”, “D”, “E”.

‘SA’ denotes shortage of attendance (as per Clause 6) and hence prevented from writing end semester examination. ‘SA’ will appear only in the result sheet.

‘U’ denotes Reappearance (RA) is required for the examination in that particular course. ‘W’ denotes withdrawal from exam for the particular course.  
(The grades U and W will figure both in Mark Sheet as well as in Result Sheet)

## 15.2 GRADE SHEET

After results are declared, Grade Sheets will be issued to each student which will contain the following details:

- The college in which the candidate has studied.
- The list of courses enrolled during the semester and the grades scored.
- The Grade Point Average (GPA) for the semester and
- The Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

GPA for a semester is the ratio of the sum of the products of the number of credits for courses acquired and the corresponding points to the sum of the number of credits for the courses acquired in the semester. CGPA will be calculated in a similar manner, considering all the courses registered from first semester.

$$\text{GPA / CGPA} = \frac{\sum_{i=1}^n C_i GP_i}{\sum_{i=1}^n C_i}$$

where

$C_i$  is the number of credits assigned to the course

$GP_i$  is the Grade point corresponding to the grade obtained for each Course

$n$  is number of all Courses successfully cleared during the particular semester in the case of GPA and during all the semesters in the case of **CGPA**.

“U”, “I” and “W” grades will be excluded for calculating GPA and CGPA.

## 16 CLASSIFICATION OF THE DEGREE AWARDED

### 16.1 FIRST CLASS WITH DISTINCTION:

A candidate who satisfies the following conditions shall be declared to have passed the examination in **First class with Distinction**:

#### **M.E. / M.Tech. M.B.A.(Full Time)**

- Should have passed the End semester examination in all the courses of all the four semesters in his/her **First Appearance** within two years. Withdrawal from examination (vide Clause 17) will not be considered as an appearance. One year authorized break of study (if availed of) is permitted in addition to two years for award of First class with Distinction.
- Should have secured a CGPA of not less than 8.50

#### **M.E. / M.Tech. M.B.A.(Part Time) and M.C.A (Full Time)**

- Should have passed the End semester examination in all the courses of all the six semesters in his/her **First Appearance** within three years. Withdrawal from examination (vide Clause 17) will not be considered as an appearance. One year authorized break of study (if availed of) is permitted in addition to three years for award of First class with Distinction.
- Should have secured a CGPA of not less than 8.50.

### 16.2 FIRST CLASS:

A candidate who satisfies the following conditions shall be declared to have passed the examination in **First class**:

#### **M.E. / M.Tech. M.B.A.(Full Time)**

- Should have passed the End semester examination in all the courses of all the four semesters within three years. One year authorized break of study (if availed of) or prevention from writing the End Semester examination due to lack of attendance (if applicable) is included in the three years.
- Should have secured a CGPA of not less than 6.50.

#### **M.E. / M.Tech. M.B.A. (Part Time) and M.C.A (Full Time)**

- Should have passed the End semester examination in all the courses of all the six semesters within four years. One year authorized break of study (if availed of) or prevention from writing the End Semester examination due to lack of attendance (if applicable) is included in the four years.
- Should have secured a CGPA of not less than 6.50.

### **16.3 SECOND CLASS:**

All other candidates (not covered in clauses 16.1 and 16.2) who qualify for the award of the degree (vide Clause 14) shall be declared to have passed the examination in **Second Class**.

- 16.4.** A candidate who is absent in semester examination in a course / project work after having registered for the same shall be considered to have appeared in that examination for the purpose of classification.

### **16.5 Photocopy / Revaluation**

A candidate can apply for photocopy of his/her semester examination answer paper in a theory course, within 2 weeks from the declaration of results, on payment of a prescribed fee through proper application to the Controller of Examinations through the Head of Institutions. The answer script is to be valued and justified by a faculty member, who handled the subject and recommend for revaluation with breakup of marks for each question. Based on the recommendation, the candidate can register for the revaluation through proper application to the Controller of Examinations. The Controller of Examinations will arrange for the revaluation and the results will be intimated to the candidate concerned through the Head of the Institutions. Revaluation is not permitted for practical courses and for project work.

A candidate can apply for revaluation of answer scripts for not exceeding 5 subjects at a time.

### **16.6 Review**

Candidates not satisfied with Revaluation can apply for Review of his/ her examination answer paper in a theory course, within the prescribed date on payment of a prescribed fee through proper application to Controller of Examination through the Head of the Institution.

Candidates applying for Revaluation only are eligible to apply for Review.

### **17 PROVISION FOR WITHDRAWAL FROM EXAMINATION:**

A candidate may for valid reasons and on prior application, be granted permission to withdraw from appearing for the examination of any one course or consecutive examinations of more than one course in a semester examination.

- 17.1** Such withdrawal shall be permitted only once during the entire period of study of the degree programme.
- 17.2** Withdrawal application is valid only if it is made within 10 days prior to the commencement of the examination in that course or courses and recommended by the Head of the Institution and approved by the Controller of Examinations.
- 17.3** Notwithstanding the requirement of mandatory TEN days notice, applications for withdrawal for special cases under extraordinary conditions will be considered on the merit of the case.
- 17.4** Withdrawal shall not be construed as an appearance for the eligibility of a candidate for First Class with Distinction. Withdrawal is not permitted in the final semester.

- 17.5 Withdrawal from the End semester examination is **NOT** applicable to arrears subjects of previous semesters
- 17.6 The candidate shall reappear for the withdrawn courses during the examination conducted in the subsequent semester.

## **18 AUTHORIZED BREAK OF STUDY FROM A PROGRAMME**

- 18.1 Break of Study shall be granted only once for valid reasons for a maximum of one year during the entire period of study of the degree programme. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for break of study. If a candidate intends to temporarily discontinue the programme in the middle of the semester for valid reasons, and rejoin the programme in a subsequent year, permission may be granted based on the merits of the case provided he / she applies to the **Director, Student Affairs** in advance, but not later than the last date for registering for the end semester examination of the semester in question, through the Head of the Institution stating the reasons therefor and the probable date of rejoining the programme.
- 18.2 The candidates permitted to rejoin the programme after break of study / prevention due to lack of attendance, shall be governed by the Curriculum and Regulations in force at the time of rejoining. The students rejoining in new Regulations shall apply to the Director, Academic Courses in the prescribed format through Head of the Institution at the beginning of the readmitted semester itself for prescribing additional courses, if any, from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.
- 18.3 The authorized break of study (for a maximum of one year) will not be counted for the duration specified for passing all the courses for the purpose of classification. (vide Clause 16.1). However, additional break of study granted will be counted for the purpose of classification.
- 18.4 The total period for completion of the Programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 3.1 irrespective of the period of break of study (vide clause 18.1) in order that he/she may be eligible for the award of the degree.
- 18.5 If any student is detained for want of required attendance, the period spent in that semester shall not be considered as authorized 'Break of Study' is not applicable for this case.

## **19 DISCIPLINE**

- 19.1 Every student is required to observe disciplined and decorous behavior both inside and outside the college and not to indulge in any activity which will tend to bring down the prestige of the University / College. The Head of Institution shall constitute a disciplinary committee consisting of Head of Institution, Two Heads of Department of which one should be from the faculty of the student, to enquire into acts of indiscipline and notify the University about the disciplinary action recommended for approval. In case of any serious disciplinary action which leads to suspension or dismissal, then a committee shall be constituted including one representative from Anna University, Chennai. In this regard, the member will be nominated by the University on getting information from the Head of the Institution.

19.2 If a student indulges in malpractice in any of the University / internal examination he / she shall be liable for punitive action as prescribed by the University from time to time.

**20 REVISION OF REGULATIONS, CURRICULUM AND SYLLABI**

The University may from time to time revise, amend or change the Regulations, Curriculum, Syllabus and scheme of examinations through the Academic Council with the approval of Syndicate.

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**AFFILIATED INSTITUTIONS****ANNA UNIVERSITY: : CHENNAI 600 025****REGULATIONS - 2013****I TO IV SEMESTERS (FULL TIME) CURRICULUM AND SYLLABUS****MASTER OF BUSINESS ADMINISTRATION (MBA)****SEMESTER – I**

SL.NO.	CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	BA7101	Principles of Management	3	0	0	3
2.	BA7102	Statistics for Management	3	1	0	4
3.	BA7103	Economic Analysis for Business	4	0	0	4
4.	BA7104	Total Quality Management	3	0	0	3
5.	BA7105	Organizational Behaviour	3	0	0	3
6.	BA7106	Accounting for Management	3	1	0	4
7.	BA7107	Legal Aspects of Business	3	0	0	3
8.	BA7108	Written Communication	3	0	0	3
<b>TOTAL</b>			<b>25</b>	<b>2</b>	<b>0</b>	<b>27</b>

**SEMESTER – II**

SL.NO.	CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	BA7201	Operations Management	3	0	0	3
2.	BA7202	Financial Management	3	0	0	3
3.	BA7203	Marketing Management	4	0	0	4
4.	BA7204	Human Resource Management	3	0	0	3
5.	BA7205	Information Management	3	0	0	3
6.	BA7206	Applied Operations Research	3	1	0	4
7.	BA7207	Business Research Methods	3	0	0	3
<b>PRACTICAL</b>						
8.	BA7211	Data Analysis and Business Modeling	0	0	4	2
<b>TOTAL</b>			<b>22</b>	<b>1</b>	<b>4</b>	<b>25</b>

**SUMMER SEMESTER (4 WEEKS)****SUMMER TRAINING**

Summer Training – The training report along with the company certificate should be submitted within the two weeks of the reopening date of 3<sup>rd</sup> semester. The training report should be around 40 pages containing the details of training undergone, the departments wherein he was trained with duration (chronological diary), along with the type of managerial skills developed during training. The training report should be sent to the Controller of Examinations by the HOD through the Principal, before the last working day of the 3<sup>rd</sup> Semester.

**SEMESTER – III**

SL.NO.	CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	BA7301	Enterprise Resource Planning	3	0	0	3
2.	BA7302	Strategic Management	3	0	0	3
3.	E1	Elective I	3	0	0	3
4.	E2	Elective II	3	0	0	3
5.	E3	Elective III	3	0	0	3
6.	E4	Elective IV	3	0	0	3
7.	E5	Elective V	3	0	0	3
8.	E6	Elective VI	3	0	0	3
<b>PRACTICAL</b>						
9.	BA7311	Professional Skill Development	0	0	4	2
10.	BA7312	Summer Training	0	0	2	1
<b>TOTAL</b>			<b>24</b>	<b>0</b>	<b>6</b>	<b>27</b>

**SEMESTER – IV**

SL.NO.	CODE NO.	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	BA7401	International Business Management	3	0	0	3
2.	BA7402	Business Ethics, Corporate Social Responsibility and Governance	3	0	0	3
<b>PRACTICAL</b>						
3.	BA7411	Creativity and Innovation	0	0	4	2
4.	BA7412	Project Work	0	0	18	9
<b>TOTAL</b>			<b>6</b>	<b>0</b>	<b>22</b>	<b>17</b>

**TOTAL NUMBER OF CREDITS = 96**

## LIST OF ELECTIVES

### MASTER OF BUSINESS ADMINISTRATION (MBA)

SL.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
<b>MARKETING – ELECTIVES</b>						
1	BA7011	Brand Management	3	0	0	3
2	BA7012	Retail Management	3	0	0	3
3	BA7013	Services Marketing	3	0	0	3
4	BA7014	Integrated Marketing Communication	3	0	0	3
5	BA7015	Customer Relationship Management	3	0	0	3
6	BA7016	Rural Marketing	3	0	0	3
<b>FINANCE – ELECTIVES</b>						
1	BA7021	Security Analysis and Portfolio Management	3	0	0	3
2	BA7022	Merchant Banking and Financial Services	3	0	0	3
3	BA7023	International Trade Finance	3	0	0	3
4	BA7024	Corporate Finance	3	0	0	3
5	BA7025	Micro Finance	3	0	0	3
6	BA7026	Banking Financial Services Management	3	0	0	3
<b>HUMAN RESOURCE – ELECTIVES</b>						
1	BA7031	Managerial Behavior and Effectiveness	3	0	0	3
2	BA7032	Entrepreneurship Development	3	0	0	3
3	BA7033	Organizational Theory, Design & Development	3	0	0	3
4	BA7034	Industrial Relations & Labour Welfare	3	0	0	3
5	BA7035	Labour Legislations	3	0	0	3
6	BA7036	Strategic Human Resource Management	3	0	0	3
<b>SYSTEMS - ELECTIVES</b>						
1	BA7041	Advanced Database Management Systems	3	0	0	3
2	BA7042	e-Business Management	3	0	0	3
3	BA7043	Software Project and Quality Management	3	0	0	3
4	BA7044	Datamining for Business Intelligence	3	0	0	3
<b>OPERATIONS – ELECTIVES</b>						
1	BA7051	Logistics and Supply Chain Management	3	0	0	3
2	BA7052	Services Operations Management	3	0	0	3
3	BA7053	Project Management	3	0	0	3
4	BA7054	Lean Six Sigma	3	0	0	3
<b>SHIPPING AND LOGISTICS MANAGEMENT- ELECTIVES</b>						
1.	BA7061	Containerization and Allied Business	3	0	0	3
2.	BA7062	Exim Management	3	0	0	3
3.	BA7063	Fundamentals of Shipping	3	0	0	3
4.	BA7064	Port and Terminal Management	3	0	0	3

Note: Three electives from two specializations from among the 5 areas of specialization are to be chosen by the students

**COURSE OUTCOME:**

The students should be able to describe and discuss the elements of effective management, ii) discuss and apply the planning, organizing and control processes, iii) describe various theories related to the development of leadership skills, motivation techniques, team work and effective communication, iv) communicate effectively through both oral and written presentation.

**UNIT I INTRODUCTION TO MANAGEMENT 9**

Organization- Management- Role of managers- Evolution of management thought- Organization and the environmental factors- Managing globally- Strategies for International business.

**UNIT II PLANNING 9**

Nature and purpose of planning- Planning process- Types of plans- Objectives- Managing by Objective (MBO) strategies- Types of strategies – Policies – Decision Making- Types of decision- Decision making process- Rational decision making process- Decision making under different conditions.

**UNIT III ORGANISING 9**

Nature and purpose of organizing- Organization structure- Formal and informal groups/ organization- Line and staff authority- Departmentation- Span of control- Centralization and decentralization- Delegation of authority- Staffing- Selection and Recruitment- Orientation- Career development- Career stages- Training- Performance appraisal

**UNIT IV DIRECTING 9**

Managing people- Communication- Hurdles to effective communication- Organization culture- Elements and types of culture- Managing cultural diversity.

**UNIT V CONTROLLING 9**

Process of controlling- Types of control- Budgetary and non-budgetary control techniques- Managing productivity- Cost control- Purchase control- Maintenance control- Quality control- Planning operations.

**TOTAL: 45 PERIODS****COURSE OBJECTIVE:**

To expose the students to the basic concepts of management in order to aid in understanding how an organization functions, and in understanding the complexity and wide variety of issues managers face in today's business firms.

**TEXT BOOKS:**

1. Andrew J. Dubrin, Essentials of Management, Thomson Southwestern, 9<sup>th</sup> edition, 2012.
2. Samuel C. Certo and Tervis Certo, Modern management: concepts and skills, Pearson education, 12<sup>th</sup> edition, 2012.
3. Harold Koontz and Heinz Weihrich, Essentials of management: An International & Leadership Perspective, 9<sup>th</sup> edition, Tata McGraw-Hill Education, 2012.
4. Charles W.L Hill and Steven L McShane, 'Principles of Management, McGraw Hill Education, Special Indian Edition, 2007.

**REFERENCES:**

1. Don Hellriegel, Susan E. Jackson and John W. Slocum, Management- A competency-based approach, Thompson South Western, 11<sup>th</sup> edition, 2008.
2. Heinz Weihrich, Mark V Cannice and Harold Koontz, Management- A global entrepreneurial perspective, Tata McGraw Hill, 12<sup>th</sup> edition, 2008.
3. Stephen P. Robbins, David A. De Cenzo and Mary Coulter, Fundamentals of management, Prentice Hall of India, 2012.

**COURSE OBJECTIVE:**

To learn the applications of statistics in business decision making.

**UNIT I INTRODUCTION****12**

Statistics – Definition, Types. Types of variables – Organising data - Descriptive Measures. Basic definitions and rules for probability, conditional probability independence of events, Baye's theorem, and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions.

**UNIT II SAMPLING DISTRIBUTION AND ESTIMATION****12**

Introduction to sampling distributions, sampling distribution of mean and proportion, application of central limit theorem, sampling techniques. Estimation: Point and Interval estimates for population parameters of large sample and small samples, determining the sample size.

**UNIT III TESTING OF HYPOTHESIS - PARAMETIRC TESTS****12**

Hypothesis testing: one sample and two sample tests for means and proportions of large samples (z-test), one sample and two sample tests for means of small samples (t-test), F-test for two sample standard deviations. ANOVA one and two way.

**UNIT IV NON-PARAMETRIC TESTS****12**

Chi-square test for single sample standard deviation. Chi-square tests for independence of attributes and goodness of fit. Sign test for paired data. Rank sum test. Kolmogorov-Smirnov – test for goodness of fit, comparing two populations. Mann – Whitney U test and Kruskal Wallis test. One sample run test, rank correlation.

**UNIT V CORRELATION, REGRESSION AND TIME SERIES ANALYSIS****12**

Correlation analysis, estimation of regression line. Time series analysis: Variations in time series, trend analysis, cyclical variations, seasonal variations and irregular variations, forecasting errors.

**TOTAL: 60 PERIODS****COURSE OUTCOME:**

To facilitate objective solutions in business decision making under subjective conditions

**TEXTBOOKS:**

1. Richard I. Levin, David S. Rubin, Statistics for Management, Pearson Education, 7<sup>th</sup> Edition, 2011.
2. Aczel A.D. and Sounderpandian J., "Complete Business Statistics", 6<sup>th</sup> edition, Tata McGraw – Hill Publishing Company Ltd., New Delhi, 2012.

**REFERENCES:**

1. Srivatsava TN and Shailaja Rego, Statistics for Management, Tata McGraw Hill, 2008.
2. Ken Black, Applied Business Statistics, 7<sup>th</sup> Edition, Wiley India Edition, 2012.
3. Anderson D.R., Sweeney D.J. and Williams T.A., Statistics for business and economics, 11<sup>th</sup> edition, Thomson (South – Western) Asia, Singapore, 2012.
4. N. D. Vohra, Business Statistics, Tata McGraw Hill, 2012.

**COURSE OBJECTIVE:**

To introduce the concepts of scarcity and efficiency; to explain principles of micro economics relevant to managing an organization; to describe principles of macro economics to have the understanding of economic environment of business.

**UNIT I INTRODUCTION****8**

The themes of economics – scarcity and efficiency – three fundamental economic problems – society's capability – Production possibility frontiers (PPF) – Productive efficiency Vs economic efficiency – economic growth & stability – Micro economies and Macro economies – the role of markets and government – Positive Vs negative externalities.

**UNIT II CONSUMER AND PRODUCER BEHAVIOUR****13**

Market – Demand and Supply – Determinants – Market equilibrium – elasticity of demand and supply – consumer behaviour – consumer equilibrium – Approaches to consumer behaviour – Production – Short-run and long-run Production Function – Returns to scale – economies Vs diseconomies of scale – Analysis of cost – Short-run and long-run cost function – Relation between Production and cost function.

**UNIT III PRODUCT AND FACTOR MARKET****13**

Product market – perfect and imperfect market – different market structures – Firm's equilibrium and supply – Market efficiency – Economic costs of imperfect competition – factor market – Land, Labour and capital – Demand and supply – determination of factor price – Interaction of product and factor market – General equilibrium and efficiency of competitive markets.

**UNIT IV PERFORMANCE OF AN ECONOMY – MACRO ECONOMICS****13**

Macro-economic aggregates – circular flow of macroeconomic activity – National income determination – Aggregate demand and supply – Macroeconomic equilibrium – Components of aggregate demand and national income – multiplier effect – Demand side management – Fiscal policy in theory.

**UNIT V AGGREGATE SUPPLY AND THE ROLE OF MONEY****13**

Short-run and Long-run supply curve – Unemployment and its impact – Okun's law – Inflation and the impact – reasons for inflation – Demand Vs Supply factors – Inflation Vs Unemployment tradeoff – Phillips curve – short- run and long-run – Supply side Policy and management- Money market- Demand and supply of money – money-market equilibrium and national income – the role of monetary policy.

**TOTAL: 60 PERIODS****COURSE OUTCOME:**

Students are expected to become familiar with both principles of micro and macro economics. They would also become familiar with application of these principles to appreciate the functioning of both product and input markets as well as the economy.

**TEXT BOOKS**

1. Paul A. Samuelson, William D. Nordhaus, Sudip Chaudhuri and Anindya Sen, Economics, 19<sup>th</sup> edition, Tata McGraw Hill, New Delhi, 2010.
2. William Boyes and Michael Melvin, Textbook of economics, Biztantra, 2005.
3. N. Gregory Mankiw, Principles of Economics, 3<sup>rd</sup> edition, Thomson learning, New Delhi, 2007.
4. Richard Lipsey and Alec Charystal, Economics, 12<sup>th</sup> edition, Oxford, University Press, New Delhi, 2011.
5. Karl E. Case and Ray C. fair, Principles of Economics, 6<sup>th</sup> edition, Pearson, Education Asia, New Delhi, 2002.

**COURSE OBJECTIVE:**

To learn the quality philosophies and tools in the managerial perspective.

**UNIT I INTRODUCTION****9**

Quality – vision, mission and policy statements. Customer Focus – customer perception of quality, Translating needs into requirements, customer retention. Dimensions of product and service quality. Cost of quality.

**UNIT II PRINCIPLES AND PHILOSOPHIES OF QUALITY MANAGEMENT****9**

Overview of the contributions of Deming, Juran Crosby, Masaaki Imai, Feigenbaum, Ishikawa, Taguchi techniques – introduction, loss function, parameter and tolerance design, signal to noise ratio. Concepts of Quality circle, Japanese 5S principles and 8D methodology.

**UNIT III STATISTICAL PROCESS CONTROL****9**

Meaning and significance of statistical process control (SPC) – construction of control charts for variables and attributed.

Process capability – meaning, significance and measurement – Six sigma - concepts of process capability.

Reliability concepts – definitions, reliability in series and parallel, product life characteristics curve. Total productive maintenance (TMP), Terotechnology. Business process Improvement (BPI) – principles, applications, reengineering process, benefits and limitations.

**UNIT IV TOOLS AND TECHNIQUES FOR QUALITY MANAGEMENT****9**

Quality functions development (QFD) – Benefits, Voice of customer, information organization, House of quality (HOQ), building a HOQ, QFD process. Failure mode effect analysis (FMEA) – requirements of reliability, failure rate, FMEA stages, design, process and documentation. Seven Tools (old & new). Bench marking and POKA YOKE.

**UNIT V QUALITY SYSTEMS ORGANIZING AND IMPLEMENTATION****9**

Introduction to IS/ISO 9004:2000 – quality management systems – guidelines for performance improvements. Quality Audits. TQM culture, Leadership – quality council, employee involvement, motivation, empowerment, recognition and reward - TQM framework, benefits, awareness and obstacles.

**TOTAL: 45 PERIODS****COURSE OUTCOME:**

To apply quality philosophies and tools to facilitate continuous improvement and ensure customer delight.

**TEXT BOOKS**

1. Dale H.Besterfield, Carol Besterfield – Michna, Glen H. Besterfield, Mary Besterfield – Sacre, Hermant – Urdhwareshe, Rashmi Urdhwareshe, Total Quality Management, Revised Third edition, Pearson Education, 2011
2. Shridhara Bhat K, Total Quality Management – Text and Cases, Himalaya Publishing House, First Edition 2002.

**REFERENCES**

1. Douglas C. Montgomery, Introduction to Statistical Quality Control, Wiley Student Edition, 4<sup>th</sup> Edition, Wiley India Pvt Limited, 2008.
2. James R. Evans and William M. Lindsay, The Management and Control of Quality, Sixth Edition, Thomson, 2005.
3. Poornima M.Charantimath, Total Quality Management, Pearson Education, First Indian Reprint 2003.
4. Indian standard – quality management systems – Guidelines for performance improvement (Fifth Revision), Bureau of Indian standards, New Delhi

**COURSE OBJECTIVE:**

To provide an overview of theories and practices in organizational behavior in individual, group and organizational level.

**UNIT I FOCUS AND PURPOSE 5**

Definition, need and importance of organizational behaviour – Nature and scope – Frame work – Organizational behaviour models.

**UNIT II INDIVIDUAL BEHAVIOUR 12**

Personality – types – Factors influencing personality – Theories – Learning – Types of learners – The learning process – Learning theories – Organizational behaviour modification.

Misbehaviour – Types – Management Intervention.

Emotions - Emotional Labour – Emotional Intelligence – Theories.

Attitudes – Characteristics – Components – Formation – Measurement- Values.

Perceptions – Importance – Factors influencing perception – Interpersonal perception- Impression Management.

Motivation – Importance – Types – Effects on work behavior.

**UNIT III GROUP BEHAVIOUR 10**

Organization structure – Formation – Groups in organizations – Influence – Group dynamics – Emergence of informal leaders and working norms – Group decision making techniques – **Team building** - Interpersonal relations – Communication – Control.

**UNIT IV LEADERSHIP AND POWER 8**

Meaning – Importance – Leadership styles – Theories – Leaders Vs Managers – Sources of power – Power centers – Power and Politics.

**UNIT V DYNAMICS OF ORGANIZATIONAL BEHAVIOUR 10**

Organizational culture and climate – Factors affecting organizational climate – Importance. Job satisfaction – Determinants – Measurements – Influence on behavior. Organizational change – Importance – Stability Vs Change – Proactive Vs Reaction change – the change process – Resistance to change – Managing change. Stress – Work Stressors – Prevention and Management of stress – Balancing work and Life. Organizational development – Characteristics – objectives –. Organizational effectiveness Developing Gender sensitive workplace

**TOTAL: 45 PERIODS**

**COURSE OUTCOME:**

Students will have a better understanding of human behavior in organization. They will know the framework for managing individual and group performance.

**TEXT BOOKS**

1. Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, 11<sup>th</sup> edition, 2008.
2. Fred Luthans, Organisational Behavior, McGraw Hill, 11<sup>th</sup> Edition, 2001.

**REFERENCES**

1. Mc Shane & Von Glinov, Organisational Behaviour, 4<sup>th</sup> Edition, Tata Mc Graw Hill, 2007.
2. Nelson, Quick, Khandelwal. ORGB – An innovative approach to learning and teaching. Cengage learning. 2<sup>nd</sup> edition. 2012
3. Ivancevich, Konopaske & Maheson, Organisational Behaviour & Management, 7<sup>th</sup> edition, Tata McGraw Hill, 2008.
4. Udai Pareek, Understanding Organisational Behaviour, 3<sup>rd</sup> Edition, Oxford Higher Education, 2011.
5. Jerald Greenberg, Behaviour in Organization, PHI Learning. 10<sup>th</sup> edition. 2011

**COURSE OBJECTIVE :**

- Acquire a reasonable knowledge in accounts
- Analysis and evaluate financial statements

**UNIT I FINANCIAL ACCOUNTING****12**

Introduction to Financial, Cost and Management Accounting- Generally accepted accounting principles, Conventions and Concepts-Balance sheet and related concepts- Profit and Loss account and related concepts - Introduction to inflation accounting- Introduction to human resources accounting.

**UNIT II COMPANY ACCOUNTS****12**

Meaning of Company -Maintenance of Books of Account-Statutory Books- Profit or Loss Prior to incorporation- Final Accounts of Company- Alteration of share capital- Preferential allotment, Employees stock option- Buy back of securities.

**UNIT III ANALYSIS OF FINANCIAL STATEMENTS****12**

Analysis of financial statements – Financial ratio analysis, cash flow (as per Accounting Standard 3) and funds flow statement analysis.

**UNIT IV COST ACCOUNTING****12**

Cost Accounts - Classification of manufacturing costs - Accounting for manufacturing costs. Cost Accounting Systems: Job order costing - Process costing- Activity Based Costing- Costing and the value chain- Target costing- Marginal costing including decision making- Budgetary Control & Variance Analysis - Standard cost system.

**UNIT V ACCOUNTING IN COMPUTERISED ENVIRONMENT****12**

Significance of Computerised Accounting System- Codification and Grouping of Accounts- Maintaining the hierarchy of ledgers- Prepackaged Accounting software.

**TOTAL: 45+15 = 60 PERIODS****COURSE OUTCOME**

- Possess a managerial outlook at accounts.

**TEXTBOOKS**

1. M.Y.Khan & P.K.Jain, Management Accounting, Tata McGraw Hill, 2011.
2. R.Narayanaswamy, Financial Accounting – A managerial perspective, PHI Learning, New Delhi, 2011.

**REFERENCES**

1. Jan Williams, Financial and Managerial Accounting – The basis for business Decisions, 15<sup>th</sup> edition, Tata McGraw Hill Publishers, 2010.
2. Horngren, Surdem, Stratton, Burgstahler, Schatzberg, Introduction to Management Accounting, PHI Learning, 2011.
3. Stice & Stice, Financial Accounting Reporting and Analysis, 8<sup>th</sup> edition, Cengage Learning, 2010.
4. Singhvi Bodhanwala, Management Accounting -Text and cases, PHI Learning, 2009.
5. Ashish K. Battacharya, Introduction to Financial Statement Analysis, Elsevier, 2009

**COURSE OBJECTIVE:**

To create the knowledge of Legal perspective and its practices to improvise the business.

**UNIT I COMMERCIAL LAW****9****THE INDIAN CONTRACT ACT 1872**

Definition of contract, essentials elements and types of a contract, Formation of a contract, performance of contracts, breach of contract and its remedies, Quasi contracts - Contract Of Agency: Nature of agency, Creation and types of agents, Authority and liability of Agent and principal: Rights and duties of principal and agents, termination of agency.

**THE SALE OF GOODS ACT 1930**

Nature of Sales contract, Documents of title, risk of loss, Guarantees and Warranties, performance of sales contracts, conditional sales and rights of an unpaid seller - Negotiable Instruments Act 1881: Nature and requisites of negotiable instruments. Types of negotiable instruments, liability of parties, holder in due course, special rules for Cheque and drafts, discharge of negotiable instruments.

**UNIT II COMPANY LAW****9**

Major principles – Nature and types of companies, Formation, Memorandum and Articles of Association, Prospectus, Power, duties and liabilities of Directors, winding up of companies, Corporate Governance.

**UNIT III INDUSTRIAL LAW****9**

An Overview of Factories Act - Payment of Wages Act - Payment of Bonus Act - Industrial Disputes Act.

**UNIT IV INCOME TAX ACT AND SALES TAX ACT****9**

Corporate Tax Planning, Overview of central Sales Tax Act 1956 – Definitions, Scope, Incidence of CST, Practical issues of CST, Value Added Tax – Concepts, Scope, Methods of VAT Calculation, Practical Implications of VAT.

**UNIT V CONSUMER PROTECTION ACT AND INTRODUCTION OF CYBER LAWS****9**

Consumer Protection Act – Consumer rights, Procedures for Consumer grievances redressal, Types of consumer Redressal Machineries and Forums- Competition Act 2002 - Cyber crimes, IT Act 2000 and 2002, Cyber Laws, Introduction of IPR – Copy rights, Trade marks, Patent Act.

**TOTAL: 45 PERIODS****COURSE OUTCOME:**

Legal insight will be established in the business practices according to the situation of changing environment.

**TEXT BOOKS**

1. N. D. Kapoor, Elements of mercantile Law, Sultan Chand and Company, India, 2006.
2. P. K. Goel, Business Law for Managers, Biztantatara Publishers, India, 2008.
3. Akhileshwar Pathack, Legal Aspects of Business, 4th Edition, Tata McGraw Hill, 2009.

## REFERENCES

1. P. P. S. Gogna, Mercantile Law, S. Chand & Co. Ltd., India, Fourth Edition, 2008.
2. Dr. Vinod, K. Singhania, Direct Taxes Planning and Management, 2008.
3. Richard Stim, Intellectual Property- Copy Rights, Trade Marks, and Patents, Cengage Learning, 2008.
4. Balachandran V., Legal Aspects of Business, Tata McGraw Hill, 2012
5. Daniel Albuquerque, Legal Aspect of Business, Oxford, 2012
6. Ravinder Kumar– Legal Aspect of Business.– Cengage Learning, 2<sup>nd</sup> Edition-2011.

**BA7108**

**WRITTEN COMMUNICATION**

**L T P C**  
**3 0 0 3**

### COURSE OBJECTIVE:

To familiarize learners with the mechanics of writing.

To enable learners to write in English precisely and effectively.

#### **UNIT I PERSONAL COMMUNICATION 9**

Journal writing, mails/emails, SMS, greeting cards, situation based – accepting/declining invitations, congratulating, consoling, conveying information.

#### **UNIT II SOCIAL COMMUNICATION 9**

Blogs, Reviews (films, books), posting comments, tweets, cross-cultural communication, gender sensitivity in communication.

#### **UNIT III WORK PLACE COMMUNICATION 9**

e-mails, minutes, reports of different kinds – annual report, status report, survey report, proposals, memorandums, presentations, interviews, profile of institutions, speeches, responding to enquiries, complaints, resumes, applications, summarizing, strategies for writing.

#### **UNIT IV RESEARCH WRITING 9**

Articles for publication (Journals), developing questionnaire, writing abstract, dissertation, qualities of research writing, data (charts, tables) analysis, documentation.

#### **UNIT V WRITING FOR MEDIA AND CREATIVE WRITING 9**

Features for publication (Newspapers, magazines, newsletters, notice-board), case studies, short stories, travelogues, writing for children, translation, techniques of writing

**TOTAL: 45 PERIODS**

### COURSE OUTCOME:

Learners should be able to

- i) get into the habit of writing regularly,
- ii) express themselves in different genres of writing from creative to critical to factual writing,
- iii) take part in print and online media communication,
- iv) read quite widely to acquire a style of writing, and
- v) identify their areas of strengths and weaknesses in writing.

### TEXT BOOKS

1. Raymond V Lesikar, John D Pettit, and Mary E Flatly. 2009. Lesikar's Basic BusinessCommunication. 11<sup>th</sup> ed. Tata McGraw-Hill, New Delhi.
2. Sharan J Gerson, and Steven M Gerson. 2008. Technical Writing: Process and Product. Pearson Education, New Delhi.

**REFERENCE:**

1. E. H. McGrath, S.J. 2012. Basic Managerial Skills for All. 9<sup>th</sup> ed. Prentice-Hall of India, New Delhi

## Management books

- Robin sharma - The greatness guide
- Steven Covey - 7 Habits of Effective people
- Arindham Chaudhuri - Count your chickens before they hatch
- Ramadurai - TCS Story

Blogs : Seth Godwin, Guy Kawasaki, Kiruba Shankar

Review: Harvard Business review

Reports: Deloitte, Netsis

Magazines: Bloomberg Businessweek, Economist

**BA7201****OPERATIONS MANAGEMENT****L T P C**  
**3 0 0 3****COURSE OBJECTIVE:**

To provide a broad introduction to the field of operations management and explain the concepts, strategies , tools and techniques for managing the transformation process that can lead to competitive advantage.

**UNIT I INTRODUCTION TO OPERATIONS MANAGEMENT****9**

Operations Management – Nature, Importance, historical development, transformation processes, differences between services and goods, a system perspective, functions, challenges, current priorities, recent trends; Operations Strategy – Strategic fit , framework; Supply Chain Management

**UNIT II FORECASTING, CAPACITY AND FACILITY DESIGN****9**

Demand Forecasting – Need, Types, Objectives and Steps. Overview of Qualitative and Quantitative methods. Capacity Planning – Long range, Types, Developing capacity alternatives. Overview of sales and operations planning. Overview of MRP, MRP II and ERP. Facility Location – Theories, Steps in Selection, Location Models. Facility Layout – Principles, Types, Planning tools and techniques.

**UNIT III DESIGN OF PRODUCT, PROCESS AND WORK SYSTEMS****9**

Product Design – Influencing factors, Approaches, Legal, Ethical and Environmental issues. Process – Planning, Selection, Strategy, Major Decisions. Work Study – Objectives, Procedure. Method Study and Motion Study. Work Measurement and Productivity – Measuring Productivity and Methods to improve productivity.

**UNIT IV MATERIALS MANAGEMENT****9**

Materials Management – Objectives, Planning, Budgeting and Control. Purchasing – Objectives, Functions, Policies, Vendor rating and Value Analysis. Stores Management – Nature, Layout, Classification and Coding. Inventory – Objectives, Costs and control techniques. Overview of JIT.

**UNIT V SCHEDULING AND PROJECT MANAGEMENT****9**

Project Management – Scheduling Techniques, PERT, CPM; Scheduling - work centers – nature, importance; Priority rules and techniques, shopfloor control; Flow shop scheduling – Johnson's Algorithm – Gantt charts; personnel scheduling in services.

**TOTAL: 45 PERIODS**

## **COURSE OUTCOME:**

Understanding of the strategic and operational decisions in managing manufacturing and service organizations and appreciation of the role of operations management function in an organization.

## **TEXT BOOKS**

1. Richard B. Chase, Ravi Shankar, F. Robert Jacobs, Nicholas J. Aquilano, Operations and Supply Management, Tata McGraw Hill, 12<sup>th</sup> Edition, 2010.
2. Norman Gaither and Gregory Frazier, Operations Management, South Western Cengage Learning, 2002.

## **REFERENCES**

1. William J Stevenson, Operations Management, Tata McGraw Hill, 9<sup>th</sup> Edition, 2009.
2. Russel and Taylor, Operations Management, Wiley, Fifth Edition, 2006.
3. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
4. Chary S. N, Production and Operations Management, Tata McGraw Hill, Third Edition, 2008.
5. Aswathappa K and Shridhara Bhat K, Production and Operations Management, Himalaya Publishing House, Revised Second Edition, 2008.
6. Mahadevan B, Operations Management Theory and practice, Pearson Education, 2007.
7. Pannervselvam R, Production and Operations Management, Prentice Hall India, Second Edition, 2008.

**BA7202**

**FINANCIAL MANAGEMENT**

**L T P C**  
**3 0 0 3**

## **COURSE OBJECTIVES:**

Facilitate student to

- Understand the operational nuances of a Finance Manager
- Comprehend the technique of making decisions related to finance function

### **UNIT I FOUNDATIONS OF FINANCE: 9**

Financial management – An overview- Time value of money- Introduction to the concept of risk and return of a single asset and of a portfolio- Valuation of bonds and shares-Option valuation.

### **UNIT II INVESTMENT DECISIONS: 9**

Capital Budgeting: Principles and techniques - Nature of capital budgeting- Identifying relevant cash flows - Evaluation Techniques: Payback, Accounting rate of return, Net Present Value, Internal Rate of Return, Profitability Index - Comparison of DCF techniques - Project selection under capital rationing - Inflation and capital budgeting - Concept and measurement of cost of capital - Specific cost and overall cost of capital

### **UNIT III FINANCING AND DIVIDEND DECISION: 9**

Financial and operating leverage - capital structure - Cost of capital and valuation - designing capital structure.

Dividend policy - Aspects of dividend policy - practical consideration - forms of dividend policy - forms of dividends - share splits.

### **UNIT IV WORKING CAPITAL MANAGEMENT: 9**

Principles of working capital: Concepts, Needs, Determinants, issues and estimation of working capital - Accounts Receivables Management and factoring - Inventory management - Cash management - Working capital finance : Trade credit, Bank finance and Commercial paper.

**UNIT V LONG TERM SOURCES OF FINANCE: 9**

Indian capital and stock market, New issues market Long term finance: Shares, debentures and term loans, lease, hire purchase, venture capital financing, Private Equity.

**TOTAL: 45 PERIODS**

**COURSE OUTCOME:**

Possess the techniques of managing finance in an organization

**TEXT BOOKS**

1. M.Y. Khan and P.K.Jain Financial management, Text, Problems and cases Tata McGraw Hill, 6<sup>th</sup> edition, 2011.
2. M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd., 10<sup>th</sup> edition, 2012.

**REFERENCES**

1. Aswat Damodaran, Corporate Finance Theory and practice, John Wiley & Sons, 2011.
2. James C. Vanhorne –Fundamentals of Financial Management– PHI Learning, 11<sup>th</sup> Edition, 2012.
3. Brigham, Ehrhardt, Financial Management Theory and Practice, 12<sup>th</sup> edition, Cengage Learning 2010.
4. Prasanna Chandra, Financial Management, 9<sup>th</sup> edition, Tata McGraw Hill, 2012.
5. Srivatsava, Mishra, Financial Management, Oxford University Press, 2011

**BA7203**

**MARKETING MANAGEMENT**

**L T P C  
4 0 0 4**

**COURSE OBJECTIVE:**

- To understand the changing business environment
- To identify the indicators of management thoughts and practices
- To understand fundamental premise underlying market driven strategies

**UNIT I INTRODUCTION 12**

Marketing – Definitions - Conceptual frame work – Marketing environment : Internal and External - Marketing interface with other functional areas – Production, Finance, Human Relations Management, Information System. Marketing in global environment – Prospects and Challenges.

**UNIT II MARKETING STRATEGY 12**

Marketing strategy formulations – Key Drivers of Marketing Strategies - Strategies for Industrial Marketing – Consumer Marketing — Services marketing – Competitor analysis - Analysis of consumer and industrial markets – Strategic Marketing Mix components.

**UNIT III MARKETING MIX DECISIONS 12**

Product planning and development – Product life cycle – New product Development and Management – Market Segmentation – Targeting and Positioning – Channel Management – Advertising and sales promotions – Pricing Objectives, Policies and methods.

**UNIT IV BUYER BEHAVIOUR 12**

Understanding industrial and individual buyer behavior - Influencing factors – Buyer Behaviour Models – Online buyer behaviour - Building and measuring customer satisfaction – Customer relationships management – Customer acquisition, Retaining, Defection.



**UNIT V PERFORMANCE EVALUATION AND CONTROL PROCESS 10**

Method of performance evaluation – Feedback – Industry practices. Promotion, Demotion, Transfer and Separation – Implication of job change. The control process – Importance – Methods – Requirement of effective control systems grievances – Causes – Implications – Redressal methods.

**TOTAL: 45 PERIODS**

**COURSE OUTCOME:**

Students will gain knowledge and skills needed for success as a human resources professional

**TEXT BOOKS**

1. Dessler Human Resource Management, Pearson Education Limited, 2007
2. Decenzo and Robbins, Human Resource Management, Wiley, 8<sup>th</sup> Edition, 2007.

**REFERENCES**

1. Luis R.Gomez-Mejia, David B.Balkin, Robert L Cardy. Managing Human Resource. PHI Learning. 2012
2. Bernadin , Human Resource Management ,Tata Mcgraw Hill ,8<sup>th</sup> edition 2012.
3. Wayne Cascio, Managing Human Resource, McGraw Hill, 2007.
4. Ivancevich, Human Resource Management, McGraw Hill 2012.
5. Uday Kumar Haldar, Juthika Sarkar. Human Resource management. Oxford. 2012

**BA7205**

**INFORMATION MANAGEMENT**

**L T P C  
3 0 0 3**

**COURSE OBJECTIVE**

- To understand the importance of information in business
- To know the technologies and methods used for effective decision making in an organization.

**UNIT I INTRODUCTION 10**

Data, Information, Intelligence, Information Technology, Information System, evolution, types based on functions and hierarchy, System development methodologies, Functional Information Systems, DSS, EIS, KMS, GIS, International Information System.

**UNIT II SYSTEM ANALYSIS AND DESIGN 10**

Case tools - System flow chart, Decision table, Data flow Diagram (DFD), Entity Relationship (ER), Object Oriented Analysis and Design(OOAD), UML diagram.

**UNIT III DATABASE MANAGEMENT SYSTEMS 9**

DBMS – HDBMS, NDBMS, RDBMS, OODBMS, Query Processing, SQL, Concurrency Management, Data warehousing and Data Mart

**UNIT IV SECURITY, CONTROL AND REPORTING 8**

Security, Testing, Error detection, Controls, IS Vulnerability, Disaster Management, Computer Crimes, Securing the Web, Intranets and Wireless Networks, Software Audit, Ethics in IT, User Interface and reporting.

**UNIT V NEW IT INITIATIVES 8**

Role of information management in ERP, e-business, e-governance, Data Mining, Business Intelligence, Pervasive Computing, Cloud computing, CMM.

**TOTAL: 45 PERIODS**

## COURSE OUTCOME

- Gains knowledge on effective applications of information systems in business

## TEXTBOOKS

1. Robert Schultheis and Mary Summer, Management Information Systems – The Managers View, Tata McGraw Hill, 2008.
2. Kenneth C. Laudon and Jane Price Laudon, Management Information Systems – Managing the digital firm, PHI Learning / Pearson Education, PHI, Asia, 2012.

## REFERENCES

1. Rahul de, MIS in Business, Government and Society, Wiley India Pvt Ltd, 2012
2. Gordon Davis, Management Information System : Conceptual Foundations, Structure and Development, Tata McGraw Hill, 21<sup>st</sup> Reprint 2008.
3. Haag, Cummings and Mc Cubbrey, Management Information Systems for the Information Age, McGraw Hill, 2005. 9<sup>th</sup> edition, 2013.
4. Turban, McLean and Wetherbe, Information Technology for Management – Transforming Organisations in the Digital Economy, John Wiley, 6<sup>th</sup> Edition, 2008.
5. Raymond McLeod and Jr. George P. Schell, Management Information Systems, Pearson Education, 2007.
6. James O Brien, Management Information Systems – Managing Information Technology in the E-business enterprise, Tata McGraw Hill, 2004.
7. Raplh Stair and George Reynolds, Information Systems, Cengage Learning, 10<sup>th</sup> Edition, 2012
8. Corey Schou and Dan Shoemaker, Information Assurance for the Enterprise – A Roadmap to Information Security, Tata McGraw Hill, 2007.
9. Frederick Gallegor, Sandra Senft, Daniel P. Manson and Carol Gonzales, Information Technology Control and Audit, Auerbach Publications, 4<sup>th</sup> Edition, 2013.

**BA7206**

**APPLIED OPERATIONS RESEARCH**

**L T P C**  
**3 1 0 4**

### COURSE OBJECTIVE:

To learn the concepts of operations research applied in business decision making.

#### **UNIT I INTRODUCTION TO LINEAR PROGRAMMING (LP) 12**

Introduction to applications of operations research in functional areas of management. Linear Programming-formulation, solution by graphical and simplex methods (Primal - Penalty, Two Phase), Special cases. Dual simplex method. Principles of Duality. Sensitivity Analysis.

#### **UNIT II LINEAR PROGRAMMING EXTENSIONS 12**

Transportation Models (Minimising and Maximising Problems) – Balanced and unbalanced Problems – Initial Basic feasible solution by N-W Corner Rule, Least cost and Vogel's approximation methods. Check for optimality. Solution by MODI / Stepping Stone method. Case of Degeneracy. Transshipment Models. Assignment Models (Minimising and Maximising Problems) – Balanced and Unbalanced Problems. Solution by Hungarian and Branch and Bound Algorithms. Travelling Salesman problem. Crew Assignment Models.

#### **UNIT III INTEGER PROGRAMMING AND GAME THEORY 12**

Solution to pure and mixed integer programming problem by Branch and Bound and cutting plane algorithms. Game Theory-Two person Zero sum games-Saddle point, Dominance Rule, Convex Linear Combination (Averages), methods of matrices, graphical and LP solutions.

**UNIT IV INVENTORY MODELS, SIMULATION AND DECISION THEORY 12**  
Inventory Models – EOQ and EBQ Models (With and without shortages), Quantity Discount Models. Decision making under risk – Decision trees – Decision making under uncertainty. Monte-carlo simulation.

**UNIT V QUEUING THEORY AND REPLACEMENT MODELS 12**  
Queuing Theory - single and Multi-channel models – infinite number of customers and infinite calling source. Replacement Models-Individuals replacement Models (With and without time value of money) – Group Replacement Models.

**TOTAL: 60 PERIODS**

**COURSE OUTCOME:**

To facilitate quantitative solutions in business decision making under conditions of certainty, risk and uncertainty.

**TEXT BOOKS**

1. Paneerselvam R., Operations Research, Prentice Hall of India, Fourth Print, 2008.
2. N. D Vohra, Quantitative Techniques in Management, Tata Mcgraw Hill, 2010.
3. Pradeep Prabakar Pai, Operations Research - Principles and Practice, Oxford Higher Education.

**REFERENCES**

1. Hamdy A Taha, Introduction to Operations Research, Prentice Hall India, Seventh Edition, Third Indian Reprint 2004.
2. G. Srinivasan, Operations Research – Principles and Applications, PHI, 2007.
3. Gupta P.K, Hira D.S, Problem in Operations Research, S.Chand and Co, 2007.
4. Kalavathy S, Operations Research, Second Edition, Vikas Publishing House, 2004.
5. Frederick & Mark Hillier, Introduction to Management Science – A Modeling and case studies approach with spreadsheets, Tata Mcgraw Hill, 2005.

**BA7207**

**BUSINESS RESEARCH METHODS**

**L T P C**  
**3 0 0 3**

**COURSE OBJECTIVE:**

To expose the students to the principles of scientific methodology in business enquiry; to develop analytical skills of business research; to develop the skills for scientific communications.

**UNIT I INTRODUCTION 9**  
Business Research – Definition and Significance – the research process – Types of Research – Exploratory and causal Research – Theoretical and empirical Research – Cross –Sectional and time – series Research – Research questions / Problems – Research objectives – Research hypotheses – characteristics – Research in an evolutionary perspective – the role of theory in research.

**UNIT II RESEARCH DESIGN AND MEASUREMENT 9**  
Research design – Definition – types of research design – exploratory and causal research design – Descriptive and experimental design – different types of experimental design – Validity of findings – internal and external validity – Variables in Research – Measurement and scaling – Different scales – Construction of instrument – Validity and Reliability of instrument.

**UNIT III DATA COLLECTION 9**

Types of data – Primary Vs Secondary data – Methods of primary data collection – Survey Vs Observation – Experiments – Construction of questionnaire and instrument – Validation of questionnaire – Sampling plan – Sample size – determinants optimal sample size – sampling techniques – Probability Vs Non-probability sampling methods.

**UNIT IV DATA PREPARATION AND ANALYSIS 9**

Data Preparation – editing – Coding –Data entry – Validity of data – Qualitative Vs Quantitative data analyses – Bivariate and Multivariate statistical techniques – Factor analysis – Discriminant analysis – cluster analysis – multiple regression and correlation – multidimensional scaling – Application of statistical software for data analysis.

**UNIT V REPORT DESIGN, WRITING AND ETHICS IN BUSINESS RESEARCH 9**

Research report – Different types – Contents of report – need of executive summary – chapterization – contents of chapter – report writing – the role of audience – readability – comprehension – tone – final proof – report format – title of the report – ethics in research – ethical behaviour of research – subjectivity and objectivity in research.

**TOTAL: 45 PERIODS****COURSE OUTCOME:**

Students would become acquainted with the scientific methodology in business domain. They would also become analytically skillful. They would become familiar with the nuances of scientific communications.

**TEXT BOOKS**

1. Donald R. Cooper, Pamela S. Schindler and J K Sharma, Business Research methods, 11<sup>th</sup> Edition, Tata Mc Graw Hill, New Delhi, 2012.
2. Alan Bryman and Emma Bell, Business Research methods, 3<sup>rd</sup> Edition, Oxford University Press, New Delhi, 2011.
3. Uma Sekaran and Roger Bougie, Research methods for Business, 5<sup>th</sup> Edition, Wiley India, New Delhi, 2012.
4. William G Zikmund, Barry J Babin, Jon C.Carr, Atanu Adhikari, Mitch Griffin, Business Research methods, A South Asian Perspective, 8<sup>th</sup> Edition, Cengage Learning, New Delhi, 2012.

**BA7211 DATA ANALYSIS AND BUSINESS MODELING****L T P C  
0 0 4 2****COURSE OBJECTIVE**

- to have hands- on experience on decision modeling

[Business models studied in theory to be practiced using Spreadsheet / Analysis Software]

S.No.	Exp. No.	Details of experiments	Duration
		Name	
1	1	Descriptive Statistics	4
2	2	Hypothesis - Parametric	4
3	3	Hypothesis – Non-parametric	4
4	4	Correlation & Regression	4
5	5	Forecasting	4
6	-	Extended experiment – 1	4
7	6	Portfolio Selection	4

8	7	Risk Analysis & Sensitivity Analysis	4
9	8	Revenue Management	4
10	-	Extended experiment – 2	4
11	9	Transportation & Assignment	4
12	10	Networking Models	4
13	11	Queuing Theory	4
14	12	Inventory Models	4
15	-	Extended experiments – 3	4

- Spreadsheet Software and
- Data Analysis Tools

**TOTAL: 60 PERIODS**

#### **REQUIREMENTS for a batch of 30 students**

1. Personal Computers – 30 nos
2. Any licensed Spreadsheet and Analysis software like Microsoft Excel, SPSS etc– 30 user licenses

#### **COURSE OUTCOME**

- Knowledge of spreadsheets and data analysis software for business modeling

#### **TEXT BOOKS**

1. David M. Levine et al, “Statistics for Managers using MS Excel’ (6<sup>th</sup> Edition) Pearson, 2010
2. David R. Anderson, et al, ‘An Introduction to Management Sciences: Quantitative approaches to Decision Making, (13<sup>th</sup> edition) South-Western College Pub, 2011.
3. William J. Stevenson, Ceyhun Ozgur, ‘Introduction to Management Science with Spreadsheet’, Tata McGraw Hill, 2009.
4. Wayne L. Winston, Microsoft Excel 2010: Data Analysis & Business Modeling, 3<sup>rd</sup> edition, Microsoft Press, 2011.
5. Vikas Gupta, Comdex Business Accounting with Ms Excel, 2010 and Tally ERP 9.0 Course Kit, Wiley India, 2012
6. Kiran Pandya and Smriti Bulsari, SPSS in simple steps, Dreamtech, 2011.

**BA7301**

**ENTERPRISE RESOURCE PLANNING**

**L T P C**  
**3 0 0 3**

#### **COURSE OBJECTIVES**

- to understand the business process of an enterprise
- to grasp the activities of ERP project management cycle
- to understand the emerging trends in ERP developments

#### **UNIT I INTRODUCTION**

**8**

Overview of enterprise systems – Evolution - Risks and benefits - Fundamental technology - Issues to be consider in planning design and implementation of cross functional integrated ERP systems.

#### **UNIT II ERP SOLUTIONS AND FUNCTIONAL MODULES**

**10**

Overview of ERP software solutions- Small, medium and large enterprise vendor solutions, BPR, and best business practices - Business process Management, Functional modules.

**UNIT III ERP IMPLEMENTATION 10**  
Planning Evaluation and selection of ERP systems - Implementation life cycle - ERP implementation, Methodology and Frame work- Training – Data Migration. People Organization in implementation-Consultants, Vendors and Employees.

**UNIT IV POST IMPLEMENTATION 8**  
Maintenance of ERP- Organizational and Industrial impact; Success and Failure factors of ERP Implementation.

**UNIT V EMERGING TRENDS ON ERP 9**  
Extended ERP systems and ERP add-ons -CRM, SCM, Business analytics - Future trends in ERP systems-web enabled, Wireless technologies, cloud computing.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

- knowledge of ERP implementation cycle
- awareness of core and extended modules of ERP

**TEXT BOOK**

1. Alexis Leon, ERP demystified, second Edition Tata McGraw-Hill, 2008.

**REFERENCES**

1. Sinha P. Magal and Jeffery Word, Essentials of Business Process and Information System, Wiley India, 2012
2. Jagan Nathan Vaman, ERP in Practice, Tata McGraw-Hill, 2008
3. Alexis Leon, Enterprise Resource Planning, second edition, Tata McGraw-Hill, 2008.
4. Mahadeo Jaiswal and Ganesh Vanapalli, ERP Macmillan India, 2009
5. Vinod Kumar Grag and N.K. Venkitakrishnan, ERP- Concepts and Practice, Prentice Hall of India, 2006.
6. Summer, ERP, Pearson Education, 2008

**BA7302 STRATEGIC MANAGEMENT L T P C**  
**3 0 0 3**

**COURSE OBJECTIVE:**

To learn the major initiatives taken by a company's top management on behalf of corporates, involving resources and performance in external environments. It entails specifying the organization's mission, vision and objectives, developing policies and plan to understand the analysis and implementation of strategic management in strategic business units.

**UNIT I STRATEGY AND PROCESS 9**  
Conceptual framework for strategic management, the Concept of Strategy and the Strategy Formation Process – Stakeholders in business – Vision, Mission and Purpose – Business definition, Objectives and Goals - Corporate Governance and Social responsibility-case study.

**UNIT II COMPETITIVE ADVANTAGE 9**  
External Environment - Porter's Five Forces Model-Strategic Groups Competitive Changes during Industry Evolution-Globalisation and Industry Structure - National Context and Competitive advantage Resources- Capabilities and competencies–core competencies-Low cost and differentiation Generic Building Blocks of Competitive Advantage- Distinctive Competencies-Resources and Capabilities durability of competitive Advantage- Avoiding failures and sustaining competitive advantage-Case study.

**UNIT III STRATEGIES****10**

The generic strategic alternatives – Stability, Expansion, Retrenchment and Combination strategies - Business level strategy- Strategy in the Global Environment-Corporate Strategy- Vertical Integration-Diversification and Strategic Alliances- Building and Restructuring the corporation- Strategic analysis and choice - Environmental Threat and Opportunity Profile (ETOP) - Organizational Capability Profile - Strategic Advantage Profile - Corporate Portfolio Analysis - SWOT Analysis - GAP Analysis - Mc Kinsey's 7s Framework - GE 9 Cell Model - Distinctive competitiveness - Selection of matrix - Balance Score Card-case study.

**UNIT IV STRATEGY IMPLEMENTATION & EVALUATION****9**

The implementation process, Resource allocation, Designing organisational structure-Designing Strategic Control Systems- Matching structure and control to strategy-Implementing Strategic change-Politics-Power and Conflict-Techniques of strategic evaluation & control-case study.

**UNIT V OTHER STRATEGIC ISSUES****8**

Managing Technology and Innovation-Strategic issues for Non Profit organisations. New Business Models and strategies for Internet Economy-case study

**TOTAL: 45 PERIODS****COURSE OUTCOME :**

This Course will create knowledge and understanding of management concepts principles and skills from a people, finance, marketing and organisational perspectives the development of appropriate organisational policies and strategies within a changing context to meet stakeholder interests information systems to learn from failure key tools and techniques for the analysis and design of information systems, including their human and organisational as well as technical aspects.

**TEXT BOOKS**

1. Hill. Strategic Management : An Integrated approach, 2009 Edition Wiley (2012).
2. John A.Parnell. Strategic Management, Theory and practice Biztantra (2012).
3. Azhar Kazmi, Strategic Management and Business Policy, 3<sup>rd</sup> Edition, Tata McGraw Hill, 2008.

**REFERENCES**

1. Adriaui HAberberg and Alison Rieple, Strategic Management Theory & Application, Oxford University Press, 2008.
2. Lawrence G. Hrebiniak, Making strategy work, Pearson, 2005.
3. Gupta, Gollakota and Srinivasan, Business Policy and Strategic Management – Concepts and Application, Prentice Hall of India, 2005.
4. Dr.Dharma Bir Singh, Strategic Management & Business Policy, KoGent Learning Solutions Inc., Wiley, 2012.
5. John Pearce, Richard Robinson and Amitha Mittal, Strategic Management, McGraw Hill, 12<sup>th</sup> Edition, 2012

**BA7311****PROFESSIONAL SKILL DEVELOPMENT**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**COURSE OBJECTIVE:**

To enable learners to speak fluently and flawlessly in all kinds of communicative Contexts with speakers of all nationalities.

**UNIT I PERSONAL COMMUNICATION 10**

Day-to-day conversation with family members, neighbours, relatives, friends on various topics, context specific – agreeing/disagreeing, wishing, consoling, advising, persuading, expressing opinions, arguing.

**UNIT II SOCIAL COMMUNICATION 10**

Telephone calls (official), colleagues in the workspot, discussing issues (social, political, cultural) clubs (any social gathering), answering questions, talking about films, books, news items, T.V. programmes, sharing jokes.

**UNIT III GROUP/MASS COMMUNICATION 10**

Group discussion (brainstorming ), debate, panel discussion, anchoring/master of ceremony, welcome address, proposing vote of thanks, introducing speakers, conducting meetings, making announcements, Just-a-minute (JAM), Block and tackle, shipwreck, spoof, conducting quiz, negotiations, oral reports.

**UNIT IV INTEGRATED SPEAKING AND PRESENTATION SKILLS 10**

Listening to speak (any radio programme/lecture), reading to speak, writing to speak, watching to speak, (any interesting programme on TV) Reading aloud any text/speech, lecturing, PowerPoint presentation, impromptu, Interviews of different kinds (one to one, many to one, stress interview, telephonic interview)

**UNIT V EMPLOYABILITY AND CORPORATE SKILLS 20**

Interview skills – Types of interview, preparation for interview, mock interview. Group Discussion – Communication skills in Group Discussion, Structure of GD, GD process, successful GD techniques, skills bought out in GD – leadership and co-ordination. Time management and effective planning – identifying barriers to effective time management, prudent time management techniques, relationship between time management and stress management. Stress management – causes and effect, coping strategies – simple physical exercises, simple Yoga and Meditation techniques, Relaxation techniques, stress and faith healing, positive forces of nature, relaxation by silence and music. Decision making and Negotiation skills, People skills, Team work, development of leadership qualities.

**TOTAL: 60 PERIODS**

**Note:** Students will undergo the entire programme similar to a Seminar. It is an activity based course. Student individually or as a group can organize event(s), present term papers etc. This will be evaluated by the faculty member(s) handling the course and the consolidated marks can be taken as the final mark. No end semester examination is required for this course

**COURSE OUTCOMES:**

Learners should be able to

- I. speak confidently with any speakers of English, including native speakers,
- II. speak effortlessly in different contexts – informal and formal,
- III. ‘think on feet’ even in difficult circumstances,
- IV. hold interesting and meaningful conversations with others, including strangers, and
- V. listen to others with utmost attention.

**REFERENCES:**

1. Richard Denny, “Communication to Win; Kogan Page India Pvt. Ltd., New Delhi, 2008.
2. “Value Education”, VISION for Wisdom, Vethathiri Publications, Erode, 2009
3. Listening to/Watching great speeches such as Barack Obama, M.A. Chidambaram, Vijay Mallaya etc. Tedtalk TV channels (News, documentaries).

**COURSE OBJECTIVE:**

To expose the students to the basic concepts of international business management

**UNIT I INTRODUCTION****6**

International Business –Definition – Internationalizing business-Advantages –factors causing globalization of business- international business environment – country attractiveness –Political, economic and cultural environment – Protection Vs liberalization of global business environment.

**UNIT II INTERNATIONAL TRADE AND INVESTMENT****11**

Promotion of global business – the role of GATT/WTO – multilateral trade negotiation and agreements – VIII & IX, round discussions and agreements – Challenges for global business – global trade and investment – theories of international trade and theories of international investment – Need for global competitiveness – Regional trade block – Types – Advantages and disadvantages – RTBs across the globe – brief history.

**UNIT III INTERNATIONAL STRATEGIC MANAGEMENT****11**

Strategic compulsions-Standardization Vs Differentiation – Strategic options – Global portfolio management- global entry strategy – different forms of international business – advantages - organizational issues of international business – organizational structures – controlling of international business – approaches to control – performance of global business- performance evaluation system.

**UNIT IV PRODUCTION, MARKETING, FINANCIAL AND HUMAN RESOURCE MANAGEMENT OF GLOBAL BUSINESS****11**

Global production –Location –scale of operations- cost of production – Make or Buy decisions – global supply chain issues – Quality considerations- Globalization of markets, marketing strategy – Challenges in product development , pricing, production and channel management- Investment decisions – economic- Political risk – sources of fund- exchange –rate risk and management – strategic orientation – selection of expatriate managers- Training and development – compensation.

**UNIT V CONFLICT MANAGEMENT AND ETHICS IN INTERNATIONAL BUSINESS MANAGEMENT****6**

Disadvantages of international business – Conflict in international business- Sources and types of conflict – Conflict resolutions – Negotiation – the role of international agencies –Ethical issues in international business – Ethical decision-making.

**TOTAL: 45 PERIODS****COURSE OUTCOME:**

Students would be familiar with global business environment, global strategic management practices and get acquainted with functional domain practices. They would be familiar with conflicts situations and ethical issues in global business.

**TEXT BOOKS**

1. Charles W.I. Hill and Arun Kumar Jain, International Business, 6<sup>th</sup> edition, Tata Mc Graw Hill, New Delhi, 2010.
2. John D. Daniels and Lee H. Radebaugh, International Business, Pearson Education Asia, New Delhi, 2000.
3. K. Aswathappa, International Business, 5<sup>th</sup> Edition, Tata Mc Graw Hill, New Delhi, 2012.
4. Michael R. Czinkota, Ilkka A. Ronkainen and Michael H. Moffet, International Business, 7<sup>th</sup> Edition , Cengage Learning, New Delhi, 2010.
5. Rakesh Mohan Joshi, International Business, Oxford University Press, New Delhi, 2009.
6. Vyuptakesh Sharan, International Business, 3<sup>rd</sup> Edition, Pearson Education in South Asia, New Delhi, 2011.

**COURSE OBJECTIVE:**

To have grounding on theory through the understanding of real life situations and cases.

**UNIT I INTRODUCTION 9**

Definition & nature Business ethics, Characteristics, Ethical theories; Causes of unethical behavior; Ethical abuses; Work ethics; Code of conduct; Public good.

**UNIT II ETHICS THEORY AND BEYOND 9**

Management of Ethics - Ethics analysis [ Hosmer model ]; Ethical dilemma; Ethics in practice - ethics for managers; Role and function of ethical managers- Comparative ethical behaviour of managers; Code of ethics; Competitiveness, organizational size, profitability and ethics; Cost of ethics in Corporate ethics evaluation. Business and ecological / environmental issues in the Indian context and case studies.

**UNIT III LEGAL ASPECTS OF ETHICS 9**

Political – legal environment; Provisions of the Indian constitution pertaining to Business; Political setup – major characteristics and their implications for business; Prominent features of MRTP & FERA. Social – cultural environment and their impact on business operations, Salient features of Indian culture and values.

**UNIT IV ENVIRONMENTAL ETHICS 9**

Economic Environment; Philosophy of economic grow and its implications for business, Main features of Economic Planning with respect to business; Industrial policy and framework of government contract over Business; Role of chamber of commerce and confederation of Indian Industries.

**UNIT V CORPORATE SOCIAL RESPONSIBILITY AND GOVERNANCE 9**

Definition- Evolution- Need for CSR; Theoretical perspectives; Corporate citizenship; Business practices; Strategies for CSR; Challenges and implementation; Evolution of corporate governance; Governance practices and regulation; Structure and development of boards; Role of capital market and government; Governance ratings; Future of governance- innovative practices; Case studies with lessons learnt.

**TOTAL: 45 PERIODS**

**COURSE OUTCOME:**

To understand ethical issues in workplace and be able to find solution for ‘most good’.

**TEXT BOOKS**

1. S.A. Sherlekar, Ethics in Management, Himalaya Publishing House, 2009.
2. William B. Werther and David B. Chandler, Strategic corporate social responsibility, Sage Publications Inc., 2011
3. Robert A.G. Monks and Nell Minow, Corporate governance, John Wiley and Sons, 2011.

**REFERENCES**

1. W.H. Shaw, Business Ethics, Cengage Learning, 2007.
2. Beeslory, Michel and Evens, Corporate Social Responsibility, Taylor and Francis, 1978.
3. Philip Kotler and Nancy Lee, Corporate social responsibility: doing the most good for company and your cause, Wiley, 2005.

4. Subhabrata Bobby Banerjee, Corporate social responsibility: the good, the bad and the ugly, Edward Elgar Publishing, 2007.
5. Satheesh kumar, Corporate governance, Oxford University, Press, 2010.
6. Bob Tricker, Corporate governance- Principles, policies and practices, Oxford University Press, 2009.
7. Larue Tone Hosmer and Richard D., The Ethics of Management, Irwin Inc., 1995.
8. Joseph A. Petrick and John F. Quinn, Management Ethics - integrity at work, Sage, 1997.

**BA7411**

**CREATIVITY AND INNOVATION**

**L T P C**  
**0 0 4 2**

**COURSE OBJECTIVES:**

- (i) To understand the nuances involved in Creativity & Innovation.
- (ii) To get hands on experience in applying creativity in problem solving.

**UNIT I INTRODUCTION**

**12**

Need for Creative and innovative thinking for quality – Essential theory about directed creativity, components of Creativity, Methodologies and approaches, individual and group creativity, organizational role in creativity, types of innovation, barriers to innovation, innovation process, establishing criterion for assessment of creativity & innovation.

**UNIT II MECHANISM OF THINKING AND VISUALIZATION**

**12**

Definitions and theory of mechanisms of mind heuristics and models : attitudes, Approaches and Actions that support creative thinking - Advanced study of visual elements and principles- line, plane, shape, form, pattern, texture gradation, color symmetry. Spatial relationships and compositions in 2 and 3 dimensional space - procedure for genuine graphical computer animation – Animation aerodynamics – virtual environments in scientific Visualization – Unifying principle of data management for scientific visualization – Visualization benchmarking

**UNIT III CREATIVITY**

**12**

Methods and tools for Directed Creativity – Basic Principles – Tools that prepare the mind for creative thought – stimulation – Development and Actions: - Processes in creativity ICEDIP – Inspiration, Clarification, Distillation, Perspiration, Evaluation and Incubation – Creativity and Motivation The Bridge between man creativity and the rewards of innovativeness – Applying Directed Creativity.

**UNIT IV CREATIVITY IN PROBLEM SOLVING**

**12**

Generating and acquiring new ideas, product design, service design – case studies and hands-on exercises, stimulation tools and approaches, six thinking hats, lateral thinking – Individual activity, group activity, contextual influences.

**UNIT V INNOVATION**

**12**

Achieving Creativity – Introduction to TRIZ methodology of Inventive Problem Solving - the essential factors – Innovator’s solution – creating and sustaining successful growth – Disruptive Innovation model – Segmentive Models – New market disruption - Commoditization and DE-commoditization – Managing the Strategy Development Process – The Role of Senior Executive in Leading New Growth – Passing the Baton

**TOTAL: 60 PERIODS**

**Note:** Students will undergo the entire programme similar to a Seminar. It is activity based course. Students will undergo the programme with both theoretical and practical content. Each student will be required to come out with innovative products or services. This will be evaluated by the faculty member(s) handling the course and the consolidated marks can be taken as the final mark. No end semester examination is required for this course

**COURSE OUTCOMES:**

Student will be equipped to apply his/her creative and innovative skills in solving complex problems confronting corporate realm.

**REFERENCES**

1. Rousing Creativity: Think New Now Floyd Hurr, ISBN 1560525479, Crisp Publications Inc. 1999
2. Geoffrey Petty, "how to be better at Creativity", The Industrial Society 1999
3. Clayton M. Christensen Michael E. Raynor, "The Innovator's Solution", Harvard Business School Press Boston, USA, 2003
4. Semyon D. Savransky, "Engineering of Creativity – TRIZ", CRC Press New York USA," 2000

**BA7011****BRAND MANAGEMENT**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**COURSE OBJECTIVE:**

To understand the methods of managing brands and strategies for brand management.

**UNIT I INTRODUCTION 8**

Basics Understanding of Brands – Definitions - Branding Concepts – Functions of Brand - Significance of Brands – Different Types of Brands – Co branding – Store brands.

**UNIT II BRAND STRATEGIES 10**

Strategic Brand Management process – Building a strong brand – Brand positioning – Establishing Brand values – Brand vision – Brand Elements – Branding for Global Markets – Competing with foreign brands.

**UNIT III BRAND COMMUNICATIONS 8**

Brand image Building – Brand Loyalty programmes – Brand Promotion Methods – Role of Brand ambassadors, celebrities – On line Brand Promotions.

**UNIT IV BRAND EXTENSION 9**

Brand Adoption Practices – Different type of brand extension – Factors influencing Decision for extension – Re-branding and re-launching.

**UNIT V BRAND PERFORMANCE 10**

Measuring Brand Performance – Brand Equity Management - Global Branding strategies - Brand Audit – Brand Equity Measurement – Brand Leverage -Role of Brand Managers– Branding challenges & opportunities.

**TOTAL: 45 PERIODS****COURSE OUTCOME:**

To successfully establish and sustain brands and lead to extensions

**TEXT BOOKS**

1. Kevin Lane Keller, Strategic Brand Management: Building, Measuring and Managing, Prentice Hall, 3<sup>rd</sup> Edition, 2007.
2. Moorthi YLR, Brand Management – I edition, Vikas Publishing House 2012

## REFERENCES

1. Lan Batey, Asain Branding – A Great way to fly, PHI, Singapore, 2002.
2. Paul Tmepoal, Branding in Asia, John Willy, 2000.
3. Ramesh Kumar, Managing Indian Brands, Vikas Publication, India, 2002.
4. Jagdeep Kapoor, Brandex, Biztranza, India, 2005
5. Mahim Sagar, Deepali Singh, D.P.Agarwal, Achintya Gupta.–Brand Management Ane Books Pvt.Ltd – (2009).

**BA7012**

**RETAIL MANAGEMENT**

**L T P C**

**3 0 0 3**

### **COURSE OBJECTIVE:**

To understand the concepts of effective retailing

#### **UNIT I INTRODUCTION**

**9**

An overview of Global Retailing – Challenges and opportunities – Retail trends in India – Socio economic and technological Influences on retail management – Government of India policy implications on retails.

#### **UNIT II RETAIL FORMATS**

**9**

Organized and unorganized formats – Different organized retail formats – Characteristics of each format – Emerging trends in retail formats – MNC's role in organized retail formats.

#### **UNIT III RETAILING DECISIONS**

**9**

Choice of retail locations - internal and external atmospherics – Positioning of retail shops – Building retail store Image - Retail service quality management – Retail Supply Chain Management – Retail Pricing Decisions. Mercandising and category management – buying.

#### **UNIT IV RETAIL SHOP MANAGEMENT**

**9**

Visual Merchandise Management – Space Management – Retail Inventory Management – Retail accounting and audits - Retail store brands – Retail advertising and promotions – Retail Management Information Systems - Online retail – Emerging trends .

#### **UNIT V RETAIL SHOPPER BEHAVIOUR**

**9**

Understanding of Retail shopper behavior – Shopper Profile Analysis – Shopping Decision Process - Factors influencing retail shopper behavior – Complaints Management - Retail sales force Management – Challenges in Retailing in India.

**TOTAL: 45 PERIODS**

### **COURSE OUTCOME:**

To manage the retail chains and understand the retail customer's behavior

### **TEXT BOOKS**

1. Michael Havy ,Baston, Aweitz and Ajay Pandit, Retail Management, Tata Mcgraw Hill, Sixth Edition, 2007
2. Ogden, Integrated Retail Management, Biztantra, India, 2008.

### **REFERENCES**

1. Patrick M. Dunne and Robert F Lusch, Retailing, Thomson Learning, 4<sup>th</sup> Edition 2008.
2. Chetan Bajaj, Rajnish Tow and Nidhi V. Srivatsava, Retail Management, Oxford University Press, 2007.
3. Swapna Pradhan, Retail Management -Text and Cases, Tata McGraw Hill, 3<sup>rd</sup> Edition, 2009.
4. Dunne, Retailing, Cengage Learning, 2<sup>nd</sup> Edition, 2008

5. Ramkrishnan and Y.R.Srinivasan, Indian Retailing Text and Cases, Oxford University Press, 2008
6. Dr.Jaspreet Kaur , Customer Relationship Management, Kogent solution.

**BA7013**

**SERVICES MARKETING**

**L T P C**  
**3 0 0 3**

**COURSE OBJECTIVE:**

To understand the meaning of services and the significance of marketing the services.

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Definition – Service Economy – Evolution and growth of service sector – Nature and Scope of Services – Unique characteristics of services - Challenges and issues in Services Marketing.		
<b>UNIT II</b>	<b>SERVICE MARKETING OPPORTUNITIES</b>	<b>9</b>
Assessing service market potential - Classification of services – Expanded marketing mix – Service marketing – Environment and trends – Service market segmentation, targeting and positioning.		
<b>UNIT III</b>	<b>SERVICE DESIGN AND DEVELOPMENT</b>	<b>9</b>
Service Life Cycle – New service development – Service Blue Printing – GAP model of service quality – Measuring service quality – SERVQUAL – Service Quality function development.		
<b>UNIT IV</b>	<b>SERVICE DELIVERY AND PROMOTION</b>	<b>9</b>
Positioning of services – Designing service delivery System, Service Channel – Pricing of services, methods – Service marketing triangle - Integrated Service marketing communication.		
<b>UNIT V</b>	<b>SERVICE STRATEGIES</b>	<b>9</b>
Service Marketing Strategies for health – Hospitality – Tourism – Financial – Logistics - Educational – Entertainment & public utility Information technique Services		

**TOTAL: 45 PERIODS**

**COURSE OUTCOME:**

Will be able to apply the concepts of services marketing in promoting services.

**TEXT BOOKS**

1. Christopher H.Lovelock and Jochen Wirtz, Services Marketing, Pearson Education, New Delhi, 7<sup>th</sup> edition, 2011.
2. Hoffman, Marketing of Services, Cengage Learning, 1<sup>st</sup> Edition, 2008.

**REFERENCES**

1. Kenneth E Clow, et al, Services Marketing Operation Management and Strategy, Biztantra, 2<sup>nd</sup> Edition, New Delhi, 2004.
2. Halen Woodroffe, Services Marketing, McMillan, 2003.
3. Valarie Zeithaml et al, Services Marketing, 5<sup>th</sup> International Edition, Tata McGraw Hill, 2007.
4. Christian Gronroos, Services Management and Marketing a CRM Approach, John Wiley, 2001.
5. Gronroos, Service Management and Marketing –Wiley India.

**COURSE OBJECTIVE:**

This course introduces students to the basic concepts of advertising and sales promotion and how business organisations and other institutions carry out such activities.

**UNIT I INTRODUCTION TO ADVERTISEMENT 9**

Concept –definition-scope-Objectives-functions-principles of advertisement – Social, Economic and Legal Implications of advertisements – setting advertisement objectives – Advertisement Agencies – Selection and remuneration – Advertisement campaigns – case studies.

**UNIT II ADVERTISEMENT MEDIA 9**

Media plan – Type and choice criteria – Reach and frequency of advertisements – Cost of advertisements - related to sales – Media strategy and scheduling. design and execution of advertisements -Message development – Different types of advertisements – Layout – Design appeal – Copy structure – Advertisement production – Print – Radio. T.V. and Web advertisements – Media Research – Testing validity and Reliability of ads – Measuring impact of advertisements – case studies.

**UNIT III SALES PROMOTION 9**

Scope and role of sale promotion – Definition – Objectives of sales promotion - sales promotion techniques – Trade oriented and consumer oriented. Sales promotion – Requirement identification – Designing of sales promotion campaign – Involvement of salesmen and dealers – Out sourcing sales promotion national and international promotion strategies – Integrated promotion – Coordination within the various promotion techniques – Online sales promotions- case studies.

**UNIT IV PUBLIC RELATIONS 9**

Introduction – Meaning – Objectives –Scope-Functions-integrating PR in to Promotional Mix-Marketing Public Relation function- Process of Public Relations-advantages and disadvantages of PR-Measuring the Effectiveness of PR- PR tools and techniques. PR and Media Relations, - PR consultancy: Pros and Cons. - Discussion on opinion survey of PR in Public and Private Enterprises. PR- Research, Evaluation, Counseling-Marketing Public Realtions (MPR)-Structure of Public Relations Department. Budgeting of PR. PR Agencies.

**UNIT V PUBLICITY 9**

Introduction – Meaning – Objectives - Tools – Goals of Publicity – Scope of Publicity – Importance of Publicity – Difference between Marketing, PR and Publicity - Social publicity – Web Publicity and Social media – Publicity Campaigns

**TOTAL: 45 PERIODS****COURSE OUTCOME:**

Insight into the importance of advertising and sales promotion campaigns planning and objective setting in relation to consumer decision making processes.

**TEXT BOOKS**

1. George E Belch and Michel A Belch, Advertising & Promotion, Tata McGraw Hill, 7<sup>th</sup> edition, 2010
2. Wells, Moriarty & Burnett, Advertising, Principles & Practice, Pearson Education, 7<sup>th</sup> Edition, 2007.
3. Kenneth Clow. Donald Baack, Integrated Advertisements, Promotion and Marketing communication, Prentice Hall of India, New Delhi, 2003.

## REFERENCES

1. S. H. H. Kazmi and Satish K Batra, Advertising & Sales Promotion, Excel Books, New Delhi, 2001.
2. Julian Cummings, Sales Promotion, Kogan Page, London 1998.
3. E.Betch and Michael, Advertising and Promotion, McGraw Hill, 2003.
4. Jaishri Jefhwaney, Advertising Management, Oxford, 2008.

**BA7015**

**CUSTOMER RELATIONSHIP MANAGEMENT**

**L T P C**  
**3 0 0 3**

### **COURSE OBJECTIVE:**

To understand the need and importance of maintaining a good customer relationship.

#### **UNIT I INTRODUCTION**

**9**

Definitions - Concepts and Context of relationship Management – Evolution - Transactional Vs Relationship Approach – CRM as a strategic marketing tool – CRM significance to the stakeholders.

#### **UNIT II UNDERSTANDING CUSTOMERS**

**9**

Customer information Database – Customer Profile Analysis - Customer perception, Expectations analysis – Customer behavior in relationship perspectives; individual and group customer's - Customer life time value – Selection of Profitable customer segments.

#### **UNIT III CRM STRUCTURES**

**9**

Elements of CRM – CRM Process – Strategies for Customer acquisition – Retention and Prevention of defection – Models of CRM – CRM road map for business applications.

#### **UNIT IV CRM PLANNING AND IMPLEMENTATION**

**9**

Strategic CRM planning process – Implementation issues – CRM Tools- Analytical CRM – Operational CRM – Call center management – Role of CRM Managers.

#### **UNIT V TRENDS IN CRM**

**9**

e- CRM Solutions – Data Warehousing – Data mining for CRM – an introduction to CRM software packages.

**TOTAL:45 PERIODS**

### **COURSE OUTCOME :**

To use strategic customer acquisition and retention techniques in CRM.

### **TEXT BOOKS**

1. G.Shainesh, Jagdish, N.Sheth, Customer Relationships Management Strategic Prespective, Macmillan 2005.
2. Alok Kumar et al, Customer Relationship Management : Concepts and applications, Biztantra, 2008

### **REFERENCES**

1. H.Peeru Mohamed and A.Sahadevan, Customer Relation Management, Vikas Publishing 2005.
2. Jim Catheart, The Eight Competencies of Relationship selling, Macmillan India, 2005.
3. Assel, Consumer Behavior, Cengage Learning, 6<sup>th</sup> Edition.
4. Kumar, Customer Relationship Management - A Database Approach, Wiley India, 2007.
5. Francis Buttle, Customer Relationship Management : Concepts & Tools, Elsevier, 2004.
6. Zikmund. Customer Relationship Management, Wiley 2012 .
7. Mohammed Hp/Sagadevan.A Customer Relationship Management- A step by step approach, ledition.
8. G.Shainesh, J.Jagdish N Seth. Customer Relationship Management.

**COURSE OBJECTIVES:**

- The objective of the course is to provide conceptual understanding on the Rural Marketing with special reference to Indian context and develop skills required for planning of Rural Products.
- To create awareness about the applicability of the concepts, techniques and processes of marketing in rural context.
- To familiarize with the special problems related to sales in rural markets.

**UNIT I OVERVIEW OF RURAL MARKETING 9**

Introduction of Rural marketing –Evolution of Rural Marketing in Indian and Global Context- Definition- Nature –Scope-Characteristics and potential of Rural Marketing - Importance of Rural Marketing- Socio-Cultural-economic & other environmental factors affecting in Rural Marketing-A comparative Analysis of Rural Vs Urban Marketing- Size &Structure of Rural Marketing – Emerging challenges & Opportunities in Rural Marketing.

**UNIT II RURAL MARKETS & DECISION 9**

Profile of Rural Marketing Dimensions & Consumer Profile- Rural Market Equilibrium-Classification of Rural Marketing – Regulated- Non Regulated- Marketing Mix- Segmentation- Targeting- Position- Rural Marketing Strategies- Role of Central, State Government and other Institutions in Rural Marketing Integrated Marketing Communication in Rural Marketing.

**UNIT III PRODUCT & DISTRIBUTION 9**

Product / Service Classification in Rural Marketing - New Product Development in Rural Marketing- Brand Management in Rural Marketing- Rural Distribution in channel management- Managing Physical distribution in Rural Marketing- Fostering Creativity& Innovation in Rural Marketing- - Sales force Management in Rural Marketing.

**UNIT IV RURAL CONSUMER BEHAVIOUR IN MARKETING RESEARCH 9**

Consumer Buyer Behaviour Model in Rural Marketing- Rural Marketing Research-Retail &IT models in Rural Marketing-CSR and Marketing Ethics in Rural Marketing- Source of Financing and credit agencies- Consumer Education & Consumer Methods in Promotion of Rural Marketing- Advertisement & Media Role in Rural Marketing Promotion Methods.

**UNIT V TRENDS IN RURAL MARKETING 9**

e- Rural Marketing-CRM &e-CRM in Rural Marketing- Advanced Practices in Rural Marketing- Social Marketing-Network Marketing- Green Marketing in Indian and Global Context-Co-operative Marketing- Micro Credit Marketing- Public Private Partnership Model in Rural Marketing- Advancement of Technology in Rural Marketing- Structure of Competition in Rural India.

**TOTAL: 45 PERIODS****COURSE OUTCOMES:**

Perspectives of rural marketing and the knowledge of the emerging managerial initiatives and relevant frameworks in rural marketing, institutions engaged in rural marketing

**TEXT BOOKS**

1. Rural Marketing – C G Krishnamacharyulu, Lalitha Ramakrishnan – Pearson Education
2. Rural Marketing: Indian Perspective By Awadhesh Kumar Singh Satyaprakash pandey New age publishers
3. A Textbook on Rural Consumer Behaviour in India: A Study of FMCGs By Dr. A Sarangapani

## REFERENCE BOOKS

1. New Perspectives on Rural Marketing: Includes Agricultural Marketing By Ramkishen Y.
2. Rural Marketing, Pradeep Kashyap & Siddhartha Raut, Biztantra
3. Rural Marketing – U.C.Mathur, excel books, 1/e
4. Indian Rural Marketing Rajagopal Rawat Publishers
5. Integrated Rural Development – R. C. Arora (S. Chand & Co.)

**BA7021**

**SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT**

**L T P C**

**3 0 0 3**

## COURSE OBJECTIVES :

Enables student to

- Understand the nuances of stock market operations
- Understand the techniques involved in deciding upon purchase or sale of securities

### UNIT I INVESTMENT SETTING

**8**

Financial and economic meaning of Investment – Characteristics and objectives of Investment – Types of Investment – Investment alternatives – Choice and Evaluation – Risk and return concepts.

### UNIT II SECURITIES MARKETS

**10**

Financial Market - Segments – Types - - Participants in financial Market – Regulatory Environment, Primary Market – Methods of floating new issues, Book building – Role of primary market – Regulation of primary market, Stock exchanges in India – BSE, OTCEI , NSE, ISE, and Regulations of stock exchanges – Trading system in stock exchanges –SEBI.

### UNIT III FUNDAMENTAL ANALYSIS

**9**

Economic Analysis – Economic forecasting and stock Investment Decisions – Forecasting techniques. Industry Analysis : Industry classification, Industry life cycle – Company Analysis Measuring Earnings – Forecasting Earnings – Applied Valuation Techniques – Graham and Dodds investor ratios.

### UNIT IV TECHNICAL ANALYSIS

**9**

Fundamental Analysis Vs Technical Analysis – Charting methods – Market Indicators. Trend – Trend reversals – Patterns - Moving Average – Exponential moving Average – Oscillators – Market Indicators – Efficient Market theory.

### UNIT V PORTFOLIO MANAGEMENT

**9**

Portfolio analysis –Portfolio Selection –Capital Asset Pricing model – Portfolio Revision – Portfolio Evaluation – Mutual Funds.

**TOTAL: 45 PERIODS**

## COURSE OUTCOME

- Become a good investment analyst

## TEXT BOOKS

1. Donald E.Fischer & Ronald J.Jordan, Security Analysis & Portfolio Management, PHI Learning., New Delhi, 8<sup>th</sup> edition, 2011.
2. Prasannachandra, Investment analysis and Portfolio Management, Tata McGraw Hill, 2011.

## REFERENCES

1. Reilly & Brown, Investment Analysis and Portfolio Management, Cengage Learning, 9<sup>th</sup> edition, 2011.
2. S. Kevin , Securities Analysis and Portfolio Management , PHI Learning , 2012.
3. Bodi, Kane, Markus, Mohanty, Investments, 8<sup>th</sup> edition, Tata McGraw Hill, 2011.
4. V.A.Avadhan, Securities Analysis and Portfolio Management, Himalaya Publishing House, 2011.
5. V.K.Bhalla, Investment Management, S.Chand & Company Ltd., 2012.

**BA7022**

**MERCHANT BANKING AND FINANCIAL SERVICES**

**L T P C**  
**3 0 0 3**

## OBJECTIVES :

To enable student

- Understand the modes of issuing securities
- Acquire financial evaluation technique of leasing and hire purchase

### **UNIT I MERCHANT BANKING**

**5**

Introduction – An Over view of Indian Financial System – Merchant Banking in India – Recent Developments and Challenges ahead – Institutional Structure – Functions of Merchant Bank - Legal and Regulatory Framework – Relevant Provisions of Companies Act- SERA- SEBI guidelines- FEMA, etc. - Relation with Stock Exchanges and OTCEI.

### **UNIT II ISSUE MANAGEMENT**

**12**

Role of Merchant Banker in Appraisal of Projects, Designing Capital Structure and Instruments – Issue Pricing – Book Building – Preparation of Prospectus Selection of Bankers, Advertising Consultants, etc. - Role of Registrars –Bankers to the Issue, Underwriters, and Brokers. – Offer for Sale – Green Shoe Option – E-IPO, Private Placement – Bought out Deals – Placement with FIs, MFs, FIIs, etc. Off - Shore Issues. – Issue Marketing – Advertising Strategies – NRI Marketing – Post Issue Activities.

### **UNIT III OTHER FEE BASED SERVICES**

**10**

Mergers and Acquisitions – Portfolio Management Services – Credit Syndication – Credit Rating – Mutual Funds - Business Valuation.

### **UNIT IV FUND BASED FINANCIAL SERVICES**

**10**

Leasing and Hire Purchasing – Basics of Leasing and Hire purchasing – Financial Evaluation.

### **UNIT V OTHER FUND BASED FINANCIAL SERVICES**

**8**

Consumer Credit – Credit Cards – Real Estate Financing – Bills Discounting – factoring and Forfaiting – Venture Capital.

**TOTAL: 45 PERIODS**

## OUTCOME

- Good knowledge on merchant banking activities

## TEXT BOOKS

1. M.Y.Khan, Financial Services, Tata McGraw-Hill, 12<sup>th</sup> Edition, 2012
2. Nalini Prava Tripathy, Financial Services, PHI Learning, 2011.

## REFERENCES:

1. Machiraju, Indian Financial System, Vikas Publishing House, 2nd Edition, 2010.
2. J.C.Verma, A Manual of Merchant Banking, Bharath Publishing House, New Delhi,
3. Varshney P.N. & Mittal D.K., Indian Financial System, Sultan Chand & Sons, New Delhi.
4. Sasidharan, Financial Services and System, Tata Mcgraw Hill, New Delhi, 2nd Edition, 2011.
5. Website of SEBI

**BA7023**

**INTERNATIONAL TRADE FINANCE**

**L T P C**  
**3 0 0 3**

## OBJECTIVES :

To enable student

- Understand export import finance and forex management
- Understand the documentation involved in international trade

### **UNIT I INTERNATIONAL TRADE**

**9**

International Trade – Meaning and Benefits – Basis of International Trade – Foreign Trade and Economic Growth – Balance of Trade – Balance of Payment – Current Trends in India – Barriers to International Trade – WTO – Indian EXIM Policy.

### **UNIT II EXPORT AND IMPORT FINANCE**

**9**

Special need for Finance in International Trade – INCO Terms (FOB, CIF, etc.) – Payment Terms – Letters of Credit – Pre Shipment and Post Shipment Finance – Forfaiting – Deferred Payment Terms – EXIM Bank – ECGC and its schemes – Import Licensing – Financing methods for import of Capital goods.

### **UNIT III FOREX MANAGEMENT**

**9**

Foreign Exchange Markets – Spot Prices and Forward Prices – Factors influencing Exchange rates – The effects of Exchange rates in Foreign Trade – Tools for hedging against Exchange rate variations – Forward, Futures and Currency options – FEMA – Determination of Foreign Exchange rate and Forecasting.

### **UNIT IV DOCUMENTATION IN INTERNATIONAL TRADE**

**9**

Export Trade Documents: Financial Documents – Bill of Exchange- Type- Commercial Documents - Proforma, Commercial, Consular, Customs, Legalized Invoice, Certificate of Origin Certificate Value, Packing List, Weight Certificate, Certificate of Analysis and Quality, Certificate of Inspection, Health certificate. Transport Documents - Bill of Lading, Airway Bill, Postal Receipt, Multimodal Transport Document. Risk Covering Document: Insurance Policy, Insurance Cover Note. Official Document: Export Declaration Forms, GR Form, PP Form, COD Form, Softer Forms, Export Certification, GSPS – UPCDC Norms.

### **UNIT V EXPORT PROMOTION SCHEMES**

**9**

Government Organizations Promoting Exports – Export Incentives : Duty Exemption – IT Concession – Marketing Assistance – EPCG, DEPB – Advance License – Other efforts | Export Promotion – EPZ – EQU – SEZ and Export House.

**TOTAL: 45 PERIODS**

## OUTCOME

- Possess good knowledge on international trade and the documentation involved in it.

## TEXT BOOKS

1. Apte P.G., International Financial Management, Tata McGraw Hill, 2011.
2. Jeff Madura, International Corporate Finance, Cengage Learning, 9<sup>th</sup> Edition, 2011.

## REFERENCES

1. Alan C. Shapiro, Multinational Financial Management, PHI Learning, 5<sup>th</sup> Edition, 2010.
2. Eun and Resnik, International Financial Management, Tata McGraw Hill, 5<sup>th</sup> Edition, 2011.
3. Website of Indian Government on EXIM policy

**BA7024**

**CORPORATE FINANCE**

**L T P C**  
**3 0 0 3**

### OBJECTIVES :

Student will acquire

- Nuances involved in short term corporate financing
- Good ethical practices

### UNIT I INDUSTRIAL FINANCE

**9**

Indian Capital Market – Basic problem of Industrial Finance in India. Equity – Debenture financing – Guidelines from SEBI, advantages and disadvantages and cost of various sources of Finance - Finance from international sources, financing of exports – role of EXIM bank and commercial banks.– Finance for rehabilitation of sick units.

### UNIT II SHORT TERM-WORKING CAPITAL FINANCE

**6**

Estimating working capital requirements – Approach adopted by Commercial banks, Commercial paper- Public deposits and inter corporate investments.

### UNIT III ADVANCED FINANCIAL MANAGEMENT

**12**

Appraisal of Risky Investments, certainty equivalent of cash flows and risk adjusted discount rate, risk analysis in the context of DCF methods using Probability information, nature of cash flows, Sensitivity analysis; Simulation and investment decision, Decision tree approach in investment decisions.

### UNIT IV FINANCING DECISION

**10**

Simulation and financing decision - cash inadequacy and cash insolvency- determining the probability of cash insolvency- Financing decision in the Context of option pricing model and agency costs- Inter-dependence of investment- financing and Dividend decisions.

### UNIT V CORPORATE GOVERNANCE

**8**

Corporate Governance - SEBI Guidelines- Corporate Disasters and Ethics- Corporate Social Responsibility- Stakeholders and Ethics- Ethics, Managers and Professionalism.

**TOTAL: 45 PERIODS**

### OUTCOME

- Good ethical corporate manager

## TEXT BOOKS

1. Richard A.Brealey, Stewart C.Myers and Mohanthy, Principles of Corporate Finance, Tata McGraw Hill, 9<sup>th</sup> Edition, 2011
2. I.M.Pandey, Financial Management, Vikas Publishing House Pvt., Ltd., 12<sup>th</sup> Edition, 2012.

## REFERENCES

1. Brigham and Ehrhardt, Corporate Finance - A focused Approach, Cengage Learning, 2nd Edition, 2011.
2. M.Y Khan, Indian Financial System, Tata McGraw Hill, 6<sup>th</sup> Edition, 2011
3. Smart, Megginson, and Gitman, Corporate Finance, 2nd Edition, 2011.
4. Krishnamurthy and Viswanathan, Advanced Corporate Finance, PHI Learning, 2011.
5. Website of SEBI

**BA7025**

**MICRO FINANCE**

**L T P C**  
**3 0 0 3**

## OBJECTIVES :

Enable students to

- Comprehend the importance of Micro finance
- Understand the techniques involved in their evaluation

### **UNIT I INTRODUCTION TO MICROFINANCE 9**

Basics – Need for microfinance - Characteristics of Microfinance clients – Demand and supply of microfinance in developing countries – Nature of Microfinance Markets - Microfinance as a development strategy and as an industry – Microfinance Tools – Role of Grameen Bank - Micro credit - Innovations - Group lending-Stepped lending & Repeat loan - Character & cash flow based lending -Flexible approaches to collateral-Frequent & public installment for loan & saving products

### **UNIT II FINANCIAL AND OPERATIONAL EVALUATION 9**

Financial Evaluation – Analyzing & Managing Financial Performance of MFIs: Analyzing financial statements - Financial performance ratios - Liquidity & capital adequacy – Revenue models of Micro finance - Role of subsidies & Donors - Bench Marking - Rating MFIs.

Operational Evaluation: Managing operational risks – Internal Control, Business Planning – Impact Assessment – CVP Analysis – Operating Expenses - Operating Efficiency

### **UNIT III OTHER EVALUATIONS OF MICROFINANCE 9**

Market Evaluation – Managing MF Products & Services - methodologies in MF product design and pricing – Competition - Risks. Institutional Evaluation - Appraisals and ratings - Legal compliance-Issues in Governance Social Evaluation - Social performance Measurement - Indicators - Tools – Progress out of poverty index – Transparency – Ethics

### **UNIT IV MICROFINANCE IN INDIA 9**

Challenges to Microfinance movement – Demand and Supply of Micro financial services – State Intervention in rural credit – RBI Initiatives - NABARD & SHG – Bank Linkup & Programs- – Governance and the constitution of the Board of various forms of MFIs – Intermediaries for Microfinance –State sponsored Organizations.

### **UNIT V ISSUES, TRENDS AND FRONTIERS OF MICROFINANCE 9**

Issue – Role of Technology-Strategic issues in Microfinance: Sustainability - opening new markets – Gender issues

**TOTAL: 45 PERIODS**

## OUTCOME

- Possess good knowledge in micro finance management

## TEXT BOOKS

1. Indian Institute of Banking and Finance, Micro finance: Perspectives and Operations, Macmillan India Limited, 2011.
2. Beatriz and Jonathan, The Economics of Microfinance, Prentice Hall of India, 2010.

## REFERENCES

[www. microfinancesummit.org](http://www.microfinancesummit.org).

**COURSE OBJECTIVES:**

- Grasp how banks raise their sources and how they deploy it and manage the associated risks
- Understand e-banking and the threats that go with it.

**UNIT I OVERVIEW OF INDIAN BANKING SYSTEM 9**

Overview of Indian Banking System, Functions of banks, key Acts governing the functioning of Indian banking system – RBI Act 1934, Negotiable Instruments Act 1881, Banking Regulations Act 1948 – Rights and obligations of a banker, Overview of Financial statement of banks – Balance sheet and Income Statement.

**UNIT II SOURCES AND APPLICATION OF BANK FUNDS 9**

Capital adequacy, Deposits and non-deposit sources, Designing of deposit schemes and pricing of deposit services, application of bank funds – Investments and Lending functions, Types of lending – Fund based, non-fund based, asset based – Different types of loans and their features, Major components of a typical loan policy document, Steps involved in Credit analysis, Credit delivery and administration, Pricing of loans, Customer profitability analysis.

**UNIT II CREDIT MONITORING AND RISK MANAGEMENT 9**

Need for credit monitoring, Signals of borrowers' financial sickness, Financial distress prediction models – Rehabilitation process, Risk management – Interest rate, liquidity, forex, credit, market, operational and solvency risks – risk measurement process and mitigation, Basic understanding of NPAs and ALM.

**UNIT IV MERGERS, DIVERSIFICATION AND PERFORMANCE EVALUATION 9**

Mergers and Diversification of banks into securities market, underwriting, Mutual funds and Insurance business, Risks associated therewith. Performance analysis of banks – background factors, ratio analysis and CAMELS.

**UNIT V HIGH TECH E-BANKING\ 9**

Payment system in India – Paper based, e-payments – Electronic banking – advantages – Plastic money, E-money – Forecasting of cash demand at ATMs – Security threats in e-banking and RBI's initiatives.

**TOTAL: 45 PERIODS****COURSE OUTCOME:**

- Price various types of loans proposed by banks to various prospective borrowers with different risk profiles and evaluate the performance of banks

**TEXT BOOKS**

1. Padmalatha Suresh and Justin Paul, "Management of Banking and Financial Services, Pearson, Delhi, 2012.
2. Meera Sharma, "Management of Financial Institutions – with emphasis on Bank and Risk Management", PHI Learning Pvt. Ltd., New Delhi 2010.

**REFERENCES :**

1. Peter S. Rose and Sylvia C. and Hudgins, "Bank Management and Financial Services", Tata McGraw Hill, New Delhi, 2012.

**COURSE OBJECTIVE:**

To examine managerial styles in terms of concern for production and concern for people. To assess different systems of management and relate these systems to organisational characteristics.

**UNIT I            DEFINING THE MANAGERIAL JOB****8**

Descriptive Dimensions of Managerial Jobs – Methods – Model – Time Dimensions in Managerial Jobs – Effective and Ineffective Job behaviour – Functional and level differences in Managerial Job behaviour.

**UNIT II           DESIGNING THE MANAGERIAL JOB****12**

Identifying Managerial Talent – Selection and Recruitment – Managerial Skills Development – Pay and Rewards – Managerial Motivation – Effective Management Criteria – Performance Appraisal Measures – Balanced Scorecard - Feedback – Career Management – Current Practices.

**UNIT III          THE CONCEPT OF MANAGERIAL EFFECTIVENESS****7**

Definition – The person, process, product approaches – Bridging the Gap – Measuring Managerial Effectiveness – Current Industrial and Government practices in the Management of Managerial Effectiveness- the Effective Manager as an Optimizer.

**UNIT IV          ENVIRONMENTAL ISSUES IN MANAGERIAL EFFECTIVENESS****8**

Organisational Processes – Organisational Climate – Leader – Group Influences – Job Challenge – Competition – Managerial Styles.

**UNIT V          DEVELOPING THE WINNING EDGE****10**

Organisational and Managerial Efforts – Self Development – Negotiation Skills – Development of the Competitive Spirit – Knowledge Management – Fostering Creativity and innovation .

**TOTAL: 45 PERIODS****COURSE OUTCOME:**

Students will gain knowledge about appropriate style of managerial behaviour.

**REFERENCES**

1. Peter Drucker, Management, Harper Row, 2005.
2. Milkovich and Newman, Compensation, McGraw-Hill International, 2005.
3. Blanchard and Thacker, Effective Training Systems, Strategies and Practices, Pearson 2006.
4. Dubrin, Leadership, Research Findings, Practices & Skills, Biztantra, 2008.
5. Joe Tidd , John Bessant, Keith Pavitt , Managing Innovation ,Wiley 3<sup>rd</sup> edition,2006.
6. T.V.Rao,Appraising and Developing Managerial Performance, Excel Books,2000.
7. R.M.Omkar, Personality Development and Career Management, S.Chand 1<sup>st</sup>edition,2008.
8. Richard L.Daft, Leadership, Cengage, 1 st Indian Reprint 2008.

**COURSE OBJECTIVE:**

To develop and strengthen entrepreneurial quality and motivation in students. To impart basic entrepreneurial skills and understandings to run a business efficiently and effectively.

**UNIT I ENTREPRENEURIAL COMPETENCE 6**

Entrepreneurship concept – Entrepreneurship as a Career – Entrepreneurial Personality - Characteristics of Successful, Entrepreneur – Knowledge and Skills of Entrepreneur.

**UNIT II ENTREPRENEURIAL ENVIRONMENT 12**

Business Environment - Role of Family and Society - Entrepreneurship Development Training and Other Support Organisational Services - Central and State Government Industrial Policies and Regulations - International Business.

**UNIT III BUSINESS PLAN PREPARATION 12**

Sources of Product for Business - Prefeasibility Study - Criteria for Selection of Product - Ownership - Capital - Budgeting Project Profile Preparation - Matching Entrepreneur with the Project - Feasibility Report Preparation and Evaluation Criteria.

**UNIT IV LAUNCHING OF SMALL BUSINESS 10**

Finance and Human Resource Mobilization Operations Planning - Market and Channel Selection - Growth Strategies - Product Launching – Incubation, Venture capital, IT startups.

**UNIT V MANAGEMENT OF SMALL BUSINESS 5**

Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units- Effective Management of small Business.

**TOTAL: 45 PERIODS****COURSE OUTCOME:**

Students will gain knowledge and skills needed to run a business.

**TEXT BOOKS**

1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2001.
2. S.S.Khanka, Entrepreneurial Development, S.Chand and Company Limited, New Delhi, 2001.

**REFERENCES**

1. Mathew Manimala, Entrepreneurship Theory at the Crossroads, Paradigms & Praxis, Biztrantra ,2<sup>nd</sup> Edition ,2005
2. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill, 1996.
3. P.Saravanel, Entrepreneurial Development, Ess Pee kay Publishing House, Chennai -1997.
4. Arya Kumar. Entrepreneurship. Pearson. 2012
5. Donald F Kuratko, T.V Rao. Entrepreneurship: A South Asian perspective. Cengage Learning. 2012

**COURSE OBJECTIVE:**

To learn how an organization can be designed and developed to deal with the challenges from environment, technology, and its own processes.

**UNIT I ORGANISATION & ITS ENVIRONMENT 8**

Meaning of Organisation – Need for existence - Organisational Effectiveness – Creation of Value – Measuring Organisational Effectiveness – External Resources Approach, Internal Systems Approach and Technical approach - HR implications.

**UNIT II ORGANIZATIONAL DESIGN 15**

Organizational Design – Determinants – Components – Types - Basic Challenges of design – Differentiation, Integration, Centralization, Decentralization, Standardization, Mutual adjustment- Mechanistic and Organic Structures- Technological and Environmental Impacts on Design- Importance of Design – Success and Failures in design - Implications for Managers.

**UNIT III ORGANISATIONAL CULTURE 6**

Understanding Culture – Strong and Weak Cultures – Types of Cultures – Importance of Culture - Creating and Sustaining Culture - Culture and Strategy - Implications for practicing Managers.

**UNIT IV ORGANISATIONAL CHANGE 6**

Meaning – Forces for Change - Resistance to Change – Types and forms of change – Evolutionary and Revolutionary change – Change process -Organisation Development – HR functions and Strategic Change Management - Implications for practicing Managers.

**UNIT V ORGANISATION EVOLUTION AND SUSTENANCE 10**

Organizational life cycle – Models of transformation – Models of Organizational Decision making – Organizational Learning – Innovation, Intrapreneurship and Creativity-HR implications.

**TOTAL: 45 PERIODS****COURSE OUTCOME:**

Students will be able to analyze organizations more accurately and deeply by applying organization theory.

**TEXT BOOKS**

1. Gareth R.Jones, Organisational Theory, Design & Change, Pearson Education, 6<sup>th</sup> Edition 2011.
2. Richard L. Daft, Understanding the theory & Design of Organisations, Cengage Learning Western, 10<sup>th</sup> Edition 2012.

**REFERENCES**

1. Thomson G. Cummings and Christopher G. Worley, Organisational development and Change, Cengage learning, 9<sup>th</sup> edition 2011
2. Robbins Organisation Theory; Structure Design & Applications, Prentice Hall of India, 2009.
3. Bhupen Srivastava, Organisational Design and Development: Concepts application, Biztantra , 2010.
4. Robert A Paton, James Mc Calman, Change Management, A guide to effective implementation, Response Books, 2012.
5. Adrian Thornhill, Phil Lewis, Mike Millmore and Mark Saunders, Managing Change -A Human Resource Strategy Approach, Wiley, 2010.

**COURSE OBJECTIVE:**

To explore contemporary knowledge and gain a conceptual understanding of industrial relations.

**UNIT I INDUSTRIAL RELATIONS****7**

Concepts – Importance – Industrial Relations problems in the Public Sector – Growth of Trade Unions – Codes of conduct.

**UNIT II INDUSTRIAL CONFLICTS****12**

Disputes – Impact – Causes – Strikes – Prevention – Industrial Peace – Government Machinery – Conciliation – Arbitration – Adjudication.

**UNIT III LABOUR WELFARE****8**

Concept – Objectives – Scope – Need – Voluntary Welfare Measures – Statutory Welfare Measures – Labour – Welfare Funds – Education and Training Schemes.

**UNIT IV INDUSTRIAL SAFETY****9**

Causes of Accidents – Prevention – Safety Provisions – Industrial Health and Hygiene – Importance – Problems – Occupational Hazards – Diseases – Psychological problems – Counseling – Statutory Provisions.

**UNIT V WELFARE OF SPECIAL CATEGORIES OF LABOUR****9**

Child Labour – Female Labour – Contract Labour – Construction Labour – Agricultural Labour – Differently abled Labour – BPO & KPO Labour - Social Assistance – Social Security – Implications.

**TOTAL: 45 PERIODS****COURSE OUTCOME:**

Students will know how to resolve industrial relations and human relations problems and promote welfare of industrial labour.

**TEXT BOOKS**

1. Mamoria C.B. and Sathish Mamoria, Dynamics of Industrial Relations, Himalaya Publishing House, New Delhi, 2007.
2. Arun Monappa, Ranjeet Nambudiri, Patturaja Selvaraj. Industrial relations & Labour Laws. Tata McGraw Hill. 2012

**REFERENCES**

1. Ratna Sen, Industrial Relations in India, Shifting Paradigms, Macmillan India Ltd., New Delhi, 2007.
2. C.S.Venkata Ratnam, Globalisation and Labour Management Relations, Response Books, 2007.
3. Srivastava, Industrial Relations and Labour laws, Vikas, 2007.
4. P.N.Singh, Neeraj Kumar. Employee relations Management. Pearson. 2011.
5. P.R.N Sinha, Indu Bala Sinha, Seema Priyadarshini Shekhar. Industrial Relations, Trade Unions and Labour Legislation. Pearson. 2004

**COURSE OBJECTIVE:**

To have a broad understanding of the legal principles governing the employment relationship at individual and collective level. To familiarise the students to the practical problems inherent in the implementation of labour statutes.

Contained in the following acts are to be studied.

	Periods
1. The Factories Act, 1948	3
2. The Trade Unions Act, 1926	4
3. The Payment of Wages Act, 1936	3
4. The Minimum Wages Act, 1948	2
5. The Industrial Disputes Act, 1947	5
6. The Workmen's Compensation Act, 1923	2
7. The Payment of Gratuity Act, 1972	3
8. The Payment of Bonus Act, 1965	3
9. The Employee's Provident Fund & Misc. Act, 1952	3
10. The Employees State Insurance Act, 1948	4
11. The Industrial Employment (Standing Orders) Act, 1946	3
12. The Apprentices Act, 1961	2
13. The Equal Remuneration Act, 1976	2
14. The Maternity Benefit Act, 1961	2
15. Contract Labour Regulations and Abolition Act, 1970	2
16. The Child Labour Prevention and Regulation Act, 1986	2

**TOTAL: 45 PERIODS**

**COURSE OUTCOME:**

To appreciate the application of labour laws.

Legal Provision relating to

- a) Wages
- b) Working Conditions and Labour Welfare
- c) Industrial Relations
- d) Social Security

**TEXT BOOKS:**

1. P.K. Padhi, Industrial Laws, PHI, 2008.
2. Kapoor N. D , Elements of Mercantile Law, Sultan Chand, 2008.

**REFERENCES**

1. Tax Mann, Labour Laws, 2008.
2. D. R. N. Sinha, Indu Balasinha & Semma Priyadarshini Shekar, Industrial Relation, Trade unions and Labour Legislation, 2004.
3. Arun Monappa, Ranjeet Nambudiri, Patturaja Selvaraj. Industrial relations & Labour Laws. Tata McGraw Hill. 2012
4. Srivastava, Industrial Relations and Labour laws, Vikas, 2007.
5. Respective Bare Acts.

**COURSE OBJECTIVE:**

To help students understand the transformation in the role of HR functions from being a support function to strategic function.

**UNIT I HUMAN RESOURCE DEVELOPMENT 10**

Meaning – Strategic framework for HRM and HRD – Vision, Mission and Values – Importance – Challenges to Organisations – HRD Functions - Roles of HRD Professionals - HRD Needs Assessment - HRD practices – Measures of HRD performance – Links to HR, Strategy and Business Goals – HRD Program Implementation and Evaluation – Recent trends – Strategic Capability , Bench Marking and HRD Audit.

**UNIT II E-HRM 6**

e- Employee profile– e- selection and recruitment - Virtual learning and Orientation – e - training and development – e- Performance management and Compensation design – Development and Implementation of HRIS – Designing HR portals – Issues in employee privacy – Employee surveys online.

**UNIT III CROSS CULTURAL HRM 7**

Domestic Vs International HRM - Cultural Dynamics - Culture Assessment - Cross Cultural Education and Training Programs – Leadership and Strategic HR Issues in International Assignments - Current challenges in Outsourcing, Cross border Mergers and Acquisitions - Repatriation etc - Building Multicultural Organisation - International Compensation.

**UNIT IV CAREER & COMPETENCY DEVELOPMENT 10**

Career Concepts – Roles – Career stages – Career planning and Process – Career development Models– Career Motivation and Enrichment –Managing Career plateaus- Designing Effective Career Development Systems – Competencies and Career Management – Competency Mapping Models – Equity and Competency based Compensation.

**UNIT V EMPLOYEE COACHING & COUNSELING 12**

Need for Coaching – Role of HR in coaching – Coaching and Performance – Skills for Effective Coaching – Coaching Effectiveness– Need for Counseling – Role of HR in Counseling - Components of Counseling Programs – Counseling Effectiveness – Employee Health and Welfare Programs – Work Stress – Sources - Consequences – Stress Management Techniques.- Eastern and Western Practices - Self Management and Emotional Intelligence.

**TOTAL: 45 PERIODS****COURSE OUTCOME:**

Students will have a better understanding of the tools and techniques used by organizations to meet current challenges.

**TEXT BOOKS**

1. Randy L. Desimone, Jon M. Werner – David M. Mathis, Human Resource Development, Cengage Learning, 2007.
2. Paul Boselie. Strategic Human Resource Management. Tata McGraw Hill. 2011

**REFERENCES**

1. Jeffrey A Mello, Strategic Human Resource Management, Cengage Learning, Southwestern 2007.
2. Robert L. Mathis and John H. Jackson, Human Resource Management, Cengage Learning, 2007.
3. Monir Tayeb. International Human Resource Management. Oxford. 2007
4. Randall S Schuler and Susan E Jackson. Strategic Human Resource Management. Wiley India. 2<sup>nd</sup> edition
5. McLeod. The Counsellor's workbook. Tata McGraw Hill. 2011

**COURSE OBJECTIVES**

- To understand the various advanced databases used in the organization
- To be aware of recent trends in database management

**UNIT I INTRODUCTION 9**

DBMS Models - Multimedia Databases, Parallel Databases, embedded, web, spatial, temporal databases, Virtualization, Active Databases - Embedded databases - Web databases.

**UNIT II DATABASE IMPLEMENTATION 9**

Query Processing basics and optimization – Heuristic Optimization – Transactions Models – Concurrency Control – Recovery – Security and Authorization – Storage – Indexing and Hashing – ISAM – B-Trees – Kd Trees – X Trees – Dynamic Hashing.

**UNIT III DISTRIBUTED DATABASES 9**

Distributed Databases – Queries – Optimization Access Strategies – Distributed Transactions Management – Concurrency Control – Reliability

**UNIT IV OBJECT ORIENTED DATABASES 9**

Object Oriented Concepts – Data Object Models –Object Oriented Databases – Issues in OODBMS - Object Oriented Relational Databases – Object Definition Languages – Object Query Languages

**UNIT V EMERGING TRENDS 9**

Data Mining – Data warehousing – Star, Snowflake, Fact Constellation; open source database systems, Scripting Language, JDBC, ODBC

**TOTAL: 45 PERIODS****COURSE OUTCOMES**

- Awareness of database models
- Knowledge of database technologies

**TEXT BOOKS**

1. Peter Rob, Carlos Coronel, Database System and Design, Implementation and Management, 7<sup>th</sup> edition, Cengage Learning,
2. Ramez Elmasri and Shamkant B. Navethe, Fundamentals of Database Systems, 4<sup>th</sup> , Pearson Education, 2004.

**REFERENCES**

1. Jeffrey A Hoffer et al, Modern Database Management, 10<sup>th</sup> Edition, Pearson Education, 2012,
2. Abraham Silberchatz, Henry F. Korth and S.Sudarsan, Database System Concepts, 5<sup>th</sup> Edition, McGraw-Hill, 2010.
3. Thomas M. Connolly and Carolyn E. Begg, Database Systems – A Practical Approach to Design, Implementation and Management, 3<sup>rd</sup> edition, Pearson Education, 2003.
4. Jeffrey D. Ullman and Jennifer Widom, A First Course in Database Systems, Pearson Education Asia, 1<sup>st</sup> impression 2007.
5. Stefano Ceri and Giuseppe Pelagatti, Distributed Databases Principles and Systems, McGraw-Hill International Editions, 2008.
6. Rajesh Narang, Object Oriented Interfaces and Databases, Prentice Hall of India, 2002.
7. Mark L.Gillenson & el, Introduction to database management, Wiley India Pvt. Ltd, 2008
8. Charkrabarti, Advanced Database Management Systems, Wiley India Pvt Ltd, 2011

**COURSE OBJECTIVE**

- To understand the practices and technology to start an online business

**UNIT I INTRODUCTION TO e-BUSINESS****8**

e-business, e-business vs e-commerce, Economic forces – advantages – myths – e-business models, design, develop and manage e-business, Web 2.0 and Social Networking, Mobile Commerce, S-commerce

**UNIT II TECHNOLOGY INFRASTRUCTURE****10**

Internet and World Wide Web, internet protocols - FTP, intranet and extranet, information publishing technology- basics of web server hardware and software.

**UNIT III BUSINESS APPLICATIONS****10**

Consumer oriented e-business – e-tailing and models - Marketing on web – advertising, e-mail marketing, affiliated programs - e-CRM; online services, Business oriented e-business, e-governance, EDI on the internet, Delivery management system, Web Auctions, Virtual communities and Web portals – social media marketing

**UNIT IV e-BUSINESS PAYMENTS AND SECURITY****9**

E-payments - Characteristics of payment of systems, protocols, e-cash, e-cheque and Micro payment systems- internet security – cryptography – security protocols – network security.

**UNIT V LEGAL AND PRIVACY ISSUES****8**

Legal, Ethics and privacy issues – Protection needs and methodology – consumer protection, cyber laws, contracts and warranties, Taxation and encryption policies.

**TOTAL: 45 PERIODS****COURSE OUTCOME**

- To know how to build and manage an e-business

**TEXT BOOKS**

- Harvey M.Deitel, Paul J.Deitel, Kate Steinbuhler, e-business and e-commerce for managers, Pearson, 2011.
- Efraim Turban, Jae K. Lee, David King, Ting Peng Liang, Deborrah Turban, Electronic Commerce – A managerial perspective, Pearson Education Asia, 2010.

**REFERENCES**

- Parag Kulkarni, Sunita Jahirabadkao, Pradeep Chande, e business, Oxford University Press, 2012.
- Hentry Chan & el , E-Commerce – fundamentals and Applications, Wiley India Pvt Ltd, 2007.
- Gary P. Schneider, Electronic commerce, Thomson course technology, Fourth annual edition, 2007
- Bharat Bhasker, Electronic Commerce – Frame work technologies and Applications, 3<sup>rd</sup> Edition. Tata McGrawHill Publications, 2009
- Kamlesh K.Bajaj and Debjani Nag, Ecommerce- the cutting edge of Business, Tata McGrawHill Publications, 7<sup>th</sup> reprint, 2009.
- Kalakota et al, Frontiers of Electronic Commerce, Addison Wesley, 2004
- Micheal Papaloelon and Peter Robert, e-business, Wiley India, 2006.

**COURSE OBJECTIVES**

- To understand project management cycle in software development
- To study various project estimation and quality models in software development

**UNIT I INTRODUCTION****9**

Software Projects, Projects Planning, Process models, Waterfall, RAD, V, Spiral, Incremental, Prototyping, Agile, Project Tracking.

**UNIT II SOFTWARE METRICS****9**

Goal, Question, Metric (GQM) model, Product Quality metrics, In process Quality metrics, Metrics for software maintenance and testing, Complexity Metrics.

**UNIT III SOFTWARE PROJECT ESTIMATION****9**

Effort and Cost Estimation - Expert Judgment, LOC, Function Points, Extended Function Points, Feature Points, Object Points, COCOMO-81, COCOMO-II; Risk Management.

**UNIT IV SOFTWARE QUALITY****9**

Quality Management Systems, Software Quality Models- FURPS, McCalls Models, Applying seven basic quality tools in software development, Measuring Quality, Gilb, CoQUAMO, Lean software development.

**UNIT V SOFTWARE QUALITY ASSURANCE****9**

Software Reliability models-Rayleigh model, Weibull model; Defect Removal Effectiveness; Quality standards- ISO 9000 models and standards for process improvement, ISO/IEC 9126-1 to 9126-4, SQuaRE, ISO/IEC 25000, ISO/IEC 25010, CMM, PCMM, CMMI, SPICE.

**TOTAL: 45 PERIODS****COURSE OUTCOMES**

- Knowledge of software development process and quality models
- Knowledge of software project estimation and quality assurance

**TEXT BOOKS**

1. Roger S. Pressman, Software Engineering A Practitioners Approach, McGraw Hill International Edition, New Delhi, 7<sup>th</sup> Edition, 2010.
2. Stephen Kan, Metrics and Models in Software Quality Engineering, Pearson Education Asia, 8<sup>th</sup> Impression 2009.

**REFERENCES**

1. Walker Royce, Software Project Management – A unified framework, Pearson Education Asia, New Delhi, 2000.
2. Alan Gillies, Software Quality – Theory and Management, Thomson Learning, 2011.
3. Bob Hughes and Mike Cotterell, Software Project Management, Tata McGraw Hill, 5<sup>th</sup> Edition, 2010)
4. Robert T. Futrell, Donald F. Sahefer and Linda I. Shafer, Quality Software Project Management, Pearson Education Asia, 2002.
5. Richard H. Thayer, Software Engineering Project Management, John Wiley, 2007

**COURSE OBJECTIVES**

- To know how to derive meaning from huge volume of data and information
- To understand how knowledge discovering process is used in business decision making

**UNIT I INTRODUCTION****9**

Data mining, Text mining, Web mining, Spatial mining, Process mining, BI process- Private and Public intelligence, Strategic assessment of implementing BI

**UNIT II DATA WAREHOUSING****9**

Data ware house – characteristics and view - OLTP and OLAP - Design and development of data warehouse, Meta data models, Extract/ Transform / Load (ETL) design

**UNIT III DATA MINING TOOLS, METHODS AND TECHNIQUES****9**

Regression and correlation; Classification- Decision trees; clustering –Neural networks; Market basket analysis- Association rules-Genetic algorithms and link analysis, Support Vector Machine, Ant Colony Optimization

**UNIT IV MODERN INFORMATION TECHNOLOGY AND ITS BUSINESS OPPORTUNITIES****9**

Business intelligence software, BI on web, Ethical and legal limits, Industrial espionage, modern techniques of crypto analysis, managing and organizing for an effective BI Team.

**UNIT V BI AND DATA MINING APPLICATIONS****9**

Applications in various sectors – Retailing, CRM, Banking, Stock Pricing, Production, Crime, Genetics, Medical, Pharmaceutical.

**TOTAL: 45 PERIODS****COURSE OUTCOMES**

- Big Data Management
- Appreciate the techniques of knowledge discovery for business applications

**TEXT BOOKS**

1. Jaiwei Ham and Micheline Kamber, Data Mining concepts and techniques, Kauffmann Publishers 2006
2. Efraim Turban, Ramesh Sharda, Jay E. Aronson and David King, Business Intelligence, Prentice Hall, 2008.

**REFERENCES**

1. W.H.Inmon, Building the Data Warehouse, fourth edition Wiley India pvt. Ltd. 2005.
2. Ralph Kimball and Richard Merz, The data warehouse toolkit, John Wiley, 2005.
3. Michel Berry and Gordon Linoff, Mastering Data mining, John Wiley and Sons Inc 2<sup>nd</sup> Edition, 2011
4. Michel Berry and Gordon Linoff, Data mining techniques for Marketing, Sales and Customer support, John Wiley, 2011
5. G. K. Gupta, Introduction to Data mining with Case Studies, Prentice hall of India, 2011
6. Giudici, Applied Data mining – Statistical Methods for Business and Industry, John Wiley. 2009
7. Elizabeth Vitt, Michael Luckevich Stacia Misner, Business Intelligence, Microsoft, 011
8. Michalewicz Z., Schmidt M. Michalewicz M and Chiriac C, Adaptive Business Intelligence, Springer – Verlag, 2007
9. Galit Shmueli, Nitin R. Patel and Peter C. Bruce, Data Mining for Business Intelligence – Concepts, Techniques and Applications Wiley, India, 2010

**COURSE OBJECTIVE :**

- Understand the scope and practice of business logistics and supply chain management

**UNIT I INTRODUCTION****9**

Business logistics and supply chain – importance, objectives and drivers. Strategy – planning, selecting proper channel, performance measurement. Outsourcing- Make vs buy approach – sourcing strategy.

**UNIT II MANAGING FLOWS****9**

Planning Networks – Decision making under risk – Decision trees – Decision making under uncertainty. Distribution Network Design – Role - Factors Influencing Options, Value Addition.. Supply Chain Network optimization models. Logistics information system - Role of IT – Framework for IT adoption.

**UNIT III INVENTORY AND WAREHOUSING****9**

Inventory–objectives, bullwhip effect, control - Probabilistic inventory models, Risk pooling, Vendor managed inventory, Multi-echelon inventory.

Warehousing Functions – Types – Site Selection – Decision Model – Layout Design – Costing – Virtual Warehouse.

**UNIT IV TRANSPORTATION AND PACKAGING****9**

Transportation – Drivers, Modes, Measures - Strategies for Transportation, 3PL and 4PL, Vehicle Routing and Scheduling.

Packaging- Design considerations, Material and Cost. Packaging as Unitisation. Consumer and Industrial Packaging.

**UNIT V ORGANISATION AND CONTROL****9**

Organisation Structure – need and development. Organizational – Choices, Orientation and positioning. Interfunctional and interorganisational management – alliances and partnerships. Control – Process framework, system details, information, measurement and interpretation.

**TOTAL: 45 PERIODS****COURSE OUTCOME :**

Student gains knowledge on effective management of the logistics and supply chain

**TEXT BOOKS:**

1. Ronald H. Ballou and Samir K. Srivastava, Business Logistics and Supply Chain Management, Pearson education, Fifth Edition
2. Sunil Chopra and Peter Meindl, Supply Chain Management-Strategy Planning and Operation, PHI Learning / Pearson Education, 2007.

**REFERENCES:**

1. Bowersox Donald J, Logistics Management – The Integrated Supply Chain Process, Tata McGraw Hill, 2010
2. Vinod V. Sople, Logistics Management-The Supply Chain Imperative, Pearson. 2012.
3. Coyle et al., The Management of Business Logistics, Thomson Learning, 7<sup>th</sup> Edition, 2004.
4. Mohanty R.P and Deshmukh S.G, Supply chain theories and practices, Biztantra publications, 2007.
5. Leenders, Johnson, Flynn, Fearon, Purchasing and supply management, Tata McGraw Hill, 2010.

**COURSE OBJECTIVE:**

To help understand how service performance can be improved by studying services operations management

**UNIT I INTRODUCTION****9**

Services – Importance, role in economy, service sector – growth; Nature of services -Service classification , Service Package, distinctive characteristics , open-systems view; Service Strategy – Strategic service vision, competitive environment, generic strategies, winning customers; Role of information technology; stages in service firm competitiveness; Internet strategies - Environmental strategies.

**UNIT II SERVICE DESIGN****9**

New Service Development – Design elements – Service Blue-printing - process structure – generic approaches –Value to customer; Retail design strategies – store size – Network configuration ; Managing Service Experience –experience economy, key dimensions ; Vehicle Routing and Scheduling

**UNIT III SERVICE QUALITY****9**

Service Quality- Dimensions, Service Quality Gap Model; Measuring Service Quality –SERVQUAL - Walk-through Audit; Quality service by design - Service Recovery - Service Guarantees; Service Encounter – triad, creating service orientation, service profit chain; Front-office Back-office Interface – service decoupling.

**UNIT IV SERVICE FACILITY****9**

Servicescapes – behaviour - environmental dimensions – framework; Facility design – nature, objectives, process analysis – process flow diagram, process steps, simulation; Service facility layout; Service Facility Location – considerations, facility location techniques – metropolitan metric, Euclidean, centre of gravity, retail outlet location , location set covering problem

**UNIT V MANAGING CAPACITY AND DEMAND****9**

Managing Demand – strategies; Managing capacity – basic strategies, supply management tactics, operations planning and control; Yield management; Inventory Management in Services– Retail Discounting Model, Newsvendor Model; Managing Waiting Lines –Queuing systems, psychology of waiting; Managing for growth- expansion strategies, franchising , globalization.

**TOTAL: 45 PERIODS****COURSE OUTCOME:**

To design and operate a service business using the concepts, tools and techniques of service operations management.

**TEXT BOOKS**

1. James A. Fitzsimmons, Service Management – Operations, Strategy, Information Technology, Tata McGraw-Hill – 5<sup>th</sup> Edition 2006.
2. Richard Metters, Kathryn King-Metters, Madeleine Pullman, Steve Walton Successful Service Operations Management, South-Western, Cengage Learning, 2<sup>nd</sup> Edition

**REFERENCES**

1. Cengiz Haksever, Barry Render, Roberta S. Russell, Robert G. Murdick, Service Management and Operations, Pearson Education – Second Edition.
2. Robert Johnston, Graham Clark, Service Operations Management, Pearson Education, 2<sup>nd</sup> Edition, 2005.
3. Bill Hollins and Sadie Shinkins, Managing Service Operations, Sage, 2006
4. J.Nevan Wright and Peter Race, The management of service operations, Thomson, 2<sup>nd</sup> Edition, 2004

**COURSE OBJECTIVE:**

To learn the concepts of managing projects.

- UNIT I INTRODUCTION TO PROJECT MANAGEMENT 9**  
Project Management – Definition –Goal - Lifecycles. Project Selection Methods. Project Portfolio Process – Project Formulation. Project Manager – Roles- Responsibilities and Selection – Project Teams.
- UNIT II PLANNING AND BUDGETING 9**  
The Planning Process – Work Break down Structure – Role of Multidisciplinary teams. Budget the Project – Methods. Cost Estimating and Improvement. Budget uncertainty and risk management.
- UNIT III SCHEDULING & RESOURCE ALLOCATION 9**  
PERT & CPM Networks - Crashing – Project Uncertainty and Risk Management – Simulation – Gantt Charts – Expediting a project – Resource loading and leveling. Allocating scarce resources – Goldratt's Critical Chain.
- UNIT IV CONTROL AND COMPLETION 9**  
The Plan-Monitor-Control cycle – Data Collecting and reporting – Project Control – Designing the control system. Project Evaluation, Auditing and Termination.
- UNIT V PROJECT ORGANISATION & CONFLICT MANAGEMENT 9**  
Formal Organisation Structure – Organisation Design – Types of project organizations. Conflict – Origin & Consequences. Managing conflict – Team methods for resolving conflict.

**TOTAL: 45 PERIODS**

**COURSE OUTCOME:**

To apply project management principles in business situations to optimize resource utilization and time optimisation.

**TEXT BOOKS**

1. Clifford Gray and Erik Larson, Project Management, Tata McGraw Hill Edition, 2005.
2. John M. Nicholas, Project Management for Business and Technology - Principles and Practice, Second Edition, Pearson Education, 2006.

**REFERENCES**

1. Gido and Clements, Successful Project Management, Second Edition, Thomson Learning, 2003.
2. Harvey Maylor, Project Management, Third Edition, Pearson Education, 2006.

**COURSE OBJECTIVE:**

To gain insights about the importance of lean manufacturing and six sigma practices.

**UNIT I LEAN & SIX SIGMA BACKGROUND AND FUNDAMENTALS 9**

Historical Overview – Definition of quality – What is six sigma -TQM and Six sigma - lean manufacturing and six sigma- six sigma and process tolerance – Six sigma and cultural changes – six sigma capability – six sigma need assessments - implications of quality levels, Cost of Poor Quality (COPQ), Cost of Doing Nothing – assessment questions

**UNIT II THE SCOPE OF TOOLS AND TECHNIQUES 9**

Tools for definition – IPO diagram, SIPOC diagram, Flow diagram, CTQ Tree, Project Charter – Tools for measurement – Check sheets, Histograms, Run Charts, Scatter Diagrams, Cause and effect diagram, Pareto charts, Control charts, Flow process charts, Process Capability Measurement, Tools for analysis – Process Mapping, Regression analysis, RU/CS analysis, SWOT, PESTLE, Five Whys, interrelationship diagram, overall equipment effectiveness, TRIZ innovative problem solving – Tools for improvement – Affinity diagram, Normal group technique, SMED, 5S, mistake proofing, Value stream Mapping, forced field analysis – Tools for control – Gantt chart, Activity network diagram, Radar chart, PDCA cycle, Milestone tracker diagram, Earned value management.

**UNIT III SIX SIGMA METHODOLOGIES 9**

Design For Six Sigma (DFSS), Design For Six Sigma Method - Failure Mode Effect Analysis (FMEA), FMEA process - Risk Priority Number (RPN)- Six Sigma and Leadership, committed leadership – Change Acceleration Process (CAP)- Developing communication plan – Stakeholder

**UNIT IV SIX SIGMA IMPLEMENTATION AND CHALLENGES 9**

Tools for implementation – Supplier Input Process Output Customer (SIPOC) – Quality Function Deployment or House of Quality (QFD) – alternative approach –implementation – leadership training, close communication system, project selection – project management and team – champion training – customer quality index – challenges – program failure, CPQ vs six sigma, structure the deployment of six sigma – cultural challenge – customer/internal metrics

**UNIT V EVALUATION AND CONTINUOUS IMPROVEMENT METHODS 9**

Evaluation strategy – the economics of six sigma quality, Return on six Sigma (ROSS), ROI, poor project estimates – continuous improvement – lean manufacturing – value, customer focus, Perfection, focus on waste, overproduction – waiting, inventory in process (IIP), processing waste, transportation, motion, making defective products, underutilizing people – Kaizen – 5S

**TOTAL: 45 PERIODS****COURSE OUTCOME:**

The student would be able to relate the tools and techniques of lean sigma to increase productivity

**REFERENCES:**

1. Michael L.George, David Rownalds, Bill Kastle, What is Lean Six Sigma, McGraw – Hill 2003
2. Thomas Pyzdek, The Six Sigma Handbook, McGraw-Hill, 2000.
3. Fred Soleimannejed , Six Sigma, Basic Steps and Implementation, AuthorHouse, 2004
4. Forrest W. Breyfogle, III, James M. Cupello, Becki Meadows, Managing Six Sigma:A Practical Guide to Understanding, Assessing, and Implementing the Strategy That Yields Bottom-Line Success, John Wiley & Sons, 2000
5. James P. Womack, Daniel T.Jones, Lean Thinking, Free Press Business, 2003

**COURSE OBJECTIVE:**

- To provide an overview of the various elements of containerization and allied businesses
- To realize the potential of containerization and allied businesses

**UNIT - I BASIC CONCEPT OF CONTAINERIZATION 8**

Introduction to Liner Shipping industry - Unitization concept and methods - Malcolm Mclean and the birth of containerization - Generations of container ships and their specification - Container types, their specifications and cargoes carried in them.

**UNIT - II FREIGHTING AND SIZE OF CONTAINER 10**

Container shipping business - FCL and LCL sea freight products - Freighting of FCL and LCL cargo - Slot utilization strategies - Estimation of optimum container fleet size - Multiport LCL consolidation

**UNIT - III CHARACTERISTICS AND PHYSICAL OPERATIONS 12**

Container terminal business- World's leading container terminals and location characteristics - container terminal infrastructure - container terminal productivity - container terminal profitability - Inland container terminals - Container Freight Stations

**UNIT - IV CONTAINER TYPES AND BUSINESS 8**

Container manufacturing trends - Container leasing business - Types of container leasing and their terms - maintenance and repair of containers - tracking of container movements - Container interchange.

**UNIT - V MULTIMODAL TRANSPORT 7**

Alternate uses of containers -marketing of used containers -carriage of shipper own containers - multimodal transport options for containers -Insurance for containers -strategies for managing container imbalance.

**TOTAL: 45 PERIODS****COURSE OUTCOME:**

- The students will learn the practices and ways to promote containerization and allied businesses
- The learners will have a complete idea about the different concepts, trends and strategies used for containerization and allied businesses

**REFERENCES:**

1. Marc Levinson, The Box: How the Shipping Container Made the World Smaller and the World Economy Bigger, Princeton University Press, 2008.
2. Dr. K. V. Hariharan, Containerisation, Multimodal Transport & Infrastructure Development In India, Sixth Edition, Shroff Publishers and Distributors, 2015.
3. Lee, C.-Y., Meng, Q. (Eds.), Handbook of Ocean Container Transport Logistics Making Global Supply Chains Effective, Springer, 2015

**COURSE OBJECTIVE:**

- To enlighten the students about the major functions in export and import processes.
- To provide the expertise for solving issues related to requirements in exim management.

**UNIT - I FUNDAMENTALS OF IMPORT AND EXPORT 8**

Role of Import and Export Trade in an Economy - Institutional Framework for Foreign Trade in India - Role of Director General of Foreign Trade and Commerce - Objectives of EXIM Policy - Global trade flows - Contract of International Sale of Goods - INCOTERMS 2010

**UNIT - II OVERVIEW OF EXPORT AND IMPORT 10**

Marketing for Exports - Negotiation and finalization of Export contract - Export Documentation Procedures - Cargo Insurance - Export Promotion Councils and incentive schemes- Role of Logistics in Exports- Export Houses / Trading Houses

**UNIT - III DOCUMENTATION FRAMEWORK 7**

Import for industrial use / trading - Import Documentation and Customs clearance procedures - Types of Imports - Import Licenses - Cargo Insurance - Role of Logistics in Import

**UNIT - IV CREDIT AND PAYMENTS 8**

Payment methods in Foreign Trade - Documentary Credit / Letter of Credit–UCP 600 with respect to Shipping Documents and L/C Negotiation – Export / import financing strategies - Managing payment risks.

**UNIT - V CUSTOMS CLEARANCE AND AGENCIES 12**

Roles of Service providers in EXIM transactions – Global Traders – Commodity Brokers - Custom House Agents – Transport Operators – Freight Forwarders – Warehousing and 3PL service providers – Liners /Ship Agencies – Container Freight Stations - Port – Inspection Agencies/ surveyors – Quarantine Agencies – Pest Control Agencies – Chamber of Commerce.

**TOTAL: 45 PERIODS****COURSE OUTCOME:**

- The students would be aware about the formalities of export and import industry
- The students will be able to comprehend the importance of exim management.

**REFERENCES:**

1. Justin Pauland Rajiv Aserkar, Export Import Management, Second Edition, Oxford University Press, 2013.
2. Usha Kiran Rai, Export - Import and Logistics Management, Second Edition, PHI Learning, 2010.
3. Director General of Foreign Trade, Foreign Trade Policy and Handbook of Procedures, 2015

**COURSE OBJECTIVE:**

- To provide the knowledge about fundamentals of shipping management
- to equip the students with the knowledge of shipping, ship building and repair

**UNIT - I INTERDICTION OF SHIPPING 8**

Role of Shipping in International trade-Types of ships and cargoes carried by them - International Organizations serving the shipping industry (IMO, BIMCO, ICS, IACS, IAPH)- Ship Registration and Classification.

**UNIT - II LINER SHIPPING OPERATIONS 8**

Liner shipping business - Types of Liner services - Container shipping lines and their services - Break bulk, Ro-Ro and project cargo services - Liner freight rates - Liner cargo documentation - Liner agency functions

**UNIT - III DRY BULK BUSINESS 8**

Dry Bulk shipping business- World's leading dry bulkports and cargoes handled by them - Types of Dry bulk ships and the Dry Bulk industry structure - Dry bulk market indices - Types of Chartering - Port agency functions.

**UNIT - IV TANKER OPERATIONS AND BUSINESS 12**

Liquid Bulk shipping business - World's leading wet bulk ports and cargoes handled by them- Types of tankers and gas carriers - Tanker freighting system (worldscale) -Factors affecting Tanker markets-Marine pollution conventions.

**UNIT - V SHIP BUILDING AND REPAIR 9**

Service providers to shipping industry -Ship management companies -Ports, inland terminals and Container Freight Stations- Ship building and repair yards -Financing the Shipping industry - Marine insurance providers.

**TOTAL: 45 PERIODS**

**COURSE OUTCOME:**

- The students would be acquainted with the basics of shipping management
- The students will learn the skills needed for shipping industry

**REFERENCES:**

1. Michael Robarts, Branch's Elements of Shipping, Ninth Edition, Routledge, 2014.
2. Peter Brodie, Commercial Shipping Handbook, Third Edition, Informa Law from Routledge, 2014.
3. Review of Maritime Transport, UNCTAD, 2014.

**BA7064**

**PORT AND TERMINAL MANAGEMENT**

**L T P C  
3 0 0 3**

**COURSE OBJECTIVE:**

- To enlighten the students about the major functions in the port and terminal management
- To expose the students on the trends in port and terminal management

**UNIT - I INTRODUCTION TO PORT AND TERMINAL 8**

Role of ports in international trade and transport - Economic impact of ports on the regional economy - Multiplier effect - Location characteristics of ports - Different types of ports (natural, manmade, river, estuary).

**UNIT - II PORT OPERATIONS 12**

Design features of facilities in ports for handling various cargoes - Organization structure in Ports - Delivery of port services and the relationship between various departments - Marine Department – Traffic Department – other departments.

**UNIT - III PORT MARKETING AND SERVICES**

**8**

Marketing of Port services - Pricing of Port services - Components of port tariff - Concept of hinterland – Identifying the needs of ship owners and operators, ship agents, forwarders, truckers, rail and barge operators - Concept of Total Logistics cost.

**UNIT - IV PORT PERFORMANCE**

**10**

Measurement of port performance - vessel turn round time, cargo volume, speed of cargo handling - Information flow requirements of the port, statutory bodies and port users - Port community computer systems and EDI applications.

**UNIT - V PORT SECURITY AND ISSUES**

**7**

Environmental issues connected with Ports & Terminals - Health and safety issues - Port security issues - International Ships and Port facility security (ISPS) code - Role of national, regional and local governments in owning / operating / managing ports.

**TOTAL: 45 PERIODS**

**COURSE OUTCOME:**

- The students would be aware about skills pertaining to port and terminal management
- The students should be able to understand the principles and applications for port and terminal management

**REFERENCES:**

1. Maria G. Burns, Port Management and Operations, CRC Press, 2014.
2. Patrick Alderton, Port Management and Operations, Third Edition, Lloyd's Practical Shipping Guides, 2008.
3. H. Ligteringen, H. Velsink, Ports and Terminals, VSSD Publishers, 2012.

**ANNA UNIVERSITY, CHENNAI**  
**AFFILIATED INSTITUTIONS**

**REGULATIONS - 2013**

**CURRICULUM AND SYLLABUS I TO VI SEMESTERS (FULL TIME)**  
**MASTER OF COMPUTER APPLICATION**

**PROGRAMME EDUCATIONAL OBJECTIVES**

- I. To excel in problem solving and programming skills in the various computing fields of IT industries
- II. To develop the ability to plan, analyze, design, code, test, implement & maintain a software product for real time system
- III. To promote students capability to set up their own enterprise in various sectors of Computer applications
- IV. To experience the students in finding solutions and developing system based applications for real time problems in various domains involving technical, managerial, economical & social constraints
- V. To prepare the students to pursue higher studies in computing or related disciplines and to work in the fields of teaching and research.

**PROGRAMME OBJECTIVES**

- a) Understand and Apply mathematical foundation, computing and domain knowledge for the conceptualization of computing model of problems.
- b) Identify, Analyze the computing requirements of a problem and Solve them using computing principles.
- c) Design and Evaluate a computer based system, components and process to meet the specific needs of applications.
- d) Use current techniques and tools necessary for complex computing practices.
- e) Use suitable architecture or platform on design and implementation with respect to performance
- f) Develop and integrate effectively system based components into user environment.
- g) Understand and commit to Cyber regulations and responsibilities in Professional computing practices.
- h) Recognize the need for and develop the ability to engage in continuous learning as a Computing professional.
- i) Apply the understanding of management principles with computing knowledge to manage the projects in multidisciplinary environments.
- j) Communicate effectively with the computing community as well as society by being able to comprehend effective documentations and presentations.
- k) Understand societal, environmental, health, legal, ethical issues within local and global contexts and the consequential responsibilities relevant to professional practice.
- l) Function effectively in a team environment to accomplish a common goal.
- m) Identify opportunities and use innovative ideas to create value and wealth for the betterment of the individual and society.
- n) Use knowledge to analyze, interpret the data and synthesis the information to derive valid conclusions using research methods.
- o) Expertise in developing application with required domain knowledge.

**ANNA UNIVERSITY, CHENNAI**  
**AFFILIATED INSTITUTIONS**  
**REGULATIONS - 2013**  
**CURRICULUM I TO VI SEMESTERS (FULL TIME)**  
**MASTER OF COMPUTER APPLICATION**

**SEMESTER I**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MA7151	Mathematical Foundation for Computer Applications	3	1	0	4
2.	MC7101	Computer Organization	3	0	0	3
3.	MC7102	Problem Solving and Programming	3	0	0	3
4.	MC7103	Database Management Systems	3	0	0	3
5.	MC7104	Data Structures and Algorithms	3	1	0	4
<b>PRACTICAL</b>						
6.	MC7111	DBMS Laboratory	0	0	3	2
7.	MC7112	Data Structures and Algorithms Laboratory	0	0	3	2
8.	MC7113	Communication Skill Laboratory	1	0	2	2
<b>TOTAL</b>			<b>16</b>	<b>2</b>	<b>8</b>	<b>23</b>

**SEMESTER II**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MC7201	Object Oriented Programming	3	0	0	3
2.	MC7202	Web Programming Essentials	3	0	0	3
3.	MC7203	System Software	3	0	0	3
4.	MC7204	Operating Systems	3	0	0	3
5.	MC7205	Computer Graphics and Multimedia	3	0	0	3
<b>PRACTICAL</b>						
6.	MC7211	Object Oriented Programming Laboratory	0	0	3	2
7.	MC7212	Web Programming Laboratory	0	0	3	2
8.	MC7213	Graphics and Multimedia Laboratory	0	0	3	2
<b>TOTAL</b>			<b>15</b>	<b>0</b>	<b>9</b>	<b>21</b>

**SEMESTER III**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MC7301	Computer Networks	3	0	0	3
2.	MC7302	Embedded Systems	3	0	0	3
3.	MC7303	Software Engineering	3	0	0	3
4.	MC7304	Professional Ethics	3	0	0	3
5.	MC7305	Internet Programming	3	0	0	3
<b>PRACTICAL</b>						
6.	MC7311	Embedded Systems Laboratory	0	0	3	2
7.	MC7312	Internet Programming Laboratory	0	0	3	2
8.	MC7313	Visual Programming Laboratory	1	0	3	2
<b>TOTAL</b>			<b>16</b>	<b>0</b>	<b>9</b>	<b>21</b>

**SEMESTER IV**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MC7401	Resource Management Techniques	3	0	0	3
2.	MC7402	Object Oriented Analysis and Design	3	0	0	3
3.	MC7403	Data Warehousing and Data Mining	3	0	0	3
4.	MC7404	Network Programming	3	0	0	3
5.		Elective I	3	0	0	3
<b>PRACTICAL</b>						
6.	MC7411	Software Development- Case Tools Laboratory	0	0	3	2
7.	MC7412	Network Programming Laboratory	0	0	3	2
8.	MC7413	Technical Seminar and Report Writing	0	0	3	2
<b>TOTAL</b>			<b>15</b>	<b>0</b>	<b>9</b>	<b>21</b>

**SEMESTER V**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MC7501	Web Application Development	3	0	0	3
2.	MC7502	Service Oriented Architecture	3	0	0	3
3.	MC7503	Mobile computing	3	0	0	3
4.		Elective II	3	0	0	3
5.		Elective III	3	0	0	3
<b>PRACTICAL</b>						
6.	MC7511	Advanced Internet Programming Laboratory	0	0	3	2
7.	MC7512	XML and Web Services Laboratory	0	0	3	2
8.	MC7513	Mini Project(Socially Relevant)	0	0	3	2
<b>TOTAL</b>			<b>15</b>	<b>0</b>	<b>9</b>	<b>21</b>

**SEMESTER VI**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	MC7611	Project Work	0	0	24	12
<b>TOTAL</b>			<b>0</b>	<b>0</b>	<b>24</b>	<b>12</b>

**TOTAL NO OF CREDITS:119****LIST OF ELECTIVES**

SL.NO.	COURSE CODE	L	T	P	C
<b>ELECTIVE I</b>					
MC7001	Game Programming	3	0	0	3
MC7002	Soft Computing	3	0	0	3
MC7003	Accounting and Financial Management	3	0	0	3
MC7004	Energy Aware Computing	3	0	0	3
MC7005	Security in computing	3	0	0	3
MA7071	Numerical and Statistical Methods	3	0	0	3
<b>ELECTIVE II</b>					
MC7006	M-commerce	3	0	0	3
MC7007	Health Care Management	3	0	0	3
MC7008	Geological Information Systems	3	0	0	3
MC7009	Human Resource Management	3	0	0	3
MC7010	Enterprise Application Integration	3	0	0	3
MC7011	Big Data Analytics	3	0	0	3
<b>ELECTIVE III</b>					
MC7012	Ad hoc and Sensor networks	3	0	0	3
MC7013	Semantic Web	3	0	0	3
MC7014	Software Testing and Quality Assurance	3	0	0	3
MC7015	Software Project Management	3	0	0	3
MC7016	Cloud Computing	3	0	0	3
MC7017	Network Protocols	3	0	0	3

**COURSE OBJECTIVES:**

- To understand the concepts and operations of matrix algebra needed for computing graphics modeling
- To understand and apply the class of functions which transform a finite set into another finite set which relates to input output functions in computer science.
- To impart discrete knowledge in computer engineering through finite automata and Context free grammars

**UNIT I MATRIX ALGEBRA****9**

Matrices, Rank of Matrix, Solving System of Equations-Eigen Values and Eigen Vectors-Inverse of a Matrix - Cayley Hamilton Theorem

**UNIT II BASIC SET THEORY****9**

Basic Definitions - Venn Diagrams and set operations - Laws of set theory - Principle of inclusion and exclusion - partitions- Permutation and Combination - Relations- Properties of relations - Matrices of relations - Closure operations on relations - Functions - injective, subjective and objective functions.

**UNIT III MATHEMATICAL LOGIC****9**

Propositions and logical operators - Truth table - Propositions generated by a set, Equivalence and implication - Basic laws- Some more connectives - Functionally complete set of connectives- Normal forms - Proofs in Propositional calculus - Predicate calculus.

**UNIT IV FORMAL LANGUAGES****9**

Languages and Grammars-Phrase Structure Grammar-Classification of Grammars-Pumping Lemma For Regular Languages-Context Free Languages.

**UNIT V FINITE STATE AUTOMATA****9**

Finite State Automata-Deterministic Finite State Automata(DFA), Non Deterministic Finite State Automata (NFA)-Equivalence of DFA and NFA-Equivalence of NFA and Regular Languages

**TOTAL: 45+15= 60 PERIODS****COURSE OUTCOMES:**

- Acquire the basic knowledge of matrix, set theory, functions and relations concepts needed for designing and solving problems
- Acquire the knowledge of logical operations and predicate calculus needed for computing skill
- Able to design and solve Boolean functions for defined problems
- Apply the acquired knowledge of formal languages to the engineering areas like Compiler Design
- Apply the acquired knowledge of finite automata theory and design discrete problems to solve by computers.

**REFERENCES:**

1. Kenneth H.Rosen, "Discrete Mathematics and Its Applications", Tata McGraw Hill, Fourth Edition, 2002 (Unit 1,2 & 3).
2. Hopcroft and Ullman, "Introduction to Automata Theory, Languages and Computation", Narosa Publishing House, Delhi, 2002. (Unit 4,5)
3. A.Tamilarasi & A.M.Natarajan, "Discrete Mathematics and its Application", Khanna Publishers, 2<sup>nd</sup> Edition 2005.
4. M.K.Venkataraman "Engineering Mathematics", Volume II, National Publishing company, 2<sup>nd</sup> Edition,1989.
5. Juraj Hromkovic, "Theoretical Computer Science", Springer Indian Reprint, 2010.
6. David Makinson, "Sets, Logic and Maths for Computing", Springer Indian Reprint, 2011.



**COURSE OBJECTIVES:**

- To understand the basic concepts of problem solving approaches and develop optimal program structure using conditional and iterative control structures and functions.
- To design, implement, test, and apply the basic C programming concepts.
- Apply the techniques of structured (functional) decomposition to break a program into smaller pieces and describe the mechanics of parameter passing.

**UNIT I INTRODUCTION TO COMPUTER PROBLEM SOLVING****8**

Introduction – The Problem Solving aspect – Top down design – Implementation of algorithm – Program Verification – The efficiency of algorithm – The analysis of algorithm.

**UNIT II PROGRAMMING, ALGORITHMS AND FLOWCHARTS****9**

Programs and Programming – building blocks for simple programs -Programming life cycle phases – pseudo code representation – flow charts - Algorithm - Programming Languages - compiler – Interpreter, Loader and Linker - Program execution – Classification of Programming Language - Structured Programming Concept.

**UNIT III BASICS OF 'C', INPUT / OUTPUT & CONTROL STATEMENTS****9**

Introduction- Identifier – Keywords - Variables – Constants – I/O Statements - Operators - Initialization –Expressions – Expression Evaluation – Lvalues and Rvalues – Type Conversion in C – Formatted input and output functions - Specifying Test Condition for Selection and Iteration- Conditional Execution - and Selection – Iteration and Repetitive Execution- go to Statement – Nested Loops- Continue and break statements.

**UNIT IV ARRAYS, STRINGS, FUNCTIONS AND POINTERS****10**

Array – One dimensional Character Arrays- Multidimensional Arrays- Arrays of Strings - Two dimensional character array – functions - parameter passing mechanism scope – storage classes – recursion - comparing iteration and recursion- pointers – pointer operators - uses of pointers- arrays and pointers – pointers and strings - pointer indirection- pointers to functions - Dynamic memory allocation.

**UNIT V USER-DEFINED DATATYPES & FILES****9**

Structures – initialization - nested structures – structures and arrays – structures and pointers - union – typedef and enumeration types - bit fields - File Management in C – Files and Streams – File handling functions – Sequential access file- Random access file – Command line arguments.

**TOTAL:45 PERIODS****COURSE OUTCOMES:**

- Able to design a computational solution for a given problem.
- Able to break a problem into logical modules that can be solved (programmed).
- Able to transform a problem solution into programs involving programming constructs
- To write programs using structures, strings, arrays, pointers and files for solving complex computational problem.
- Able to introduce modularity using functions and pointers which permit ad hoc run-time polymorphism

## REFERNCES:

1. How to solve it by computer , R.G.Dromey, Pearson education , fifth edition, 2007.
2. Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, First Edition, Oxford University Press, 2009
3. Kamthane, A.N., “Programming with ANSI and Turbo C”, Pearson Education, Delhi,2006
4. Deitel and Deitel, ”C How to Program”, Pearson Education. 2010 6<sup>th</sup> edition
5. Brian W. Kernighan and Dennis M. Ritchie, “The C programming Language”,2006, Prentice-Hall
6. Yashavant Kanetkar, “Understanding Pointers In C”, 4th Revised & Updated Edition, 2008, Bpb Publications
7. Cormen,Leiserson, Rivest, Stein, “ Introduction to Algorithms”, McGraw Hill , Publishers, 2002
8. Peter Norton, “Introduction to Computers”, Sixth Edition, Tata McGraw Hill Publications, 2007.
9. Reema Thareja, “Programming in C”, Oxford University Press, 2011.

**MC7103**

**DATABASE MANAGEMENT SYSTEMS**

**L T P C**  
**3 0 0 3**

## COURSE OBJECTIVES

- To understand the fundamentals of data models and conceptualize and depict a database system using ER diagram
- To make a study of SQL and relational database design.
- To know about data storage techniques an query processing.
- To impart knowledge in transaction processing, concurrency control techniques and recovery procedures.

### UNIT I INTRODUCTION

**9**

File systems versus Database systems – Data Models – DBMS Architecture – Data Independence – Data Modeling using Entity – Relationship Model – Enhanced E-R Modeling.

### UNIT II RELATIONAL MODEL AND QUERY EVALUATION

**9**

Relational Model Concepts – Relational Algebra – SQL – Basic Queries – Complex SQL Queries – Views – Constraints – Relational Calculus – Tuple Relational Calculus – Domain Relational Calculus – overview of commercial RDBMSs – Database Design – Functional Dependencies – Normal Forms – 1NF – 2NF-3NF-BCNF – 4NF-5NF - Algorithms for Executing Query Operations — Cost Estimation

### UNIT III TRANSACTION PROCESSING

**9**

Transaction Processing – Properties of Transactions - Serializability – Transaction support in SQL - Locking Techniques – Time Stamp ordering – Validation Techniques – Granularity of Data Items – Recovery concepts – Shadow paging – Log Based Recovery – Database Security Issues – Access control – Statistical Database Security.

### UNIT IV FILES AND INDEXING

**9**

File operations – Hashing Techniques – Indexing – Single level and Multi-level Indexes – B+ tree – Static Hashing - Indexes on Multiple Keys.

### UNIT V SPECIAL PURPOSE DATABASES

**9**

OODBMS- - Object-Based Databases - OO Data Model - OO Languages – Persistence – Object Relational Databases - XML – Structure of XML - Temporal Databases – Mobile Databases – Spatial Databases – Case Study for Design and Manage the Database for any Project

**TOTAL : 45 PERIODS**

## COURSE OUTCOMES:

- Understand the basic concepts of the database and data models.
- design a database using ER diagrams and map ER into Relations and normalize the relations
- Acquire the knowledge of query evaluation to monitor the performance of the DBMS.
- Develop a simple database applications using normalization.
- Acquire the knowledge about different special purpose databases and to critique how they differ from traditional database systems.

## REFERENCES:

1. Abraham Silberschatz, Henry F.Korth and S.Sundarshan “Database System Concepts”, Sixth Edition, McGraw Hill, 2010.
2. C.J. Date, “An Introduction to Database Systems”, Eight Edition, Pearson Education Delhi, 2003.
3. Ramez Elamassri and Shankant B-Navathe, “Fundamentals of Database Systems”, Sixth Edition, Pearson Education Delhi, 2010.
4. Raghu Ramakrishnan, Johannes Gehrke ,’ Database management systems” McGraw Hill, 2003.
5. Peter Rob, Carlos Coronel, “Database System Concepts”, Cengage Learning, 2008.
6. Frank. P. Coyle, “XML, Web Services And The Data Revolution”, Pearson Education, 2012.
7. Lee Chao, “Database Development and Management”, Auerbach Publications, 2010.
8. Peter Rob, Carlos coronel , “Data base system concepts” , Ceange Learning 2008

MC7104

DATA STRUCTURES AND ALGORITHMS

L T P C  
3 1 0 4

## COURSE OBJECTIVES

- To understand the linear and non linear data structures available in solving problems
- To know about the sorting and searching techniques and its efficiencies
- To get a clear idea about the various algorithm design techniques
- Using the data structures and algorithms in real time applications
- Able to analyze the efficiency of algorithm

### UNIT I LINEAR DATA STRUCTURES

9+3

Introduction - Abstract Data Types (ADT) – Arrays and its representation – Structures – Stack – Queue – Circular Queue - Applications of stack – Infix to postfix conversion – evaluation of expression – Applications of Queue - Linked Lists – Doubly Linked lists – Applications of linked list – Polynomial Addition

### UNIT II TREE STRUCTURES

9+3

Need for non-linear structures – Trees and its representation – Binary Tree – expression trees – Binary tree traversals – left child right sibling data structures for general trees – applications of trees – Huffman Algorithm - Binary search tree.

### UNIT III BALANCED SEARCH TREES, SORTING AND INDEXING

9+3

AVL trees –B-Trees - Sorting – Bubble sort - Quick Sort - Insertion Sort – Heap sort – Hashing - Hashing functions - Collision Resolution Techniques - Separate chaining - Open addressing - Multiple hashing.

**UNIT IV      GRAPHS****9+3**

Definitions – Representation of graph - Graph Traversals - Depth-first traversal – breadth-first traversal - applications of graphs - Topological sort – shortest-path algorithms – minimum spanning tree – Prim’s and Kruskal’s algorithms – biconnectivity – Euler circuits.

**UNIT V      ALGORITHM DESIGN AND ANALYSIS****9+3**

Algorithm Analysis – Asymptotic Notations - Divide and Conquer – Merge Sort – Binary Search - Greedy Algorithms – Knapsack Problem – Dynamic Programming – Warshall’s Algorithm for Finding Transitive Closure – Backtracking – Sum of Subset Problem – Branch and Bound – Travelling Salesman Problem.

**TOTAL 45+15: 60 PERIODS****COURSE OUTCOMES:**

- Able to select and apply the data structure to suit any given problem.
- Able to design their own data structure according to the application need.
- Able to apply the algorithm design techniques to any of the real world problem.
- Able to develop any new application with the help of data structures and algorithms.
- Able to write efficient algorithm for a given problem and able to analyze its time complexity.

**REFERENCES:**

1. M. A. Weiss, “Data Structures and Algorithm Analysis in C++”, Pearson Education Asia, 2013.
2. Tanaenbaum A.S.,Langram Y. Augestein M.J “ Data Structures using C” Pearson Education , 2004
3. Anany Levitin “Introduction to the Design and Analysis of Algorithms” Pearson Education 2003.
4. E. Horowitz, S.Sahni and Dinesh Mehta, “Fundamentals of Data structures in C++”, University Press, 2007.
5. E. Horowitz, S. Sahni and S. Rajasekaran, “Computer Algorithms/C++”, Second Edition, University Press, 2007.
6. Reema Thareja, “Data Structures using C”, Oxford Press, 2012.
7. V. Aho, J. E. Hopcroft, and J. D. Ullman, “Data Structures and Algorithms”, Pearson Education, 1983.
8. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to algorithms", Second Edition

**MC7111****DBMS LABORATORY****L T P C  
0 0 3 2**

1. Creation of base tables and views.
2. Data Manipulation INSERT, DELETE and UPDATE in Tables. SELECT, Sub Queries and JOIN
3. Data Control Commands
4. High level language extensions – PL/SQL. Or Transact SQL – Packages
5. Use of Cursors, Procedures and Functions
6. Embedded SQL or Database Connectivity.
7. Oracle or SQL Server Triggers – Block Level – Form Level Triggers
8. Working with Forms, Menus and Report Writers for a application project in any domain
9. Front-end tools – Visual Basic/Developer 2000.

**TOTAL: 45 PERIODS**

**MC7112**

**DATA STRUCTURES AND ALGORITHMS LABORATORY**

**L T P C**  
**0 0 3 2**

1. Polynomial Addition using array
2. Array implementation of stack
3. Array implementation of Queue
4. Infix to postfix conversion
5. Singly Linked List operations
6. Binary tree traversals
7. Quick sort
8. Dictionary application using any of the data structure
9. Find the Shortest Path using Dijkstra's Algorithm – Greedy method
10. Warshall's Algorithm for finding transitive closure using Dynamic programming
11. Sum of subset problem using backtracking

**TOTAL: 45 PERIODS**

**MC7113**

**COMMUNICATION SKILL LABORATORY**

**L T P C**  
**1 0 2 2**

**I. PC based session (Weightage 40%) 21 periods**

**A. English Language Lab (15 Periods)**

1. **Listening Comprehension:** (5)  
Listening and typing – Listening and sequencing of sentences – Filling in the blanks - Listening and answering questions.
2. **Reading Comprehension:** (5)  
Filling in the blanks - Close exercises – Vocabulary building - Reading and answering questions.
3. **Speaking:** (5)  
Phonetics: Intonation – Ear training - Correct Pronunciation – Sound recognition exercises – Common Errors in English. Conversations: Face to Face Conversation – Telephone conversation – Role play activities (Students take on roles and engage in conversation)

**B. Discussion of audio-visual materials (6 periods) (Samples to learn and practice)**

1. **Resume / Report Preparation / Letter Writing** (1)  
Structuring the resume / report - Letter writing / Email Communication - Samples.
2. **Presentation skills:** (1)  
Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language – Video samples
3. **Soft Skills:** (2)  
Time management – Articulateness – Assertiveness – Psychometrics – Innovation and Creativity - Stress Management & Poise - Video Samples
4. **Group Discussion:** (1)  
Why is GD part of selection process ? - Structure of GD – Moderator – led and other GDs - Strategies in GD – Team work - Body Language - Mock GD –Video samples

- 5. Interview Skills:** (1)  
Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews- Video samples.

## **II. Practice Session (Weightage – 60%) 24 periods**

- 1. Resume / Report Preparation / Letter writing:** Students prepare their own resume and report. (2)
- 2. Presentation Skills:** Students make presentations on given topics. (8)
- 3. Group Discussion:** Students participate in group discussions. (6)
- 4. Interview Skills:** Students participate in Mock Interviews (8)

### **REFERENCES:**

1. Anderson, P.V, **Technical Communication**, Thomson Wadsworth , Sixth Edition, New Delhi, 2007.
2. Prakash, P, **Verbal and Non-Verbal Reasoning**, Macmillan India Ltd. Second Edition, New Delhi, 2004.
3. John Seely, **The Oxford Guide to Writing and Speaking**, Oxford University Press, New Delhi, 2004.
4. Evans, D, **Decisionmaker**, Cambridge University Press, 1997.
5. Thorpe, E, and Thorpe, S, **Objective English**, Pearson Education, Second Edition, New Delhi, 2007.
6. Turton, N.D and Heaton, J.B, **Dictionary of Common Errors**, Addison Wesley Longman Ltd., Indian reprint 1998.

### **LAB REQUIREMENTS:**

1. Teacher console and systems for students.
2. English Language Lab Software
3. Career Lab Software

### **Guidelines for the course**

1. A batch of 60 students is divided into two groups – one group for the PC- based session and the other group for the Class room session.
2. The English Lab (2 Periods) and the Career Lab (2 Periods) may be handled by any competent teacher
3. **Record Notebook:** At the end of each session of English Lab, review exercises are given for the students to answer and the computer evaluated sheets are to be compiled as record notebook. Similar exercises for the career lab are to be compiled in the record notebook.
4. **Internal Assessment:** The 15 marks (the other 5 marks for attendance) allotted for the internal assessment will be based on the record notebook compiled by the candidate. 10 marks may be allotted for English Lab component and 5 marks for the Career Lab component.
5. **End semester Examination:** The end-semester examination carries 40% weightage for English Lab and 60% weightage for Career Lab.

**TOTAL :45 PERIODS**

**COURSE OBJECTIVES:**

- To learn how C++ supports Object Oriented principles such as abstraction, polymorphism etc
- To understand and apply the principles hiding, localization and modularity in software development.
- Use the generic programming features of C++ including the STL
- Design and implement reliable and maintainable object-oriented applications of moderate complexity composed of several classes

**UNIT I FUNDAMENTALS OF OBJECT ORIENTED PROGRAMMING 9**  
 Object-Oriented Programming concepts – Encapsulation – Programming Elements – Program Structure – Enumeration Types – Functions and Pointers – Function Invocation – Overloading Functions – Scope and Storage Class – Pointer Types – Arrays and Pointers – Call-by-Reference – Assertions – Standard template library.

**UNIT II IMPLEMENTING ADTS AND ENCAPSULATION 9**  
 Aggregate Type struct – Structure Pointer Operators – Unions – Bit Fields – Data Handling and Member Functions – Classes – Constructors and Destructors – Static Member – this Pointer – reference semantics – implementation of simple ADTs.

**UNIT III POLYMORPHISM 9**  
 ADT Conversions – Overloading – Overloading Operators – Unary Operator Overloading – Binary Operator Overloading – Function Selection – Pointer Operators – Visitation – Iterators – containers – Sequence Containers - List – List Iterators – Associative Containers.

**UNIT IV TEMPLATES AND FILE HANDLING 9**  
 Template Class – Function Templates – RTTI Templates - Class Templates – Parameterizing – STL – Algorithms – Function Adaptors – Streams and Formatted I/O – I/O Manipulations -File handling – Random Access

**UNIT V INHERITANCE 9**  
 Derived Class – Typing Conversions and Visibility – Code Reuse – Virtual Functions – Templates and Inheritance – Run-Time Type Identifications – Exceptions – Handlers – Standard Exceptions.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

- Able to understand and design the solution to a problem using object-oriented programming concepts.
- Able to use proper class protection mechanism to provide security.
- Able to demonstrate the use of virtual functions to implement polymorphism.
- Understand and implement the features of C++ including templates, exceptions and file handling for providing programmed solutions to complex problems
- Able to reuse the code with extensible Class types, User-defined operators and function overloading

## REFERENCES:

1. Bhushan Trivedi, "Programming with ANSI C++", Oxford Press, Second Edition, 2012.
2. HM Deitel and PJ Deitel "C++ How to Program", Seventh Edition, 2010, Prentice Hall
3. Ira Pohl, "Object-Oriented Programming Using C++", Pearson Education, 2 Edition, 2003.
4. E Balagurusamy, "Object oriented Programming with C++", 3 edition, 2006, Tata McGraw Hill
5. Stanley B.Lippman, Josee Lajoie, "C++ Primer", Pearson Education, Third Edition, 2005.
6. Kamthane," Object Oriented Programming with ANSI and Turbo C++", Person Education, 2003.
7. Bhave , " Object Oriented Programming With C++", Pearson Education , 2004.
8. S.B Lippman, Josee, Josee Lajoie, Barbara, " C++ Premier" 4 Edition, Pearson , 2012
9. Ray Lischner, "Exploring C++ : The programmer's introduction to C++" , apress, 2010.

MC7202

WEB PROGRAMMING ESSENTIALS

L T P C  
3 0 0 3

## COURSE OBJECTIVES:

- To understand the concepts and architecture of the World Wide Web.
- To understand and practice mark up languages
- To understand and practice embedded dynamic scripting on client side Internet Programming
- To understand and practice web development techniques on client-side

### UNIT I INTRODUCTION TO WWW

9

Internet Standards – Introduction to WWW – WWW Architecture – SMTP – POP3 – File Transfer Protocol - Overview of HTTP, HTTP request – response — Generation of dynamic web pages.

### UNIT II UI DESIGN

9

**Markup Language (HTML):** Introduction to HTML and HTML5 - Formatting and Fonts -Commenting Code – Anchors – Backgrounds – Images – Hyperlinks – Lists – Tables – Frames - HTML Forms.

**Cascading Style Sheet (CSS):** The need for CSS, Introduction to CSS – Basic syntax and structure - Inline Styles – Embedding Style Sheets - Linking External Style Sheets – Backgrounds - Manipulating text - Margins and Padding - Positioning using CSS.

### UNIT III INTRODUCTION TO JAVASCRIPT

9

Introduction - Core features - Data types and Variables - Operators, Expressions, and Statements - Functions - Objects - Array, Date and Math related Objects - Document Object Model - Event Handling - Controlling Windows & Frames and Documents - Form handling and validations.

### UNIT IV ADVANCED JAVASCRIPT

9

Browser Management and Media Management – Classes – Constructors – Object-Oriented Techniques in JavaScript – Object constructor and Prototyping - Sub classes and Super classes – JSON - jQuery and AJAX.

### UNIT V PHP

9

Introduction - How web works - Setting up the environment (LAMP server) - Programming basics - Print/echo - Variables and constants – Strings and Arrays – Operators, Control structures and looping structures – Functions – Reading Data in Web Pages - Embedding PHP within HTML - Establishing connectivity with MySQL database.

## COURSE OUTCOMES:

- Acquire knowledge about functionalities of world wide web
- Explore markup languages features and create interactive web pages using them
- Learn and design Client side validation using scripting languages
- Acquire knowledge about Open source JavaScript libraries
- Able to design front end web page and connect to the back end databases.

## REFERENCE BOOKS:

1. Harvey & Paul Deitel & Associates, Harvey Deitel and Abbey Deitel, "Internet and World Wide Web - How To Program", Fifth Edition, Pearson Education, 2011.
2. Achyut S Godbole and Atul Kahate, "Web Technologies", Second Edition, Tata McGraw Hill, 2012.
3. Thomas A Powell, Fritz Schneider, "JavaScript: The Complete Reference", Third Edition, Tata McGraw Hill, 2013.
4. David Flanagan, "JavaScript: The Definitive Guide, Sixth Edition", O'Reilly Media, 2011
5. Steven Holzner, "The Complete Reference - PHP", Tata McGraw Hill, 2008
6. Mike Mcgrath, "PHP & MySQL in easy Steps", Tata McGraw Hill, 2012.
7. <http://php.net/manual/>

MC7203

SYSTEM SOFTWARE

L T P C  
3 0 0 3

## COURSE OBJECTIVES:

- To understand the relationship between system software and machine architecture, design and implementation of assemblers, linkers and loaders.
- To understand the design, function and implementation of assemblers, linkers and loaders
- To have an understanding of macro processors and system software tools

### UNIT I BASICS OF SYSTEM SOFTWARE AND ASSEMBLER

9

Introduction – System software and SIC/XE machine architecture - Basic assembler functions – Assembler algorithms and data structures – Machine dependent assembler features, Instruction formats and addressing modes – Program relocation – Machine independent assembler features – Literals – Symbol-defining statements – Expressions – Program Blocks – Control Sections and Program Linking-Implementation examples MASM assembler.

### UNIT II COMPILER- LEXICAL ANALYSIS, SYNTAX ANALYSIS

9

Phases of compiler-Lexical Analysis: Role of a Lexical analyzer, input buffering, specification and recognition of tokens, Finite Automata, Designing a lexical analyzer generator, Pattern matching based on NFA's. Syntax Analysis: Role of Parser, Top-down parsing, recursive descent and predictive parsers (LL), Bottom-Up parsing, Operator precedence parsing, LR, SLR and LALR parsers.

### UNIT III COMPILER- CODE GENERATION, OPTIMIZATION

9

Intermediate languages: graphical representations, DAGs, Three address code, types of three address statements, syntax directed translation into three address code, implementation of three address statements-Code Optimization: Machine dependent and machine independent code generation: Sources of optimization-Code Generation-Semantic stacks, evaluation of expressions, control structures, and procedure calls.

**UNIT IV LOADERS AND LINKERS****9**

Basic loader functions: Design of an Absolute Loader – A Simple Bootstrap Loader Machine dependent loader features Relocation – Program Linking – Algorithm and Data Structures for Linking Loader. Machine-independent loader features – Automatic Library Search – Loader Options Loader design options – Linkage Editors – Dynamic Linking – Bootstrap Loaders. Implementation examples: MSDOS linker.

**UNIT V MACRO PROCESSORS & OTHER SYSTEM SOFTWARE****9**

Basic macro processor functions – Macro Definition and Expansion – Macro Processor Algorithm and data structures – Implementation examples: MASM Macro Processor- Text editors – Overview of Editing Process - User Interface – Editor Structure – Interactive Debugging Systems – Debugging functions and capabilities –Relationships with Other parts of the system – User Interface Criteria. - Virtual Machines

**TOTAL: 45 PERIODS .****COURSE OUTCOMES:**

- Able to trace the path of a source code to object code and the to executable file
- To design the front end of the compiler-scanner, parser
- Understand and identify the relationship between system software and machine architecture
- Analyze the functions of assembler, compiler, linker, and loaders
- Know the design and implementation of loaders and linkers

**REFERENCES:**

1. Leland Beck - “System Software – An Introduction to Systems Programming”, Third Edition, Pearson Education, Inc., 2008
2. A.V. Aho, R. Shethi and Ulman; Compilers - Principles, Techniques and Tools, Second Edition, Pearson Education, 2002.
3. D. M. Dhamdhare, "Systems Programming and Operating Systems", Tata McGraw Hill Company, Second Edition, 2009.
4. John J. Donovan, “Systems Programming”, Tata McGraw Hill Company, Second Edition, 2000.
5. V. Raghavan, “Principles of Compiler Design”, Tata McGrawHill Education Publishers, 2010.
6. Srimanta Pal, “ Systems Programming “ , Oxford University Press, 2011.

**MC7204****OPERATING SYSTEMS****L T P C  
3 0 0 3****COURSE OBJECTIVES:**

- To be aware of the evolution and fundamental principles of operating system, processes and their communication
- To understand the various operating system components like process management, memory management and
- To know about file management and the distributed file system concepts in operating systems
- To be aware of components of operating system with relevant case study

**UNIT I INTRODUCTION****9**

Introduction -Types of operating systems-operating systems structures-Systems components-operating systems services-System calls-Systems programs-Processes-process concept- process scheduling-operation on processes-co-operating processes-Inter process communications-CPU Scheduling-Scheduling criteria-Scheduling algorithms-Multiple-processor Scheduling

<b>UNIT II</b>	<b>PROCESS SYNCHRONIZATION</b>	<b>9</b>
Process Synchronization –Critical Section problem – Semaphores-Classical problems of synchronization-critical regions-Monitors-Deadlock Characterization-Deadlock handling-Deadlock Prevention-Deadlock avoidance-Deadlock Detection-Deadlock Recovery –Threads-Multithreading Models		
<b>UNIT III</b>	<b>MEMORY MANAGEMENT</b>	<b>9</b>
Memory Management-Swapping-Contiguous Memory allocation-Paging-Segmentation-Virtual Memory-Demand paging-Page Replacement-Thrashing		
<b>UNIT IV</b>	<b>DISK SCHEDULING AND DISTRIBUTED SYSTEMS</b>	<b>9</b>
Disk Structures-Disk Scheduling-File Systems Interface-File concepts-Access methods-Directory Structures-File System Implementation-File Systems structures-Directory Implementation-Allocation Methods-Free Space management-Distributed File systems-Naming and Transparency-Remote File Accesses- Stateful Versus Stateless Service-File replication		
<b>UNIT V</b>	<b>CASE STUDIES</b>	<b>9</b>
Linux System-design Principles- process management-File Systems-Windows Vista-Systems Structures-Process management-memory management-Android OS-Virtual machine OS		

**COURSE OUTCOMES:**

- Able to understand the operating system components and its services
- Implement the algorithms in process management and solving the issues of IPC
- Able to demonstrate the mapping between the physical memory and virtual memory
- Able to understand file handling concepts in OS perspective
- Able to understand the operating system components and services with the recent OS

**TOTAL : 45 PERIODS**

**REFERENCES:**

1. Abraham Silberschalz Peter B Galvin, G.Gagne, "Operating Systems Concepts", Seventh Edition, Addison Wesley Publishing Co.,2010
2. Andrew S.Tanenbaum, "Modern operating Systems", Third Edition, PHI Learning Pvt.Ltd., 2008
3. William Stallings, "Operating Systems: Internals and Design Principles",Seventh Edition, Prentice Hall, 2011.
4. H M Deital, P J Deital and D R Choffnes, "Operating Systems" ,3<sup>rd</sup> edition, Pearson Education, 2011.
5. D M Dhamdhare, " Operating Systems: A Concept-based Approach", Second Edition, Tata McGraw-Hill Education, 2007.

<b>MC7205</b>	<b>COMPUTER GRAPHICS AND MULTIMEDIA</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

**COURSE OBJECTIVES:**

- To understand computational development of graphics with mathematics
- To provide in-depth knowledge of display systems, image synthesis, shape modeling of 3D application.
- To Understand basic concepts related to Multimedia including data standards, algorithms and software
- To Experience development of multimedia software by utilizing existing libraries and descriptions of algorithms

<b>UNIT I</b>	<b>BASIC CONCEPTS</b>	<b>9</b>
2D Transformations – Clipping – Window – View Prot Mapping – Graphical User Interfaces and Interactive Input Methods – Picture Construction Techniques – Virtual Reality Environment.		
<b>UNIT II</b>	<b>3D GRAPHICS</b>	<b>9</b>
3D Transformation – 3D Viewing – Visible Surface Detection – Back Face Detection – Depth Buffer Method – Scan Line Method.		
<b>UNIT III</b>	<b>MULTIMEDIA BASICS</b>	<b>9</b>
Introduction to Multimedia – Components – Hypermedia – Authoring – Authoring tools – File formats – Color models – Digital Audio representation – Transmission – Audio signal processing – Digital music making – MIDI – Digital video – Video compression techniques – Video performance measurements – Multimedia Databases – Animation – Key frames and tweening techniques – Principles of animation – Virtual reality – Multimedia for portable devices		
<b>UNIT IV</b>	<b>MULTIMEDIA COMMUNICATION</b>	<b>9</b>
Stream characteristics for Continuous media – Temporal Relationship – Object Stream Interactions - Media Synchronization – Models for Temporal Specifications – Streaming of Audio and Video – Recovering from packet loss – RTSP — Multimedia Communication Standards –RTP/RTCP – SIP and H.263- Real time streaming and On-demand streaming		
<b>UNIT V</b>	<b>MULTIMEDIA APPLICATION DEVELOPMENT</b>	<b>9</b>
Design, Development and evaluation of multimedia a system - The development of user interface design - Design Process - MultiMedia & the Internet - Multimedia conferencing - Multimedia file sharing – Multimedia broadcasting - Multimedia Development Issues - Multimedia project - Structured Multimedia development - Multimedia project timing - Sample project		

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

- Gain proficiency in 3D computer graphics API programming
- Enhance the perspective of modern computer system with modeling, analysis and interpretation of 2D and 3D visual information.
- Able to understand different realizations of multimedia tools
- Able to develop interactive animations using multimedia tools
- Gain the knowledge of different media streams in multimedia transmission

**REFERENCES:**

1. Donald Hearn and M. Pauline Baker, “Computer Graphics in C Version”, Second Edition, Pearson Education
2. Tom McReynolds – David Blythe “ Advanced Graphics Programming Using OpenGL” , Elsevier, 2010
3. Parag Havaldar and Gerard Medioni, “Multimedia Systems-Algorithms, Standards and Industry Practices”, Course Technology, Cengage Learning, 2010.
4. John F. Koegel Bufend , “Multimedia systems”, Pearson Education, Delhi, 2002
5. Ralf Steinmetz and Klara “Multimedia Computing, Communications and Applications”, Pearson Education,2004.
6. Kurose and Ross, ‘Computer Networks : A top down Approach’, Pearson Education, 2002
7. Mohammad Dastbaz, Desgning Interactive Multimedia Systems
8. Multimedia – Technology and applications David Hillman Galgotia Publications, Delhi
9. Ralf Steinmetz and Klara Nahrstedt “Multimedia Applications”, Springer, 2007.

**MC7211****OBJECT ORIENTED PROGRAMMING LABORATORY****L T P C**  
**0 0 3 2**

1. Write a C++ Program to illustrate Enumeration and Function Overloading
2. Write a C++ Program to illustrate Scope and Storage class
3. Implementation of ADT such as Stack and Queues
4. Write a C++ Program to illustrate the use of Constructors and Destructors and Constructor Overloading
5. Write a Program to illustrate Static member and methods
6. Write a Program to illustrate Bit fields
7. Write a Program to overload as binary operator, friend and member function
8. Write a Program to overload unary operator in Postfix and Prefix form as member and friend function
9. Write a Program to illustrate Iterators and Containers
10. Write a C++ Program to illustrate function templates
11. Write a C++ Program to illustrate template class
12. Write C++ Programs and incorporating various forms of Inheritance
13. Write a C++ Program to illustrate Virtual functions
14. Exception Handling
15. File Handling – Read, Write, Update

**TOTAL: 45 PERIODS****MC7212****WEB PROGRAMMING LABORATORY****L T P C**  
**0 0 3 2**

1. Create a web page with the following using HTML5
  - (i) To embed an image map in a web page
  - (ii) To fix the hot spots
  - (iii) Show all the related information when the hot spots are clicked.
2. Create a web page with all types of Cascading style sheets.
3. Implement Client Side Scripts for Validating Web Form Controls using JavaScript.
4. Designing Quiz Application Personal Information System/ Using JavaScript
5. Write a JavaScript for Loan Calculation.
6. Develop and demonstrate a HTML file that includes JavaScript that uses functions for the following problems:
  - a) Parameter: A string  
Output: The position in the string of the left-most vowel
  - b) Parameter: A number  
Output: The number with its digits in the reverse order
7. Develop PHP program using Arrays, control structures, looping structures and Form Handling
8. Using PHP and MySQL, develop a program to accept book information viz. Accession number, title, authors, edition and publisher from a web page and store the information in a database and to search for a book with the title specified by the user and to display the search results with proper headings.
9. Write an AJAX program for parsing a JSON file and formatting the output.
10. Develop a web application for Airline Reservation System using PHP & AJAX.

**TOTAL: 45 PERIODS**

**UNIT I TWO DIMENSIONAL TRANSFORMATIONS 9**

Creation of two dimensional objects and applying simple transformations like Translation, Scaling, Rotation and applying Composite transformations.

**UNIT II CLIPPING AND WINDOWING 9**

Clipping and windowing of a part of the created two dimensional object using any one of the clipping algorithms

**UNIT III THREE DIMENSIONAL TRANSFORMATIONS 9**

Creation of simple three dimensional objects like cube, cone and cylinder and applying simple transformations like Translation, Scaling, Rotation, Composite transformations, projections –Parallel, Perspective.

**UNIT IV VISIBLE SURFACE DETECTION 9**

Finding out visible surfaces and removal of hidden surfaces in simple objects using object space and image space algorithms.

**UNIT V IMAGE EDITING 9**

Image enhancement, Image transformation from color to gray scale and vice versa, Image manipulation and Image optimization for web - Usage of editing tools, layers, filters, special effects and color modes. Creation of simple Gif animated images with textual illustrations, Image Compression.

**Software:**

1. C/C++/Java
2. OpenGL 3.7 (precompiled GLUT libraries 3.7 – Open source)
3. Any open source software like 'GIMP 2.6'/ Flash 8.0 /Photoshop

**TOTAL: 45 PERIODS****COURSE OBJECTIVES:**

- To understand networking concepts and basic communication model
- To understand network architectures and components required for data communication.
- To analyze the function and design strategy of physical, data link, network layer and transport layer
- To Acquire knowledge of various application protocol standard developed for internet

**UNIT I NETWORK FUNDAMENTALS 9**

Uses of Networks – Categories of Networks -Communication model –Data transmission concepts and terminology – Protocol architecture – Protocols – OSI – TCP/IP – LAN Topology - Transmission media

**UNIT II DATA LINK LAYER 9**

Data link control - Flow Control – Error Detection and Error Correction - MAC – Ethernet, Token ring, Wireless LAN MAC – Blue Tooth - Bridges.

**UNIT III NETWORK LAYER 9**  
Network layer – Switching concepts – Circuit switching – Packet switching –IP – Datagrams – IP addresses- IPV6– ICMP – Routing Protocols – Distance Vector – Link State- BGP.

**UNIT IV TRANSPORT LAYER 9**  
Transport layer –service –Connection establishment – Flow control – Transmission control protocol – Congestion control and avoidance – User datagram protocol. -Transport for Real Time Applications (RTP).

**UNIT V APPLICATIONS 9**  
Applications - DNS- SMTP – WWW –SNMP- Security –threats and services - DES- RSA- web security -SSL

**TOTAL : 45 PERIODS**

**COURSE OUTCOMES:**

- Able to trace the flow of information from one node to another node in the network
- Able to Identify the components required to build different types of networks
- Able to understand the functionalities needed for data communication into layers
- Able to choose the required functionality at each layer for given application
- Able to understand the working principles of various application protocols
- Acquire knowledge about security issues and services available

**REFERENCES:**

1. Larry L. Peterson & Bruce S. Davie, “Computer Networks – A systems Approach”, Fourth Edition, Harcourt Asia / Morgan Kaufmann, 2007.
2. William Stallings, “Data and Computer Communications”, Ninth Edition, Prentice Hall , 2011.
3. Forouzan, “ Data Communication and Networking”, Fifth Edition , TMH 2012
4. Andrew S.Tannenbaum David J. Wetherall, “Computer Networks” Fifth Edition , Pearson Education 2011
5. James F. Kurose, Keith W. Ross, “Computer Networking: A Top-down Approach, Pearson Education, Limited, sixth edition,2012
6. John Cowley, “Communications and Networking : An Introduction”, Springer Indian Reprint, 2010.
7. Achyut S Godbole,Atul Hahate, “ Data Communications and Networks”second edition 2011
8. Wayne Tomasi, “ Introduction to Data communications and Networking” , Pearson 2011

**MC7302 EMBEDDED SYSTEMS L T P C**  
**3 0 0 3**

**COURSE OBJECTIVES:**

- To understand the architecture and functions of 8085 processor
- To Learn Assembly language programming
- To understand the Basic concepts of Embedded systems and 8051 microcontroller
- To gain knowledge about how the I/O devices are interfaced with 8051 microcontroller
- To understand the basics of RTOS and to learn the method of designing a real time systems

**UNIT I INTRODUCTION TO MICROPROCESSORS 9**  
Evolution Of Microprocessors - 8-Bit Processor - 8085 Architecture – Register Organization - Instruction Set – Timing Diagram- Addressing Modes – Interrupts- Interrupt Service Routines- Assembly Language Programming Using 8085

**UNIT II INTRODUCTION TO EMBEDDED SYSTEMS 9**  
Embedded Systems- Processor Embedded Into A System-Embedded Hardware And Software Units- Applications-Design Process – Intel 8051 Architecture- Processor And Memory Organization- Interrupts Of 8051 - Assembly Language Programming Using 8051

**UNIT III INTERFACING WITH 8051 9**  
Input-Output Interfacing – Bus Standards – PCI – ISA – Timing And Control – Input Output Devices – Serial And Parallel Communication – Motor Control-Programming Display Devices – ARM Architecture

**UNIT IV REAL – TIME OPERATING SYSTEM 9**  
Inter Process Communication – Signal Functions – Socket Programming – Mailbox - Pipes – RTOS – OS Services – Process Management - Timer Function –Event Function – Memory Management – Device, Files And I/O Subsystem – Basic Design Of RTOS.

**UNIT V RTOS PROGRAMMING 9**  
Basic Functions – Types Of RTOS – RTOS  $\mu$ COS – RTLinux – Real Time Linux Functions- Programming With RTLinux – Case Study

**TOTAL : 45 PERIODS**

**COURSE OUTCOMES:**

- Able to understand the functionality of 8085 microprocessor
- Able to design and control real time control systems
- Able incorporate enhanced features in the embedded systems through software
- Able to rectify minor problems by troubleshooting
- Acquire the knowledge of real time operating system and implement real time functions

**REFERENCE BOOKS:**

1. Rajkamal, “Embedded System: Architecture, Programming And Design” Tata Mcgraw-Hill Education, Second Edition, 2008.
2. B.Kanth Rao, “Embedded Systems” PHI Learning Private Limited, 2011.
3. Marilyn Wolf, “Computers As A Components” Third Edition, Morgan Kaufmann Series 2012.
4. A.P.Godse & A.O.Mulani ”Embedded Systems” Third Edition, Technical publications 2009.
5. Mohamed Rafiquzzaman, “Microprocessors and Micro computer-based system design”, CRC Press, Second Edition, 2013.

**MC7303**

**SOFTWARE ENGINEERING**

**L T P C  
3 0 0 3**

**COURSE OBJECTIVES:**

- to provide an insight into the processes of software development
- To understand and practice the various fields such as analysis, design, development, testing of Software Engg .
- To develop skills to construct software of high quality with high reliability
- To apply metrics and testing techniques to evaluate the software

**UNIT I INTRODUCTION 9**  
Software Engineering paradigms – Waterfall Life cycle model – Spiral Model – Prototype Model – fourth Generation Techniques – Planning – Software Project Scheduling, – Risk analysis and management – Requirements and Specification – Case Study for Project Plan and SRS

**UNIT II SOFTWARE DESIGN 9**  
Abstraction – Modularity – Software Architecture – Cohesion – Coupling – Various Design Concepts and notations – Real time and Distributed System Design – Documentation – Dataflow Oriented design – Jackson System development – Designing for reuse – Programming standards – Case Study for Design of any Application Project.

**UNIT III SOFTWARE TESTING AND MAINTENANCE 9**  
Software Testing Fundamentals – Software testing strategies – Black Box Testing – White Box Testing – System Testing – Object Orientation Testing – State based Testing - Testing Tools – Test Case Management – Software Maintenance Organization – Maintenance Report – Types of Maintenance – Case Study for Testing Techniques

**UNIT IV SOFTWARE METRICS 9**  
Scope – Classification of metrics – Measuring Process and Product attributes – Direct and Indirect measures – Cost Estimation - Reliability – Software Quality Assurance – Standards – Case Study for COCOMO model

**UNIT V SCM & WEB ENGINEERING 9**  
Need for SCM – Version Control – SCM process – Software Configuration Items – Taxonomy – CASE Repository – Features – Web Engineering

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

- Get an insight into the processes of software development
- Able to understand the problem domain for developing SRS and various models of software engineering
- Able to Model software projects into high level design using DFD,UML diagrams
- Able to Measure the product and process performance using various metrics
- Able to Evaluate the system with various testing techniques and strategies

**REFERENCE BOOKS:**

1. Roger S. Pressman, “Software Engineering: A Practitioner Approach”, Seventh edition, McGrawHill, 2010.
2. Richard Fairley, “ Software Engineering Concepts”, Tata McGraw Hill Edition, 2008
3. Ali Behforroz, Frederick J.Hudson, “Software Engineering Fundamentals”, Oxford Indian Reprint, 2012
4. Sommerville, “Software Engineering”, Sixth Edition, Addison Wesley-Longman, 2004.
5. Kassem A. Saleh, “Software Engineering”, First Edition, J.Ross Publishing, 2009.
6. Pankaj Jalote, “An Integrated approach to Software Engineering”, Third Edition, Springer Verlag, 2005.
7. Roger S. Pressman, David Lowe, “Web Engineering: A Practitioner’s Approach”, Special Indian edition, McGrawHill, 2008.
8. Jibitesh Mishra, Ashok Mohanty, “Software Engineering”, Pearson Education, First Edition, 2012

**COURSE OBJECTIVES**

- To understand the concepts of computer ethics in work environment.
- To understand the threats in computing environment
- To understand the intricacies of accessibility issues
- To ensure safe exits when designing the software projects

**UNIT I            COMPUTER ETHICS INTRODCUTION AND COMPUTER HACKING            9**

A general Introduction – Computer ethics: an overview – Identifying an ethical issue – Ethics and law – Ethical theories - Professional Code of conduct – An ethical dilemma – A framework for ethical decision making - Computer hacking – Introduction – definition of hacking – Destructive programs – hacker ethics - Professional constraints – BCS code of conduct – To hack or not to hack? – Ethical positions on hacking

**UNIT II            ASPECTS OF COMPUTER CRIME AND INTELLECTUAL PROPERTY RIGHTS            9**

Aspects of computer crime - Introduction - What is computer crime – computer security measures – Professional duties and obligations - Intellectual Property Rights – The nature of Intellectual property – Intellectual Property – Patents, Trademarks, Trade Secrets, Software Issues, Copyright - The extent and nature of software piracy – Ethical and professional issues – free software and open source code

**UNIT III            REGULATING INTERNET CONTENT, TECHNOLOGY AND SAFETY            9**

Introduction – In defence of freedom expression – censorship – laws upholding free speech – Free speech and the Internet - Ethical and professional issues - Internet technologies and privacy – Safety and risk – assessment of safety and risk – risk benefit analysis – reducing risk

**UNIT IV            COMPUTER TECHNOLOGIES ACCESSIBILITY ISSUES            9**

Introduction – Principle of equal access – Obstacles to access for individuals – professional responsibility - Empowering computers in the workplace – Introduction – computers and employment – computers and the quality of work – computerized monitoring in the work place – telecommuting – social, legal and professional issues - Use of Software, Computers and Internet-based Tools - Liability for Software errors - Documentation Authentication and Control – Software engineering code of ethics and practices – IEEE-CS – ACM Joint task force

**UNIT V            SOFTWARE DEVELOPMENT AND SOCIAL NETWORKING            9**

Software Development – strategies for engineering quality standards – Quality management standards – Social Networking – Company owned social network web site – the use of social networks in the hiring process – Social Networking ethical issues – Cyber bullying – cyber stalking – Online virtual world – Crime in virtual world - digital rights management - Online defamation – Piracy – Fraud

**TOTAL: 45 PERIODS****COURSE OUTCOMES:**

- Helps to examine situations and to internalize the need for applying ethical principles, values to tackle with various situations.
- Develop a responsible attitude towards the use of computer as well as the technology.
- Able to envision the societal impact on the products/ projects they develop in their career
- Understanding the code of ethics and standards of computer professionals.
- Analyze the professional responsibility and empowering access to information in the work place.

## REFERENCES:

1. Penny Duquenoey, Simon Jones and Barry G Blundell, "Ethical , legal and professional issues in computing", Middlesex University Press, 2008
2. George Reynolds, "Ethics in Information Technology", Cengage Learning, 2011
3. Caroline Whitback," Ethics in Engineering Practice and Research ", Cambridge University Press, 2011
4. Richard Spinello, "Case Studies in Information and Computer Ethics", Prentice Hall, 1997.
5. John Weckert and Douglas Adeney, Computer and Information Ethics, Greenwood Press, 1997.
6. Sara Baase, "A Gift of Fire: Social, Legal, and Ethical Issues for Computing and the Internet",3rd Edition,Prentice Hall, 2008
7. [http://www.infosectoday.com/Articles/Intro\\_Computer\\_Ethics.htm](http://www.infosectoday.com/Articles/Intro_Computer_Ethics.htm)

**MC 7305**

**INTERNET PROGRAMMING**

**L T P C**  
**3 0 0 3**

## COURSE OBJECTIVES:

- To provide an overview of working principles of internet, web related functionalities
- To understand and apply the fundamentals core java, packages, database connectivity for computing
- To enhance the knowledge to server side programming
- To provide knowledge on advanced features like Swing, JavaBeans, Sockets.

### UNIT I INTERNET APPLICATIONS

**9**

Domain Name System - Exchanging E-mail – Sending and Receiving Files - Fighting Spam, Sorting Mail and avoiding e-mail viruses – Chatting and Conferencing on the Internet – Online Chatting - Messaging – Usenet Newsgroup – Voice and Video Conferencing – Web Security, Privacy, and site-blocking – FTP.

### UNIT II JAVA FUNDAMENTAL

**9**

Java features – Java Platform – Java Fundamentals – Expressions, Operators, and Control Structures – Classes, Packages and Interfaces – Exception Handling.

### UNIT III PACKAGES

**9**

AWT package – Layouts – Containers – Event Package – Event Model – Painting – Garbage Collection - Multithreading  
– Language Packages.

### UNIT IV ADVANCED JAVA PROGRAMMING

**9**

Utility Packages – Input Output Packages – Inner Classes – Java Database Connectivity - Servlets - RMI – Swing Fundamentals - Swing Classes.

### UNIT V JAVA BEANS AND NETWORKING

**9**

Java Beans – Application Builder Tools - Using the Bean Developer Kit-Jar Files-Introspection- BDK-Using BeanInfo Interface – Persistence- Java Beans API – Using Bean Builder - Networking Basics - Java and the Net – InetAddress – TCP/IP Client Sockets – URL –URL Connection – TCP/IP Server Sockets – A Caching Proxy HTTP Server – Datagrams.

**TOTAL: 45 PERIODS**

## **COURSE OUTCOMES:**

- Able to understand the internet standards and recent web technologies like Conferencing, newsgroup etc.
- Able to implement, compile, test and run Java program,
- Able to make use of hierarchy of Java classes to provide a solution to a given set of requirements found in the Java API
- Able to understand the components and patterns that constitute a suitable architecture for a web application using java servlets
- Able to demonstrate systematic knowledge of backend and front end by developing an appropriate application.

## **REFERENCES:**

1. Margaret Levine Young, "Internet and WWW", 2<sup>nd</sup> Edition, Tata McGraw Hill, 2002.
2. Paul J. Deitel, Harvey M. Deitel, "Internet & World Wide Web: How to Program", Pearson Education International, 2009
3. Herbert Schildt, The Complete Reference – Java 2, 4<sup>th</sup> Edition, Tata McGraw Hill, 2001
4. Joyce Farrell, "Java Programming", Cengage Learning, Sixth Edition, 2011
5. C. Xavier, "Java Programming: A Practical Approach", Tata McGraw Hill, 2011
6. Keyur shah, "Gateway to Java Programmer Sun Certification", Tata Mc Graw Hill 2002
7. Poomachandra Sarang, "Java Programming", McGraw Hill Professional, 2012
8. Herbert Schildt, Dale Skrien, "Java Fundamentals – A Comprehensive Introduction", Tata Mc Graw Hill, 2013
9. John Dean, Raymond Dean, " Introduction to Programming with JAVA – A Problem Solving Approach", Tata Mc Graw Hill, 2012
10. Ralph Bravaco, Shai Simonson, "Java Programming : From the Ground Up", Tata McGraw Hill Edition, 2012
11. D.S.Malik, "Java Programming", Cengage Learning, 2009
12. Rashmi Kanta Das, "Core Java for Beginners" , Vikas Publishing House Pvt. Ltd., 2011

**MC7311**

**EMBEDDED SYSTEMS LABORATORY**

**L T P C**  
**0 0 3 2**

1. Assembly Language Programs Using 8085 – 3 Experiments
2. 8051 Microcontroller Based Simple ALP Experiments – 2 Experiments
3. 8051 Microcontroller Based I/O Interfacing - 2 Experiments
4. Real Time Systems Program Using RTOS – 2 Experiments
5. Case Study Using RTLinux

**TOTAL : 45 PERIODS**

**MC7312****INTERNET PROGRAMMING LABORATORY****L T P C  
0 0 3 2**

1. Basics - Sending and receiving mails from one or more email clients, Video Conferencing demonstration.
2. Writing Java programs by making use of class, interface, package, etc for the following
  - # Different types of inheritance study
  - # Uses of 'this' keyword
  - # Polymorphism
  - # Creation of user specific packages
  - # Creation of jar files and using them
  - # User specific exception handling
3. Writing window based GUI applications using frames and applets such as Calculator application, Fahrenheit to Centigrade conversion etc
4. Application of threads examples
5. Reading and writing text files
6. Writing an RMI application to access a remote method
7. Writing a Servlet program with database connectivity for a web based application such as students result status checking, PNR number enquiry etc
8. Creation and usage of Java bean
9. Create a Personal Information System using Swing
10. Event Handling in Swing
11. FTP Using Sockets.

**TOTAL : 45 PERIODS****MC7313****VISUAL PROGRAMMING LABORATORY****L T P C  
1 0 3 2****VB**

1. Database applications using data control.

**VC++**

1. SDK type programs code for GDI objects.
2. Implementation of Process management using PWCT
3. Implementation of advanced dynamic Slider & Image control applications
4. Programming for reading and writing into documents.
5. Creating DLLs and using them.
6. Data access through ODBC – Cdatabase, Crecordset.
7. Creating status bar application, static and dynamic splitter windows
8. create an application that will load the bit map dynamically with and with out wizard
9. Creating Active-x controls using .Net

**TOTAL : 45 PERIODS**

**COURSE OBJECTIVES:**

- To provide the concept and an understanding of basic concepts in Operations Research Techniques for Analysis and Modeling in Computer Applications.
- To understand , develop and solve mathematical model of linear programming problems
- To understand , develop and solve mathematical model of Transport and assignment problems
- To Understand network modeling for planning and scheduling the project activities

**UNIT I LINEAR PROGRAMMING MODELS 9**

Mathematical Formulation - Graphical Solution of linear programming models – Simplex method – Artificial variable Techniques- Variants of Simplex method

**UNIT II TRANSPORTATION AND ASSIGNMENT MODELS 9**

Mathematical formulation of transportation problem- Methods for finding initial basic feasible solution – optimum solution - degeneracy – Mathematical formulation of assignment models – Hungarian Algorithm – Variants of the Assignment problem

**UNIT III INTEGER PROGRAMMING MODELS 9**

Formulation – Gomory's IPP method – Gomory's mixed integer method – Branch and bound technique.

**UNIT IV SCHEDULING BY PERT AND CPM 9**

Network Construction – Critical Path Method – Project Evaluation and Review Technique – Resource Analysis in Network Scheduling

**UNIT V QUEUEING MODELS 9**

Characteristics of Queuing Models – Poisson Queues - (M / M / 1) : (FIFO / / ), (M / M / 1) : (FIFO / N / ), (M / M / C) : (FIFO / / ), (M / M / C) : (FIFO / N / ) models.

**TOTAL : 45 PERIODS****COURSE OUTCOMES:**

- Understand and apply linear, integer programming to solve operational problem with constraints
- Apply transportation and assignment models to find optimal solution in warehousing and Travelling,
- To prepare project scheduling using PERT and CPM
- Identify and analyze appropriate queuing model to reduce the waiting time in queue.
- Able to use optimization concepts in real world problems

**REFERENCES:**

1. Taha H.A., "Operations Research : An Introduction " 8<sup>th</sup> Edition, Pearson Education, 2008.
2. A.M.Natarajan, P.Balasubramani, A.Tamilarasi, "Operations Research", Pearson Education, Asia, 2005.
3. Prem Kumar Gupta, D.S. Hira, "Operations Research", S.Chand & Company Ltd, New Delhi, 3rd Edition , 2008.
4. John W. Chinneck "Feasibility and Infeasibility in Optimization Algorithms and Computational Methods' Springer, 2008
5. Ravindran, Phillips, Solberg,"Operations Research: Principles And Practice", 2ND ED, John Wiley & Sons, 01-Jul-2007
6. Ibe, O.C. "Fundamentals of Applied Probability and Random Processes", Elsevier, U.P., 1st Indian Reprint, 2007.
7. Gross, D. and Harris, C.M., "Fundamentals of Queueing Theory", Wiley Student, 3rd Edition, New Jersey, 2004.

**COURSE OBJECTIVES:**

- To provide a brief, hands-on overview of object-oriented analysis in software process
- To discuss Case studies based project specifications to develop object-oriented models and identify implementation strategies.
- To demonstrate and apply basic object oriented techniques to create and modify object oriented analysis and design models.
- To understand and apply testing techniques for object oriented software

**UNIT I INTRODUCTION****9**

An overview – Object basics – Object state and properties – Behavior – Methods – Messages – Information hiding – Class hierarchy – Relationships – Associations – Aggregations- Identity – Dynamic binding – Persistence – Metaclasses – Object oriented system development life cycle.

**UNIT II METHODOLOGY AND UML****9**

Introduction – Survey – Rumbaugh, Booch, Jacobson methods – Patterns – Creational - Abstract Factory – Factory Method – Behavioral – Momento – Mediator - Structural – Decorator - Facade - Concurrency Patterns –Lock – Reactor – Scheduler - Frameworks – Unified approach – Unified modeling language – Static and Dynamic models – UML diagrams – Class diagram – Usecase diagrams – Dynamic modeling – Model organization – Extensibility.

**UNIT III OBJECT ORIENTED ANALYSIS****9**

Identifying Usecase – Business object analysis – Usecase driven object oriented analysis – Usecase model – Documentation – Classification – Identifying object, relationships, attributes, methods – Super-sub class – A part of relationships Identifying attributes and methods – Object responsibility

**UNIT IV OBJECT ORIENTED DESIGN****9**

Design process and benchmarking – Axioms – Corollaries – Designing classes – Class visibility – Refining attributes – Methods and protocols – Object storage and object interoperability – Databases – Object relational systems – Designing interface objects – Macro and Micro level processes – The purpose of a view layer interface-OOUI - MVC Architectural Pattern and Design – Designing the system.

**UNIT V QUALITY AND TESTING****9**

Quality assurance – Testing strategies – Test cases – Automated Testing Tools – Case Study - Cryptanalysis – Health Care Systems- Inventory Control System - Rational Rose Suite.

**TOTAL : 45 PERIODS****COURSE OUTCOMES:**

- Understand the basic concepts to identify state & behavior of real world objects
- Able to learn the various object oriented methodologies and choose the appropriate one for solving the problem with the help of various case studies
- Understand the concept of analysis, design & testing to develop a document for the project
- Able to implement analysis, design & testing phases in developing a software project
- Able to understand the testing strategies and know about automated testing tools

## REFERENCES :

1. Ali Bahrami, "Object Oriented System Development", McGraw Hill International Edition, 2008.
2. Craig Larman, Applying UML and Patterns, 2<sup>nd</sup> Edition, Pearson, 2002.
3. Brahma Dathan, Sarnath Ramnath, "Object-Oriented Analysis, Design and Implementation", Universities Press, 2010.
4. Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language User Guide", Addison Wesley Long man, 1999.
5. Bernd Bruegge, Allen H. Dutoit, Object Oriented Software Engineering using UML, Patterns and Java, Pearson 2004
6. Martin Fowler, "UML Distilled A Brief Guide to Standard Object Modeling Language", 3<sup>rd</sup> Edition, Addison Wesley, 2003
7. Russ Miles, Kim Hamilton, "Learning UML 2.0", O'Reilly, 2008.

**MC7403**

**DATA WAREHOUSING AND DATA MINING**

**L T P C**  
**3 0 0 3**

## COURSE OBJECTIVES:

- To expose the students to the concepts of Data warehousing Architecture and Implementation
- To Understand Data mining principles and techniques and Introduce DM as a cutting edge business intelligence
- To learn to use association rule mining for handling large data
- To understand the concept of classification for the retrieval purposes
- To know the clustering techniques in details for better organization and retrieval of data
- To identify Business applications and Trends of Data mining

### **UNIT I DATA WAREHOUSE**

**8**

Data Warehousing - Operational Database Systems vs. Data Warehouses - Multidimensional Data Model - Schemas for Multidimensional Databases – OLAP Operations – Data Warehouse Architecture – Indexing – OLAP queries & Tools.

### **UNIT II DATA MINING & DATA PREPROCESSING**

**9**

Introduction to KDD process – Knowledge Discovery from Databases - Need for Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation.

### **UNIT III ASSOCIATION RULE MINING**

**8**

Introduction - Data Mining Functionalities - Association Rule Mining - Mining Frequent Itemsets with and without Candidate Generation - Mining Various Kinds of Association Rules - Constraint-Based Association Mining.

### **UNIT IV CLASSIFICATION & PREDICTION**

**10**

Classification vs. Prediction – Data preparation for Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

## UNIT V CLUSTERING

10

Cluster Analysis: - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High- Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

**TOTAL : 45 PERIODS**

### COURSE OUTCOMES:

Upon Completion of the course, the students will be able to

- Store voluminous data for online processing
- Preprocess the data for mining applications
- Apply the association rules for mining the data
- Design and deploy appropriate classification techniques
- Cluster the high dimensional data for better organization of the data
- Discover the knowledge imbibed in the high dimensional system
- Evolve Multidimensional Intelligent model from typical system
- Evaluate various mining techniques on complex data objects

### REFERENCES:

1. Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques” Second Edition, Elsevier, Reprinted 2008.
2. K.P. Soman, Shyam Diwakar and V. Ajay, “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.
3. G. K. Gupta, “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall of India, 2006.
4. BERSON, ALEX & SMITH, STEPHEN J, Data Warehousing, Data Mining, and OLAP, TMH Pub. Co. Ltd, New Delhi, 2012
5. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, Pearson Education, 2007
6. PRABHU Data Warehousing, PHI Learning Private Limited, New Delhi, 2012, ,
7. PONNIAH, PAULRAJ, Data Warehousing Fundamentals, John Wiley & Sons, New Delhi, 2011
8. MARAKAS, GEORGE M, Modern Data Warehousing, Mining, and Visualiza Visualization, Pearson Education, 2011

**MC7404**

**NETWORK PROGRAMMING**

**L T P C  
3 0 0 3**

### COURSE OBJECTIVES :

1. To understand interprocess and inter-system communication
2. To understand socket programming in its entirety
3. To understand usage of TCP/UDP / Raw sockets
4. To understand how to build network applications

## UNIT I INTRODUCTION

9

Overview of UNIX OS - Environment of a UNIX process - Process control – Process relationships Signals – Interprocess Communication- overview of TCP/IP protocols

## UNIT II ELEMENTARY TCP SOCKETS

9

Introduction to Socket Programming –Introduction to Sockets – Socket address Structures – Byte ordering functions – address conversion functions – Elementary TCP Sockets – socket, connect, bind, listen, accept, read, write , close functions – Iterative Server – Concurrent Server.

**UNIT III APPLICATION DEVELOPMENT****9**

TCP Echo Server – TCP Echo Client – Posix Signal handling – Server with multiple clients – boundary conditions: Server process Crashes, Server host Crashes, Server Crashes and reboots, Server Shutdown – I/O multiplexing – I/O Models – select function – shutdown function – TCP echo Server (with multiplexing) – poll function – TCP echo Client (with Multiplexing)

**UNIT IV SOCKET OPTIONS, ELEMENTARY UDP SOCKETS****9**

Socket options – getsockopt and setsockopt functions – generic socket options – IP socketoptions – ICMP socket options – TCP socket options – Elementary UDP sockets – UDP echo Server – UDP echo Client – Multiplexing TCP and UDP sockets – Domain name system – gethostbyname function – Ipv6 support in DNS – gethostbyadr function – getservbyname and getservbyport functions.

**UNIT V ADVANCED SOCKETS****9**

Ipv4 and Ipv6 interoperability – threaded servers – thread creation and termination – TCP echo server using threads – Mutexes – condition variables – raw sockets – raw socket creation – raw socket output – raw socket input – ping program – trace route program.

**TOTAL: 45 PERIODS****COURSE OUTCOMES:**

1. To write socket API based programs
2. To design and implement client-server applications using TCP and UDP sockets
3. To analyze network programs

**REFERENCES:**

1. W. Richard Stevens, B. Fenner, A.M. Rudoff, “Unix Network Programming – The Sockets Networking API”, 3<sup>rd</sup> edition, Pearson, 2004.
2. W. Richard Stevens, S.A Rago, “Programming in the Unix environment”, 2<sup>nd</sup> edition, Pearson, 2005.

**MC7411 SOFTWARE DEVELOPMENT – CASE TOOLS LABORATORY****L T P C  
0 0 3 2**

1. Practicing the different types of case tools such as Rational Rose / other Open Source be used for all the phases of Software development life cycle.
2. Data modeling
3. Source code generators
4. Apply the following to typical application problems:
  1. Project Planning
  2. Software Requirement Analysis
  3. Software Design
  4. Data Modeling & Implementation
  5. Software Estimation
  6. Software Testing

A possible set of applications may be the following:

- a. Library System
- b. Student Marks Analyzing System
- c. Text Editor.
- d. Create a dictionary.
- e. Telephone directory.
- f. Inventory System.

**TOTAL: 45 PERIODS**

**MC7412**

**NETWORK PROGRAMMING LABORATORY**

**L T P C  
0 0 3 2**

1. Implementation of File System Calls
2. Implementation of ICP Techniques – Pipe, Message Queue, Shared Memory
3. Socket Programming
  - a) TCP Sockets
  - b) UDP Sockets
  - c) Applications using Sockets
4. Simulation of Sliding Window Protocol
5. Simulation of Routing Protocols
6. RPC
7. Development of applications such as DNS / HTTP / E-mail / Multi-user chat

**TOTAL : 45 PERIODS**

**MC7413**

**TECHNICAL SEMIANR AND REPORT WRITING**

**L T P C  
0 0 3 2**

The goal of this course is to train the students to critically evaluate a well-defined set of research subjects and to summarize the findings concisely in a paper of scientific quality. The paper will be evaluated based on the ability to understand a topic, communicate it and identify the issues. Results from this term paper will be presented to fellow students and a committee of faculty members.

1. Every student selects a topic related to current trends and the same should be approved by the respective committee. This selection should have at least 5 distinct primary sources.
2. Every student must write a short review of the topic and present it to fellow students and faculty (discuss the topic – expose the flaws – analyze the issues) every week.
3. The faculty should evaluate the short review and award marks with respect to the following.
  - a. Has the student analyzed – not merely quoted – the most significant portions of the primary sources employed?
  - b. Has the student offered original and convincing insights?
  - c. Plagiarism to be checked.
4. Every student should re-submit and present the review article including issues/ comments/ conclusions which had arisen during the previous discussion.
5. Every student should submit a final paper as per project specifications along with all short review reports (at least 4 internal reviews) and corresponding evaluation comments.
6. Every student should appear for a final external review exam to defend themselves.

**TOTAL: 45 PERIODS**

**COURSE OBJECTIVES:**

- To acquire knowledge on the usage of recent platforms in developing web applications
- To understand architecture of J2EE and design applications using J2EE, Struts and JSP
- To understand framework of .NET and design applications using .NET, C#, Silverlight
- To Design and develop interactive, client-side, server-side executable web applications LAMP Stack.

**UNIT I J2EE Platform 9**

Introduction -Enterprise Architecture Styles - J2EE Architecture - Containers - J2EE Technologies - Developing J2EE Applications - Naming and directory services - Using JNDI - JNDI Service providers - Java and LDAP - LDAP operations - Searching an LDAP server - Storing and retrieving java objects in LDAP - Application Servers - Implementing the J2EE Specifications - J2EE packaging and Deployment - J2EE packaging overview - Configuring J2EE packages

**UNIT II STRUTS AND HIBERNATE 9**

Struts Architecture - Struts classes - Action Forward, Action Form, Action Servlet, Action classes - Understanding struts - config.xml, Understanding Action Mappings, Struts flow with an example application, Struts Tiles Framework, Struts Validation Framework – Hibernate - Architecture of Hibernate - Downloading Hibernate - Exploring HQL - Understanding Hibernate O/R Mapping.

**UNIT III LAMP STACK 9**

Overview of Lamp Stack - Features of Lamp Stack –Understanding Python Understanding LAMP and Its Effect on Web Development

**UNIT IV .Net, C# 9**

Introduction - .Net revolution - .Net framework and its architecture – CLR – What is Assembly – Components of Assembly – DLL hell and Assembly Versioning. Overview to C# - C # Compilation and Execution Process – C# Fundamentals (Data types, Operators, Programming constructs) – Inheritance –Sealed Classes – Interface - Overloading – OverRiding – Method Hiding – C# Property – Exception Handling

**UNIT V ASP.NET AND SILVERLIGHT 9**

ASP.Net- IIS - ASP.Net Page Life Cycle – ASP Vs ASP.Net - HTML Controls Vs Server side Controls – Validation Controls – Data binding in ASP.Net – Caching – Configuration in ASP.Net (web.config) – Session management – View State in ASP.Net – ASP.Net. Introduction - RIA – Silverlight – XAML – App.Xaml – XAP – How Silverlight application executes in a web browser

**TOTAL : 45 PERIODS****COURSE OUTCOMES:**

- Knows how to design and implement Internet systems for enhancing education and engineering design,
- Able to understand functionality of Internet system
- Able to design a system according to customer needs using the available Internet technologies
- Able to Design and develop interactive, client-side, server-side executable web applications.
- Explore the features of various platforms and frameworks used in web applications development

## REFERENCES:

1. James Holmes "Struts: The Complete Reference, " 2nd Edition 2007 McGraw Hill Professional
2. Patrick Peak And Nick Heudecker, Patrick Peak, Nick Heudecker Hibernate Quickly, " 2007 Dreamtech
3. Subrahmanyam Allamaraju and Cedric Buest , "Professional Java Server Programming(J2EE 1.3 Edition), ", Shroff Publishers & Distributors Pvt Ltd
4. Jesse Liberty , 'Programming C#, " , 4th Edition, O'Reilly Media
5. Mario Szpuszta, Matthew MacDonald , "Pro ASP.NET 4 in C# 2010: Includes Silverlight 2, "Apress, Third Edition
6. Jason Beres, Bill Evjen, Devin Rader , 'Professional Silverlight 4 Print", December 2012 www.free-ebooks-library.com
7. James Lee, Brent Ware , "Open Source Development with LAMP: Using Linux, Apache, MySQL, Perl, and PHP" Addison Wesley, Pearson 2009
8. Vern Ceder , "The Quick Python Book," Second Edition, Manning Publications Company, 2010

**MC7502**

**SERVICE ORIENTED ARCHITECTURE**

**L T P C**  
**3 0 0 3**

## COURSE OBJECTIVES:

- To provide fundamental concepts of Service Oriented Architecture..
- To gain knowledge about SOAP, UDDI and XML to create web services.
- To know about the Cloud Computing architecture and services.

### UNIT I SOA BASICS

**9**

Roots of SOA – Characteristics of SOA - Comparing SOA to client-server and distributed internet architectures – Anatomy of SOA- How components in an SOA interrelate - Principles of service orientation – Service Layers.

### UNIT II XML AND WEB SERVICES

**9**

XML structure – Elements – Creating Well-formed XML - Name Spaces – Schema Elements, Types, Attributes – XSL Transformations – Parser – Web Services Overview – Architecture.

### UNIT III WSDL, SOAP and UDDI

**9**

WSDL - Overview Of SOAP – HTTP – XML-RPC – SOAP: Protocol – Message Structure – Intermediaries – Actors – Design Patterns And Faults – SOAP With Attachments – UDDI.

### UNIT IV SOA in J2EE and .NET

**9**

SOA platform basics – SOA support in J2EE – Java API for XML-based web services (JAX-WS) - Java architecture for XML binding (JAXB) – Java API for XML Registries (JAXR) - Java API for XML based RPC (JAX-RPC) – JAX-RS SOA support in .NET – ASP.NET web services.

### UNIT V CLOUD COMPUTING

**9**

Vision of Cloud computing – Cloud Definition – Characteristics and Benefits – Virtualization – Cloud computing Architecture – Cloud Reference Model, Types of Clouds – Cloud Platforms in Industry.

**TOTAL : 45 PERIODS**

## COURSE OUTCOMES:

- Known about the basic principles of service oriented architecture , its components and techniques
- Understand the architecture of web services
- Able to design and develop web services using protocol
- Understand technology underlying the service design
- Acquire the fundamental knowledge of cloud computing

## REFERENCES:

1. Thomas Erl, "Service-Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2006.
2. Heather Williamson, "XML, The Complete Reference", McGraw Hill Education, 2012.
3. Frank. P. Coyle, "XML, Web Services And The Data Revolution", Pearson Education, 2002.
4. Sandeep Chatterjee, James Webber, "Developing Enterprise Web Services. An Architect's Guide", Pearson Education, 2005.
5. Newcomer, Lomow, "Understanding SOA with Web Services", Pearson Education, 2005.
6. Dan woods and Thomas Mattern, "Enterprise SOA designing IT for Business Innovation", O'REILLY, First Edition, 2006.
7. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education, 2013.

MC7503

MOBILE COMPUTING

L T P C  
3 0 0 3

## COURSE OBJECTIVES:

- To learn the basic concepts, aware of the GSM, SMS, GPRS Architecture.
- To have an exposure about wireless protocols -WLN, Bluetooth, WAP, ZigBee **issues**.
- To Know the Network, Transport Functionalities of Mobile communication
- To understand the concepts of Adhoc and wireless sensor networks.
- To impart knowledge about Mobile Application Development

### UNIT I WIRELESS COMMUNICATION FUNDAMENTALS, ARCHITECTURE 9

Frequencies Spectrum- Multiplexing- Spread spectrum-GSM vs CDMA - 2G Mobile Wireless Services -Comparison of 2G and 3 G - GSM Architecture-Entities-Call Routing-PLMN-Address and identifiers-Network Aspects-Mobility Management-Frequency Allocation-Authentication and Security-SMS Architecture-Value Added Service through SMS-GPRS-GPRS and Packet Data Network-Architecture-Network Operations-Data Service-Application .

### UNIT II MOBILE WIRELESS SHORT RANGE NETWORKS 9

Introduction-WLAN Equipment-WLAN Topologies-WLAN Technologies-IEEE 802.11 Architecture-WLAN MAC-Security of WLAN, Power Management-Standards- WAP Architecture-WAP 2.0-Bluetooth enabled Devices Network-Layers in Bluetooth Protocol-Security in Bluetooth- IrDA- ZigBee

### UNIT III MOBILE IP NETWORK LAYER, TRANSPORT LAYER 9

IP and Mobile IP Network Layer- Packet delivery and Handover Management-Location Management-Registration- Tunneling and Encapsulation-Route Optimization- Dynamic Host Configuration Protocol-VoIP -IPsec -Mobile Transport Layer-Conventional TCP/IP Transport Layer Protocol-Indirect, Snooping, Mobile TCP

#### **UNIT IV MOBILE AD-HOC, SENSOR NETWORKS**

**9**

Introduction to Mobile Ad hoc Network- MANET-Routing and Routing Algorithm-Security – Wireless Sensor Networks-Applications- Distributed Network and Characteristics-Communication Coverage-Sensing Coverage-Localization- Routing -Function Computation- Scheduling

#### **UNIT V MOBILE APPLICATION DEVELOPMENT**

**9**

Mobile Applications Development -Application Development Overflow-Techniques for Composing Applications - Understanding the Android Software Stack – Android Application Architecture – Developing for Android – The Android Application Life Cycle – The Activity Life Cycle – Creating Your First Android Activity – Creating Applications and Activities – Creating User Interfaces – Intents – Broadcast Receivers – Adapters – Data Storage, Retrieval, and Sharing.-Geo services- creating mobile applications like game, Clock, calendar, Convertor, phone book, Text Editor

**TOTAL: 45 PERIODS**

#### **COURSE OUTCOMES:**

- Gain the knowledge about various types of Wireless Data Networks and Wireless Voice Networks.
- understand the architectures, the challenges and the Solutions of Wireless Communication those are in use.
- realize the role of Wireless Protocols in shaping the future Internet.
- know about different types of Wireless Communication Networks and their functionalities.
- Able to develop simple Mobile Application Using Android

#### **REFERENCES**

1. Asoke K Talukder, Hasan Ahmed,Roopa R Yavagal “Mobile Computing”, Tata McGraw Hill Pub ,Aug – 2010
2. Raj Kamal “Mobile Computing” Oxford Higher Education, Second Edition, 2012
3. Pei Zheng, Larry L. Peterson, Bruce S. Davie, Adrian Farrell “Wireless Networking Complete” Morgan Kaufmann Series in Networking , 2009( introduction, WLAN MAC)
4. Vijay K Garg “Wireless Communications & Networking” Morgan Kaufmann Series, 2010
5. Jochen Schillar “Mobile Communications” Pearson Education second Edition
6. Donn Felker ,’Android Application Development For Dummies, Wiley, 2010
7. Reto Meier,Professional Android 2 Application Development, Wrox’s Programmer to Programmer series
8. Ed Burnette,’Hello, Android: Introducing Google’s Mobile Development Platform’ third edition’ Pragmatic Programmers,2012
9. Jerome(J.F) DiMarzio “Android A programmer’s Guide” Tata McGraw-Hill 2010 Edition

**MC7511**

**ADVANCED INTERNET PROGRAMMING LABORATORY**

**L T P C**  
**0 0 3 2**

1. Develop a car showroom inventory web application with 2-tier architecture. Use JSP and JDBC
2. Develop a real estate web application with n-tier architecture. Use JSP, Servlets and JDBC. The application should be able to add and search all properties such as rental/own, individual/apartment and duplex/semi-duplex
3. Develop any web application which authenticates using LDAP
4. Develop a standalone java application or a web application to add, modify and delete the LDAP attributes of the given input
5. Design a student identity management web application using struts framework. The application should be able to provide an identity such as student id, access to department assets with department id, access to lab assets with lab id.
6. Create an online bookstore that includes all validation controls available in ASP.NET
7. Create a component that receives two numbers from the user through a Web Form, and based on the user's selection add or subtract the two numbers and returns the result to the Web Form. The result should be displayed in the Web Form using ASP.NET
8. Create a Silverlight Application for the SharePoint Client Object Model
9. Create a graph using the SharePoint Object Model and Silverlight Graphing controls

**TOTAL : 45 PERIODS**

**MC7512**

**XML AND WEB SERVICES LABORATORY**

**L T P C**  
**0 0 3 2**

1. XML document creation.
2. Importing and Exporting XML document in database.
3. XSL Transformation
4. Internal and External DTD creation
5. XML Schema creation
6. Parsing XML document using DOM/SAX parser.
7. Web Service creation using JAX-WS
8. Web Service creation using JAX-RS
9. Web Service creation using .NET
10. JAXB Marshaling and Unmarshaling

A possible set of applications may be the following:

- a. Currency Conversion
- b. Temperature Conversion
- c. Ticket Booking
- d. Dictionary

**TOTAL: 45 PERIODS**

**MC7513**

**MINI PROJECT (SOCIALY RELEVANT)**

**L T P C**  
**0 0 3 2**

- Team Project with a maximum of four in a team
- Students shall select a domain and develop an application with social relevance
- Documentation is to be based on the standards
- Evaluation pattern is like Lab examination
- Need to submit a report, presentation with demo.
- User Based Testing and feedback from the benefited society required

**TOTAL: 45 PERIODS.**

**MC7001**

**GAME PROGRAMMING**

**L T P C**  
**3 0 0 3**

**COURSE OBJECTIVES:**

- To understand of game design and development
- To understand the processes, mechanics, issues in game design, game engine development
- To understand modeling, techniques, handling situations, and logic.

**UNIT I 3D GRAPHICS FOR GAME PROGRAMMING**

**9**

Coordinate Systems, Ray Tracing, Modeling in Game Production, Vertex Processing, Rasterization, Fragment Processing and Output Merging, Illumination and Shaders, Parametric Curves and Surfaces, Shader Models, Image Texturing, Bump Mapping, Advanced Texturing, Character Animation, Physics-based Simulation

**UNIT II GAME DESIGN PRINCIPLES**

**9**

Character development, Story Telling, Narration, Game Balancing, Core mechanics, Principles of level design, Genres of Games, Collision Detection, Game Logic, Game AI, Path Finding

**UNIT III GAMING ENGINE DESIGN**

**9**

Renderers, Software Rendering, Hardware Rendering, and Controller based animation, Spatial Sorting, Level of detail, collision detection, standard objects, and physics

**UNIT IV GAMING PLATFORMS AND FRAMEWORKS**

**9**

Flash, DirectX, OpenGL, Java, Python, XNA with Visual Studio, Mobile Gaming for the Android, iOS, Game engines - Adventure Game Studio, DXStudio, Unity

**UNIT V GAME DEVELOPMENT**

**9**

Developing 2D and 3D interactive games using OpenGL, DirectX – Isometric and Tile Based Games, Puzzle games, Single Player games, Multi Player games.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

- Able to understand and apply 3 D concepts in Game programming.
- Gain knowledge about principles and levels of design in various game development
- Gain knowledge about gaming engine design for controlling
- Explore into various platforms and frameworks available for game development
- Able to design and develop interactive games

## REFERENCE BOOKS:

1. David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics" Morgan Kaufmann, 2 Edition, 2006.
2. JungHyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC, 1st edition, 2011.
3. Mike McShaffrly, "Game Coding Complete", Third Edition, Charles River Media, 2009.
4. Jonathan S. Harbour, "Beginning Game Programming", Course Technology PTR, 3 edition, 2009.
5. Ernest Adams and Andrew Rollings, "Fundamentals of Game Design", Prentice Hall 1st edition, 2006.
6. Roger E. Pedersen, "Game Design Foundations", Edition 2, Jones & Bartlett Learning, 2009.
7. Scott Rogers, "Level Up!: The Guide to Great Video Game Design", Wiley, 1<sup>st</sup> edition, 2010.
8. Jason Gregory, "Game Engine Architecture", A K Peters, 2009.
9. Jeannie Novak, "Game Development Essentials", 3rd Edition, Delmar Cengage Learning, 2011.
10. Andy Harris, "Beginning Flash Game Programming For Dummies", For Dummies; Updated edition, 2005.
11. John Hattan, "Beginning Game Programming: A GameDev.net Collection", Course Technology PTR, 1 edition, 2009.
12. 8. Eric Lengyel, "Mathematics for 3D Game Programming and Computer Graphics", Third Edition, Course Technology PTR, 3rd edition, 2011.
13. Dino Dini, "Essential 3D Game Programming", Morgan Kaufmann, 1st edition 2012.
14. Jim Thompson, Barnaby Berbank-Green, and Nic Cusworth, "Game Design: Principles, Practice, and Techniques - The Ultimate Guide for the Aspiring Game Designer", 1st edition, Wiley, 2007.

MC7002

SOFT COMPUTING

L T P C  
3 0 0 3

## COURSE OBJECTIVES

- To learn the key aspects of Soft computing
- To know about the components and building block hypothesis of Genetic algorithm.
- To understand the features of neural network and its applications
- To study the fuzzy logic components
- To gain insight onto Neuro Fuzzy modeling and control.
- To gain knowledge in machine learning through Support vector machines.

## UNIT I INTRODUCTION TO SOFT COMPUTING

9

Evolution of Computing - Soft Computing Constituents – From Conventional AI to Computational Intelligence - Machine Learning Basics

## UNIT II GENETIC ALGORITHMS

9

Introduction, Building block hypothesis, working principle, Basic operators and Terminologies like individual, gene, encoding, fitness function and reproduction, Genetic modeling: Significance of Genetic operators, Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, GA optimization problems, JSPP (Job Shop Scheduling Problem), TSP (Travelling Salesman Problem), Differences & similarities between GA & other traditional methods, Applications of GA.

**UNIT III NEURAL NETWORKS 9**

Machine Learning using Neural Network, Adaptive Networks – Feed Forward Networks – Supervised Learning Neural Networks – Radial Basis Function Networks - Reinforcement Learning – Unsupervised Learning Neural Networks – Adaptive Resonance Architectures – Advances in Neural Networks.

**UNIT IV FUZZY LOGIC 9**

Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions-Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making

**UNIT V NEURO-FUZZY MODELING 9**

Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rule base Structure Identification – Neuro-Fuzzy Control – Case Studies.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

- Implement machine learning through neural networks.
- Gain Knowledge to develop Genetic Algorithm and Support vector machine based machine learning system
- Write Genetic Algorithm to solve the optimization problem
- Understand fuzzy concepts and develop a Fuzzy expert system to derive decisions.
- Able to Model Neuro Fuzzy system for data clustering and classification.

**REFERENCES:**

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2003
2. Kwang H.Lee, "First course on Fuzzy Theory and Applications", Springer-Verlag Berlin Heidelberg, 2005.
3. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 1995.
4. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Edn., 2003.
5. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, 2007.
6. Mitsuo Gen and Runwei Cheng,"Genetic Algorithms and Engineering Optimization", Wiley Publishers 2000.
7. Mitchell Melanie, "An Introduction to Genetic Algorithm", Prentice Hall, 1998.
8. S.N.Sivanandam, S.N.Deepa, "Introduction to Genetic Algorithms", Springer, 2007.
9. A.E. Eiben and J.E. Smith "Introduction to Evolutionary Computing" Springer, 2003
10. E. Sanchez, T. Shibata, and L. A. Zadeh, Eds., "Genetic Algorithms and Fuzzy Logic Systems: Soft Computing Perspectives, Advances in Fuzzy Systems - Applications and Theory", Vol. 7, River Edge, World Scientific, 1997.
11. ROSS TIMOTHY J, Fuzzy Logic with Engineering Applications, Wiley India Pvt Ltd, New Delhi, 2010

**COURSE OBJECTIVES**

- To understand the basic principles of Double entry system and preparation of balance sheet.
- To understand the process of estimating the cost of a particular product.
- To Prepare the estimate for various business activities such as purchase, sale, production and cash budgets
- To ensure decision making process of an organization.
- 

**UNIT I FINANCIAL ACCOUNTING****9**

Meaning and Scope of Accounting-Principles-Concepts-Conventions-Accounting Standards-Final Accounts-Trial Balance-Trading Account-Profit and Loss Account-Balance Sheet-Accounting Ratio Analysis-Funds Flow Analysis-Cash Flow Analysis

**UNIT II ACCOUNTING****9**

Meaning-Objectives-Elements of Cost-Cost Sheet-Marginal Costing and Cost Volume Profit Analysis-Break Even Analysis-Applications-Limitations-Standard Costing and Variance Analysis-Material-Labor-Overhead-Sales-Profit Variances

**UNIT III BUDGETS AND BUDGETING CONTROL****9**

Budgets and Budgetary Control-Meaning-Types-Sales Budget-Production Budget-Cost of Production Budget-Flexible Budgeting-Cash Budget-Master Budget-Zero Base Budgeting-Computerized Accounting

**UNIT IV INVESTMENT DECISION AND COST OF CAPITAL****9**

Objectives and Functions of Financial Management-Risk-Return Relationship-Time Value of Money Concepts-Capital Budgeting-Methods of Appraisal-Cost of Capital Factors Affecting Cost of Capital-Computation for Each Source of Finance and Weighted Average Cost of Capital

**UNIT V FINANCING DECISION AND WORKING CAPITAL MANAGEMENT****9**

Capital Structure-Factors Affecting Capital Structure-Dividend Policy-Types of Dividend Policy-Concepts of Working Capital-Working Capital Policies-Factors affecting Working Capital-Estimation of Working Capital Requirements

**COURSE OUTCOMES**

- Able to understand the balance sheet preparation and do analysis
- Able to understand the budget preparation and control of a company
- Helps to decide about the state of affairs of a particular firm / company.
- Ensures the preparation of fiscal policies of the organization.
- Ensures the factors to be considered in investment policies.

**REFERENCES:**

1. S.N.Maheswari, "Financial and Management Accounting", Sultan Chand & Sons, 5 edition, 2010
2. I.M.Pandey, "Financial Management", Vikas Publishing House Pvt. Ltd., 9<sup>th</sup> Edition, 2009.
3. M.Y.Khan and P.K.Jain, "Financial Management, Text, Problems and Cases", Tata McGraw Hill, 5<sup>th</sup> Edition, 2008.
4. Aswat Damodaran, "Corporate Finance Theory and Practice", John Wiley & Sons, 2008.
5. I.M.Pandey, "Management Accounting", Vikas Publishing House Pvt. Ltd., 3<sup>rd</sup> Edition, 2009
6. Brigham, Ehrhardt, "Financial Management Theory and Practice" 11<sup>th</sup> Edition, Cengage Learning, 2008
7. Srivatsava, Mishra, "Financial Management", Oxford University

**COURSE OBJECTIVES:**

- To examines the design of power efficient architecture, power and performance tradeoffs, restructuring of software and applications and standards for energy aware Hardware and Software.
- To know the fundamental principles energy efficient devices
- To study the concepts of Energy efficient storage
- To introduce energy efficient algorithms
- Enable the students to know energy efficient techniques involved to support real-time systems.
- To study Energy aware applications.

**UNIT I INTRODUCTION****9**

Energy efficient network on chip architecture for multi core system-Energy efficient MIPS CPU core with fine grained run time power gating – Low power design of Emerging memory technologies.

**UNIT II ENERGY EFFICIENT STORAGE****9**

Disk Energy Management-Power efficient strategies for storage system-Dynamic thermal management for high performance storage systems-Energy saving technique for Disk storage systems

**UNIT III ENERGY EFFICIENT ALGORITHMS****9**

Scheduling of Parallel Tasks – Task level Dynamic voltage scaling – Speed Scaling – Processor optimization- Memetic Algorithms – Online job scheduling Algorithms.

**UNIT IV REAL TIME SYSTEMS****9**

Multi processor system – Real Time tasks- Energy Minimization – Energy aware scheduling- Dynamic Reconfiguration- Adaptive power management-Energy Harvesting Embedded system..

**UNIT V ENERGY AWARE APPLICATIONS****9**

On chip network – Video codec Design – Surveillance camera- Low power mobile storage.

**TOTAL: 45 PERIODS****COURSE OUTCOMES:**

- To Design Power efficient architecture Hardware and Software.
- To analyze power and performance trade off between various energy aware storage devices.
- To implement various energy aware algorithms.
- To restructure the software and Hardware for Energy aware applications.
- To know the Energy aware applications

**REFERENCE BOOKS:**

1. Handbook of Energy Aware and Green computing, Ishfaq Ah mad, Sanjay Ranka, Chapman and Hall/CRC ,2012
2. Energy Aware system design Algorithms and Architecture, Chong-Min Kyung, Sungioo yoo, Springer,2011.
3. Energy Aware computing, Bob steiger wald ,Chris:Luero,Intel Press,2012.



4. Michael Howard, David LeBlanc, John Viega, "24 Deadly Sins of Software Security: Programming Flaws and How to Fix Them", First Edition, Mc GrawHill Osborne Media, 2009.
5. Matt Bishop, "Computer Security: Art and Science", First Edition, Addison-Wesley, 2002.
6. Wesley, 2002.
7. [https://www.owasp.org/index.php/Top\\_10\\_2010](https://www.owasp.org/index.php/Top_10_2010)
8. [https://www.pcisecuritystandards.org/security\\_standards/pci\\_dss.shtml](https://www.pcisecuritystandards.org/security_standards/pci_dss.shtml)
9. <http://cwe.mitre.org/top25/index.html>
10. Justin Clarke "SQL injection Attacks and defense" Elsevier ,2012

**MA7071**

**NUMERICAL AND STATISTICAL METHODS**

**L T P C**  
**3 0 0 3**

**COURSE OBJECTIVES:**

- To understand and apply numerical methods for solving systems of linear equations
- To understand and apply numerical integration and differentiation
- To solving initial value problems of ordinary differential equations numerically
- To provide an understanding of the statistical methods and probabilistic concepts by which real-life problems are analyzed  
(Focus on problems- No derivations)

**UNIT I LINEAR SYSTEM OF EQUATIONS 9**

Solution of Systems of equations – Solution of Simultaneous linear equations – Gauss elimination methods – Gauss Jordan methods, Jacobi and Gauss Seidal iterative methods

**UNIT II NUMERICAL DIFFERENTIATION AND INTEGRATION 9**

Interpolation, Differentiation and integration – difference table – Newton’s forward and backward interpolation –Lagrangian interpolation –Differentiation formulae– Trapezoidal and Simpson rule Gaussian – Quadrature

**UNIT III DIFFERENTIAL EQUATIONS 9**

Ordinary Differential equations–Taylor Series and Euler methods, Runge– Kutta methods – Predictor-corrector method – Milne and Adam – Bashforth methods – Error Analysis

**UNIT IV PROBABILITY DISTRIBUTIONS 9**

Probability axioms- Bayes Theorem- One dimensional Discrete random variables and Continuous random variables – Density and Distribution functions – Binomial and normal distribution

**UNIT V SAMPLING DISTRIBUTIONS 9**

Small sample, t-test, F-test,  $\chi^2$ -test, ANOVA one way classification and two way classification

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

- Develop a good understanding of the various methods used for the numerical solution of scientific problems
- Able to solve system of linear equations and initial value problems of ordinary differential equations numerically
- Help to understand the value of probability and Statistics in acquiring knowledge and making decisions
- Develop an ability to apply statistical tests in experiments, as well as to analyze and interpret data

**REFERENCES:**

1. Baghel Singh Grewal, "Numerical Methods in Engineering and Science, Khanna Publisher 2011
2. John.E..Freund, Irwin Miller, Marylees Miller "Mathematical Statistics with Applications ", Seventh Edition, Prentice Hall of India, 2011.
3. T.Veerarajan , "Probability, statistics and random process" third edition Tata Mcgrawhill publications,2009
4. Steven C. Chapra, Raymond P. Canale, " Numerical methods for Engineers", McGraw-Hill Higher Education, 01-Aug-2010
5. A.M.Natarajan & A.Tamilarasi, "Probability Random Processes and Queuing theory", New Age International Publishers, 2<sup>nd</sup> Edition, 2005.
6. C. Woodford, "*Numerical Methods with Worked Examples: Matlab Edition* Springer,2012.

**MC7006****M - COMMERCE****L T P C  
3 0 0 3****COURSE OBJECTIVES:**

- Ñ To understand the E – commerce strategies and value chains
- Ñ To understand the M-commerce services
- Ñ To understand M – commerce infrastructure and applications.
- Ñ To know the availability of latest technology and applications of M- commerce in various domains.
- Ñ To apply mobile commerce in business-to-business application.

**UNIT I ELECTRONIC COMMERCE****9**

Introduction -The e-commerce environment - The e-commerce marketplace -Focus on portals, Location of trading in the marketplace - Commercial arrangement for transactions - Focus on auctions - Business models for e-commerce - Revenue models - Focus on internet start-up companies - the dot-com - E-commerce versus E-business.

**UNIT II MOBILE COMMERCE****9**

Introduction – Infrastructure Of M– Commerce – Types Of Mobile Commerce Services – Technologies Of Wireless Business – Benefits And Limitations, Support, Mobile Marketing & Advertisement, Non– Internet Applications In M– Commerce – Wireless/Wired Commerce Comparisons

**UNIT III MOBILE COMMERCE: TECHNOLOGY****9**

A Framework For The Study Of Mobile Commerce – NTT Docomo's I– Mode – Wireless Devices For Mobile Commerce – Towards A Classification Framework For Mobile Location Based Services – Wireless Personal And Local Area Networks –The Impact Of Technology Advances On Strategy Formulation In Mobile Communications Networks

**UNIT IV MOBILE COMMERCE: THEORY AND APPLICATIONS****9**

The Ecology Of Mobile Commerce – The Wireless Application Protocol – Mobile Business Services – Mobile Portal – Factors Influencing The Adoption Of Mobile Gaming Services – Mobile Data Technologies And Small Business Adoption And Diffusion – M–Commerce In The Automotive Industry – Location– Based Services: Criteria For Adoption And Solution Deployment – The Role Of Mobile Advertising In Building A Brand – M– Commerce Business Models

**UNIT V BUSINESS– TO– BUSINESS MOBILE E-COMMERCE****9**

Enterprise Enablement – Email And Messaging – Field Force Automation (Insurance,Real Estate, Maintenance, Healthcare) – Field Sales Support (Content Access, Inventory) – Asset Tracking And Maintenance/Management – Remote IT Support –Customer Retention (B2C Services, Financial, Special Deals) – Warehouse Automation – Security.

**TOTAL : 45 PERIODS**

**COURSE OUTCOMES:**

- Ñ Able to apply E – commerce principles in market place.
- Ñ Able to apply M – commerce principles to various business domains
- Ñ Understand the theory and applications of M-commerce in business domain
- Ñ Get an exposure to current technological advancements in M-commerce.
- Ñ Able to build M – commerce business models.

**REFERENCE BOOKS:**

1. Dave Chaffey, “E-Business and E-Commerce Management”, Third Edition, 2009, Pearson Education
2. Brian E. Mennecke, Troy J. Strader, “Mobile Commerce: Technology, Theory and Applications”, Idea Group Inc., IGI Global, 2003.
3. P. J. Louis, “ M-Commerce Crash Course”, McGraw- Hill Companies February 2001.
4. Paul May, “Mobile Commerce: Opportunities, Applications, and Technologies of Wireless Business” Cambridge University Press March 2001.
5. Michael P. Papazoglou, Peter M.A. Ribbers, ‘e-business organizational and Technical foundation’, Wiley India 2009
6. Dr.Pandey , Saurabh Shukla E-commerce and Mobile commerce Technologies , Sultan chand ,2011

**MC7007****HEALTH CARE MANAGEMENT****L T P C****3 0 0 3****COURSE OBJECTIVES:**

- To understand the basic concepts of health care system.
- To know about creating and maintaining health care information systems
- To ensure access of clinical information system on the fly
- To understand IT governance and assessment of health care information system

**UNIT I INTRODUCTION****9**

Introduction to health care information – Health care data quality – Health care information regulations, laws and standards.

**UNIT II HEALTH CARE INFORMATION SYSTEMS****9**

History and evolution of health care information systems – Current and emerging use of clinical information systems – system acquisition – System implementation and support.

**UNIT III INFORMATION TECHNOLOGY****9**

Information architecture and technologies that support health care information systems – Health care information system standards – Security of health care information systems.

**UNIT IV MANAGEMENT OF IT CHALLENGES****9**

Organizing information technology services – IT alignment and strategic planning – IT governance and management.

**UNIT V IT INITIATIVES****9**

Management’s role in major IT initiatives – Assessing and achieving value in health care information systems. Case study

**TOTAL : 45 PERIODS**

## **COURSE OUTCOMES:**

- Develop an understanding of basic research skills applicable to the design, evaluation and implementation of appropriate Healthcare Information Systems (HIS) ;
- Define and analyse the impact, strengths and weaknesses of various HIS in any healthcare settings
- Write reports on the roles of HIS and their impact on facilitating superior healthcare delivery
- Design a suitable HIS architecture
- Use research methods and analysis together to plan the successful implementation of an appropriate HIS solution

## **REFERENCE BOOKS:**

1. Karen A Wager, Frances Wickham Lee, John P Glaser, “ Managing Health Care Information Systems: A Practical Approach for Health Care Executives”, John Wiley, 2<sup>nd</sup> edition 2009.
2. Marion J. Ball, Charlotte Weaver, Joan Kiel ,”Healthcare Information Management Systems: Cases, Strategies, and Solutions”, Springer, 2010, 3<sup>rd</sup> edition
3. Rudi Van De Velde and Patrice Degoulet, “Clinical Information Systems: A Component based approach”, Springer 2005.
4. Kevin Beaver,Healthcare Information Systems, Second edition Best Practices, CRC Press, 2002
5. Marion J. BallHealthcare Information Management Systems: A Practical Guide Springer-Verlag GmbH, 1995

**MC7008**

**GEOLOGICAL INFORMATION SYSTEMS**

**L T P C**  
**3 0 0 3**

## **COURSE OBJECTIVES:**

- Understand the basic concepts of Geological information systems.
- To provide an exposure to spatial database structures and their utility in GIS.
- Understand the process of scanning, digitizing and georeferencing.
- To introduce the raster and vector geoprocessing capabilities of GIS.

### **UNIT I SPATIAL DATA REPRESENTATION**

**9**

GIS – Definition and related terminology- Components of GIS: Data,Technology,Application– digital representation of geospatial data – raster – vector – object oriented – geo database model-analysis .

### **UNIT II DATA DIGITIZATION AND PREPARATION**

**9**

Characteristics of raster data processing—raster File format-Acquiring and handling raster Data – Georeferencing-Preprocessing-mosaicking– Linking digital databases: ODBC – GPS data integration Characteristics of Vector Geoprocessing -Vector Data Input – Digitizer: Principles, Co-ordinate transformation – Graphical data editing – Scanner: Principles, On Screen Digitization-post scanning-importing- data editing

### **UNIT III RASTER DATA ANALYSIS**

**9**

Raster Geospatial Data Analysis-Local operations: Reclassification, Logical and Arithmetic overlay operations – Neighbourhood operations: Aggregation, Filtering, Slope and Aspect map – Extended neighbourhood operations: - Statistical Analysis, Proximity, Connectivity operations, Buffering, Viewshed analysis – Regional operations: Area, Perimeter, Shape, Identification of region and Classification-output functions of Raster geoprocessing

**UNIT IV VECTOR DATA PROCESSING****9**

Non-topological analysis: Attribute database query, SQL, Summary statistics-statistical computation-calculation-quantification- Address geocoding, -Topological analysis Feature based topological functions-overlay-buffering- Layer based topological function-Reclassification, Aggregation, Overlay analysis- Point-in-polygon, Line-in-polygon, Polygon-on-polygon: Clip, Erase, Identity, Union, Intersection – Network based Geoprocessing –Output functions

**UNIT V GIS MODELLING AND APPLICATIONS****9**

Spatial modelling – External, Conceptual, Logical, Internal –GIS Modeling with case study- spatial data mining-DEM- introduction and applications

**COURSE OUTCOMES:**

- Understand GIS concepts and spatial data representation
- Able to design spatial data input in raster form as well as vector form
- Understand vector data analysis and output functions
- Understand raster data geo processing
- Able to design a GIS model for real world problem

**REFERENCES:**

1. Lo, C.P. and Yeung, Albert K.W., Concepts and Techniques of Geographic Information Systems, Prentice Hall, 2/E,2009.
2. Peter A. Burrough, Rachael A. McDonnell, Principles of GIS, Oxford University Press, 2000
3. Kang-Tsung Chang ,Introduction to Geographic Information Systems, McGraw-Hill Higher Education, 2006
4. Robert Laurini and Derek Thompson, Fundamentals of Spatial Information Systems, Academic Press, 1996
5. Paul A. Longley, Mike Goodchild, David J. Maguire, Geographic Information Systems and Science, John Wiley & Sons Inc ,2011.

**MC7009****HUMAN RESOURCE MANAGEMENT****L T P C  
3 0 0 3****COURSE OBJECTIVES:**

- To understand the importance of human resources.
- To describe the steps involved in the human resource planning process
- To understand the stages of employee socialization and training needs.
- To know about the purposes of performance management systems and appraisal.
- To know the list of occupational safety and health administration enforcement priorities.

**UNIT I FUNDAMENTALS OF HRM****9**

Introduction- importance of HRM – functions- qualities of HR manager – evolution and growth of HRM – trends and opportunities - HRM in global environment – legal and ethical context – laws for discriminatory practices – equal opportunity employment.

**UNIT II STAFFING, RECRUITMENT AND SELECTION****9**

HR polices - need, type and scope – human resource planning – job analysis – recruiting goals – recruiting sources – global perspective – selection process – pre-employment testing – interviews – job offers – hiring mistakes - key element for successful predictors.

**UNIT III TRAINING AND DEVELOPMENT 9**  
Socialization – new employee orientation, training, development – organizational development – methods – evaluating training – international training and development issues – career development - value for organization and individual – mentoring and coaching – traditional career stages

**UNIT IV PERFORMANCE EVALUATION, REWARDS AND BENEFITS 9**  
Appraisal process – methods – factors distort appraisal – team appraisal – international appraisal – rewards – Theories of motivation - compensation administration – job evaluation and pay structure – special cases of compensation – executive compensation programs – employee benefits.

**UNIT V SAFE AND HEALTHY WORK ENVIRONMENT 9**  
Occupational safety and health act - issues – stress – assistance program – labor management - employee unions – labor legislation. Promotion, demotion, transfer and separation – employee grievances - redressal methods.

**TOTAL: 45 PERIODS**

### **OUTCOMES**

- Identify the primary external influences affecting HRM.
- Outline the components and the goals of staffing, training and development.
- Understand the selection procedure in various organizations.
- Understand the practices used to retain the employees and able to evaluate their performance.
- Able to identify the stress and the cause of burn out.

### **REFERENCES:**

1. Decenzo and Robbins, Human Resource Management, Wilsey, 10th edition, 2012.
2. Mamoria C.B. and Mamoria. S., Personnel Management, Himalaya Publishing Company, 1997.
3. Mirza S. Saiyadain Human Resource Management , Tata McGraw Hill , 4<sup>th</sup> edition 2009
4. Eugence Mckenna and Nic Beach Human Resource Management, , Pearson Education Limited, 2002.
5. Dessler, Human Resource Management, Pearson Education Limited, 2002.
6. Decenzo and Robbins, Human Resource Management, Wilsey, 6<sup>th</sup> edition, 2001.
7. Wayne Cascio, Managing Human Resource, McGraw Hill, 1998.
8. Ivancevich, Human Resource Management, McGraw Hill 2002.
9. Biswajeet Pattanayak, Human Resource Management, Prentice Hall of India, 3<sup>rd</sup> edition 2005.

**MC7010**

**ENTERPRISE APPLICATION INTEGRATION**

**L T P C  
3 0 0 3**

### **COURSE OBJECTIVES:**

- Describe approaches to enterprise application integration
- Understand the integration middleware
- Evaluate the integration approaches suitable for a given problem

**UNIT I INTRODUCTION 6**  
Requirements for EAI - Challenges in EAI – Integration with legacy systems – Integration with partners - Heterogeneous environment – Implementation approaches – Web services, messaging, ETL, direct data integration – Middleware requirements – Approaches to integration – services oriented and messaging.

**UNIT II INTEGRATION PATTERNS****6**

Introduction to integration patterns – Architecture for application integration – Integration patterns – Point to point, broker, message bus, publish/subscribe, Challenges in performance, security, reliability - Case studies

**UNIT III SERVICE ORIENTED INTEGRATION****12**

Business process integration - Composite applications-services – Web services – Service choreography and orchestration - Business process modeling - BPMN, Business process execution - BPEL – Middleware infrastructure - Case studies

**UNIT IV MESSAGING BASED INTEGRATION****9**

Messaging – Synchronous and asynchronous – Message structure – Message oriented middleware – Reliability mechanisms – Challenges – Messaging infrastructure – Java Messaging Services – Case studies

**UNIT V ENTERPRISE SERVICE BUS****12**

Enterprise Service Bus – routing, scalable connectivity, protocol and message transformations, data enrichment, distribution, correlation, monitoring – Deployment configurations – Global ESB, Directly connected, Federated, brokered ESBs – Application server based – Messaging system based – Hardware based ESBs – Support to SOA, message based and event based integrations - Case studies.

**TOTAL: 45 PERIODS****COURSE OUTCOMES:**

Upon Completion of the course, the students will be able to

- Describe different approaches to integration enterprise applications
- Analyze specifications and identify appropriate integration approaches
- Develop a suitable integration design for a given problem
- Identify appropriate integration middleware for a given problem
- Evaluate the integration approaches against specified requirements

**REFERENCES**

1. George Mentzas and Andreas Frezen (Eds), "Semantic Enterprise Application Integration for Business Processes: Service-oriented Frameworks", Business Science Reference, 2009
2. Waseem Roshen, "SOA Based Enterprise Integration", Tata McGrawHill, 2009.
3. G Hohpe and B Woolf, "Enterprise Integration Patterns: Designing, Building, and Deploying Messaging Solutions", Addison-Wesley Professional, 2003
4. D Linthicum, "Next Generation Application Integration: From Simple Information to Web Services", Addison-Wesley, 2003
5. Martin Fowler, "Patterns of Enterprise Application Architecture", Addison-Wesley, 2003
6. Kapil Pant and Matiaz Juric, "Business Process Driven SOA using BPMN and BPEL: From Business Process Modeling to Orchestration and Service Oriented Architecture", Packt Publishing, 2008

**COURSE OBJECTIVES:**

- To explore the fundamental concepts of big data analytics
- To learn to analyze the big data using intelligent techniques.
- To understand the various search methods and visualization techniques.
- To learn to use various techniques for mining data stream.
- To understand the applications using Map Reduce Concepts.

**UNIT I INTRODUCTION TO BIG DATA****8**

Introduction to BigData Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.

**UNIT II MINING DATA STREAMS****9**

Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

**UNIT III HADOOP****10**

History of Hadoop- The Hadoop Distributed File System – Components of Hadoop- Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS-Basics-Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features

**UNIT IV HADOOP ENVIRONMENT****9**

Setting up a Hadoop Cluster - Cluster specification - Cluster Setup and Installation - Hadoop Configuration-Security in Hadoop - Administering Hadoop – HDFS - Monitoring-Maintenance-Hadoop benchmarks- Hadoop in the cloud

**UNIT V FRAMEWORKS****9**

Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM InfoSphere BigInsights and Streams. Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications

**TOTAL : 45 PERIODS****COURSE OUTCOMES:**

The students will be able to:

- Work with big data platform
- Analyze the big data analytic techniques for useful business applications.
- Design efficient algorithms for mining the data from large volumes.
- Analyze the HADOOP and Map Reduce technologies associated with big data analytics
- Explore on Big Data applications Using Pig and Hive
- Understand the fundamentals of various bigdata analysiss techniques

## REFERENCES

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Tom White "Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.
3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012
4. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
5. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.
6. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007
7. Pete Warden, "Big Data Glossary", O'Reilly, 2011.
8. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.
9. Da Ruan, Guoqing Chen, Etienne E. Kerre, Geert Wets, Intelligent Data Mining, Springer, 2007
10. Paul Zikopoulos, Dirk deRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan, Harness the Power of Big Data The IBM Big Data Platform, Tata McGraw Hill Publications, 2012
11. Michael Minelli (Author), Michele Chambers (Author), Ambiga Dhiraj (Author), Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley Publications, 2013
12. Zikopoulos, Paul, Chris Eaton, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, Tata McGraw Hill Publications, 2011

MC7012

AD-HOC AND SENSOR NETWORKS

L T P C  
3 0 0 3

### COURSE OBJECTIVES:

- To understand the basics of Ad-hoc & Sensor Networks
- To learn various fundamental and emerging protocols of all layers in ad-hoc network
- To study about the issues pertaining to major obstacles in establishment and efficient management of ad-hoc and sensor networks
- To understand the nature and applications of ad-hoc and sensor networks
- To understand various security practices and protocols of Ad-hoc and Sensor Networks

### UNIT I ADHOC NETWORKS FUNDAMENTALS AND MAC PROTOCOLS 9

Fundamentals Of WLans – IEEE 802.11 Architecture - Self Configuration And Auto Configuration - Issues In Ad-Hoc Wireless Networks – MAC Protocols For Ad-Hoc Wireless Networks – Contention Based Protocols - TCP Over Ad-Hoc Networks-TCP Protocol Overview - TCP And MANETs – Solutions For TCP Over Ad-Hoc Networks

### UNIT II ADHOC NETWORK ROUTING AND MANAGEMENT 9

Routing in Ad-Hoc Networks- Introduction -Topology based versus Position based Approaches - Proactive, Reactive, Hybrid Routing Approach - Principles and issues – Location services - DREAM – Quorums based Location Service – Grid – Forwarding Strategies – Greedy Packet Forwarding – Restricted Directional Flooding- Hierarchical Routing- Other Routing Protocols.



**COURSE OBJECTIVES:**

- To understand the need of semantic web in web services
- To know the methods to discover, classify and build ontology for more reasonable results in searching
- To build and implement a small ontology that is semantically descriptive of chosen problem domain
- To implement applications that can access, use and manipulate the ontology

**UNIT I INTRODUCTION****9**

Introduction to the Syntactic web and Semantic Web – Evolution of the Web – The visual and syntactic web – Levels of Semantics – Metadata for web information - The semantic web architecture and technologies –Contrasting Semantic with Conventional Technologies –Semantic Modeling - Potential of semantic web solutions and challenges of adoption

**UNIT II ONTOLOGICAL ENGINEERING****9**

Ontologies – Taxonomies –Topic Maps – Classifying Ontologies – Terminological aspects: concepts, terms, relations between them – Complex Objects –Subclasses and Sub-properties definitions – Upper Ontologies – Quality – Uses - Types of terminological resources for ontology building – Methods and methodologies for building ontologies – Multilingual Ontologies -Ontology Development process and Life cycle – Methods for Ontology Learning – Ontology Evolution – Versioning

**UNIT III STRUCTURING AND DESCRIBING WEB RESOURCES****9**

Structured Web Documents - XML – Structuring – Namespaces – Addressing – Querying – Processing - RDF – RDF Data Model – Serialization Formats- RDF Vocabulary –Inferencing - RDFS – basic Idea – Classes – Properties- Utility Properties – RDFS Modeling for Combinations and Patterns- Transitivity

**UNIT IV WEB ONTOLOGY LANGUAGE****9**

OWL – Sub-Languages – Basic Notions -Classes- Defining and Using Properties – Domain and Range – Describing Properties - Data Types – Counting and Sets- Negative Property Assertions – Advanced Class Description – Equivalence – Owl Logic.

**UNIT V SEMANTIC WEB TOOLS AND APPLICATIONS****9**

Development Tools for Semantic Web – Jena Framework – SPARL –Querying semantic web - Semantic Wikis - Semantic Web Services – Modeling and aggregating social network data - Ontological representation of social relationships, Aggregating and reasoning with social network data

**TOTAL: 45 PERIODS****COURSE OUTCOMES:**

- Understand semantic web basics, architecture and technologies
- Able to represent data from a chosen problem in XML with appropriate semantic tags obtained or derived from the ontology
- Able to understand the semantic relationships among these data elements using Resource Description Framework (RDF)
- Able to design and implement a web services application that “discovers” the data and/or other web services via the semantic web
- Able to discover the capabilities and limitations of semantic web technology for social networks

## REFERENCES:

1. Liyang Yu, "A Developer's Guide to the Semantic Web", Springer, First Edition, 2011
2. John Hebel, Matthew Fisher, Ryan Blace and Andrew Perez-Lopez, "Semantic Web Programming", Wiley, First Edition, 2009.
3. Grigoris Antoniou, Frank van Harmelen, "A Semantic Web Primer", Second Edition (Cooperative Information Systems) (Hardcover), MIT Press, 2008
4. Robert M. Colomb, "Ontology and the Semantic Web", Volume 156 Frontiers in Artificial Intelligence and Applications (Frontier in Artificial Intelligence and Applications), IOS Press, 2007.
5. Dean Allemang and James Hendler, "Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL, Morgan Kaufmann", Second Edition, 2011.
6. Michael C. Daconta, Leo J. Obrst and Kevin T. Smith, "The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management", Wiley, First Edition 2003
7. Karin Breitman, Marco Antonio Casanova and Walt Truszkowski, "Semantic Web: Concepts, Technologies and Applications (NASA Monographs in Systems and Software Engineering)", Springer, Softcover, 2010.
8. Vipul Kashyap, Christoph Bussler and Matthew Moran, "The Semantic Web: Semantics for Data and Services on the Web (Data-Centric Systems and Applications), Springer, 2008.
9. Peter Mika, "Social networks and the Semantic Web", Springer, 1st edition 2007.

**MC7014**

**SOFTWARE TESTING AND QUALITY ASSURANCE**

**L T P C**  
**3 0 0 3**

## COURSE OBJECTIVES:

- To know the behavior of the testing techniques to detect the errors in the software
- To understand standard principles to check the occurrence of defects and its removal.
- To learn the functionality of automated testing tools
- To understand the models of software reliability.

### **UNIT I TESTING ENVIRONMENT AND TEST PROCESSES**

**9**

World-Class Software Testing Model – Building a Software Testing Environment - Overview of Software Testing Process – Organizing for Testing – Developing the Test Plan – Verification Testing – Analyzing and Reporting Test Results – Acceptance Testing – Operational Testing – Post Implementation Analysis

### **UNIT II TESTING TECHNIQUES AND LEVELS OF TESTING**

**9**

Using White Box Approach to Test design - Static Testing Vs. Structural Testing – Code Functional Testing – Coverage and Control Flow Graphs –Using Black Box Approaches to Test Case Design – Random Testing – Requirements based testing –Decision tables –State-based testing – Cause-effect graphing – Error guessing – Compatibility testing – Levels of Testing - Unit Testing - Integration Testing - Defect Bash Elimination. System Testing - Usability and Accessibility Testing – Configuration Testing - Compatibility Testing - Case study for White box testing and Black box testing techniques.

### **UNIT III INCORPORATING SPECIALIZED TESTING RESPONSIBILITIES**

**9**

Testing Client/Server Systems – Rapid Application Development Testing – Testing in a Multiplatform Environment – Testing Software System Security - Testing Object-Oriented Software – Object Oriented Testing – Testing Web based systems – Web based system – Web Technology Evolution – Traditional Software and Web based Software – Challenges in Testing for Web-based Software – Testing a Data Warehouse - Case Study for Web Application Testing.

#### **UNIT IV TEST AUTOMATION**

**9**

Selecting and Installing Software Testing Tools - Software Test Automation – Skills needed for Automation – Scope of Automation – Design and Architecture for Automation – Requirements for a Test Tool – Challenges in Automation – Tracking the Bug – Debugging – Case study using Bug Tracking Tool.

#### **UNIT V SOFTWARE TESTING AND QUALITY METRICS**

**9**

Testing Software System Security - Six-Sigma – TQM - Complexity Metrics and Models – Quality Management Metrics - Availability Metrics - Defect Removal Effectiveness - FMEA - Quality Function Deployment – Taguchi Quality Loss Function – Cost of Quality. Case Study for Complexity and Object Oriented Metrics.

#### **COURSE OUTCOMES:**

- Test the software by applying testing techniques to deliver a product free from bugs
- Evaluate the web applications using bug tracking tools.
- Investigate the scenario and the able to select the proper testing technique
- Explore the test automation concepts and tools
- Deliver quality product to the clients by way of applying standards such as TQM, Six Sigma
- Evaluate the estimation of cost, schedule based on standard metrics

#### **REFERENCES:**

1. William Perry, “Effective Methods of Software Testing”, Third Edition, Wiley Publishing 2007
2. Srinivasan Desikan and Gopalswamy Ramesh, “Software Testing – Principles and Practices”, Pearson Education, 2007.
3. Naresh Chauhan , “Software Testing Principles and Practices ” Oxford University Press , New Delhi , 2010.
4. Dale H. Besterfiled et al., “Total Quality Management”, Pearson Education Asia, Third Edition, Indian Reprint (2006).
5. Stephen Kan, “Metrics and Models in Software Quality”, Addison – Wesley, Second Edition, 2004.
6. Llene Burnstein, “ Practical Software Testing”, Springer International Edition, Chennai, 2003
7. Renu Rajani, Pradeep Oak, “Software Testing – Effective Methods, Tools and Techniques”, Tata McGraw Hill, 2004.
8. Edward Kit, “ Software Testing in the Real World – Improving the Process”, Pearson Education, 1995.
9. Boris Beizer, “ Software Testing Techniques” – 2<sup>nd</sup> Edition, Van Nostrand Reinhold, New York, 1990
10. Adithya P. Mathur, “ Foundations of Software Testing – Fundamentals algorithms and techniques”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.

**MC7015**

**SOFTWARE PROJECT MANAGEMENT**

**L T P C**  
**3 0 0 3**

#### **COURSE OBJECTIVES:**

- To know of how to do project planning for the software process.
- To learn the cost estimation techniques during the analysis of the project.
- To understand the quality concepts for ensuring the functionality of the software

<b>UNIT I</b>	<b>SOFTWARE PROJECT MANAGEMENT CONCEPTS</b>	<b>9</b>
Introduction to Software Project Management: An Overview of Project Planning: Select Project, Identifying Project scope and objectives, infrastructure, project products and Characteristics. Estimate efforts, Identify activity risks, and Allocate resources.		
<b>UNIT II</b>	<b>SOFTWARE EVALUATION AND COSTING</b>	<b>9</b>
Project Evaluation: Strategic Assessment, Technical Assessment, cost-benefit analysis, Cash flow forecasting, cost-benefit evaluation techniques, Risk Evaluation. Selection of Appropriate Project approach: Choosing technologies, choice of process models, Structured methods.		
<b>UNIT III</b>	<b>SOFTWARE ESTIMATION TECHNIQUES</b>	<b>9</b>
Software Effort Estimation: Problems with over and under estimations, Basis of software Estimation, Software estimation techniques, expert Judgment, Estimating by analogy. Activity Planning: Project schedules, projects and activities, sequencing and scheduling Activities, networks planning models, formulating a network model.		
<b>UNIT IV</b>	<b>RISK MANAGEMENT</b>	<b>9</b>
Risk Management: Nature of Risk, Managing Risk, Risk Identification and Analysis, Reducing the Risk. Resource Allocation: Scheduling resources, Critical Paths, Cost scheduling, Monitoring and Control: Creating Framework, cost monitoring, prioritizing monitoring.		
<b>UNIT V</b>	<b>SOFTWARE QUALITY MANAGEMENT</b>	<b>9</b>
TQM, Six Sigma, Software Quality: defining software quality, ISO9126, External Standards, Comparison of project management software's: dot Project, Launch pad, openProj. Case study: PRINCE2		

**TOTAL ; 45 PERIODS**

**COURSE OUTCOMES:**

- Understand the activities during the project scheduling of any software application.
- Learn the risk management activities and the resource allocation for the projects.
- Can apply the software estimation and recent quality standards for evaluation of the software projects
- Acquire knowledge and skills needed for the construction of highly reliable software project
- Able to create reliable, replicable cost estimation that links to the requirements of project planning and managing

**REFERENCES:**

1. Bob Hughes & Mike Cotterell, "Software Project Management", Tata McGraw- Hill Publications, Fifth Edition 2012.
2. S. A. Kelkar, "Software Project Management" PHI, New Delhi, Third Edition ,2013.
3. Richard H.Thayer "Software Engineering Project Management,": IEEE Computer Society
4. Futrell , "Quality Software Project Management", Pearson Education India, 2008
5. [http://en.wikipedia.org/wiki/Comparison\\_of\\_project\\_management\\_software](http://en.wikipedia.org/wiki/Comparison_of_project_management_software)
6. [http://www.ogc.gov.uk/methods\\_prince\\_2.asp](http://www.ogc.gov.uk/methods_prince_2.asp)

**COURSE OBJECTIVES:**

- To introduce the broad perceptives of cloud architecture and model
- To understand the concept of Virtualization and design of cloud Services
- To be familiar with the lead players in cloud.
- To understand the features of cloud simulator
- To apply different cloud programming model as per need.
- To learn to design the trusted cloud Computing system

**UNIT I CLOUD ARCHITECTURE AND MODEL 9**

Technologies for Network-Based System – System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture.

Cloud Models:- Characteristics – Cloud Services – Cloud models (IaaS, PaaS, SaaS) – Public vs Private Cloud – Cloud Solutions - Cloud ecosystem – Service management – Computing on demand.

**UNIT II VIRTUALIZATION 9**

Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Virtual Clusters and Resource management – Virtualization for Data-center Automation.

**UNIT III CLOUD INFRASTRUCTURE 9**

Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.

**UNIT IV PROGRAMMING MODEL 9**

Parallel and Distributed Programming Paradigms – MapReduce , Twister and Iterative MapReduce – Hadoop Library from Apache – Mapping Applications - Programming Support - Google App Engine, Amazon AWS - Cloud Software Environments -Eucalyptus, Open Nebula, OpenStack, Aneka, CloudSim

**UNIT V SECURITY IN THE CLOUD 9**

Security Overview – Cloud Security Challenges and Risks – Software-as-a-Service Security – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security - Identity Management and Access Control – Autonomic Security.

**TOTAL:45 PERIODS****COURSE OUTCOMES:**

- Compare the strengths and limitations of cloud computing
- Identify the architecture, infrastructure and delivery models of cloud computing
- Apply suitable virtualization concept.
- Choose the appropriate cloud player , Programming Models and approach.
- Address the core issues of cloud computing such as security, privacy and interoperability
- Design Cloud Services and Set a private cloud

## REFERENCES:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH, 2009.
4. Kumar Saurabh, "Cloud Computing – insights into New-Era Infrastructure", Wiley India,2011.
5. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly
6. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
7. Katarina Stanoevska-Slabeva, Thomas Wozniak, Santi Ristol, "Grid and Cloud Computing – A Business Perspective on Technology and Applications", Springer.
8. Ronald L. Krutz, Russell Dean Vines, "Cloud Security – A comprehensive Guide to Secure Cloud Computing", Wiley – India, 2010.
9. Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi, 'Mastering Cloud Computing', TMGH,2013.
10. Gautam Shroff,Enterprise Cloud Computing,Cambridge University Press,2011
11. Michael Miller, Cloud Computing,Que Publishing,2008
12. Nick Antonopoulos, Cloud computing,Springer Publications,2010

**MC7017**

**NETWORK PROTOCOLS**

**L T P C**  
**3 0 0 3**

## OBJECTIVES:

- To understand the existing network architecture models and analyze the their performance
- To understand the high speed network protocols and design issues.
- To learn Network Security Technologies and Protocols
- To study various protocols in wireless LAN, MAN.

## **UNIT I FUNDAMENTALS OF NETWORKING STANDARDS AND PROTOCOLS**

**9**

Network Communication Architecture and Protocols - OSI Network Architecture seven Layers Model - Definition and Overview of TCP/IP Protocols -TCP/IP Four Layers Architecture Model - Other Network Architecture Models: IBM SNA.

## **UNIT II ROUTED AND ROUTING PROTOCOLS**

**9**

Application Layer Protocols-Presentation Layer Protocols- Session Layer Protocols - Transport Layer Protocols - Network Layer Protocols - Data Link Layer Protocols - Routing Protocols - Multicasting Protocols - MPLS.

## **UNIT III ISDN AND NETWORK MANAGEMENT PROTOCOLS**

**9**

Overview of ISDN – Channels – User access – Protocols Network management requirements – Network monitoring – Network control – SNMP V<sub>1</sub>, V<sub>2</sub> and V<sub>3</sub> – Concepts, MIBs – Implementation issues-RMON.

**UNIT IV SECURITY AND TELEPHONY PROTOCOLS****9**

Network Security Technologies and Protocols - AAA Protocols - Tunneling Protocols - Security Protocols- Private key encryption – Data encryption system, public key encryption – RSA – Elliptic curve cryptography – Authentication mechanisms– Web security -Secured Routing Protocols - IP telephony -Voice over IP and VOIP Protocols –Signaling Protocols- Media/CODEC.

**UNIT V NETWORK ENVIRONMENTS AND PROTOCOLS****9**

Wide Area Network and WAN Protocols - Frame relay - ATM - Broadband Access Protocols -PPP Protocols - Local Area Network and LAN Protocols - Ethernet Protocols - Virtual LAN Protocols - Wireless LAN Protocols - Metropolitan Area Network and MAN Protocol - Storage Area Network and SAN Protocols.

**TOTAL:45 PERIODS****OUTCOME:**

- Ability to study, analyze and design seven layers of protocols of wired and wireless networks.

**REFERENCES:**

1. Javvin, “Network Protocols” , Javvin Technologies Inc , second edition, 2005
2. William Stallings, “Cryptography and Network Security”, PHI, 2000.
3. Mani Subramanian, “Network Management–Principles and Practices”, Addison Wesley, 2000.
4. William Stallings, “SNMP, SNMPV2, SNMPV3 and RMON1 and 2”, 3rd Edition, Addison Wesley, 1999.
5. William Stallings, “Data and Computer Communications” 5th Edition, PHI, 1997.

**ANNA UNIVERSITY, CHENNAI**  
**AFFILIATED INSTITUTIONS**  
**REGULATIONS 2013**  
**M.E. AERONAUTICAL ENGINEERING**  
**I TO IV SEMESTERS (FULL TIME) CURRICULUM AND SYLLABUS**

**SEMESTER I**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MA7170	Advanced Mathematical Methods	3	1	0	4
2.	AO7101	Aerodynamics	3	1	0	4
3.	AO7102	Aircraft Structural Mechanics	3	1	0	4
4.	AO7103	Aerospace Propulsion	3	1	0	4
5.	AO7104	Theory of Vibrations	3	0	0	3
6.		Elective I	3	0	0	3
<b>PRACTICAL</b>						
7.	AO7111	Aerodynamics Laboratory	0	0	4	2
<b>TOTAL</b>			<b>18</b>	<b>4</b>	<b>4</b>	<b>24</b>

**SEMESTER II**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	AO7201	Flight Mechanics	3	1	0	4
2.	AO7202	Finite Element Methods	3	1	0	4
3.	AO7203	Computational Fluid Dynamics in Aerospace Engineering	3	1	0	4
4.	AO7204	Composite Materials and Structures	3	0	0	3
5.		Elective II	3	0	0	3
6.		Elective III	3	0	0	3
<b>PRACTICAL</b>						
7.	AO7211	Structures Laboratory	0	0	4	2
<b>TOTAL</b>			<b>18</b>	<b>3</b>	<b>4</b>	<b>23</b>

**SEMESTER III**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.		Elective IV	3	0	0	3
2.		Elective V	3	0	0	3
<b>PRACTICAL</b>						
4.	AO7311	Project Work (Phase I)	0	0	12	6
<b>TOTAL</b>			<b>6</b>	<b>0</b>	<b>12</b>	<b>12</b>

**SEMESTER IV**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
<b>PRACTICAL</b>						
1.	AO7411	Project Work (Phase II)	0	0	24	12
<b>TOTAL</b>			<b>0</b>	<b>0</b>	<b>24</b>	<b>12</b>

**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 71**

**LIST OF ELECTIVES FOR M.E. AERONAUTICAL ENGINEERING****SEMESTER I (Elective I)**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	AO7001	Boundary Layer Theory	3	0	0	3
2	AO7002	Aircraft Design	3	0	0	3
3	AO7003	Industrial Aerodynamics	3	0	0	3
4	AO7004	Helicopter Aerodynamics	3	0	0	3
5	AO7005	Structural Dynamics	3	0	0	3
6	AO7006	Aero Elasticity	3	0	0	3

**SEMESTER II (Elective II & III)**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	AO7007	Theory of Plates and Shells	3	0	0	3
2	AO7008	High Temperature Problems in Structures	3	0	0	3
3	AO7009	Fatigue and Fracture Mechanics	3	0	0	3
4	AO7010	Theory of Elasticity	3	0	0	3
5	AO7011	Hypersonic Aerodynamics	3	0	0	3
6	AO7012	High Temperature Gas Dynamics	3	0	0	3
7	AO7013	Wind Power Engineering	3	0	0	3

**SEMESTER III (Elective IV & V)**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	AO7014	Experimental Stress Analysis	3	0	0	3
2	AO7015	Computational Heat Transfer	3	0	0	3
3	AO7016	Advanced Propulsion Systems	3	0	0	3
4	AO7017	Experimental Aerodynamics	3	0	0	3
5	AO7018	Rocketry and Space Mechanics	3	0	0	3
6	AO7019	High Speed Jet Flows	3	0	0	3
7	AO7020	Combustion in Jet and Rocket Engines	3	0	0	3
8	AO7021	Propeller Aerodynamics	3	0	0	3
9	AO7022	Aerospace Guidance and Control	3	0	0	3

**OBJECTIVES:**

- To familiarize the students in differential equations for solving boundary value problems associated with engineering applications.
- To expose the students to calculus of variation, conformal mappings and tensor analysis.

**OUTCOME:**

- This subject helps to develop the mathematical methods of applied mathematics and mathematical physics with an emphasis on calculus of variation and integral transforms.

**UNIT I LAPLACE TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS****(9+3)**

Laplace transform: Definitions, properties -Transform of error function, Bessel's function, Dirac Delta function, Unit Step functions – Convolution theorem – Inverse Laplace Transform: Complex inversion formula – Solutions to partial differential equations: Heat equation, Wave equation.

**UNIT II FOURIER TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS****(9+3)**

Fourier transform: Definitions, properties -Transform of elementary functions, Dirac Delta function – Convolution theorem – Parseval's identity– Solutions to partial differential equations: Heat equation, Wave equation, Laplace and Poisson's equations.

**UNIT III CALCULUS OF VARIATIONS****(9+3)**

Concept of variation and its properties – Euler's equation – Functional dependant on first and higher order derivatives – Functionals dependant on functions of several independent variables – Variational problems with moving boundaries – problems with constraints - Direct methods: Ritz and Kantorovich methods.

**UNIT IV CONFORMAL MAPPING AND APPLICATIONS****(9+3)**

Introduction to conformal mappings and bilinear transformations - Schwarz- Christoffel transformation – Transformation of boundaries in parametric form – Physical applications: Fluid flow and heat flow problems.

**UNIT V TENSOR ANALYSIS****(9+3)**

Summation convention – Contravariant and covariant vectors – contraction of tensors – innerproduct – quotient law – metric tensor – Christoffel symbols – covariant differentiation – gradient, divergence and curl.

**TOTAL: 60 PERIODS****BOOKS FOR STUDY:**

1. Sankara Rao K., "Introduction to Partial Differential Equations", Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
2. Gupta A.S., "Calculus of Variations with Applications", Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
3. Spiegel M.R., "Theory and Problems of Complex Variables and its Application" (Schaum's Outline Series), McGraw Hill Book Co., Singapore, 1981.
4. Ramanaiah, G.T., "Tensor Analysis", S. Viswanathan Pvt. Ltd., 1990.
5. James G., "Advanced Modern Engineering Mathematics", Pearson Education, Third Edition, 2004.
6. O'Neil P.V., "Advanced Engineering Mathematics", Thomson Asia Pvt. Ltd., Singapore, 2003.

**REFERENCES:**

1. Andrew L.C. and Shivamoggi B.K., "Integral Transforms for Engineers", Prentice Hall of India Pvt. Ltd., New Delhi, 2003.
2. Elsgolts L., "Differential Equations and the Calculus of Variations", MIR Publishers, Moscow, 1973.
3. Mathews J.H. and Howell R.W., "Complex Analysis for Mathematics and Engineering", Narosa Publishing House, New Delhi, 1997.
4. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, Fortieth Edition, 2007

**AO7101**

**AERODYNAMICS**

**L T P C**

**3 1 0 4**

**OUTCOME:**

Upon completion of the course, students will understand the behaviour of airflow over bodies with particular emphasis on airfoil sections in the incompressible flow regime.

**UNIT I INTRODUCTION TO AERODYNAMICS 15**

Hot air balloon and aircrafts, Various types of airplanes, Wings and airfoils, lift and Drag, Centre of pressure and aerodynamic centre, Coefficient of pressure, moment coefficient, Continuity and Momentum equations, Point source and sink, doublet, Free and Forced Vortex, Uniform parallel flow, combination of basic flows, Pressure and Velocity distributions on bodies with and without circulation in ideal and real fluid flows, Magnus effect

**UNIT II INCOMPRESSIBLE FLOW THEORY 12**

Conformal Transformation, Kutta condition, Karman – Trefftz profiles, Thin aerofoil Theory and its applications. Vortex line, Horse shoe vortex, Biot - Savart law, lifting line theory

**UNIT III COMPRESSIBLE FLOW THEORY 13**

Compressibility, Isentropic flow through nozzles, shocks and expansion waves, Rayleigh and Fanno Flow, Potential equation for compressible flow, small perturbation theory, Prandtl- Glauert Rule, Linearised supersonic flow, Method of characteristics

**UNIT IV AIRFOILS, WINGS AND AIRPLANE CONFIGURATION IN HIGH SPEED FLOWS 8**

Critical Mach number, Drag divergence Mach number, Shock stall, super critical airfoils, Transonic area rule, Swept wings (ASW and FSW), supersonic airfoils, wave drag, delta wings, Design considerations for supersonic airplanes

**UNIT V VISCOUS FLOW AND FLOW MEASUREMENTS 12**

Basics of viscous flow theory – Boundary Layer – Displacement, momentum and Energy Thickness – Laminar and Turbulent boundary layers – Boundary layer over flat plate – Blasius Solution - Types of wind tunnels – Flow visualization techniques– Measurement of force and moments in wind tunnels.

**TOTAL : 60 PERIODS**

**REFERENCES**

1. J.D. Anderson, "Fundamentals of Aerodynamics", McGraw-Hill Book Co., New York, 1985.
2. Rathakrishnan.E., Gas Dynamics, Prentice Hall of India, 1995.
3. Shapiro, A.H., Dynamics & Thermodynamics of Compressible Fluid Flow, Ronald Press, 1982.
4. E.L. Houghton and N.B. Caruthers, Aerodynamics for Engineering Students, Edward Arnold Publishers Ltd., London (First Indian Edition), 1988
5. Zucrow, M.J., and Anderson, J.D., Elements of gas dynamics McGraw-Hill Book Co., New York, 1989.
6. W.H. Rae and A. Pope, "Low speed Wind Tunnel Testing", John Wiley Publications, 1984.

**AO7102**

**AIRCRAFT STRUCTURAL MECHANICS**

**L T P C**

**3 1 0 4**

**OUTCOME:**

Upon completion of the course, students will get knowledge on different types of beams and columns subjected to various types of loading and support conditions with particular emphasis on aircraft structural components.

<b>UNIT I</b>	<b>BENDING OF BEAMS</b>	<b>12</b>
Elementary theory of bending – Introduction to semi-monocoque structures - Stresses in beams of symmetrical and unsymmetrical sections -Box beams – General formula for bending stresses-principal axes method – Neutral axis method.		
<b>UNIT II</b>	<b>SHEAR FLOW IN OPEN SECTIONS</b>	<b>9</b>
Shear stresses in beams – Shear flow in stiffened panels - Shear flow in thin walled open tubes – Shear centre – Shear flow in open sections with stiffeners.		
<b>UNIT III</b>	<b>SHEAR FLOW IN CLOSED SECTIONS</b>	<b>15</b>
Shear flow in closed sections with stiffeners– Angle of twist - Shear flow in two flange and three flange box beams – Shear centre - Shear flow in thin walled closed tubes - Bredt-Batho theory - Torsional shear flow in multi cell tubes - Flexural shear flow in multi cell stiffened structures.		
<b>UNIT IV</b>	<b>STABILITY PROBLEMS</b>	<b>12</b>
Stability problems of thin walled structures– Buckling of sheets under compression, shear, bending and combined loads - Crippling stresses by Needham's and Gerard's methods–Sheet stiffener panels-Effective width, Inter rivet and sheet wrinkling failures-Tension field web beams(Wagner's).		
<b>UNIT V</b>	<b>ANALYSIS OF AIRCRAFT STRUCTURAL COMPONENTS</b>	<b>12</b>
Loads on Wings – Schrenk's curve - Shear force, bending moment and torque distribution along the span of the Wing. Loads on fuselage - Shear and bending moment distribution along the length of the fuselage. Analysis of rings and frames.		

**TOTAL: 60 PERIODS**

**REFERENCES**

1. E.F. Bruhn, "Analysis and Design of Flight Vehicle Structures", Tristate Offset Co., 1980.
2. Megson, T.M.G; Aircraft Structures for Engineering Students, Edward Arnold, 1995.
3. Peery, D.J. and Azar, J.J., Aircraft Structures, 2<sup>nd</sup> Edition, McGraw-Hill, New York, 1993.
4. Stephen P. Timoshenko & S.woinowsky Krieger, Theory of Plates and Shells, 2<sup>nd</sup> Edition, McGraw-Hill, Singapore, 1990.
5. Rivello, R.M., Theory and Analysis of Flight structures, McGraw-Hill, N.Y., 1993.

**AO7103**

**AEROSPACE PROPULSION**

**L T P C**  
**3 1 0 4**

**OUTCOME:**

Upon completion of the course, students will learn the principles of operation and design of aircraft and spacecraft power plants.

<b>UNIT I</b>	<b>ELEMENTS OF AIRCRAFT PROPULSION</b>	<b>12</b>
Classification of power plants - Methods of aircraft propulsion – Propulsive efficiency – Specific fuel consumption - Thrust and power- Factors affecting thrust and power- Illustration of working of Gas turbine engine - Characteristics of turboprop, turbofan and turbojet , Ram jet, Scram jet – Methods of Thrust augmentation.		
<b>UNIT II</b>	<b>PROPELLER THEORY</b>	<b>12</b>
Momentum theory, Blade element theory, combined blade element and momentum theory, propeller power losses, propeller performance parameters, prediction of static thrust- and in flight, negative thrust, prop fans, ducted propellers, propeller noise, propeller selection, propeller charts.		
<b>UNIT III</b>	<b>INLETS, NOZZLES AND COMBUSTION CHAMBERS</b>	<b>12</b>
Subsonic and supersonic inlets – Relation between minimum area ratio and external deceleration ratio – Starting problem in supersonic inlets –Modes of inlet operation, jet nozzle – Efficiencies – Over expanded, under and optimum expansion in nozzles – Thrust reversal. Classification of Combustion chambers - Combustion chamber performance – Flame tube cooling – Flame stabilization.		

**UNIT IV AXIAL FLOW COMPRESSORS, FANS AND TURBINES 12**  
 Introduction to centrifugal compressors- Axial flow compressor- geometry- twin spools- three spools- stage analysis- velocity polygons- degree of reaction – radial equilibrium theory- performance maps- axial flow turbines- geometry- velocity polygons- stage analysis- performance maps- thermal limit of blades and vanes.

**UNIT V ROCKET AND ELECTRIC PROPULSION 12**  
 Introduction to rocket propulsion – Reaction principle – Thrust equation – Classification of rockets based on propellants used – solid, liquid and hybrid – Comparison of these engines with special reference to rocket performance – electric propulsion – classification- electro thermal – electro static – electromagnetic thrusters- geometries of Ion thrusters- beam/plume characteristics – hall thrusters.

**TOTAL : 60 PERIODS**

**REFERENCES**

1. Hill,P.G. and Peterson, C.R. Mechanics and Thermodynamics of Propulsion, Addison – Wesley Longman Inc. 1999
2. Cohen, H. Rogers, G.F.C. and Saravanamuttoo,H.I.H, Gas Turbine Theory, Longman,1989
3. G.C. Oates, “Aerothermodynamics of Aircraft Engine Components”, AIAA Education Series, 1985.
4. G.P.Sutton, “Rocket Propulsion Elements”, John Wiley & Sons Inc., New York, 5<sup>th</sup> Edition, 1986.
5. W.P.Gill, H.J.Smith & J.E. Ziurys, “Fundamentals of Internal Combustion Engines as applied to Reciprocating, Gas turbine & Jet Propulsion Power Plants”, Oxford & IBH Publishing Co., 1980.

**AO7104 THEORY OF VIBRATIONS L T P C**  
**3 0 0 3**

**OUTCOME:**

Upon completion of the course, students will learn the dynamic behaviour of different aircraft components and the interaction among the aerodynamic, elastic and inertia forces

**UNIT I SINGLE DEGREE OF FREEDOM SYSTEMS 10**  
 Simple harmonic motion, definition of terminologies, Newton’s Laws, D’Alembert’s principle, Energy methods. Free and forced vibrations with and without damping, base excitation, and vibration measuring instruments.

**UNIT II MULTI-DEGREES OF FREEDOM SYSTEMS 12**  
 Two degrees of freedom systems, Static and dynamic couplings, eigen values, eigen vectors and orthogonality conditions of eigen vectors, Vibration absorber, Principal coordinates, Principal modes. Hamilton’s Principle, Lagrange’s equation and its applications.

**UNIT III VIBRATION OF ELASTIC BODIES 10**  
 Transverse vibrations of strings, Longitudinal, Lateral and Torsional vibrations. Approximate methods for calculating natural frequencies.

**UNIT IV EIGEN VALUE PROBLEMS & DYNAMIC RESPONSE OF LARGE SYSTEMS 8**  
 Eigen value extraction methods – Subspace hydration method, Lanczos method – Eigen value reduction method – Dynamic response of large systems – Implicit and explicit methods.

**UNIT V ELEMENTS OF AEROELASTICITY 5**  
 Aeroelastic problems – Collar’s triangle of forces – Wing divergence – Aileron control reversal – Flutter.

**TOTAL : 45 PERIODS**

**REFERENCES**

1. Timoshenko, S. “Vibration Problems in Engineering”, John Wiley & Sons, Inc., 1987.

2. Meirovitch, L. "Elements of Vibration Analysis", McGraw-Hill Inc., 1986.
3. Thomson W.T, Marie Dillon Dahleh, "Theory of Vibrations with Applications", Prentice Hall, 1997
4. F.S. Tse., I.F. Morse and R.T. Hinkle, "Mechanical Vibrations", Prentice-Hall of India, 1985.
5. Rao.J.S. and Gupta.K. "Theory and Practice of Mechanical Vibrations", Wiley Eastern Ltd., New Delhi, 1999.
6. Fung, Y.C., "An Introduction to the Theory of Aeroelasticity", John Wiley & Sons Inc., New York, 1985.

**A07111**

**AERODYNAMICS LABORATORY**

**L T P C**  
**0 0 4 2**

**OUTCOME:**

Upon completion of the course, students will be in a position to use wind tunnel for pressure and force measurements on various models.

**LIST OF EXPERIMENTS**

1. Calibration of subsonic wind tunnel
2. Pressure distribution over a smooth and rough cylinders
3. Pressure distribution over a symmetric aerofoil section
4. Pressure distribution over a cambered aerofoil section
5. Force and moment measurements using wind tunnel balance
6. Pressure distribution over a wing of symmetric aerofoil section
7. Pressure distribution over a wing of cambered aerofoil section
8. Flow visualization studies in incompressible flows
9. Calibration of supersonic wind tunnel
10. Supersonic flow visualization studies

**TOTAL NUMBER OF PERIODS: 60**

**LABORATORY EQUIPMENTS REQUIREMENTS**

1. Subsonic wind tunnel
2. Rough and smooth cylinder
3. Symmetrical Cambered aerofoil
4. Wind tunnel balance
5. Schlieren system
6. Pressure Transducers

**A07201**

**FLIGHT MECHANICS**

**L T P C**  
**3 1 0 4**

**OUTCOME:**

Upon completion of the course, students will understand the static, dynamic longitudinal, directional and lateral stability and control of airplane, effect of maneuvers.

**UNIT I PRINCIPLES OF FLIGHT**

**12**

Physical properties and structure of the atmosphere, International Standard Atmosphere, Temperature, pressure and altitude relationship, Measurement of speed – True, Indicated and Equivalent air speed, Streamlined and bluff bodies, Various Types of drag in airplanes, Drag polar, Methods of drag reduction of airplanes.

**UNIT II AIRCRAFT PERFORMANCE IN LEVEL, CLIMBING AND GLIDING FLIGHTS**

**11**

Straight and level flight, Thrust required and available, Power required and available, Effect of altitude on thrust and power, Conditions for minimum drag and minimum power required, Gliding and Climbing flight, Range and Endurance

**UNIT III ACCELERATED FLIGHT 10**  
 Take off and landing performance, Turning performance, horizontal and vertical turn, Pull up and pull down, maximum turn rate, V-n diagram with FAR regulations.

**UNIT IV LONGITUDINAL STABILITY AND CONTROL 15**  
 Degrees of freedom of a system, static and dynamic stability, static longitudinal stability, Contribution of individual components, neutral point, static margin, Hinge moment, Elevator control effectiveness, Power effects, elevator angle to trim, elevator angle per g, maneuver point, stick force gradient, aerodynamic balancing, Aircraft equations of motion, stability derivatives, stability quartic, Phugoid motion

**UNIT V LATERAL, DIRECTIONAL STABILITY AND CONTROL 12**  
 Yaw and side slip, Dihedral effect, contribution of various components, lateral control, aileron control power, strip theory, aileron reversal, weather cock stability, directional control, rudder requirements, dorsal fin, One engine inoperative condition, Dutch roll, spiral and directional divergence, autorotation and spin

**TOTAL: 60 PERIODS**

**REFERENCES**

1. Houghton, E.L., and Caruthers, N.B., Aerodynamics for engineering students, Edward Arnold Publishers, 1988.
2. Perkins C.D., & Hage, R.E. Airplane performance, stability and control, Wiley Toppan, 1974.
3. Kuethe, A.M., and Chow, C.Y., Foundations of Aerodynamics, John Wiley & Sons, 1982.
4. Clancey, L.J. Aerodynamics, Pitman, 1986.
5. Babister, A.W. Aircraft stability and response, Pergamon Press, 1980.
6. Nelson, R.C. Flight Stability & Automatic Control, McGraw-Hill, 1989.
7. McCormic, B.W., Aerodynamics, Aeronautics & Flight Mechanics John Wiley, 1995.

**A07202 FINITE ELEMENT METHODS L T P C**  
**3 1 0 4**

**OUTCOME:**

Upon completion of the course, students will learn the concept of numerical analysis of structural components

**UNIT I INTRODUCTION 12**  
 Review of various approximate methods – Rayleigh-Ritz, Galerkin and Finite Difference Methods - Stiffness and flexibility matrices for simple cases - Basic concepts of finite element method - Formulation of governing equations and convergence criteria.

**UNIT II DISCRETE ELEMENTS 14**  
 Structural analysis of bar and beam elements for static and dynamic loadings. Bar of varying section – Temperature effects  
 Program Development and use of software package for application of bar and beam elements for static, dynamic and stability analysis.

**UNIT III CONTINUUM ELEMENTS 14**  
 Plane stress, Plane strain and Axisymmetric problems – CST Element – LST Element. Consistent and lumped load vectors. Use of local co-ordinates. Numerical integration. Application to heat transfer problems.  
 Solution for 2-D problems (static analysis and heat transfer) using software packages.

**UNIT IV ISOPARAMETRIC ELEMENTS 12**  
 Definition and use of different forms of 2-D and 3-D elements. - Formulation of element stiffness matrix and load vector.  
 Solution for 2-D problems (static analysis and heat transfer) using software packages.

**UNIT V SOLUTION SCHEMES****8**

Different methods of solution of simultaneous equations governing static, dynamics and stability problems. General purpose Software packages.

**TOTAL: 60 PERIODS****REFERENCES**

1. Segerlind, L.J. "Applied Finite Element Analysis", Second Edition, John Wiley and Sons Inc., New York, 1984.
2. Tirupathi R. Chandrupatla and Ashok D. Belegundu, Introduction to Finite Elements in Engineering, Prentice Hall, 2002
3. S.S.Rao, "Finite Element Method in Engineering", Butterworth, Heinemann Publishing, 3<sup>rd</sup> Edition, 1998
4. Robert D. Cook, David S. Malkus, Michael E. Plesha and Robert J. Witt "Concepts and Applications of Finite Element Analysis", 4<sup>th</sup> Edition, John Wiley & Sons, 2002.
5. K.J. Bathe and E.L. Wilson, "Numerical Methods in Finite Elements Analysis", Prentice Hall of India Ltd., 1983.
6. C.S. Krishnamurthy, "Finite Elements Analysis", Tata McGraw-Hill, 1987.

**AO7203****COMPUTATIONAL FLUID DYNAMICS IN AEROSPACE ENGINEERING****L T P C  
3 1 0 4****OUTCOME:**

Upon completion of the course, students will learn the flow of dynamic fluids by computational methods.

**UNIT I NUMERICAL SOLUTIONS OF SOME FLUID DYNAMICAL PROBLEMS****15**

Basic fluid dynamics equations, Equations in general orthogonal coordinate system, Body fitted coordinate systems, Stability analysis of linear system. Finding solution of a simple gas dynamic problem, Local similar solutions of boundary layer equations, Numerical integration and shooting technique.

Numerical solution for CD nozzle isentropic flows and local similar solutions of boundary layer equations.

**UNIT II GRID GENERATION****15**

Need for grid generation – Various grid generation techniques – Algebraic, conformal and numerical grid generation – importance of grid control functions – boundary point control – orthogonality of grid lines at boundaries.

Elliptic grid generation using Laplace's equations for geometries like airfoil and CD nozzle.

**UNIT III TRANSONIC RELAXATION TECHNIQUES****15**

Small perturbation flows, Transonic small perturbation (TSP) equations, Central and backward difference schemes, conservation equations and shockpoint operator, Line relaxation techniques, Acceleration of convergence rate, Jameson's rotated difference scheme -stretching of coordinates, shock fitting techniques Flow in body fitted coordinate system.

Numerical solution of 1-D conduction- convection energy equation using time dependent methods using both implicit and explicit schemes – application of time split method for the above equation and comparison of the results.

**UNIT IV TIME DEPENDENT METHODS****15**

Stability of solution, Explicit methods, Time split methods, Approximate factorization scheme, Unsteady transonic flow around airfoils. Some time dependent solutions of gas dynamic problems. Numerical solution of unsteady 2-D heat conduction problems using SLOR methods

**UNIT V PANEL METHODS****15**

Elements of two and three dimensional panels, panel singularities. Application of panel methods to incompressible, compressible, subsonic and supersonic flows.



**OUTCOME:**

Upon completion of the course, students will acquire experimental knowledge on the unsymmetrical bending of beams, finding the location of shear centre, obtaining the stresses in circular discs and beams using photoelastic techniques, calibration of photo – elastic materials.

**LIST OF EXPERIMENTS**

1. Constant strength Beams
2. Buckling of columns
3. Unsymmetrical Bending of Beams
4. Shear Centre Location for Open Section
5. Shear Centre Location for Closed Section
6. Flexibility Matrix for Cantilever Beam
7. Combined Loading
8. Calibration of Photo Elastic Materials
9. Stresses in Circular Disc Under Diametrical Compression – Photo Elastic Method
10. Vibration of Beams with Different Support Conditions
11. Determination of elastic constants of a composite laminate.
12. Wagner beam

**NOTE:** Any TEN experiments will be conducted out of 12.

**TOTAL: 60 PERIODS**

**LABORATORY EQUIPMENTS REQUIREMENTS**

1. Constant strength beam setup
2. Column setup
3. Unsymmetrical Bending setup
4. Experimental setup for location of shear centre (open & close section)
5. Cantilever beam setup
6. Experimental setup for bending and torsional loads
7. Diffuser transmission type polariscope with accessories
8. Experimental setup for vibration of beams
9. Universal Testing Machine
10. Wagner beam setup

**OUTCOME:**

Upon completion of the course, students will acquire knowledge on viscous fluid flow, development of boundary layer for 2D flows.

**UNIT I VISCIOUS FLOW EQUATIONS****9**

Navier-Stokes Equations, Creeping motion, Couette flow, Poiseuille flow through ducts, Ekman drift.

**UNIT II LAMINAR BOUNDARY LAYER****9**

Development of boundary layer – Estimation of boundary layer thickness, Displacement thickness - Momentum and energy thicknesses for two dimensional flow – Two dimensional boundary layer equations – Similarity solutions - Blasius solution.

**UNIT III TURBULENT BOUNDARY LAYER****9**

Physical and mathematical description of turbulence, two-dimensional turbulent boundary layer equations, Velocity profiles – Inner, outer and overlap layers, Transition from laminar to turbulent boundary layers, turbulent boundary layer on a flat plate, mixing length hypothesis.

**UNIT IV      APPROXIMATE SOLUTION TO BOUNDARY LAYER EQUATIONS      9**

Approximate integral methods, digital computer solutions – Von Karman – Polhausen method.

**UNIT V      THERMAL BOUNDARY LAYER      9**

Introduction to thermal boundary layer – Heat transfer in boundary layer - Convective heat transfer, importance of non dimensional numbers – Prandtl number, Nusselt number, Lewis number etc.

**TOTAL: 45 PERIODS**

**REFERENCES**

1. H. Schlichting, "Boundary Layer Theory", McGraw-Hill, New York, 1979.
2. Frank White – Viscous Fluid flow – McGraw Hill, 1998
3. A. J. Reynolds, "Turbulent flows in Engineering", John Wiley & Sons, 1980.
4. Ronald L., Panton, "Incompressible fluid flow", John Wiley & Sons, 1984.
5. Tuncer Cebeci and Peter Bradshaw, "Momentum transfer in boundary layers", Hemisphere Publishing Corporation, 1977.

**A07002**

**AIRCRAFT DESIGN**

**L T P C  
3 0 0 3**

**OUTCOME:**

Upon completion of the course, students will get the basic concept of aircraft design.

**UNIT I      REVIEW OF DEVELOPMENTS IN AVIATION      9**

Categories and types of aircrafts – various configurations – Layouts and their relative merits – strength, stiffness, fail safe and fatigue requirements – Manoeuvring load factors – Gust and manoeuvrability envelopes – Balancing and maneuvering loads on tail planes.

**UNIT II      POWER PLANT TYPES AND CHARACTERISTICS      9**

Characteristics of different types of power plants – Propeller characteristics and selection – Relative merits of location of power plant.

**UNIT III      PRELIMINARY DESIGN      9**

Selection of geometric and aerodynamic parameters – Weight estimation and balance diagram – Drag estimation of complete aircraft – Level flight, climb, takeoff and landing calculations – range and endurance – static and dynamic stability estimates – control requirements.

**UNIT IV      SPECIAL PROBLEMS      9**

Layout peculiarities of subsonic and supersonic aircraft – optimization of wing loading to achieve desired performance – loads on undercarriages and design requirements.

**UNIT V      STRUCTURAL DESIGN      9**

Estimation of loads on complete aircraft and components – Structural design of fuselage, wings and undercarriages, controls, connections and joints. Materials for modern aircraft – Methods of analysis, testing and fabrication.

**PRACTICALS**

Conceptual design of an aircraft for given specifications.

**TOTAL: 45 PERIODS**

**REFERENCES**

1. D.P. Raymer, "Aircraft conceptual design", AIAA Series, 1988.
2. G. Corning, "Supersonic & Subsonic Airplane Design", II Edition, Edwards Brothers Inc., Michigan, 1953.
3. E.F. Bruhn, "Analysis and Design of Flight Vehicle Structures", Tristate Offset Co., U.S.A., 1980.
4. E. Torenbeek, "Synthesis of Subsonic Airplane Design", Delft University Press, London, 1976.



**UNIT III PERFORMANCE 9**  
Hover and vertical flight, forward level flight, Climb in forward flight, optimum speeds, Maximum level speed, rotor limits envelope – performance curves with effects of altitude

**UNIT IV STABILITY AND CONTROL 9**  
Helicopter Trim, Static stability – Incidence disturbance, forward speed disturbance, angular velocity disturbance, yawing disturbance, Dynamic Stability.

**UNIT V AERODYNAMIC DESIGN 8**  
Blade section design, Blade tip shapes, Drag estimation – Rear fuselage upsweep,

**TOTAL: 45 PERIODS**

**REFERENCES**

1. J. Seddon, “ Basic Helicopter Aerodynamics”, AIAA Education series, Blackwell scientific publications, U.K, 1990.
2. A. Gessow and G.C.Meyers, “Aerodynamics of the Helicopter”, Macmillan and Co., New York, 1982.
3. John Fay, “The Helicopter”, Himalayan Books, New Delhi, 1995.
4. Lalit Gupta, “Helicopter Engineering”, Himalayan Books, New Delhi, 1996.
5. Lecture Notes on “Helicopter Technology”, Department of Aerospace Engineering, IIT –Kanpur and Rotary Wing aircraft R&D center, HAL, Bangalore, 1998.

**AO7005 STRUCTURAL DYNAMICS L T P C**  
**3 0 0 3**

**OUTCOME:**

Upon completion of the course, students will learn how to use the approximate methods for dynamic response of continuous systems.

**UNIT I FORCE-DEFLECTION PROPERTIES OF STRUCTURES 10**  
Constraints and Generalized coordinates – Virtual work and generalized forces – Force – Deflection influence functions – stiffness and flexibility methods.

**UNIT II PRINCIPLES OF DYNAMICS 10**  
Free, Damped and forced vibrations of systems with finite degrees of freedom. D’Alembert’s principle – Hamilton’s principle – Lagrange’s equations of motion and its applications.

**UNIT III NATURAL MODES OF VIBRATION 10**  
Equations of motion for free vibrations. Solution of Eigen value problems – Normal coordinates and orthogonality conditions of eigen vectors.

**UNIT IV ENERGY METHODS 8**  
Rayleigh’s principle and Rayleigh – Ritz method. Coupled natural modes. Effect of rotary inertia and shear on lateral vibrations of beams.

**UNIT V APPROXIMATE METHODS 7**  
Approximate methods of evaluating the eigen values and the dynamic response of continuous systems. Application of Matrix methods for dynamic analysis.

**TOTAL: 45 PERIODS**

**REFERENCES**

1. W.C. Hurty and M.F. Rubinstein, “Dynamics of Structures”, Prentice Hall of India Pvt., Ltd., New Delhi, 1987.
2. F.S.Tse, I.E. Morse and H.T. Hinkle, “Mechanical Vibration”, Prentice Hall of India Pvt., Ltd., New Delhi, 1988.
3. R.K. Vierck, “Vibration Analysis”, 2nd Edition, Thomas Y. Crowell & Co., Harper & Row Publishers, New York, U.S.A., 1989.



**AO7007**

**THEORY OF PLATES AND SHELLS**

**L T P C**  
**3 0 0 3**

**OUTCOME:**

Upon completion of the course, students will get knowledge on the behaviour of plates and shells with different geometry under various types of loads.

**UNIT I CLASSICAL PLATE THEORY**

**8**

Classical Plate Theory – Assumptions – Differential Equations – Boundary Conditions.

**UNIT II PLATES OF VARIOUS SHAPES**

**10**

Navier's Method of Solution for Simply Supported Rectangular Plates – Levy's Method of Solution for Rectangular Plates under Different Boundary Conditions – Circular plates.

**UNIT III EIGEN VALUE ANALYSIS**

**8**

Stability and Free Vibration Analysis of Rectangular Plates with various end conditions.

**UNIT IV APPROXIMATE METHODS**

**10**

Rayleigh – Ritz, Galerkin Methods– Finite Difference Method – Application to Rectangular Plates for Static, Free Vibration and Stability Analysis.

**UNIT V SHELLS**

**9**

Basic Concepts of Shell Type of Structures – Membrane and Bending Theories for Circular Cylindrical Shells.

**TOTAL: 45 PERIODS**

**REFERENCES**

1. Timoshenko, S.P. Winowsky. S., and Kreger, Theory of Plates and Shells, McGraw Hill Book Co., 1990.
2. T.K.Varadan & K. Bhaskar, "Análisis of plates – Theory and problems", Narosha Publishing Co., 1999.
3. Flugge, W. Stresses in Shells, Springer – Verlag, 1985.
4. Timoshenko, S.P. and Gere, J.M., Theory of Elastic Stability, McGraw Hill Book Co. 1986.
5. Harry Kraus, 'Thin Elastic Shells', John Wiley and Sons, 1987.

**AO7008**

**HIGH TEMPERATURE PROBLEMS IN STRUCTURES**

**L T P C**  
**3 0 0 3**

**OUTCOME:**

Upon completion of the course, students will learn the analysis of bar, plane truss and beam under mechanical and thermal loads.

**UNIT I TEMPERATURE EQUATIONS & AERODYNAMIC HEATING**

**9**

Basics of conduction, radiation and convection – Fourier's equation – Boundary and initial conditions – One-dimensional problem formulations – Methods and Solutions. Heat balance equation for idealised structures – Adiabatic temperature – Variations – Evaluation of transient temperature.

**UNIT II THERMAL STRESS ANALYSIS**

**9**

Thermal stresses and strains – Equations of equilibrium – Boundary conditions – Thermoelasticity – Two dimensional problems and solutions – Airy stress function and applications.

**UNIT III THERMAL STRESS IN BEAMS, TRUSSES AND THIN CYLINDERS**

**9**

Analysis of bar, plane truss and beam under mechanical loads and temperature. Thermal stress analysis of thin cylinder.

**UNIT IV THERMAL STRESSES IN PLATES 9**  
Membrane thermal stresses –Rectangular plates – Circular plates – Thick plates with temperature varying along thickness.

**UNIT V SPECIAL TOPICS & MATERIALS 9**  
Thermal bucking – Analysis including material properties variation with temperature..

**TOTAL: 45 PERIODS**

**REFERENCES**

1. A.B. Bruno and H.W. Jerome, "Theory of Thermal Stresses", John Wiley & Sons Inc., New York, 1980.
2. N.J. Hoff, "High Temperature effects in Aircraft Structures", John Wiley & Sons Inc., London, 1986.
3. D.J. Johns, "Thermal Stress Analysis", Pergamon Press, Oxford, 1985.

**AO7009 FATIGUE AND FRACTURE MECHANICS L T P C**  
**3 0 0 3**

**OUTCOME:**

Upon completion of the course, students will learn about fracture behaviour, fatigue design and testing of structures.

**UNIT I FATIGUE OF STRUCTURES 10**  
S.N. curves – Endurance limit – Effect of mean stress – Goodman, Gerber and Soderberg relations and diagrams – Notches and stress concentrations – Neuber's stress concentration factors – plastic stress concentration factors – Notched S-N curves.

**UNIT II STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR 8**  
Low cycle and high cycle fatigue – Coffin-Manson's relation – Transition life – Cyclic Strain hardening and softening – Analysis of load histories – Cycle counting techniques – Cumulative damage – Miner's theory – other theories.

**UNIT III PHYSICAL ASPECTS OF FATIGUE 5**  
Phase in fatigue life – Crack initiation – Crack growth – Final fracture – Dislocations – Fatigue fracture surfaces.

**UNIT IV FRACTURE MECHANICS 15**  
Strength of cracked bodies – potential energy and surface energy – Griffith's theory – Irwin – Orwin extension of Griffith's theory to ductile materials – Stress analysis of cracked bodies – Effect of thickness on fracture toughness – Stress intensity factors for typical geometries.

**UNIT V FATIGUE DESIGN AND TESTING 7**  
Safe life and fail safe design philosophies – Importance of Fracture Mechanics in aerospace structure – Application to composite materials and structures.

**TOTAL: 45 PERIODS**

**REFERENCES**

1. D.Brock, "Elementary Engineering Fracture Mechanics", Noordhoff International Publishing Co., London, 1994.
2. J.F.Knott, "Fundamentals of Fracture Mechanics", Butterworth & Co., (Publishers) Ltd., London, 1983.
3. W.Barrois and L.Ripley, "Fatigue of Aircraft Structures", Pergamon Press, Oxford, 1983.
4. C.G.Sih, "Mechanics of Fracture", Vol.1 Sijthoff and Noordhoff International Publishing Co., Netherland, 1989.

**A07010**

**THEORY OF ELASTICITY**

**L T P C**  
**3 0 0 3**

**OUTCOME:**

Upon completion of the course, students will understand the theoretical concepts of material behaviour with particular emphasis on their elasticity property.

**UNIT I INTRODUCTION**

**6**

Definition, notations and sign conventions for stress and strain – Stress - strain relations, Strain-displacement relations- Elastic constants.

**UNIT II BASIC EQUATIONS OF ELASTICITY**

**10**

Equations of equilibrium – Compatibility equations in strains and stresses –Boundary Conditions - Saint-Venant's principle - Stress ellipsoid – Stress invariants – Principal stresses in 2-D and 3-D.

**UNIT III 2 - D PROBLEMS IN CARTESIAN COORDINATES**

**9**

Plane stress and plain strain problems - Airy's stress function – Biharmonic equations – 2-D problems – Cantilever and simply supported beams.

**UNIT IV 2 - D PROBLEMS IN POLAR COORDINATES**

**12**

Equations of equilibrium – Strain – displacement relations – Stress – strain relations – Airy's stress function – Use of Dunder's table. - Axisymmetric problems - Bending of Curved Bars - Circular Discs and Cylinders – Rotating Discs and Cylinders - Kirsch, Boussinasque's and Michell's problems.

**UNIT V TORSION**

**8**

Coulomb's theory-Navier's theory-Saint Venant's Semi-Inverse method – Torsion of Circular, Elliptical and Triangular sections - Prandtl's theory-Membrane analogy.

**TOTAL: 45 PERIODS**

**REFERENCES**

1. Ugural, A.C and Fenster, S.K, Advanced Strength and Applied Elasticity, Prentice hall, 2003
2. Wang, C.T. Applied elasticity, McGraw Hill 1993
3. Enrico Volterra and Caines, J.H, Advanced strength of Materials, Prentice Hall,1991.
4. S.P. Timoshenko and J.N. Goodier, Theory of Elasticity, McGraw-Hill, 1985.
5. E. Sechler, "Elasticity in Engineering" John Wiley & Sons Inc., New York, 1980.

**A07011**

**HYPERSONIC AERODYNAMICS**

**L T P C**  
**3 0 0 3**

**OUTCOME:**

Upon completion of the course, students will learn basics of hypersonic flow, shock wave - boundary layer interaction and hypersonic aerodynamic heating.

**UNIT I BASICS OF HYPERSONIC AERODYNAMICS**

**8**

Thin shock layers – entropy layers – low density and high density flows – hypersonic flight paths hypersonic flight similarity parameters – shock wave and expansion wave relations of inviscid hypersonic flows.

**UNIT II SURFACE INCLINATION METHODS FOR HYPERSONIC INVISCID FLOWS**

**9**

Local surface inclination methods – modified Newtonian Law – Newtonian theory – tangent wedge or tangent cone and shock expansion methods – Calculation of surface flow properties

**UNIT III APPROXIMATE METHODS FOR INVISCID HYPERSONIC FLOWS' 9**  
 Approximate methods hypersonic small disturbance equation and theory – thin shock layer theory – blast wave theory - entropy effects - rotational method of characteristics - hypersonic shock wave shapes and correlations.

**UNIT IV VISCOUS HYPERSONIC FLOW THEORY 10**  
 Navier–Stokes equations – boundary layer equations for hypersonic flow – hypersonic boundary layer – hypersonic boundary layer theory and non similar hypersonic boundary layers – hypersonic aerodynamic heating and entropy layers effects on aerodynamic heating – heat flux estimation.

**UNIT V VISCOUS INTERACTIONS IN HYPERSONIC FLOWS 9**  
 Strong and weak viscous interactions – hypersonic shockwaves and boundary layer interactions – Estimation of hypersonic boundary layer transition- Role of similarity parameter for laminar viscous interactions in hypersonic viscous flow.

**TOTAL: 45 PERIODS**

**REFERENCES**

1. John D. Anderson, Jr, Hypersonic and High Temperature Gas Dynamics, McGraw-Hill Series, New York, 1996.
2. John.D.Anderson, Jr., Modern Compressible Flow with Historical perspective Hypersonic Series.
3. William H. Heiser and David T. Pratt, Hypersonic Air Breathing propulsion, AIAA Education Series.
4. John T. Bertin, Hypersonic Aerothermodynamics, 1994 AIAA Inc., Washington D.

**AO7012 HIGH TEMPERATURE GAS DYNAMICS L T P C**  
**3 0 0 3**

**OUTCOME:**  
 Upon completion of the course, students will learn statistical thermodynamics and the transport properties of high temperature gases.

**UNIT I INTRODUCTION 8**  
 Nature of high temperature flows – Chemical effects in air – Real perfect gases – Gibb's free energy and entropy by chemical and non equilibrium – Chemically reacting mixtures and boundary layers.

**UNIT II STATISTICAL THERMODYNAMICS 8**  
 Introduction to statistical thermodynamics – Relevance to hypersonic flow - Microscopic description of gases – Boltzman distribution – Cartesian function

**UNIT III KINETIC THEORY AND HYPERSONIC FLOWS 9**  
 Chemical equilibrium calculation of equilibrium composition of high temperature air – equilibrium properties of high temperature air – collision frequency and mean free path – velocity and speed distribution functions.

**UNIT IV INVISCID HIGH TEMPERATURE FLOWS 10**  
 Equilibrium and non – equilibrium flows – governing equations for inviscid high temperature equilibrium flows – equilibrium normal and oblique shock wave flows – frozen and equilibrium flows – equilibrium conical and blunt body flows – governing equations for non equilibrium inviscid flows.

**UNIT V TRANSPORT PROPERTIES IN HIGH TEMPERATURE GASES 10**  
 Transport coefficients – mechanisms of diffusion – total thermal conductivity – transport characteristics for high temperature air – radiative transparent gases – radiative transfer equation for transport, absorbing and emitting and absorbing gases.

**TOTAL: 45 PERIODS**

## REFERENCES

1. John D. Anderson, Jr., Hypersonic and High Temperature Gas Dynamics, McGraw-Hill Series, New York, 1996.
2. John D. Anderson, Jr., Modern Compressible Flow with Historical perspective McGraw-Hill Series, New York, 1996.
3. William H. Heiser and David T. Pratt, Hypersonic Air breathing propulsion, AIAA Education Series.
4. John T. Bertin, Hypersonic Aerothermodynamics publishers - AIAA Inc., Washington, D.C., 1994.
5. T.K. Bose, High Temperature Gas Dynamics,

**AO7013**

**WIND POWER ENGINEERING**

**L T P C**  
**3 0 0 3**

### OUTCOME:

Upon completion of the course, students will learn about aerodynamics, design and control of wind turbines.

### **UNIT I INTRODUCTION TO WIND ENERGY 8**

Background, Motivations, and Constraints, Historical perspective, Modern wind turbines, Components and geometry, Power characteristics.

### **UNIT II WIND CHARACTERISTICS AND RESOURCES 8**

General characteristics of the wind resource, Atmospheric boundary layer characteristics, Wind data analysis and resource estimation, Wind turbine energy production estimates using statistical techniques

### **UNIT III AERODYNAMICS OF WIND TURBINES 12**

Overview, 1-D Momentum theory, Ideal horizontal axis wind turbine with wake rotation, Airfoils and aerodynamic concepts - Momentum theory and blade element theory General rotor blade shape performance prediction - Wind turbine rotor dynamics

### **UNIT IV WIND TURBINE DESIGN & CONTROL 9**

Brief design overview – Introduction - Wind turbine control systems - Typical grid-connected turbine operation - Basic concepts of electric power - Power transformers - Electrical machines

### **UNIT V ENVIRONMENTAL AND SITE ASPECTS 8**

Overview - Wind turbine siting - Installation and operation - Wind farms - Overview of wind energy economics - Electromagnetic interference - noise - Land use impacts - Safety

**TOTAL: 45 PERIODS**

### REFERENCES:

1. Emil Simiu & Robert H Scanlan, Wind effects on structures - fundamentals and applications to design, John Wiley & Sons Inc New York, 1996.
2. Tom Lawson Building Aerodynamics Imperial College Press London, 2001
3. N J Cook, Design Guides to wind loading of buildings structures Part I & II, Butterworths, London, 1985
4. IS: 875 (1987) Part III Wind loads, Indian Standards for Building codes.

**A07014**

**EXPERIMENTAL STRESS ANALYSIS**

**L T P C**  
**3 0 0 3**

**OUTCOME:**

Upon completion of the course, students will be able to appreciate use of strain gauges and its principles, principle of photoelasticity and its use, NDT techniques.

**UNIT I INTRODUCTION**

**8**

Principle of measurements-Accuracy, sensitivity and range- Mechanical, Optical, Acoustical and Electrical extensometers.

**UNIT II ELECTRICAL RESISTANCE STRAIN GAUGES**

**12**

Principle of operation and requirements-Types and their uses-Materials for strain gauge-Calibration and temperature compensation-Cross sensitivity-Rosette analysis-Wheatstone bridge-Potentiometer circuits for static and dynamic strain measurements-Strain indicators- Application of strain gauges to wind tunnel balance.

**UNIT III PRINCIPLES OF PHOTOELASTICITY**

**9**

Two dimensional photo elasticity-Concepts of photoelastic effects-Photoelastic materials-Stress optic law-Plane polariscope-Circular polariscope-Transmission and Reflection type-Effect of stressed model in Plane and Circular polariscope. Interpretation of fringe pattern Isoclinics and Isochromatics.-Fringe sharpening and Fringe multiplication techniques-Compensation and separation techniques-Introduction to three dimensional photoelasticity.

**UNIT IV PHOTOELASTICITY AND INTERFEROMETRY TECHNIQUES**

**9**

Fringe sharpening and Fringe multiplication techniques-Compensation and separation techniques-Calibration methods -Photo elastic materials. Introduction to three dimensional photoelasticity. Moire fringes – Laser holography – Grid methods-Stress coat

**UNIT V NON DESTRUCTIVE TECHNIQUES**

**7**

Radiography- Ultrasonics- Magnetic particle inspection- Fluorescent penetrant technique-Eddy current testing- thermography- MICRO FOCUS CT scan.

**TOTAL: 45 PERIODS**

**REFERENCES**

1. J.W. Dally and M.F. Riley, "Experimental Stress Analysis", McGraw-Hill Book Co., New York, 1988.
2. Srinath,L.S., Raghava,M.R., Lingaiah,K. Gargesha,G.,Pant B. and Ramachandra,K. – Experimental Stress Analysis, Tata McGraw Hill, New Delhi, 1984
3. P. Fordham, "Non-Destructive Testing Techniques" Business Publications, London, 1988.
4. M. Hetenyi, "Handbook of Experimental Stress Analysis", John Wiley & Sons Inc., New York, 1980.
5. G.S. Holister, "Experimental Stress Analysis, Principles and Methods", Cambridge University Press, 1987.
6. A.J. Durelli and V.J. Parks, "Moire Analysis of Strain", Prentice Hall Inc., Englewood Cliffs, New Jersey, 1980.

**A07015**

**COMPUTATIONAL HEAT TRANSFER**

**L T P C**  
**3 0 0 3**

**OUTCOME:**

Upon completion of the course, students will learn the concepts of computation applicable to heat transfer for practical applications.

**UNIT I INTRODUCTION**

**9**

Finite Difference Method-Introduction-Taylor's series expansion - Discretisation Methods Forward, backward and central differencing scheme for 1<sup>st</sup> order and second order Derivatives – Types of

partial differential equations-Types of errors. Solution to algebraic equation-Direct Method and Indirect Method-Types of boundary condition.  
FDM - FEM - FVM.

**UNIT II CONDUCTIVE HEAT TRANSFER 9**

General 3D-heat conduction equation in Cartesian, cylindrical and spherical coordinates.  
Computation(FDM) of One –dimensional steady state heat conduction –with Heat generation-without Heat generation- 2D-heat conduction problem with different boundary conditions- Numerical treatment for extended surfaces. Numerical treatment for 3D- Heat conduction.  
Numerical treatment to 1D-steady heat conduction using FEM.

**UNIT III TRANSIENT HEAT CONDUCTION 9**

Introduction to Implicit, explicit Schemes and crank-Nicolson Schemes Computation(FDM) of One –dimensional un-steady heat conduction –with heat Generation-without Heat generation - 2D-transient heat conduction problem with different boundary conditions using Implicit, explicit Schemes. Importance of Courant number.  
Analysis for 1-D,2-D transient heat Conduction problems.

**UNIT IV CONVECTIVE HEAT TRANSFER 9**

Convection- Numerical treatment(FDM) of steady and unsteady 1-D and 2-d heat convection-diffusion steady-unsteady problems- Computation of thermal and Velocity boundary layer flows. Upwind scheme. Stream function-vorticity approach-Creeping flow.

**UNIT V RADIATIVE HEAT TRANSFER 9**

Radiation fundamentals-Shape factor calculation-Radiosity method- Absorption Method- Monte Carlo method-Introduction to Finite Volume Method- Numerical treatment of radiation enclosures using finite Volume method.  
Developing a numerical code for 1D, 2D heat transfer problems.

**TOTAL: 45 PERIODS**

**REFERENCES**

1. Pletcher and Tannahils “ Computational Heat Transfer” .....
2. Yunus A. Cengel, Heat Transfer – A Practical Approach Tata McGraw Hill Edition, 2003.
3. S.C. Sachdeva, “Fundamentals of Engineering Heat & Mass Transfer”, Wiley Eastern Ltd., New Delhi, 1981.
3. John H. Lienhard, “A Heat Transfer Text Book”, Prentice Hall Inc., 1981.
4. J.P. Holman, “Heat Transfer”, McGraw-Hill Book Co., Inc., New York, 6<sup>th</sup> Edition, 1991.
5. John D. Anderson, JR” Computational Fluid Dynamics”, McGraw-Hill Book Co., Inc., New York, 1995.
6. T.J. Chung, Computational Fluid Dynamics, Cambridge University Press, 2002
7. C.Y.Chow, “Introduction to Computational Fluid Dynamics”, John Wiley, 1979.

**A07016 ADVANCED PROPULSION SYSTEMS L T P C  
3 0 0 3**

**OUTCOME:**

Upon completion of the course, students will learn in detail about gas turbines, ramjet, fundamentals of rocket propulsion and chemical rockets.

**UNIT I THERMODYNAMIC CYCLE ANALYSIS OF AIR-BREATHING PROPULSION SYSTEMS 8**

Air breathing propulsion systems like Turbojet, turboprop, ducted fan, Ramjet and Air augmented rockets – Thermodynamic cycles – Pulse propulsion – Combustion process in pulse jet engines – inlet charging process – Subcritical, Critical and Supercritical charging.

<b>UNIT II</b>	<b>RAMJETS AND AIR AUGMENTED ROCKETS</b>	<b>8</b>
Preliminary performance calculations – Diffuser design with and without spike, Supersonic inlets – combustor and nozzle design – integral Ram rocket.		
<b>UNIT III</b>	<b>SCRAMJET PROPULSION SYSTEM</b>	<b>12</b>
Fundamental considerations of hypersonic air breathing vehicles – Preliminary concepts in engine airframe integration – calculation of propulsion flow path – flowpath integration – Various types of supersonic combustors – fundamental requirements of supersonic combustors – Mixing of fuel jets in supersonic cross flow – performance estimation of supersonic combustors.		
<b>UNIT IV</b>	<b>NUCLEAR PROPULSION</b>	<b>9</b>
Nuclear rocket engine design and performance – nuclear rocket reactors – nuclear rocket nozzles – nuclear rocket engine control – radioisotope propulsion – basic thruster configurations – thruster technology – heat source development – nozzle development – nozzle performance of radioisotope propulsion systems.		
<b>UNIT V</b>	<b>ELECTRIC AND ION PROPULSION</b>	<b>8</b>
Basic concepts in electric propulsion – power requirements and rocket efficiency – classification of thrusters – electrostatic thrusters – plasma thruster of the art and future trends – Fundamentals of ion propulsion – performance analysis – ion rocket engine.		

**TOTAL: 45 PERIODS**

**REFERENCES**

1. G.P. Sutton, "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 1998.
2. William H. Heiser and David T. Pratt, Hypersonic Airbreathing propulsion, AIAA Education Series, 2001.
3. Fortescue and Stark, Spacecraft Systems Engineering, 1999.
4. Cumpsty, Jet propulsion, Cambridge University Press, 2003.

<b>A07017</b>	<b>EXPERIMENTAL AERODYNAMICS</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

**OUTCOME:**

Upon completion of the course, students will learn about the measurement of flow properties in wind tunnels and their associated instrumentation.

<b>UNIT I</b>	<b>BASIC MEASUREMENTS IN FLUID MECHANICS</b>	<b>8</b>
Objective of experimental studies – Fluid mechanics measurements – Properties of fluids – Measuring instruments – Performance terms associated with measurement systems – Direct measurements - Analogue methods – Flow visualization – Components of measuring systems – Importance of model studies - Experiments on Taylor-Proudman theorem and Ekman layer – Measurements in boundary layers -		
<b>UNIT II</b>	<b>WIND TUNNEL MEASUREMENTS</b>	<b>8</b>
Characteristic features, operation and performance of low speed, transonic, supersonic and special tunnels - Power losses in a wind tunnel – Instrumentation and calibration of wind tunnels – Turbulence- Wind tunnel balance – Principle and application and uses – Balance calibration.		
<b>UNIT III</b>	<b>FLOW VISUALIZATION AND ANALOGUE METHODS</b>	<b>10</b>
Visualization techniques – Smoke tunnel – Hele-Shaw apparatus - Interferometer – Fringe-Displacement method – Shadowgraph - Schlieren system – Background Oriented Schlieren (BOS) System - Hydraulic analogy – Hydraulic jumps – Electrolytic tank		

**UNIT IV PRESSURE, VELOCITY AND TEMPERATURE MEASUREMENTS 10**

Pitot-Static tube characteristics - Velocity measurements - Hot-wire anemometry – Constant current and Constant temperature Hot-Wire anemometer – Hot-film anemometry – Laser Doppler Velocimetry (LDV) – Particle Image Velocimetry (PIV) – Pressure Sensitive Paints - Pressure measurement techniques - Pressure transducers – Temperature measurements.

**UNIT V DATA ACQUISITION SYSTEMS AND UNCERTAINTY ANALYSIS 9**

Data acquisition and processing – Signal conditioning - Estimation of measurement errors – Uncertainty calculation - Uses of uncertainty analysis.

**TOTAL: 45 PERIODS**

**REFERENCES**

1. Rathakrishnan, E., "Instrumentation, Measurements, and Experiments in Fluids,"CRC Press – Taylor & Francis, 2007.
2. Robert B Northrop, "Introduction to Instrumentation and Measurements", Second Edition, CRC Press, Taylor & Francis, 2006.

**A07018**

**MECHANICS**

**L T P C**

**3 0 0 3**

**OUTCOME:**

Upon completion of the course, students will have an idea about solar system, basic concepts of orbital mechanics with particular emphasis on interplanetary trajectories.

**UNIT I ORBITAL MECHANICS 9**

Description of solar system – Kepler's Laws of planetary motion – Newton's Law of Universal gravitation – Two body and Three-body problems – Jacobi's Integral, Librations points - Estimation of orbital and escape velocities

**UNIT II SATELLITE DYNAMICS 9**

Geosynchronous and geostationary satellites- factors determining life time of satellites – satellite perturbations – methods to calculate perturbations- Hohmann orbits – calculation of orbit parameters – Determination of satellite rectangular coordinates from orbital elements

**UNIT III ROCKET MOTION 10**

Principle of operation of rocket motor - thrust equation – one dimensional and two dimensional rocket motions in free space and homogeneous gravitational fields – Description of vertical, inclined and gravity turn trajectories determinations of range and altitude – simple approximations to burnout velocity.

**UNIT IV ROCKET AERODYNAMICS 9**

Description of various loads experienced by a rocket passing through atmosphere – drag estimation – wave drag, skin friction drag, form drag and base pressure drag – Boat-tailing in missiles – performance at various altitudes – conical and bell shaped nozzles – adapted nozzles – rocket dispersion – launching problems.

**UNIT V STAGING AND CONTROL OF ROCKET VEHICLES 8**

Need for multistaging of rocket vehicles – multistage vehicle optimization – stage separation dynamics and separation techniques- aerodynamic and jet control methods of rocket vehicles - SITVC.

**TOTAL: 45 PERIODS**

**REFERENCES**

1. G.P. Sutton, "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 5<sup>th</sup> Edition, 1986.
2. J.W. Cornелиsse, "Rocket Propulsion and Space Dynamics", J.W. Freeman & Co., Ltd., London, 1982
3. Van de Kamp, "Elements of astromechanics", Pitman Publishing Co., Ltd., London, 1980.
4. E.R. Parker, "Materials for Missiles and Spacecraft", McGraw-Hill Book Co., Inc., 1982.

**OUTCOME:**

Upon completion of the course, students will learn the basics of nozzle flows, methods of jet control and acoustics of jet.

**UNIT I INTRODUCTION****9**

Types of nozzles – overexpanded and underexpanded flows - Isentropic flow through nozzles– Interaction of nozzle flows over adjacent surfaces – Mach disk - Jet flow – types - Numerical problems.

**UNIT II COMPRESSIBLE FLOW THEORY****9**

One-dimensional compressible fluid flow – flow through variable area passage – nozzles and diffusers –normal and oblique shock waves and calculation of flow and fluid properties across the shocks and expansion fans. Interaction of shocks with solid and fluid surface.

**UNIT III JET CONTROL****9**

Types of jet control - single jet, multi jet, co-flow jet, parallel flow jet. Subsonic jets- Mathematical treatment of jet profiles- Theory of Turbulent jets- Mean velocity and mean temperature- Turbulence characteristics of free jets- Mixing length- Experimental methods for studying jets and the Techniques used for analysis- Expansion levels of jets- Overexpanded, Correctly expanded, Underexpanded jets - Control of jets. Centre line decay, Mach number Profile, Iso-Mach (or iso-baric) contours, Shock cell structure in underexpanded and overexpanded jets, Mach discs.

**UNIT IV BOUNDARY LAYER CONCEPT****9**

Boundary Layer – displacement and momentum thickness- laminar and turbulent boundary layers over flat plates – velocity distribution in turbulent flows over smooth and rough boundaries- laminar sublayer. Shock-boundary layer interactions.

**UNIT V JET ACOUSTICS****9**

Introduction to Acoustic – Types of noise – Source of generation- Traveling wave solution- standing wave solution – multi-dimensional acoustics -Noise suppression techniques– applications to problems.

**TOTAL: 45 PERIODS****REFERENCES**

1. Ethirajan Rathakrishnan, “Applied Gas Dynamics”, John Wiley, NY,, 2010.
2. Shapiro, AH, “Dynamics and Thermodynamics of Compressible Fluid Flow”, Vols. I & II, Ronald Press, New York, 1953.
3. Rathakrishnan E., “Gas Dynamics”, Prentice Hall of India, New Delhi, 2008.
4. Liepmann and Roshko, “Elements of Gas Dynamics”, John Wiley, NY, 1963.

**OUTCOME:**

Upon completion of the course, students will learn about the thermodynamics, physics and chemistry of combustion.

**UNIT I THERMODYNAMICS OF COMBUSTION****8**

Stoichiometry – absolute enthalpy- enthalpy of formation- enthalpy of combustion- laws of thermochemistry- pressure and temperature effect on enthalpy of formation, adiabatic flame temperature, chemical and equilibrium products of combustion.



**UNIT V EXPERIMENTAL AND SIMULATION APPROACH OF PROPELLERS 9**  
 Experimental Methods- Wind tunnel interference- Thrust and Torque distribution- Scale effect- Compressibility Effect. Basics of propeller simulations- Domain selection- Grid independency study- Turbulence model investigation.

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Durand, W.F., "Applied Aerodynamics- Volume IV", Stanford University, California, 1934.
2. Seddon, J., "Basic Helicopter Aerodynamics", BSP Professional Books, Oxford London, 1990.
3. Kerwin, Justin, "lecture Notes on Hydrofoils and Propellers", Cambridge, 2001.
4. "Modeling Propeller Flow-Fields Using CFD" – AIAA 2008-402.

**AO7022 AEROSPACE GUIDANCE AND CONTROL L T P C**  
**3 0 0 3**

**OUTCOME:**

Upon completion of the course, students will learn about longitudinal and lateral autopilot, guidance of missile and launch vehicles.

**UNIT I INTRODUCTION 4**  
 Introduction to Guidance and control - definition, Historical background

**UNIT II AUGMENTATION SYSTEMS 7**  
 Need for automatic flight control systems, Stability augmentation systems, control augmentation systems, Gain scheduling concepts.

**UNIT III LONGITUDINAL AUTOPILOT 12**  
 Displacement Autopilot-Pitch Orientation Control system, Acceleration Control System, Glide Slope Coupler and Automatic Flare Control and Flight path stabilization, Longitudinal control law design using back stepping algorithm.

**UNIT IV LATERAL AUTOPILOT 10**  
 Damping of the Dutch Roll, Methods of Obtaining Coordination, Yaw Orientation Control system, turn compensation, Automatic lateral Beam Guidance. Introduction to Fly-by-wire flight control systems, Lateral control law design using back stepping algorithm.

**UNIT V MISSILE AND LAUNCH VEHICLE GUIDANCE 12**  
 Operating principles and design of guidance laws, homing guidance laws- short range, Medium range and BVR missiles, Launch Vehicle- Introduction, Mission requirements, Implicit guidance schemes, Explicit guidance, Q guidance schemes

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Blake Lock, J.H 'Automatic control of Aircraft and missiles ', John Wiley Sons, New York, 1990.
2. Stevens B.L & Lewis F.L, 'Aircraft control & simulation', John Wiley Sons, New York, 1992.
3. Collinson R.P.G, 'Introduction to Avionics', Chapman and Hall, India, 1996.
4. Garnel.P. & East.D.J, 'Guided Weapon control systems', Pergamon Press, Oxford, 1977.
5. Nelson R.C 'Flight stability & Automatic Control', McGraw Hill, 1989.
6. Bernad Etkin,'Dynamic of flight stability and control', John Wiley, 1972.

**AFFILIATED INSTITUTIONS**  
**ANNA UNIVERSITY, CHENNAI**  
**REGULATIONS – 2013**  
**M.E. COMMUNICATION SYSTEMS**  
**I TO IV SEMESTERS CURRICULUM AND SYLLABUS (FULL TIME)**

**SEMESTER I**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	MA7158	<u>Applied Mathematics for Communication Engineers</u>	3	1	0	4
2.	CU7101	<u>Advanced Radiation Systems</u>	3	0	0	3
3.	CU7102	<u>Advanced Digital Communication Techniques</u>	3	0	0	3
4.	AP7101	<u>Advanced Digital Signal Processing</u>	3	1	0	4
5.	CU7103	<u>Optical Networks</u>	3	0	0	3
6.		Elective I	3	0	0	3
<b>PRACTICAL</b>						
7.	CU7111	<u>Communication Systems Laboratory</u>	0	0	3	2
<b>TOTAL CREDITS</b>			<b>18</b>	<b>2</b>	<b>3</b>	<b>22</b>

**SEMESTER II**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	CU7201	<u>Wireless Communication Networks</u>	3	0	0	3
2.	CU7202	<u>MIC and RF System Design</u>	3	0	0	3
3.	AP7301	<u>Electromagnetic Interference and Compatibility</u>	3	0	0	3
4.		Elective II	3	0	0	3
5.		Elective III	3	0	0	3
6.		Elective IV	3	0	0	3
<b>PRACTICAL</b>						
7.	CU7211	<u>Innovative System Design Laboratory</u>	0	0	3	2
<b>TOTAL CREDITS</b>			<b>18</b>	<b>0</b>	<b>3</b>	<b>20</b>

### SEMESTER III

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1.	CU7301	<u>Advanced Satellite Based Systems</u>	3	0	0	3
2.		Elective V	3	0	0	3
3.		Elective VI	3	0	0	3
<b>PRACTICAL</b>						
4.	CU7311	Project Work (Phase I)	0	0	12	6
<b>TOTAL CREDITS</b>			<b>9</b>	<b>0</b>	<b>12</b>	<b>15</b>

### SEMESTER IV

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
<b>PRACTICAL</b>						
1.	CU7411	Project Work (Phase II)	0	0	24	12
<b>TOTAL CREDITS</b>			<b>0</b>	<b>0</b>	<b>24</b>	<b>12</b>

**TOTAL NO OF CREDITS:69**

### LIST OF ELECTIVES

#### ELECTIVE I

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	AP7103	<u>Advanced Microprocessor and Microcontroller</u>	3	0	0	3
2.	VL7001	<u>Analog and Mixed Mode VLSI Design</u>	3	0	0	3
3.	CU7001	<u>Real Time Embedded Systems</u>	3	0	0	3
4.	CU7002	<u>MEMS and NEMS</u>	3	0	0	3
5.	AP7202	<u>ASIC and FPGA Design</u>	3	0	0	3

**ELECTIVE II**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	NC7102	<u>Communication Network Modelling and Simulation</u>	3	0	0	3
2.	CU7003	<u>Digital Communication Receivers</u>	3	0	0	3
3.	CU7004	<u>Detection and Estimation Theory</u>	3	0	0	3
4.	VL7013	<u>VLSI for Wireless Communication</u>	3	0	0	3
5.	CU7005	<u>Cognitive Radio</u>	3	0	0	3

**ELECTIVE III**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	DS7071	<u>Speech And Audio Signal Processing</u>	3	0	0	3
2.	DS7201	<u>Advanced Digital Image Processing</u>	3	0	0	3
3.	DS7202	<u>Radar Signal Processing</u>	3	0	0	3
4.	CP7008	<u>Speech Processing and Synthesis</u>	3	0	0	3

**ELECTIVE IV**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	CU7006	<u>Wavelet Transforms and Applications</u>	3	0	0	3
2.	DS7101	<u>DSP Processor Architecture and Programming</u>	3	0	0	3
3.	NC7101	<u>High Performance Networks</u>	3	0	0	3
4.	CP7023	<u>Reconfigurable Computing</u>	3	0	0	3

**ELECTIVE V**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	NC7001	<u>Network Routing Algorithms</u>	3	0	0	3
2.	NC7202	<u>Wireless Adhoc and Sensor Networks</u>	3	0	0	3
3.	CU7007	<u>Internetworking Multimedia</u>	3	0	0	3
4.	NC7002	<u>Multimedia Compression Techniques</u>	3	0	0	3
5.	CU7008	Ultra Wide Band Communication	3	0	0	3

**ELECTIVE VI**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	IF7301	<u>Soft Computing</u>	3	0	0	3
2.	NC7003	<u>Network Processor</u>	3	0	0	3
3.	NE7007	Network Management	3	0	0	3
4.	NC7201	<u>Communication Network Security</u>	3	0	0	3
5.	CU7009	<u>Neural Network and Applications</u>	3	0	0	3

**OBJECTIVES:**

- To develop the ability to use the concepts of Linear algebra and Special functions for solving problems related to Networks.
- To formulate and construct a mathematical model for a linear programming problem in real life situation;
- To expose the students to solve ordinary differential equations by various techniques.

**OUTCOMES:**

- To achieve an understanding of the basic concepts of algebraic equations and method of solving them.
- To familiarize the students with special functions and solve problems associated with Engineering applications.

**UNIT I          LINEAR ALGEBRA****12**

Vector spaces – norms – Inner Products – Eigen values using QR transformations – QR factorization - generalized eigenvectors – Canonical forms – singular value decomposition and applications - pseudo inverse – least square approximations --Toeplitz matrices and some applications.

**UNIT II          LINEAR PROGRAMMING****12**

Formulation – Graphical solution – Simplex method – Two phase method - Transportation and Assignment Models

**UNIT III          ORDINARY DIFFERENTIAL EQUATIONS****12**

Runge Kutta Methods for system of IVPs, numerical stability, Adams-Bashforth multistep method, solution of stiff ODEs, shooting method, BVP: Finite difference method, orthogonal collocation method, orthogonal collocation with finite element method, Galerkin finite element method.

**UNIT IV          TWO DIMENSIONAL RANDOM VARIABLES****12**

Joint distributions – Marginal and Conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation.

**UNIT V          QUEUEING MODELS****12**

Poisson Process – Markovian queues – Single and Multi-server Models – Little's formula - Machine Interference Model – Steady State analysis – Self Service queue.

**TOTAL: 45+15:60 PERIODS****REFERENCES:**

1. Richard Bronson, Gabriel B.Costa, "Linear Algebra", Academic Press, Second Edition, 2007.
2. Richard Johnson, Miller & Freund, "Probability and Statistics for Engineers", 7<sup>th</sup> Edition, Prentice – Hall of India, Private Ltd., New Delhi (2007).
3. Taha H.A., "Operations Research: An introduction", Pearson Education Asia, New Delhi, Ninth Edition, 2012.
4. Donald Gross and Carl M. Harris, "Fundamentals of Queueing Theory", 2<sup>nd</sup> edition, John Wiley and Sons, New York (1985).
5. Moon, T.K., Sterling, W.C., Mathematical methods and algorithms for signal processing, Pearson Education, 2000.

**UNIT I ANTENNA FUNDAMENTALS****9**

Antenna fundamental parameters , . Radiation integrals ,Radiation from surface and line current distributions – dipole, monopole, loop antenna; Mobile phone antenna- base station, hand set antenna; Image; Induction ,reciprocity theorem, Broadband antennas and matching techniques, Balance to unbalance transformer, Introduction to numerical techniques.

**UNIT II RADIATION FROM APERTURES****9**

Field equivalence principle, Radiation from Rectangular and Circular apertures, Uniform aperture distribution on an infinite ground plane; Slot antenna; Horn antenna; Reflector antenna, aperture blockage, and design consideration.

**UNIT III ARRAYS****9**

Introduction-General structure of phased array, linear array theory, variation of gain as a function of pointing direction, effects of phase quantization, frequency scanned arrays, analog beam forming matrices-Active modules, digital beam forming, MEMS technology in phased arrays-Retro directive and self phased arrays.

**UNIT IV MICRO STRIP ANTENNA****9**

Radiation Mechanism from patch; Excitation techniques; Microstrip dipole; Rectangular patch, Circular patch, and Ring antenna – radiation analysis from transmission line model, cavity model; input impedance of rectangular and circular patch antenna; Microstrip array and feed network; Application of microstrip array antenna.

**UNIT V EMC ANTENNA AND ANTENNA MEASUREMENTS****9**

Concept of EMC measuring antenna; Receiver and Transmitter antenna factors; Log periodic dipole, Biconical, Ridge guide, Multi turn loop; Antenna measurement and instrumentation – Gain, Impedance and antenna factor measurement; Antenna test range Design.

**TOTAL : 45 PERIODS****REFERENCES:**

1. Hubregt.J.Visser “Antenna Theory and Applications” 1<sup>st</sup> Edition, John Wiley & Sons Ltd, Newyork,2012.
2. Zhijun Zhang” Antenna Design for Mobile Devices” 1<sup>st</sup> Edition, John Wiley & Sons (Asia) Ltd, Newyork,2011.
3. Xavier Begaud, “Ultra Wide Band Antennas” , 1st Edition, ISTE Ltd and John Wiley & Sons Ltd, Newyork,2013.
4. Balanis.A, “Antenna Theory Analysis and Design”, John Wiley and Sons, New York, 1982.
5. Krauss.J.D, “Antennas”, II edition, John Wiley and sons, New York, 1997.
6. I.J. Bahl and P. Bhartia,” Microstrip Antennas”,Artech House,Inc.,1980
7. W.L.Stutzman and G.A.Thiele,”Antenna Theory and Design”, 2nd Edition, John Wiley& Sons Inc.,1998.
8. S.Drabowitch et.al.;; ”Modern Antennas”, 2<sup>nd</sup> Edition Springer science business Media, Inc.2005.

**OBJECTIVES:**

- To understand the basics of signal-space analysis and digital transmission.
- To understand the coherent and noncoherent receivers and its impact on different channel characteristics.
- To understand Orthogonal Frequency Division Multiplexing.
- To understand the different block coded and convolutional coded digital communication systems.
- To understand the different Equalizers.

**UNIT I COHERENT AND NON-COHERENT COMMUNICATION 9**

Coherent receivers – Optimum receivers in WGN – IQ modulation & demodulation – Noncoherent receivers in random phase channels; MFSK receivers – Rayleigh and Rician channels – Partially coherent receivers – DPSK; M-PSK; M-DPSK--BER Performance Analysis. Carrier Synchronization- Bit synchronization.

**UNIT II EQUALIZATION TECHNIQUES 9**

Band Limited Channels- ISI – Nyquist Criterion- Controlled ISI-Partial Response signals- Equalization algorithms – Viterbi Algorithm – Linear equalizer – Decision feedback equalization – Adaptive Equalization algorithms.

**UNIT III BLOCK CODED DIGITAL COMMUNICATION 9**

Architecture and performance – Binary block codes; Orthogonal; Biorthogonal; Transorthogonal – Shannon's channel coding theorem; Channel capacity; Matched filter; Concepts of Spread spectrum communication – Coded BPSK and DPSK demodulators– Linear block codes; Hamming; Golay; Cyclic; BCH ; Reed – Solomon codes - Space time block codes

**UNIT IV CONVOLUTIONAL CODED DIGITAL COMMUNICATION 9**

Representation of codes using Polynomial, State diagram, Tree diagram, and Trellis diagram – Decoding techniques using Maximum likelihood, Viterbi algorithm, Sequential and Threshold methods – Error probability performance for BPSK and Viterbi algorithm, Turbo Coding.

**UNIT V OFDM 9**

Generation of sub-carriers using the IFFT; Guard Time and Cyclic Extension; Windowing; OFDM signal processing; Peak Power Problem: PAP reduction schemes- Clipping, Filtering, Coding and Scrambling.-

**TOTAL: 45 PERIODS****OUTCOMES:**

Upon Completion of the course, the students will be able to

- Develop the ability to understand the concepts of signal space analysis coherent and non-coherent receivers.
- Comprehend the generation of OFDM signals and the processing of the signals.
- Possess knowledge on different block codes and convolutional codes.
- Conceptually appreciate different Equalization techniques.

**REFERENCES:**

1. M.K.Simon, S.M.Hinedi and W.C.Lindsey, Digital communication techniques; Signalling and detection, Prentice Hall India, New Delhi. 1995.
2. Simon Haykin, Digital communications, John Wiley and sons, 1998
3. Bernard Sklar., 'Digital Communications', second edition, Pearson Education,2001.
4. John G. Proakis., 'Digital Communication', 4 th edition, Mc Graw Hill Publication, 2001
5. Theodore S.Rappaport., 'Wireless Communications', 2nd edition, Pearson Education, 2002.
6. Stephen G. Wilson., 'Digital Modulation and Coding', First Indian Reprint ,Pearson Education, 2003.
7. Richard Van Nee & Ramjee Prasad., 'OFDM for Multimedia Communications' Artech House Publication,2001.

**OBJECTIVES:**

The purpose of this course is to provide in-depth treatment on methods and techniques in

- discrete-time signal transforms, digital filter design, optimal filtering
- power spectrum estimation, multi-rate digital signal processing
- DSP architectures which are of importance in the areas of signal processing, control and communications.

**OUTCOMES:**

Students should be able to:

- To design adaptive filters for a given application
- To design multirate DSP systems.

**UNIT I DISCRETE RANDOM SIGNAL PROCESSING 9**

Weiner Khitchine relation - Power spectral density – filtering random process, Spectral Factorization Theorem, special types of random process – Signal modeling-Least Squares method, Pade approximation, Prony's method, iterative Prefiltering, Finite Data records, Stochastic Models.

**UNIT II SPECTRUM ESTIMATION 9**

Non-Parametric methods - Correlation method - Co-variance estimator - Performance analysis of estimators – Unbiased consistent estimators - Periodogram estimator - Barlett spectrum estimation - Welch estimation - Model based approach - AR, MA, ARMA Signal modeling - Parameter estimation using Yule-Walker method.

**UNIT III LINEAR ESTIMATION AND PREDICTION 9**

Maximum likelihood criterion - Efficiency of estimator - Least mean squared error criterion - Wiener filter - Discrete Wiener Hoff equations - Recursive estimators - Kalman filter - Linear prediction, Prediction error - Whitening filter, Inverse filter - Levinson recursion, Lattice realization, Levinson recursion algorithm for solving Toeplitz system of equations.

**UNIT IV ADAPTIVE FILTERS 9**

FIR Adaptive filters - Newton's steepest descent method - Adaptive filters based on steepest descent method - Widrow Hoff LMS Adaptive algorithm - Adaptive channel equalization - Adaptive echo canceller - Adaptive noise cancellation - RLS Adaptive filters - Exponentially weighted RLS - Sliding window RLS - Simplified IIR LMS Adaptive filter.

**UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING 9**

Mathematical description of change of sampling rate - Interpolation and Decimation - Continuous time model - Direct digital domain approach - Decimation by integer factor - Interpolation by an integer factor - Single and multistage realization - Poly phase realization - Applications to sub band coding - Wavelet transform and filter bank implementation of wavelet expansion of signals.

**L +T= 45+15, TOTAL: 60 PERIODS**

**REFERENCES:**

1. Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons Inc., New York, 2006.
2. Sophoncles J. Orfanidis, "Optimum Signal Processing", McGraw-Hill, 2000.
3. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Prentice Hall of India, New Delhi, 2005.
4. Simon Haykin, "Adaptive Filter Theory", Prentice Hall, Englewood Cliffs, NJ1986.
5. S. Kay, "Modern spectrum Estimation theory and application", Prentice Hall, Englewood Cliffs, NJ1988.
6. P. P. Vaidyanathan, "Multirate Systems and Filter Banks", Prentice Hall, 1992.

**UNIT I OPTICAL SYSTEM COMPONENTS 9**

Light propagation in optical fibers – Loss & bandwidth, System limitations, Non-Linear effects; Solitons; Optical Network Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters.

**UNIT II OPTICAL NETWORK ARCHITECTURES 9**

Introduction to Optical Networks; SONET / SDH standards, Metropolitan Area Networks, Layered Architecture; Broadcast and Select Networks–Topologies for Broadcast Networks, Media Access Control Protocols, Testbeds for Broadcast & Select WDM; Wavelength Routing Architecture.

**UNIT III WAVELENGTH ROUTING NETWORKS 9**

The optical layer, Node Designs, Optical layer cost tradeoff, Routing and wavelength Assignment [RWA], Virtual topology design, Wavelength Routing Testbeds, Architectural variations.

**UNIT IV PACKET SWITCHING AND ACCESS NETWORKS 9**

Photonic Packet Switching – OTDM, Multiplexing and Demultiplexing, Synchronisation, Broadcast OTDM networks, Switch-based networks; Access Networks – Network Architecture overview, OTDM networks; Optical Access Network Architectures; Future Access Networks.

**UNIT V NETWORK DESIGN AND MANAGEMENT 9**

Transmission System Engineering – System model, Power penalty - transmitter, receiver, Optical amplifiers, crosstalk, dispersion; Wavelength stabilization ; Overall design considerations;

Control and Management – Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface.

**TOTAL: 45 PERIODS****REFERENCES:**

1. Rajiv Ramaswami and Kumar N. Sivarajan, "Optical Networks : A Practical Perspective", Harcourt Asia Pte Ltd., Second Edition 2004.
2. C. Siva Ram Moorthy and Mohan Gurusamy, "WDM Optical Networks : Concept, Design and Algorithms", Prentice Hall of India, 1st Edition, 2002.
3. Biswanath Mukherjee, "Optical Communication Networks", Mc-GrawHill ©1997, First Edition ISBN 0-07-044435-8.
4. P.E. Green, Jr., "Fiber Optic Networks", Prentice Hall, NJ, 1993.
5. Rajiv Ramaswami and Kumar N. Sivarajan, "Optical Networks : A Practical Perspective", Harcourt Asia Pte Ltd., First Edition 2004.

**List of Experiments**

Use Network Analyser for the following experiments:

1. Measurement of transmission line parameters.
2. S-parameter estimation of Microwave devices.
3. Design and testing of a Microstrip coupler.
4. Characteristics of  $\lambda/4$  and  $\lambda/2$  transmission lines.

Use appropriate simulation tools for the following experiments:

1. Channel equalizer design ( LMS, RLS )
2. Antenna Radiation Pattern measurement.
3. Performance Evaluation of digital modulation schemes
4. OFDM transceiver design
5. Simulation of Microstrip Antennas
6. Performance evaluation of simulated CDMA System.

**TOTAL : 45 PERIODS**

**OBJECTIVES:**

- To introduce the concepts of wireless communication.
- To make the students to know about the various propagation methods, Channel models, capacity calculations multiple antennas and multiple user techniques used in the mobile communication.
- To enhance the understanding of Wi-fi, 3G systems and 4G networks.

**UNIT I WIRELESS CHANNEL PROPAGATION AND MODEL 9**

Propagation of EM signals in wireless channel – Reflection, diffraction and Scattering-Small scale fading- channel classification- channel models – COST -231 Hata model, Longley-Rice Model, NLOS Multipath Fading Models: Rayleigh, Rician, Nakagami, Composite Fading –shadowing Distributions, Link power budget Analysis.

**UNIT II DIVERSITY 9**

Capacity of flat and frequency selective fading channels-Realization of independent fading paths, Receiver Diversity: selection combining, Threshold Combining, Maximum-ratio Combining, Equal gain Combining. Transmitter Diversity: Channel known at transmitter, channel unknown at the transmitter.

**UNIT III MIMO COMMUNICATIONS 9**

Narrowband MIMO model, Parallel decomposition of the MIMO channel, MIMO channel capacity, MIMO Diversity Gain:Beamforming, Diversity-Multiplexing trade-offs, Space time Modulation and coding : STBC,STTC, Spatial Multiplexing and BLAST Architectures.

**UNIT IV MULTI USER SYSTEMS 9**

Multiple Access : FDMA,TDMA, CDMA,SDMA, Hybrid techniques, Random Access: ALOHA,SALOHA,CSMA, Scheduling, power control, uplink downlink channel capacity, multiuser diversity, MIMO-MU systems.

**UNIT V WIRELESS NETWORKS 9**

3G Overview, Migration path to UMTS, UMTS Basics, Air Interface, 3GPP Network Architecture, 4G features and challenges, Technology path, IMS Architecture - Introduction to wireless LANs - IEEE 802.11 WLANs - Physical Layer- MAC sublayer.

**TOTAL: 45 PERIODS****REFERENCES:**

1. Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2007.
2. HARRY R. ANDERSON, "Fixed Broadband Wireless System Design" John Wiley – India, 2003.
3. Andreas.F. Molisch, "Wireless Communications", John Wiley – India, 2006.
4. Simon Haykin & Michael Moher, "Modern Wireless Communications", Pearson Education, 2007.
5. Rappaport. T.S., "Wireless communications", Pearson Education, 2003.
6. Clint Smith. P.E., and Daniel Collins, "3G Wireless Networks", 2<sup>nd</sup> Edition, Tata McGraw Hill, 2007.
7. Vijay. K. Garg, "Wireless Communication and Networking", Morgan Kaufmann Publishers, [http://books.elsevier.com/9780123735805](http://books.elsevier.com/9780123735805;)., 2007.
8. Kaveth Pahlavan,. K. Prashanth Krishnamuorthy, "Principles of Wireless Networks", Prentice Hall of India, 2006.
9. William Stallings, "Wireless Communications and networks" Pearson / Prentice Hall of India, 2<sup>nd</sup> Ed., 2007.
10. Sumit Katera and Nishit Narang, "3G Networks – Architecture, Protocols and Procedures", Tata McGraw Hill, 2007.

**OUTCOMES:**

1. The students understand the state of art techniques in wireless communication.
2. Students are enriched with the knowledge of present day technologies to enable them to face the world and contribute back as researchers.

**CU7202****MIC AND RF SYSTEM DESIGN****L T P C  
3 0 0 3****OBJECTIVES:**

1. To understand the fundamentals of RF radio system design.
2. To understand the various components that constitute an RF radio system for wireless Communications.
3. To know the basic analysis techniques needed for evaluating the performance of an RF radio system for Wireless applications.

**UNIT I CMOS PHYSICS, TRANSCEIVER SPECIFICATIONS AND ARCHITECTURES****9**

CMOS: Introduction to MOSFET Physics – Noise: Thermal, shot, flicker, popcorn noise  
 transceiver Specifications: Two port Noise theory, Noise Figure, THD, IP2, IP3, Sensitivity, SFDR,  
 Phase noise - Specification distribution over a communication link Transceiver Architectures:  
 Receiver: Homodyne, Heterodyne, Image reject, Low IF Architectures – Transmitter: Direct up  
 conversion, Two step up conversion

**UNIT II IMPEDANCE MATCHING AND AMPLIFIERS****9**

S-parameters with Smith chart – Passive IC components - Impedance matching networks  
 Amplifiers: Common Gate, Common Source Amplifiers – OC Time constants in bandwidth  
 estimation and enhancement – High frequency amplifier design Low Noise Amplifiers: Power  
 match and Noise match – Single ended and Differential LNAs – Terminated with Resistors and  
 Source Degeneration LNAs.

**UNIT III FEEDBACK SYSTEMS AND POWER AMPLIFIERS****9**

Feedback Systems: Stability of feedback systems: Gain and phase margin, Root-locus techniques  
 – Time and Frequency domain considerations – Compensation Power Amplifiers: General model –  
 Class A, AB, B, C, D, E and F amplifiers – Linearisation Techniques – Efficiency boosting  
 techniques – ACPR metric – Design considerations

**UNIT IV RF FILTER DESIGN, OSCILLATOR, MIXER****9**

Overview-basic resonator and filter configuration-special filter realizations-filter implementation.  
 Basic oscillator model-high frequency oscillator configuration-basic characteristics of mixers-phase  
 locked loops-RF directional couplers hybrid couplers-detector and demodulator circuits.

**UNIT V MIC COMPONENTS, ANTENNAS AND MEASUREMENT TECHNIQUES****9**

Introduction to MICs-Fabrication Technology, Advantages and applications, MIC components-  
 Micro strip components, Coplanar circuits, Integrated antennas, photonic band gap antennas,  
 Measurement techniques-test fixture measurements, probe station measurements, thermal and  
 cryogenic measurements, experimental field probing techniques.

**TOTAL: 45 PERIODS****OUTCOMES:**

- To be able to design RF circuits
- To be able to analyse the performance of RF circuits

**REFERENCES:**

1. T. Lee, "Design of CMOS RF Integrated Circuits", Cambridge, 2004.
2. B. Razavi, "RF Microelectronics", Pearson Education, 1997.
3. Jan Crols, Michiel Steyaert, "CMOS Wireless Transceiver Design", Kluwer Academic Publications, 1997.
4. B. Razavi, "Design of analog CMOS Integrated Circuits", McGraw Hill, 2001.
5. I.D. Robertson & S. Lucyszyn, "RFIC and MMIC Design and Technology", IEE Circuits, Devices and Systems series 13, London, UK, 2001.

**AP7301                      ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY                      L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To understand the basics of EMI
- To study EMI Sources
- To understand EMI problems
- To understand Solution methods in PCB
- To understand Measurement technique for emission
- To understand Measurement technique for immunity

**UNIT I                      EMI/EMC CONCEPTS                      9**

EMI-EMC definitions and Units of parameters; Sources and victim of EMI; Conducted and Radiated EMI Emission and Susceptibility; Transient EMI, ESD; Radiation Hazards.

**UNIT II                      EMI COUPLING PRINCIPLES                      9**

Conducted, radiated and transient coupling; Common ground impedance coupling ; Common mode and ground loop coupling ; Differential mode coupling ; Near field to cable coupling, cross talk ; Field to cable coupling ; Power mains and Power supply coupling.

**UNIT III                      EMI CONTROL TECHNIQUES                      9**

Shielding- Shielding Material-Shielding integrity at discontinuities, Filtering- Characteristics of Filters-Impedance and Lumped element filters-Telephone line filter, Power line filter design, Filter installation and Evaluation, Grounding- Measurement of Ground resistance-system grounding for EMI/EMC-Cable shielded grounding, Bonding, Isolation transformer, Transient suppressors, Cable routing, Signal control. EMI gaskets

**UNIT IV                      EMC DESIGN OF PCBs                      9**

EMI Suppression Cables-Absorptive, ribbon cables-Devices-Transient protection hybrid circuits ,Component selection and mounting; PCB trace impedance; Routing; Cross talk control-Electromagnetic Pulse-Noise from relays and switches, Power distribution decoupling; Zoning; Grounding; VIAs connection; Terminations.

**UNIT V                      EMI MEASUREMENTS AND STANDARDS                      9**

Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic chamber; Tx /Rx Antennas, Sensors, Injectors / Couplers, and coupling factors; EMI Rx and spectrum analyzer; Civilian standards-CISPR, FCC, IEC, EN; Military standards-MIL461E/462. Frequency assignment - spectrum conversation. British VDE standards, Euro norms standards in japan - comparisons. EN Emission and Susceptibility standards and Specifications.

**TOTAL: 45 PERIODS**

## OUTCOMES:

Upon Completion of the course, the students will be able to

- To design a EMI free system
- To reduce system level crosstalk
- To design high speed Printed Circuit board with minimum interference
- To make our world free from unwanted electromagnetic environment

## REFERENCES:

1. V.P.Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press, Newyork, 1996.
2. Clayton R.Paul," Introduction to Electromagnetic Compatibility", John Wiley Publications, 2008
3. Henry W.Ott., "Noise Reduction Techniques in Electronic Systems", A Wiley Inter Science Publications, John Wiley and Sons, Newyork, 1988.
4. Bemhard Keiser, "Principles of Electromagnetic Compatibility", 3<sup>rd</sup> Ed, Artech house, Norwood, 1986. .
5. Don R.J.White Consultant Incorporate, "Handbook of EMI/EMC" , Vol I-V, 1988.

CU7211

INNOVATIVE SYSTEM DESIGN LABORATORY

L T P C  
0 0 4 2

## OBJECTIVES:

1. To encourage the students to identify socially relevant problems,
2. To enable him to think of creative solutions for the same,
3. To design and conduct suitable experiments, as well as to analyze and interpret data to produce meaningful conclusions and match with theoretical concepts,
4. To enable the student to appreciate the practical aspects of system design and understand the associated challenges.
5. To help him develop low cost proof of concept system prototype.

## METHODOLOGY:

- Students could form teams not exceeding 2 members,
- Students should submit / present their ideas to the Lab-in-Charge and get it approved,
- Student should submit proposal with system/ technical details and cost implications,
- Students should periodically demonstrate the progress they have made.

## EVALUATION:

- Students should be evaluated on the basis of the following:
  - Social relevance of their work
  - Utility of the system developed
  - Level of proof of concept
  - Industry support if obtained, etc.

## OUTCOMES:

1. The student would be able to identify socially relevant issues and apply his knowledge to evolve feasible solutions.
2. The student would be able to comprehensively record and report the measured data, write reports, communicate research ideas and do oral presentations effectively.

**TOTAL: 60 PERIODS**

**UNIT I NAVIGATION, TRACKING AND SAFETY SYSTEMS 9**

Global Navigation Satellite Systems - Basic concepts of GPS. Space segment, Control segment, user segment, GPS constellation, GPS measurement characteristics, selective availability (AS), Anti spoofing (AS). Applications of Satellite and GPS for 3D position, Velocity, determination as function of time, Interdisciplinary applications. Regional Navigation Systems- Distress and Safety- Cospas-Sarsat- Inmarsat Distress System- Location-Based service.

**UNIT II INERTIAL NAVIGATION AND DIFFERENTIAL GPS SYSTEMS 9**

Introduction to Inertial Navigation- Inertial Sensors - Navigation Coordinates-System Implementations- System-Level Error Models- Introduction to Differential GPS- LADGPS- WADGPS-WAAS - GEO Uplink Subsystem (GUS) - GEO Uplink Subsystem (GUS) Clock Steering Algorithms - GEO Orbit Determination - Problems

**UNIT III REMOTE SENSING SYSTEMS AND TECHNIQUES 9**

Introduction - Commercial Imaging - DigitalGlobe – GeoEye - Meteorology – Meteosat - Land Observation – Landsat- Remote Sensing Data- Sensors- Overview - Optical Sensors: Cameras- Non-Optical Sensors- Image Processing - Image Interpretation- System Characteristics.

**UNIT IV BROADCAST SYSTEMS 9**

Introduction - Satellite Radio Systems - XM Satellite Radio Inc. - Sirius Satellite Radio –world space - Direct Multimedia Broadcast- MBCO and TU Multimedia - European Initiatives - Direct-to-Home Television - Implementation Issues - DTH Services- Representative DTH Systems - Military Multimedia Broadcasts - US Global Broadcast Service (GBS)- Business TV(BTV), GRAMSAT, Specialized services – E –mail, Video conferencing, Internet.

**UNIT V SATELLITE NETWORKING SYSTEM WITH IPV6 9**

Overview of IPv6 and its benefits- Migration and Coexistence- IPv6 Addressing Mechanisms- Addresses for Hosts and Routers- IPv6 Infrastructure - Routing and Route Management- Configuration Methods- Dynamic Host Configuration Protocol for IPv6 - IPv6 and Related Protocols- IPv6 Header Format- Traffic Classes.

**TOTAL: 45 PERIODS****REFERENCES:**

1. Global Positioning Systems, Inertial Navigation, and Integration. MOHINDER S. GREWAL California State University at Fullerton, A John Wiley & Sons, Inc. Publication.
2. Satellite Systems Engineering in an IPv6 Environment, Daniel Minoli, CRC Press.
3. Satellite systems for personal Applications, Madhavendra Richharia, A John Wiley and Sons, Ltd., Publication.
4. Dennis Roddy, 'Satellite Communication', McGraw Hill International, 4th Edition, 2006.
5. Wilbur L. Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, 'Satellite Communication Systems Engineering', Prentice Hall/Pearson, 2007 (Books to be added)

**OBJECTIVES:**

- To familiarize the fundamental concepts of microprocessor architecture.
- To gain knowledge about high performance CISC and RISC architectures.
- To study about 8 bit Microcontrollers viz. 68HC11 and PIC.

**UNIT I OVERVIEW 9**

Generic Architecture--Instruction Set – Data formats –Addressing modes – Memory hierarchy – register file –Cache – Virtual memory and paging – Segmentation- pipelining –the instruction pipeline – pipeline hazards – instruction level parallelism – reduced instruction set –Computer principles – RISC versus CISC.

**UNIT II HIGH PERFORMANCE CISC ARCHITECTURE – PENTIUM 9**

CPU Architecture- Bus Operations – Pipelining – Branch predication – floating point unit-Operating Modes –Paging – Multitasking – Exception and Interrupts – Instruction set –addressing modes – Programming the Pentium processor.

**UNIT III HIGH PERFORMANCE RISC ARCHITECTURE – ARM 9**

Organization of CPU – Bus architecture –Memory management unit - ARM instruction set- Thumb Instruction set- addressing modes – Programming the ARM processor.6

**UNIT IV MOTOROLA 68HC11 MICROCONTROLLERS 9**

Instruction set addressing modes – operating modes- Interrupt system- RTC-Serial Communication Interface – A/D Converter PWM and UART.

**UNIT V PIC MICROCONTROLLER 9**

CPU Architecture – Instruction set – interrupts- Timers- I2C Interfacing –UART- A/D Converter –PWM and introduction to C-Compilers.

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Daniel Tabak, "Advanced Microprocessors" McGraw Hill.Inc., 1995 (recent edition)
2. James L. Antonakos , " The Pentium Microprocessor " Pearson Education , 1997.
3. Steve Furber , "ARM System –On –Chip architecture" Addison Wesley, 2000.
4. Gene .H.Miller." Micro Computer Engineering," Pearson Education, 2003.
5. John .B.Peatman , " Design with PIC Microcontroller , Prentice hall, 1997.
6. James L.Antonakos , " An Introduction to the Intel family of Microprocessors " Pearson Education 1999.
7. Barry.B.Breg," The Intel Microprocessors Architecture, Programming and Interfacing " , PHI,2002.
8. Valvano "Embedded Microcomputer Systems" Thomson Asia PVT LTD first reprint 2001.

**VL7001 ANALOG AND MIXED MODE VLSI DESIGN L T P C  
3 0 0 3**

**OBJECTIVES:**

- To study the concepts of MOS large signal model and small signal model
- To understand the concepts of D/A conversion methods and their architectures.
- To design filters for ADC.
- To study about the switched capacitor circuits.

**UNIT I INTRODUCTION AND BASIC MOS DEVICES 9**

Challenges in analog design-Mixed signal layout issues- MOS FET structures and characteristics- large signal model – small signal model- single stage Amplifier-Source follower- Common gate stage – Cascode Stage

**UNIT II SIBMICRON CIRCUIT DESIGN 9**  
 Submicron CMOS process flow, Capacitors and resistors, Current mirrors, Digital Circuit Design, Delay Elements – Adders- OP Amp parameters and Design

**UNIT III DATA CONVERTERS 9**  
 Characteristics of Sample and Hold- Digital to Analog Converters- architecture-Differential Non linearity-Integral Non linearity- Voltage Scaling-Cyclic DAC-Pipeline DAC-Analog to Digital Converters- architecture – Flash ADC-Pipeline ADC-Differential Non linearity-Integral Non linearity

**UNIT IV SNR IN DATA CONVERTERS 9**  
 Overview of SNR of Data Converters- Clock Jitters- Improving Using Averaging – Decimating Filters for ADC- Band pass and High Pass Sinc Filters- Interpolating Filters for DAC

**UNIT V SWITCHED CAPACITOR CIRCUITS 9**  
 Resistors, First order low pass Circuit, Switched capacitor Amplifier, Switched Capacitor Integrator

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Vineetha P.Geji Analog and Mixed Mode Design - Prentice Hall, 1st Edition , 2011
2. JeyaGowri Analog and Mixed Mode Design- Sapna publishing House 2011.

**CU7001 REAL TIME EMBEDDED SYSTEMS L T P C**  
**3 0 0 3**

**UNIT I INTRODUCTION TO EMBEDDED COMPUTING 9**  
 Complex systems and microprocessors – Design example: Model train controller – Embedded system design process – Formalism for system design – Instruction sets Preliminaries – ARM Processor – CPU: Programming input and output – Supervisor mode, exception and traps – Coprocessor – Memory system mechanism – CPU performance – CPU power consumption.

**UNIT II COMPUTING PLATFORM AND DESIGN ANALYSIS 9**  
 CPU buses – Memory devices – I/O devices – Component interfacing – Design with microprocessors – Development and Debugging – Program design – Model of programs – Assembly and Linking – Basic compilation techniques – Analysis and optimization of execution time, power, energy, program size – Program validation and testing.

**UNIT III PROCESS AND OPERATING SYSTEMS 9**  
 Multiple tasks and multi processes – Processes – Context Switching – Operating Systems – Scheduling policies - Multiprocessor – Inter Process Communication mechanisms – Evaluating operating system performance – Power optimization strategies for processes.

**UNIT IV HARDWARE ACCELERATES & NETWORKS 9**  
 Accelerators – Accelerated system design – Distributed Embedded Architecture – Networks for Embedded Systems – Network based design – Internet enabled systems.

**UNIT V CASE STUDY 9**  
 Hardware and software co-design - Data Compressor - Software Modem – Personal Digital Assistants – Set–Top–Box. – System-on-Silicon – FOSS Tools for embedded system development.

**TOTAL: 45 PERIODS**

## REFERENCES:

1. Wayne Wolf, "Computers as Components - Principles of Embedded Computer System Design", Morgan Kaufmann Publisher, 2006.
2. David E-Simon, "An Embedded Software Primer", Pearson Education, 2007.
3. K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming", dreamtech press, 2005.
4. Tim Wilmshurst, "An Introduction to the Design of Small Scale Embedded Systems", Palgrave Publisher, 2004.
5. Sriram V Iyer, Pankaj Gupta, "Embedded Real Time Systems Programming", Tata Mc-Graw Hill, 2004.
6. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.

**CU7002**

**MEMS AND NEMS**

**L T P C**  
**3 0 0 3**

## OBJECTIVES:

- To introducing the concepts of microelectromechanical devices.
- To know the fabrication process of Microsystems.
- To know the design concepts of micro sensors and micro actuators.
- To introducing concepts of quantum mechanics and nano systems.

## **UNIT I OVERVIEW AND INTRODUCTION 9**

New trends in Engineering and Science: Micro and Nanoscale systems Introduction to Design of MEMS and NEMS, Overview of Nano and Microelectromechanical Systems, Applications of Micro and Nanoelectromechanical systems, Microelectromechanical systems, devices and structures Definitions, Materials for MEMS: Silicon, silicon compounds, polymers, metals

## **UNIT II MEMS FABRICATION TECHNOLOGIES 9**

Microsystem fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect-Ratio (LIGA and LIGA-like) Technology; Packaging: Microsystems packaging, Essential packaging technologies, Selection of packaging materials

## **UNIT III MICRO SENSORS 9**

MEMS Sensors: Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors- engineering mechanics behind these Microsensors. Case study: Piezo-resistive pressure sensor

## **UNIT IV MICRO ACTUATORS 9**

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators), Micromechanical Motors and pumps. Case study: Comb drive actuators

## **UNIT V NANOSYSTEMS AND QUANTUM MECHANICS 9**

Atomic Structures and Quantum Mechanics, Molecular and Nanostructure Dynamics: Shrodinger Equation and Wavefunction Theory, Density Functional Theory, Nanostructures and Molecular Dynamics, Electromagnetic Fields and their quantization, Molecular Wires and Molecular Circuits.

**TOTAL:45 PERIODS**

**REFERENCES:**

1. Marc Madou, "Fundamentals of Microfabrication", CRC press 1997.
2. Stephen D. Senturia, "Micro system Design", Kluwer Academic Publishers, 2001
3. Tai Ran Hsu, "MEMS and Microsystems Design and Manufacture", Tata Mcraw Hill, 2002.
4. Chang Liu, "Foundations of MEMS", Pearson education India limited, 2006,
5. Sergey Edward Lyshevski, "MEMS and NEMS: Systems, Devices, and Structures" CRC Press, 2002

**AP7202****ASIC AND FPGA DESIGN****L T P C  
3 0 0 3****OBJECTIVES:**

- To study the design flow of different types of ASIC.
- To familiarize the different types of programming technologies and logic devices.
- To learn the architecture of different types of FPGA.
- To gain knowledge about partitioning, floor planning, placement and routing including circuit extraction of ASIC
- To analyse the synthesis, Simulation and testing of systems.
- To understand the design issues of SOC.
- To know about different high performance algorithms and its applications in ASICs.

**UNIT I OVERVIEW OF ASIC AND PLD 9**

Types of ASICs - Design flow – CAD tools used in ASIC Design – Programming Technologies: Antifuse – static RAM – EPROM and EEPROM technology, Programmable Logic Devices : ROMs and EPROMs – PLA –PAL. Gate Arrays – CPLDs and FPGAs

**UNIT II ASIC PHYSICAL DESIGN 9**

System partition -partitioning - partitioning methods – interconnect delay models and measurement of delay - floor planning - placement – Routing : global routing - detailed routing - special routing - circuit extraction - DRC

**UNIT III LOGIC SYNTHESIS, SIMULATION AND TESTING 9**

Design systems - Logic Synthesis - Half gate ASIC -Schematic entry - Low level design language - PLA tools -EDIF- CFI design representation. Verilog and logic synthesis -VHDL and logic synthesis - types of simulation -boundary scan test - fault simulation - automatic test pattern generation.

**UNIT IV FPGA 9**

Field Programmable gate arrays- Logic blocks, routing architecture, Design flow technology - mapping for FPGAs, Xilinx XC4000 - ALTERA's FLEX 8000/10000, ACTEL's ACT-1,2,3 and their speed performance

Case studies: Altera MAX 5000 and 7000 - Altera MAX 9000 – Spartan II and Virtex II FPGAs - Apex and Cyclone FPGAs

**UNIT V SOC DESIGN 9**

Design Methodologies – Processes and Flows - Embedded software development for SOC – Techniques for SOC Testing – Configurable SOC – Hardware / Software codesign Case studies: Digital camera, Bluetooth radio / modem, SDRAM and USB

**TOTAL: 45 PERIODS**



**UNIT V HIGHER LAYER MODELING & MODELING THE NETWORK TOPOLOGY**

**9**

Higher Layer Modeling :Modeling the Network Layer and Routing Protocols, Components of a Routing Protocol, Metrics, Virtual Routing on Overlays, Modeling Transport Layer Protocols, Modeling Application Traffic.

Modeling the Network Topology : Abstraction of Network Topologies by Graphs, Characterizing Graphs, Common Topology Models, Geometric Random Graphs – The Waxman Model, Hierarchical Topologies, Preferential Linking – The Barabási-Albert Model , Modeling the Internet.

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. K.Wehrle, Gunes, J.Gross, "Modeling and Tools for Network simulation", Springer, 2010.
2. Irene Karzela, "Modeling and Simulating Communications Networks", Prentice Hall India, 1998,
3. William.H.Tranter, K. Sam Shanmugam, Theodore. S. Rappaport, Kurt L. Kosbar, "Principles of Communication Systems Simulation", Pearson Education (Singapore) Pvt. Ltd, 2004.
4. M.C. Jeruchim, P.Balaban and K. Sam Shanmugam, "Simulation of Communication Systems: Modeling, Methodology and Techniques", Plenum Press, New York, 2001.
5. Nejat; Bragg, Arnold, "Recent Advances in Modeling and Simulation Tools for Communication Networks and Services", Springer, 2007

**CU7003**

**DIGITAL COMMUNICATION RECEIVERS**

**L T P C  
3 0 0 3**

**UNIT I REVIEW OF DIGITAL COMMUNICATION TECHNIQUES**

**9**

Base band communication; signal space representation, linear and nonlinear modulation techniques, Error tracking and Spectral characteristics of digital modulation.

**UNIT II OPTIMUM RECEIVERS FOR AWGN CHANNEL**

**9**

Correlation demodulator, matched filter , maximum likelihood sequence detector,optimum receiver for CPM signals, M-ary orthogonal signals, envelope detectors for Maryand correlated binary signals.

**UNIT III RECEIVERS FOR FADING CHANNELS**

**9**

Characterization of fading multiple channels, statistical models, flat and frequency selective fading, diversity technique, Optimal receivers for data detection and synchronization parameter estimation, coded waveform for fading channel.

**UNIT IV SYNCHRONIZATION TECHNIQUES**

**9**

Carrier and signal synchronization, carrier phase estimation-PLL, Decision directed loops, symbol timing estimation, maximum likelihood and non-decision directed timing estimation, joint estimation.

**UNIT V ADAPTIVE EQUALIZATION**

**9**

Zero forcing algorithm, LMS algorithm, adaptive decision-feedback equalizer and Equalization of Trellis-coded signals. Kalman algorithm, blind equalizers and stochastic gradient algorithm.

**TOTAL : 45 PERIODS**

**REFERENCES:**

1. Heinrich Meyer, Mare Moeneclacy, Stefan.A.Fechtel, " Digital communication receivers ", Vol I & Vol II, John Wiley, New York, 1997.
2. U.Mengali & A.N.D'Andrea, Synchronization Techniques for Digital Receivers, Kluwer, 1997.
3. John.G.Proakis, "Digital communication "4th Edition, McGraw-Hill, New York, 2001.
4. E.A.Lee and D.G. Messerschmitt, "Digital communication ", 2nd Edition, Allied Publishers, New Delhi, 1994.
5. Simon Marvin, "Digital communication over fading channel; An unified approach to performance Analysis ", John Wiley, New York, 2000.
6. H.Meyr & G.Ascheid, Synchronization in Digital Communications, John Wiley, 1990.
7. R. G. Gallager, Principles of Digital Communication, Cambridge University Press, 2008.

**CU7004****DETECTION AND ESTIMATION THEORY****L T P C**  
**3 0 0 3****OBJECTIVES:**

- To enable the student to understand the basic principles of random signal processing , spectral estimation methods and their applications.
- To enable the student to understand the different signal detection and estimation methods used in communication system design and the implications of proper synchronization methods for proper functioning of the system.

**UNIT I DISCRETE RANDOM SIGNAL PROCESSING****9**

Discrete Random Processes- Ensemble Averages, Stationary processes, Bias and Estimation, Auto covariance, Autocorrelation, Parseval's theorem, Wiener-Khintchine relation, White noise, Power Spectral Density, Spectral factorization, Filtering Random Processes, Special types of Random Processes – ARMA, AR, MA – Yule-Walker equations.

**UNIT II SPECTRAL ESTIMATION****9**

Estimation of spectra from finite duration signals, Nonparametric methods – Periodogram, Modified periodogram, Bartlett, Welch and Blackman-Tukey methods, Parametric methods – ARMA, AR and MA model based spectral estimation, Solution using Levinson-Durbin algorithm.

**UNIT III DETECTION AND ESTIMATION CRITERIA****9**

Detection criteria : Bayes detection techniques, MAP, ML,– detection of M-ary signals, Neyman Peason, minimax decision criteria. Estimation: linear estimators, non-linear estimators, Bayes, MAP,ML, properties of estimators, phase and amplitude estimation.

**UNIT IV SYNCHRONIZATION****9**

Signal parameter estimation, carrier phase estimation, symbol timing estimator, joint estimation of carrier phase and symbol timing.

**UNIT V RECEIVERS FOR AWGN AND FADING CHANNELS****9**

Optimum receivers for AWGN channel -Correlation demodulator, matched filter, maximum likelihood sequence detector, envelope detectors for M-ary signals; Characterization of fading multipath channels, RAKE demodulator, Multiuser detection techniques.

**TOTAL: 45 PERIODS****REFERENCES:**

1. Monson H. Hayes, 'Statistical Digital Signal Processing and Modeling', John Wiley and Sons, Inc, Singapore, 2002
2. John J. Proakis, Dimitris G. Manolakis, : Digital Signal Processing', Pearson Education, 2002.
3. John G. Proakis., 'Digital Communication', 4 th edition, Mc Graw Hill Publication, 2001.
4. Bernard Sklar and Pabitra Kumar Roy, Digital Communications: Fundamentals & Applications, 2/E, Pearson Education India, 2009
5. John G. Proakis, Masoud Salehi, "Communication Systems Engineering", Prentice Hall, 1994.

**OUTCOMES:**

- The student would be able to demonstrate an understanding of the basic principles of random signal processing, spectral estimation methods and their applications.
- The student would be able to demonstrate an understanding of the different signal detection and estimation methods used in communication system design and the implications of proper synchronization methods for proper functioning of the system.
- The student would be in a position to apply his knowledge for designing a baseband system addressing the channel impairments.
- Heinrich Meyer, Mare Moeneclacy, Stefan.A.Fechtel, " Digital communication receivers ", Vol I & Vol II, John Wiley, New York, 1997.
- Sergio Verdu, "Multiuser Detection", Cambridge University Press, 1998.

**VL7013****VLSI FOR WIRELESS COMMUNICATION****L T P C  
3 0 0 3****OBJECTIVES:**

- To study the design concepts of low noise amplifiers.
- To study the various types of mixers designed for wireless communication.
- To study and design PLL and VCO.
- To understand the concepts of CDMA in wireless communication.

**UNIT I COMPONENTS AND DEVICES****9**

Integrated inductors, resistors, MOSFET and BJT AMPLIFIER DESIGN: Low Noise Amplifier Design - Wideband LNA - Design Narrowband LNA - Impedance Matching - Automatic Gain Control Amplifiers – Power Amplifiers

**UNIT II MIXERS****9**

Balancing Mixer - Qualitative Description of the Gilbert Mixer - Conversion Gain – Distortion - Low Frequency Case: Analysis of Gilbert Mixer – Distortion - High-Frequency Case – Noise - A Complete Active Mixer. Switching Mixer - Distortion in Unbalanced Switching Mixer - Conversion Gain in Unbalanced Switching Mixer - Noise in Unbalanced Switching Mixer - A Practical Unbalanced Switching Mixer. Sampling Mixer - Conversion Gain in Single Ended Sampling Mixer - Distortion in Single Ended Sampling Mixer - Intrinsic Noise in Single Ended Sampling Mixer - Extrinsic Noise in Single Ended Sampling Mixer.

**UNIT III FREQUENCY SYNTHESIZERS****9**

Phase Locked Loops - Voltage Controlled Oscillators - Phase Detector – Analog Phase Detectors – Digital Phase Detectors - Frequency Dividers - LC Oscillators - Ring Oscillators - Phase Noise - A Complete Synthesizer Design Example (DECT Application).

**UNIT IV SUB SYSTEMS****9**

Data converters in communications, adaptive Filters, equalizers and transceivers

**UNIT V IMPLEMENTATIONS****9**

VLSI architecture for Multitier Wireless System - Hardware Design Issues for a Next generation CDMA System .

**TOTAL : 45 PERIODS**

**REFERENCES:**

1. B.Razavi ,”RF Microelectronics” , Prentice-Hall ,1998.
2. Bosco H Leung “VLSI for Wireless Communication”, Pearson Education, 2002.
3. Thomas H.Lee, “The Design of CMOS Radio –Frequency Integrated Circuits’, Cambridge University Press ,2003.
4. Emad N Farag and Mohamed I Elmasry, “Mixed Signal VLSI Wireless Design - Circuits and Systems”, Kluwer Academic Publishers, 2000.
5. Behzad Razavi, “Design of Analog CMOS Integrated Circuits” McGraw-Hill, 1999.
6. J. Crols and M. Steyaert, “CMOS Wireless Transceiver Design,” Boston, Kluwer Academic Pub., 1997.

**CU7005****COGNITIVE RADIO****L T P C  
3 0 0 3****OBJECTIVES:**

1. To enable the student to understand the evolving paradigm of cognitive radio communication and the enabling technologies for its implementation.
2. To enable the student to understand the essential functionalities and requirements in designing software defined radios and their usage for cognitive communication.
3. To expose the student to the evolving next generation wireless networks and their associated challenges.

**UNIT I INTRODUCTION TO SDR****9**

Definitions and potential benefits, software radio architecture evolution – foundations, technology tradeoffs and architecture implications, Antenna for Cognitive Radio.

**UNIT II SDR ARCHITECTURE****9**

Essential functions of the software radio, architecture goals, quantifying degrees of programmability, top level component topology, computational properties of functional components, interface topologies among plug and play modules, architecture partitions.

**UNIT III INTRODUCTION TO COGNITIVE RADIOS****9**

Marking radio self-aware, the cognition cycle, organization of cognition tasks, structuring knowledge for cognition tasks, Enabling location and environment awareness in cognitive radios – concepts, architecture, design considerations.

**UNIT IV COGNITIVE RADIO ARCHITECTURE****9**

Primary Cognitive Radio functions, Behaviors, Components, A–Priori Knowledge taxonomy, observe – phase data structures, Radio procedure knowledge encapsulation, components of orient, plan, decide phases, act phase knowledge representation, design rules.

**UNIT V NEXT GENERATION WIRELESS NETWORKS****9**

The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.

**TOTAL: 45 PERIODS****REFERENCES:**

1. Alexander M. Wyglinski, Maziar Nekovee, And Y. Thomas Hou, “ Cognitive Radio Communications And Networks - Principles And Practice”, Elsevier Inc. , 2010.
2. “E. Biglieri, A.J. Goldsmith., L.J. Greenstein, N.B. Mandayam, H.V. Poor, Principles of Cognitive Radio”, Cambridge University Press, 2013.
3. Kwang-Cheng Chen and Ramjee Prasad, ” Cognitive Radio Networks” , John Wiley & Sons, Ltd, 2009.
4. Khattab, Ahmed, Perkins, Dmitri, Bayoumi, Magdy, “Cognitive Radio Networks - From Theory to Practice”, Springer Series: Analog Circuits and Signal Processing, 2009.

5. J. Mitola, "Cognitive Radio: An Integrated Agent Architecture for software defined radio", Doctor of Technology thesis, Royal Inst. Technology, Sweden 2000.
6. Simon Haykin, "Cognitive Radio: Brain –empowered wireless communications", IEEE Journal on selected areas in communications, Feb 2005.
7. Ian F. Akyildiz, Won – Yeol Lee, Mehmet C. Vuran, Shantidev Mohanty, "NeXt generation /dynamic spectrum access / cognitive radio wireless networks: A Survey Elsevier Computer Networks, May 2006.

**OUTCOMES:**

1. The student would be able to appreciate the motivation and the necessity for cognitive radio communication strategies.
2. The student would be able to evolve new techniques and demonstrate their feasibility using mathematical validations and simulation tools.
3. The student would be able to demonstrate the impact of the evolved solutions in future wireless network design.

**DS7071**

**SPEECH AND AUDIO SIGNAL PROCESSING**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To study the basic concepts of speech and audio.
- To study the analysis of various M-band filter banks for audio coding
- To learn various transform coders for audio coding.
- To study the speech processing methods in time and frequency domain

**UNIT I MECHANICS OF SPEECH AND AUDIO**

**9**

Introduction - Review Of Signal Processing Theory-Speech production mechanism – Nature of Speech signal – Discrete time modelling of Speech production – Classification of Speech sounds – Phones – Phonemes – Phonetic and Phonemic alphabets – Articulatory features.

Absolute Threshold of Hearing - Critical Bands- Simultaneous Masking, Masking-Asymmetry, and the Spread of Masking- Nonsimultaneous Masking - Perceptual Entropy - Basic measuring philosophy -Subjective versus objective perceptual testing - The perceptual audio quality measure (PAQM) - Cognitive effects in judging audio quality.

**UNIT II TIME-FREQUENCY ANALYSIS: FILTER BANKS AND TRANSFORMS**

**9**

Introduction -Analysis-Synthesis Framework for M-band Filter Banks- Filter Banks for Audio Coding: Design Considerations - Quadrature Mirror and Conjugate Quadrature Filters- Tree-Structured QMF and CQF M-band Banks - Cosine Modulated "Pseudo QMF" M-band Banks - Cosine Modulated Perfect Reconstruction (PR) M-band Banksand the Modified Discrete Cosine Transform (MDCT) - Discrete Fourier and Discrete Cosine Transform - Pre-echo Distortion- Pre-echo Control Strategies.

**UNIT III AUDIO CODING AND TRANSFORM CODERS**

**9**

Lossless Audio Coding-Lossy Audio Coding- ISO-MPEG-1A,2A,2A Advaned , 4AudioCoding - Optimum Coding in the Frequency Domain - Perceptual Transform Coder -Brandenburg-Johnston Hybrid Coder - CNET Coders - Adaptive Spectral Entropy Coding -Differential Perceptual Audio Coder - DFT Noise Substitution -DCT with Vector Quantization -MDCT with Vector Quantization.

**UNIT IV TIME AND FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING**

**9**

Time domain parameters of Speech signal – Methods for extracting the parameters :Energy, Average Magnitude – Zero crossing Rate – Silence Discrimination using ZCR and energy

Short Time Fourier analysis – Formant extraction – Pitch Extraction using time and frequency domain methods

**HOMOMORPHIC SPEECH ANALYSIS:**

Cepstral analysis of Speech – Formant and Pitch Estimation – Homomorphic Vocoders.

**UNIT V LINEAR PREDICTIVE ANALYSIS OF SPEECH**

**9**

Formulation of Linear Prediction problem in Time Domain – Basic Principle – Auto correlation method – Covariance method – Solution of LPC equations – Cholesky method – Durbin's Recursive algorithm – lattice formation and solutions – Comparison of different methods – Application of LPC parameters – Pitch detection using LPC parameters – Formant analysis – VELP – CELP.

**TOTAL: 45 PERIODS**

**REFERENCES**

1. Digital Audio Signal Processing, Second Edition, Udo Zölzer, A John Wiley & sons Ltd Publications
2. Applications of Digital Signal Processing to Audio And Acoustics  
Mark Kahrs, Karlheinz Brandenburg, KLUWER ACADEMIC PUBLISHERS NEW YORK, BOSTON, DORDRECHT, LONDON, MOSCOW
3. Digital Processing of Speech signals – L.R.Rabiner and R.W.Schaffer - Prentice Hall --1978

**DS7201**

**ADVANCED DIGITAL IMAGE PROCESSING**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To understand the image fundamentals and mathematical transforms necessary for image processing and to study the image enhancement techniques.
- To understand the image segmentation and representation techniques.
- To understand how image are analyzed to extract features of interest.
- To introduce the concepts of image registration and image fusion.
- To analyze the constraints in image processing when dealing with 3D data sets.

**UNIT I FUNDAMENTALS OF DIGITAL IMAGE PROCESSING**

**9**

Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, 2D image transforms-DFT, DCT, KLT, and SVD. Image enhancement in spatial and frequency domain, Review of morphological image processing

**UNIT II SEGMENTATION**

**9**

Edge detection, Thresholding, Region growing, Fuzzy clustering, Watershed algorithm, Active contour methods, Texture feature based segmentation, Model based segmentation, Atlas based segmentation, Wavelet based Segmentation methods

**UNIT III FEATURE EXTRACTION**

**9**

First and second order edge detection operators, Phase congruency, Localized feature extraction-detecting image curvature, shape features Hough transform, shape skeletonization, Boundary descriptors, Moments, Texture descriptors- Autocorrelation, Co-occurrence features, Runlength features, Fractal model based features, Gabor filter, wavelet features.



**UNIT II SIGNAL MODELS 9**

Components of a radar signal, amplitude models, types of clutters, noise model and signal-to-noise ratio, jamming, frequency models: the doppler shift, spatial models, spectral model

**UNIT III SAMPLING AND QUANTIZATION OF PULSED RADAR SIGNALS 9**

Domains and criteria for sampling radar signals, Sampling in the fast time dimension, Sampling in slow time: selecting the pulse repetition interval, sampling the doppler spectrum, Sampling in the spatial and angle dimension, Quantization, I/Q Imbalance and Digital I/Q

**UNIT IV RADAR WAVEFORMS 9**

Introduction, The waveform matched filter, Matched filtering of moving targets, The ambiguity function, The pulse burst waveform, frequency-modulated pulse compression waveforms, Range sidelobe control for FM waveforms, the stepped frequency waveform, Phase-modulated pulse compression waveforms, COSTAS Frequency Codes.

**UNIT V DOPPLER PROCESSING 9**

Alternate forms of the Doppler spectrum, Moving target indication (MTI), Pulse Doppler processing, dwell-to-dwell stagger, Pulse pair processing, additional Doppler processing issues, clutter mapping and the moving target detector, MTI for moving platforms: adaptive displaced phase center antenna processing

**TOTAL : 45 PERIODS**

**REFERENCES:**

1. Fundamentals of Radar Signal Processing, Mark A. Richards McGraw-Hill, New York, 2005
2. Principles of Radar and Sonar Signal Processing, Francois Le Chevalier, Artech House
3. Radar systems, Peak Detection and Tracking, Michael O Kolawole ,2010,Elseveir
4. Introduction To Radar Systems 3/E, Skolnik, McGraw Hill.
5. Radar Principles, Peyton Z. Peebles, 2009 Wiley India
6. Radar Design Principles-Signal Processing and the environment, Fred E. Nathanson, PHI

**CP7008 SPEECH PROCESSING AND SYNTHESIS L T P C  
3 0 0 3**

**OBJECTIVES:**

- To understand the mathematical foundations needed for speech processing
- To understand the basic concepts and algorithms of speech processing and synthesis
- To familiarize the students with the various speech signal representation, coding and recognition techniques
- To appreciate the use of speech processing in current technologies and to expose the students to real– world applications of speech processing

**UNIT I FUNDAMENTALS OF SPEECH PROCESSING 9**

Introduction – Spoken Language Structure – Phonetics and Phonology – Syllables and Words – Syntax and Semantics – Probability, Statistics and Information Theory – Probability Theory – Estimation Theory – Significance Testing – Information Theory.

**UNIT II SPEECH SIGNAL REPRESENTATIONS AND CODING 9**

Overview of Digital Signal Processing – Speech Signal Representations – Short time Fourier Analysis – Acoustic Model of Speech Production – Linear Predictive Coding – Cepstral Processing – Formant Frequencies – The Role of Pitch – Speech Coding – LPC Coder.

**UNIT III SPEECH RECOGNITION 9**  
Hidden Markov Models – Definition – Continuous and Discontinuous HMMs – Practical Issues – Limitations. Acoustic Modeling – Variability in the Speech Signal – Extracting Features – Phonetic Modeling – Adaptive Techniques – Confidence Measures – Other Techniques.

**UNIT IV TEXT ANALYSIS 9**  
Lexicon – Document Structure Detection – Text Normalization – Linguistic Analysis – Homograph Disambiguation – Morphological Analysis – Letter-to-sound Conversion – Prosody – Generation schematic – Speaking Style – Symbolic Prosody – Duration Assignment – Pitch Generation

**UNIT V SPEECH SYNTHESIS 9**  
Attributes – Formant Speech Synthesis – Concatenative Speech Synthesis – Prosodic Modification of Speech – Source-filter Models for Prosody Modification – Evaluation of TTS Systems.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon completion of the course, the students will be able to

- Identify the various temporal, spectral and cepstral features required for identifying speech units – phoneme, syllable and word
- Determine and apply Mel-frequency cepstral coefficients for processing all types of signals
- Justify the use of formant and concatenative approaches to speech synthesis
- Identify the apt approach of speech synthesis depending on the language to be processed
- Determine the various encoding techniques for representing speech.

**REFERENCES:**

1. Xuedong Huang, Alex Acero, Hsiao-Wuen Hon, “Spoken Language Processing – A guide to Theory, Algorithm and System Development”, Prentice Hall PTR, 2001.
2. Thomas F. Quatieri, “Discrete-Time Speech Signal Processing”, Pearson Education, 2002.
3. Lawrence Rabiner and Biing-Hwang Juang, “Fundamentals of Speech Recognition”, Prentice Hall Signal Processing Series, 1993.
4. Sadaoki Furui, “Digital Speech Processing: Synthesis, and Recognition, Second Edition, (Signal Processing and Communications)”, Marcel Dekker, 2000.
5. Joseph Mariani, “Language and Speech Processing”, Wiley, 2009.

**CU7006 WAVELET TRANSFORMS AND APPLICATIONS L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To study the basics of signal representation and Fourier theory
- To understand Multi Resolution Analysis and Wavelet concepts
- To study the wavelet transform in both continuous and discrete domain
- To understand the design of wavelets using Lifting scheme
- To understand the applications of Wavelet transform

**UNIT I FUNDAMENTALS 9**  
Vector Spaces – Properties– Dot Product – Basis – Dimension, Orthogonality and Orthonormality – Relationship Between Vectors and Signals – Signal Spaces – Concept of Convergence – Hilbert Spaces for Energy Signals- Fourier Theory: Fourier series expansion, Fourier transform, Short time Fourier transform, Time-frequency analysis.



**OUTCOMES:**

Students should be able to:

- Become Digital Signal Processor specialized engineer
- DSP based System Developer

**UNIT I FUNDAMENTALS OF PROGRAMMABLE DSPs 9**

Multiplier and Multiplier accumulator – Modified Bus Structures and Memory access in PDSPs – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining – Special Addressing modes in P-DSPs – On chip Peripherals.

**UNIT II TMS320C5X PROCESSOR 9**

Architecture – Assembly language syntax - Addressing modes – Assembly language Instructions - Pipeline structure, Operation – Block Diagram of DSP starter kit – Application Programs for processing real time signals.

**UNIT III TMS320C6X PROCESSOR 9**

Architecture of the C6x Processor - Instruction Set - DSP Development System: Introduction – DSP Starter Kit Support Tools- Code Composer Studio - Support Files - Programming Examples to Test the DSK Tools – Application Programs for processing real time signals.

**UNIT IV ADSP PROCESSORS 9**

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.

**UNIT V ADVANCED PROCESSORS 9**

Architecture of TMS320C54X: Pipe line operation, Code Composer studio – Architecture of TMS320C6X - Architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. B.Venkataramani and M.Bhaskar, “Digital Signal Processors – Architecture, Programming and Applications” – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.
2. Avtar Singh and S. Srinivasan, Digital Signal Processing – Implementations using DSP Microprocessors with Examples from TMS320C54xx, cengage Learning India Private Limited, Delhi 2012
3. User guides Texas Instrumentation, Analog Devices, Motorola.
4. Rulph Chassaing, Digital Signal Processing and Applications with the C6713 and C6416 DSK, A JOHN WILEY & SONS, INC., PUBLICATION, 2005

**NC7101**

**HIGH PERFORMANCE NETWORKS**

**L T P C  
3 0 0 3**

**COURSE OBJECTIVES:**

- To develop a comprehensive understanding of multimedia networking.
- To study the types of VPN and tunneling protocols for security.
- To learn about network security in many layers and network management.

**UNIT I INTRODUCTION 9**

Review of OSI, TCP/IP; Multiplexing, Modes of Communication, Switching, Routing. SONET – DWDM – DSL – ISDN – BISDN, ATM.

**UNIT II MULTIMEDIA NETWORKING APPLICATIONS 9**

Streaming stored Audio and Video – Best effort service – protocols for real time interactive applications – Beyond best effort – scheduling and policing mechanism – integrated services – RSVP- differentiated services.

**UNIT III ADVANCED NETWORKS CONCEPTS 9**

VPN-Remote-Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN.MPLS-operation, Routing, Tunneling and use of FEC, Traffic Engineering, MPLS based VPN, overlay networks-P2P connections.

**UNIT IV TRAFFIC MODELLING 8**

Little's theorem, Need for modeling, Poisson modeling and its failure, Non- poisson models, Network performance evaluation.

**UNIT V NETWORK SECURITY AND MANAGEMENT 10**

Principles of cryptography – Authentication – integrity – key distribution and certification – Access control and: fire walls – attacks and counter measures – security in many layers. Infrastructure for network management – The internet standard management framework – SMI, MIB, SNMP, Security and administration – ASN.1

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. J.F. Kurose & K.W. Ross, "Computer Networking- A top down approach featuring the internet", Pearson, 2<sup>nd</sup> edition, 2003.
2. Walrand .J. Varatya, High performance communication network, Morgan Kauffman – Harcourt Asia Pvt. Ltd. 2<sup>nd</sup> Edition, 2000.
3. LEOM-GarCIA, WIDJAJA, "Communication networks", TMH seventh reprint 2002.
4. Aunurag kumar, D. MAnjunath, Joy kuri, "Communication Networking", Morgan Kaufmann Publishers, 1ed 2004.
5. Hersent Gurle & petit, "IP Telephony, packet Pored Multimedia communication Systems", Pearson education 2003.
6. Fred Halsall and Lingana Gouda Kulkarni, "Computer Networking and the Internet" fifth edition, Pearson education
7. Nader F.Mir ,Computer and Communication Networks, first edition.
8. Larry I.Peterson & Bruce S.David, "Computer Networks: A System Approach"- 1996

**CP7023**

**RECONFIGURABLE COMPUTING**

**L T P C  
3 0 0 3**

**OBJECTIVES**

- To understand the need for reconfigurable computing
- To expose the students to various device architectures
- To examine the various reconfigurable computing systems
- To understand the different types of compute models for programming reconfigurable architectures
- To expose the students to HDL programming and familiarize with the development environment
- To expose the students to the various placement and routing protocols
- To develop applications with FPGAs

**UNIT I DEVICE ARCHITECTURE 9**

General Purpose Computing Vs Reconfigurable Computing – Simple Programmable Logic Devices – Complex Programmable Logic Devices – FPGAs – Device Architecture - Case Studies.

<b>UNIT II</b>	<b>RECONFIGURABLE COMPUTING ARCHITECTURES AND SYSTEMS</b>	<b>9</b>
Reconfigurable Processing Fabric Architectures – RPF Integration into Traditional Computing Systems – Reconfigurable Computing Systems – Case Studies – Reconfiguration Management.		
<b>UNIT III</b>	<b>PROGRAMMING RECONFIGURABLE SYSTEMS</b>	<b>9</b>
Compute Models - Programming FPGA Applications in HDL – Compiling C for Spatial Computing – Operating System Support for Reconfigurable Computing.		
<b>UNIT IV</b>	<b>MAPPING DESIGNS TO RECONFIGURABLE PLATFORMS</b>	<b>9</b>
The Design Flow - Technology Mapping – FPGA Placement and Routing – Configuration Bitstream Generation – Case Studies with Appropriate Tools.		
<b>UNIT V</b>	<b>APPLICATION DEVELOPMENT WITH FPGAS</b>	<b>9</b>
Case Studies of FPGA Applications – System on a Programmable Chip (SoPC) Designs.		
		<b>TOTAL: 45 PERIODS</b>

**OUTCOMES:**

Upon completion of the course, the students will be able to

1. Identify the need for reconfigurable architectures
2. Discuss the architecture of FPGAs
3. Point out the salient features of different reconfigurable architectures
4. Build basic modules using any HDL
5. Develop applications using any HDL and appropriate tools
6. Design and build an SoPC for a particular application

**REFERENCES:**

1. Maya B. Gokhale and Paul S. Graham, “Reconfigurable Computing: Accelerating Computation with Field-Programmable Gate Arrays”, Springer, 2005.
2. Scott Hauck and Andre Dehon (Eds.), “Reconfigurable Computing – The Theory and Practice of FPGA-Based Computation”, Elsevier / Morgan Kaufmann, 2008.
3. Christophe Bobda, “Introduction to Reconfigurable Computing – Architectures, Algorithms and Applications”, Springer, 2010.

<b>NC7001</b>	<b>NETWORK ROUTING ALGORITHMS</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

**OBJECTIVES:**

- To expose the students to the layered architecture for communication networks and the specific functionality of the network layer.
- To enable the student to understand the basic principles of routing and the manner this is implemented in conventional networks and the evolving routing algorithms based on Internetworking requirements, optical backbone and the wireless access part of the network.
- To enable the student to understand the different routing algorithms existing and their performance characteristics.

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>7</b>
ISO OSI Layer Architecture, TCP/IP Layer Architecture, Functions of Network layer, General Classification of routing, Routing in telephone networks, Dynamic Non hierarchical Routing (DNHR), Trunk status map routing (TSMR), real-time network routing (RTNR), Distance vector routing, Link state routing, Hierarchical routing.		

**UNIT II INTERNET ROUTING 10**

Interior protocol : Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Bellman Ford Distance Vector Routing. Exterior Routing Protocols: Exterior Gateway Protocol (EGP) and Border Gateway Protocol (BGP). Multicast Routing: Pros and cons of Multicast and Multiple Unicast Routing, Distance Vector Multicast Routing Protocol (DVMRP), Multicast Open Shortest Path First (MOSPF), MBONE, Core Based Tree Routing.

**UNIT III ROUTING IN OPTICAL WDM NETWORKS 10**

Classification of RWA algorithms, RWA algorithms, Fairness and Admission Control, Distributed Control Protocols, Permanent Routing and Wavelength Requirements, Wavelength Rerouting- Benefits and Issues, Lightpath Migration, Rerouting Schemes, Algorithms- AG, MWPG.

**UNIT IV MOBILE - IP NETWORKS 9**

Macro-mobility Protocols, Micro-mobility protocol: Tunnel based : Hierarchical Mobile IP, Intra domain Mobility Management, Routing based: Cellular IP, Handoff Wireless Access Internet Infrastructure (HAWAII).

**UNIT V MOBILE AD –HOC NETWORKS 9**

Internet-based mobile ad-hoc networking communication strategies, Routing algorithms – Proactive routing: destination sequenced Distance Vector Routing (DSDV), Reactive routing: Dynamic Source Routing (DSR), Ad hoc On-Demand Distance Vector Routing (AODV), Hybrid Routing: Zone Based Routing (ZRP).

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. William Stallings, ' High speed networks and Internets Performance and Quality of Service', II<sup>nd</sup> Edition, Pearson Education Asia. Reprint India 2002
2. M. Steen Strub, ' Routing in Communication network, Prentice –Hall International, Newyork,1995.
3. S. Keshav, 'An engineering approach to computer networking' Addison Wesley 1999.
4. William Stallings, 'High speed Networks TCP/IP and ATM Design Principles, Prentice- Hall, New York, 1995
5. C.E Perkins, 'Ad Hoc Networking', Addison – Wesley, 2001
6. Ian F. Akyildiz, Jiang Xie and Shantidev Mohanty, " A Survey of mobility Management in Next generation All IP- Based Wireless Systems", IEEE Wireless Communications Aug.2004, pp 16-27.
7. A.T Campbell et al., " Comparison of IP Micromobility Protocols," IEEE Wireless Communications Feb.2002, pp 72-82.
8. C.Siva Rama Murthy and Mohan Gurusamy, " WDM Optical Networks – Concepts, Design and Algorithms", Prentice Hall of India Pvt. Ltd, New Delhi –2002.

**OUTCOMES:**

- Given the network and user requirements and the type of channel over which the network has to operate, the student would be in a position to apply his knowledge for identifying a suitable routing algorithm , implementing it and analyzing its performance.
- The student would also be able to design a new algorithm or modify an existing algorithm to satisfy the evolving demands in the network and by the user applications.



## REFERENCES

1. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks Architectures and Protocols", Prentice Hall, PTR, 2004.
2. C. K. Toh, "Ad Hoc Mobile Wireless Networks Protocols and Systems", Prentice Hall, PTR, 2001.
3. Charles E. Perkins, "Ad Hoc Networking", Addison Wesley, 2000.
4. Kazem Sohraby, Daniel Minoli and Taieb Znati, "Wireless Sensor Networks Technology- Protocols and Applications", John Wiley & Sons, 2007.
5. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks: an information processing approach", Else vier publication, 2004.
6. C.S.Raghavendra Krishna, M.Sivalingam and Tarib znati, "Wireless Sensor Networks", Springer publication, 2004.
7. Holger Karl , Andreas willig, "Protocol and Architecture for Wireless Sensor Networks", John wiley publication, Jan 2006.
8. K.Akkaya and M.Younis, " A Survey of routing protocols in wireless sensor networks", Elsevier Adhoc Network Journal, Vol.3, no.3,pp. 325-349, 2005.
9. Philip Levis, " TinyOS Programming", 2006 – [www.tinyos.net](http://www.tinyos.net).
10. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, "Wireless sensor networks: a survey", computer networks, Elsevier, 2002, 394 - 422.
11. Jamal N. Al-karaki, Ahmed E. Kamal, "Routing Techniques in Wireless sensor networks: A survey", IEEE wireless communication, December 2004, 6 – 28.

CU7007

INTERNETWORKING MULTIMEDIA

L T P C  
3 0 0 3

### UNIT I MULTIMEDIA NETWORKING

9

Digital Sound, Video and Graphics – Basic Multimedia Networking – Multimedia Characteristics – Evolution of Internet Services Model – Network Requirements for Audio/ Video Transform – Multimedia Coding and Compression for Text, Image Audio And Video.

### UNIT II BROADBAND NETWORK TECHNOLOGY

9

Broadband Services – ATM and IP, IPV6, High Speed Switching – Resource Reservation, Buffer Management – Traffic Shaping – Caching – Scheduling and Policing, Throughput, Delay and Jitter Performance – Storage and Media Services – Voice and Video Over IP – MPEG–2 over ATM/IP – Indexing Synchronization of Requests – Recording and Remote Control .

### UNIT III RELIABLE TRANSPORT PROTOCOL AND APPLICATIONS

9

Multicast over Shared Media Network – Multicast Routing and Addressing – Scaling Multicast and NBMA Networks – Reliable Transport Protocols – TCP Adaptation Algorithm – RTP, RTCP – MIME – Peer–to–Peer Computing – Shared Application – Video Conferencing, Centralized and Distributed Conference Control – Distributed Virtual Reality – Light Weight Session Philosophy .

### UNIT IV MULTIMEDIA COMMUNICATION STANDARDS

9

Objective of MPEG – 7 Standard – Functionalities and Systems of MPEG–7 MPEG–21 Multimedia Framework Architecture – Content Representation – Content Management and Usage – Intellectual Property Management – Audio Visual System – H322: Guaranteed QOS LAN Systems – MPEG\_4 Video Transport Across Internet.

**UNIT V MULTIMEDIA COMMUNICATION ACROSS NETWORKS****9**

Packet Audio/Video in The Network Environment –Video Transport across Generic Networks – Layered Video Coding– Error Resilient Video Coding Techniques – Scalable Rate Control – Streaming Video Across Internet – Multimedia Transport Across ATM Networks and IP Network – Multimedia Across Wireless Networks .

**TOTAL: 45 PERIODS****REFERENCES:**

1. B O Szuprowicz, "Multimedia Networking", McGraw Hill, Newyork, 1995.
2. K R Rao, Zoran S, Bojkovic and Dragorad A, Milovanovic "Multimedia communication systems", PHI, 2003.
3. Jon Crowcroft, Mark Handley, Ian Wakeman "Internetworking Multimedia" Harcourt, Singapore, 1998.
4. Tay Vaughan, "Multimedia Making it to work", 4th edition Tata McGraw Hill, NewDelhi, 2000.

**NC7002****MULTIMEDIA COMPRESSION TECHNIQUES****L T P C  
3 0 0 3****OBJECTIVES:**

To provide in-depth knowledge about

- Data Compression
- Text Compression and Audio Compression
- Image and Video Compression

**OUTCOMES:**

Students will be able to

- Explain Scalar quantization theory and Rate distribution Theory
- Understand different coding techniques
- Describe Contour based compression and Motion estimation techniques

**UNIT I INTRODUCTION****9**

Special features of Multimedia – Graphics and Image Data Representations -Fundamental Concepts in Video and Digital Audio – Storage requirements for multimedia applications -Need for Compression - Taxonomy of compression techniques – Overview of source coding, source models, scalar and vector quantization theory – Evaluation techniques – Error analysis and methodologies

**UNIT II TEXT COMPRESSION****9**

Compaction techniques – Huffmann coding – Adaptive Huffmann Coding – Arithmetic coding – Shannon-Fano coding – Dictionary techniques – LZW family algorithms.

**UNIT III AUDIO COMPRESSION****9**

Audio compression techniques -  $\mu$ - Law and A- Law companding. Speech compression- waveform codecs-source codecs- hybrid codecs-Shorten compressor, Frequency domain and filtering – Basic sub-band coding – Application to speech coding – G.722 –Application to audio coding – MPEG audio, progressive encoding for audio – Silence compression, speech compression techniques – Formant and CELP Vocoders.

**UNIT IV IMAGE COMPRESSION****9**

Predictive techniques – DM, PCM, DPCM: Optimal Predictors and Optimal Quantization– Contour based compression – Transform Coding – JPEG Standard – Sub-band coding algorithms: Design of Filter banks – Wavelet based compression: Implementation using filters – EZW, SPIHT coders – JPEG 2000 standards – JBIG, JBIG2 Standards

**UNIT V VIDEO COMPRESSION****9**

Video compression techniques and standards – MPEG Video Coding I: MPEG – 1 and 2 MPEG Video Coding II: MPEG – 4 and 7 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – PLV performance – DVI real time compression – Packet Video.

**TOTAL: 45 PERIODS****REFERENCES:**

1. Khalid Sayood : Introduction to Data Compression, Morgan Kauffman Harcourt India, 2nd Edition, 2000.
2. David Salomon : Data Compression – The Complete Reference, Springer Verlag New York Inc., 2nd Edition, 2001.
3. Yun Q.Shi, Huifang Sun : Image and Video Compression for Multimedia Engineering - Fundamentals, Algorithms & Standards, CRC press, 2003.
4. Peter Symes : Digital Video Compression, McGraw Hill Pub., 2004.
5. Mark Nelson : Data compression, BPB Publishers, New Delhi, 1998.
6. Mark S.Drew, Ze-Nian Li : Fundamentals of Multimedia, PHI, 1st Edition, 2003.
7. Watkinson, J : Compression in Video and Audio, Focal press, London, 1995.
8. Jan Vozer : Video Compression for Multimedia, AP Profes, New York, 1995

**CU7008****ULTRAWIDE BAND COMMUNICATION****L T P C  
3 0 0 3****UNIT I INTRODUCTION TO UWB****9**

History, Definition, FCC Mask, UWB features, UWB Interference: IEEE 802.11.a Interference, Signal to Interference ratio calculation, Interference with other wireless services.

**UNIT II UWB TECHNOLOGIES AND CHANNEL MODELS****9**

Impulse Radio , Pulsed Multiband, Multiband OFDM, features : Complexity, Power Consumption, Security and achievable data rate. MIMO Multiband OFDM, Differential multiband ofdm, Performace characterization Ultra Wide Band Wireless Channels  
Channel model: Impulse Response Modeling of UWB Wireless Channels, IEEE UWB channel model, Path loss, Delay profiles, Time and frequency modeling.

**UNIT III UWB SIGNAL PROCESSING****9**

Data Modulation schemes, UWB Multiple Access Modulation, BER, Rake Receiver, Transmit-Reference (T-R) Technique, UWB Range- Data Rate Performance, UWB Channel Capacity UWB Wireless Locationing: Position Locationing Methods, Time of Arrival Estimation, NLOS Location Error , Locationing with OFDM

**UNIT IV UWB ANTENNAS****9**

Antenna Requirements, Radiation Mechanism of the UWB Antennas, Types of Broad band antennas, Parameters, Analysis of UWB Antennas, Link Budget for UWB System. Design examples of broad band UWB antennas.

**UNIT V UWB APPLICATIONS AND REGULATIONS****9**

Wireless Ad hoc Networking, UWB Wireless Sensor, RFID , Consumer Electronics and Personal , Asset Location, Medical applications UWB Regulation and standards in various countries , UWB Regulation in ITU, IEEE Standardization

## REFERENCES:

1. Homayoun Nikookar and Ramjee Prasad, "Introduction to Ultra Wideband for Wireless Communications" 1st Edition, Springer Science & Business Media B.V. 2009.
2. Thomas Kaiser, Feng Zheng "Ultra Wideband Systems with MIMO", 1st Edition, John Wiley & Sons Ltd, Newyork, 2010.
3. W. Pam Siriwongpairat and K. J. Ray Liu, "Ultra-Wideband Communications Systems: Multiband OFDM approach" John Wiley and IEEE press, Newyork 2008.

**IF7301**

**SOFT COMPUTING**

**L T P C**  
**3 0 0 3**

## OBJECTIVES

- To learn the key aspects of Soft computing and Neural networks.
- To know about the components and building block hypothesis of Genetic algorithm.
- To understand the features of neural network and its applications
- To study the fuzzy logic components
- To gain insight onto Neuro Fuzzy modeling and control.
- To gain knowledge in machine learning through Support vector machines.

### **UNIT I INTRODUCTION TO SOFT COMPUTING 9**

Evolution of Computing - Soft Computing Constituents – From Conventional AI to Computational Intelligence - Machine Learning Basics

### **UNIT II GENETIC ALGORITHMS 9**

Introduction, Building block hypothesis, working principle, Basic operators and Terminologies like individual, gene, encoding, fitness function and reproduction, Genetic modeling: Significance of Genetic operators, Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, GA optimization problems, JSPP (Job Shop Scheduling Problem), TSP (Travelling Salesman Problem), Differences & similarities between GA & other traditional methods, Applications of GA.

### **UNIT III NEURAL NETWORKS 9**

Machine Learning using Neural Network, Adaptive Networks – Feed Forward Networks – Supervised Learning Neural Networks – Radial Basis Function Networks - Reinforcement Learning – Unsupervised Learning Neural Networks – Adaptive Resonance Architectures – Advances in Neural Networks.

### **UNIT IV FUZZY LOGIC 9**

Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions-Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making

### **UNIT V NEURO-FUZZY MODELING 9**

Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rule base Structure Identification – Neuro-Fuzzy Control – Case Studies.

**TOTAL: 45 PERIODS**

## OUTCOMES:

- Implement machine learning through Neural networks.
- Develop a Fuzzy expert system.
- Model Neuro Fuzzy system for clustering and classification.
- Write Genetic Algorithm to solve the optimization problem
- Use Support Vector Machine for enabling the machine learning

**REFERENCES:**

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2003.
2. Kwang H.Lee, "First course on Fuzzy Theory and Applications", Springer-Verlag Berlin Heidelberg, 2005.
3. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 1995.
4. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Edn., 2003.
5. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, 2007.
6. Mitsuo Gen and Runwei Cheng, "Genetic Algorithms and Engineering Optimization", Wiley Publishers 2000.
7. Mitchell Melanie, "An Introduction to Genetic Algorithm", Prentice Hall, 1998.
8. S.N.Sivanandam, S.N.Deepa, "Introduction to Genetic Algorithms", Springer, 2007.
9. Eiben and Smith "Introduction to Evolutionary Computing" Springer
10. E. Sanchez, T. Shibata, and L. A. Zadeh, Eds., "Genetic Algorithms and Fuzzy Logic Systems: Soft Computing Perspectives, Advances in Fuzzy Systems - Applications and Theory", Vol. 7, River Edge, World Scientific, 1997.

**NC7003****NETWORK PROCESSOR****L T P C**  
**3 0 0 3****UNIT I INTRODUCTION****9**

Traditional protocol processing Systems – Network processing Hardware – Basic Packet Processing Algorithms and data Structures - Packet processing functions – Protocol Software – Hardware Architectures for Protocol processing – Classification and Forwarding – Switching Fabrics.

**UNIT II NETWORK PROCESSOR TECHNOLOGY****9**

Network Processors: Motivation and purpose - Complexity of Network Processor Design – Network Processor Architectures architectural variety, architectural characteristics Peripheral Chips supporting Network Processors: Storage processors, Classification Processors, Search Engines, Switch Fabrics, Traffic Managers.

**UNIT III COMMERCIAL NETWORK PROCESSORS****9**

Multi-Chip Pipeline, Augmented RISC processor, Embedded Processor plus Coprocessors, Pipeline of Homogeneous processors. Configurable Instruction set processors – Pipeline of Heterogeneous processors – Extensive and Diverse processors – Flexible RISC plus Coprocessors – Scalability issues – Design Tradeoffs and consequences.

**UNIT IV NETWORK PROCESSOR: ARCHITECTURE AND PROGRAMMING****9**

Architecture: Intel Network Processor: Multiheaded Architecture Overview – Features- Embedded RISC processor - Packet Processor Hardware – Memory interfaces – System and Control Interface Components – Bus Interface. Programming Software Development Kit-IXP Instruction set – register formats – Micro Engine Programming – Intra thread and Inter-thread communication – thread synchronization – developing sample applications – control plane – ARM programming.

**UNIT V IOS TECHNOLOGIES****9**

CISCO IOS – Connectivity and scalability – high availability – IP routing – IP services – IPv6 – Mobile IP – MPLS – IP Multicast 0 Manageability – QoS – Security – Switching – Layer VPN2.

**TOTAL: 45PERIODS**

## REFERENCES:

1. Douglas E.Comer “Networks Systems Design using Network Processors” Prentice Hall JaN. 2003.
2. Panas C. Lekkas, “Network Processors: Architectgures, Protocols and Paradigms Telecom Engineering”, McGraw Hill, Professional, 2003.
3. Patrick Crowley, M a Eranklin, H. Hadminglu, PZ Onfryk, “Network Processor Design, Issues and Practices Vol-1” Morgan Kaufman, 2002.
4. Patrick Crowley, M a Frankliin, H. Hadimioglyum PZ Onufryk, Network Processor Design, Issues and Prentices vol.II, Morgan Kaufman, 2003.
5. Erik, J.Johnson and Aaron R.Kunze, “IXP2400/2806 Programming: The Microengine Coding Grade” Intel Press.
6. Hill Carlson, “Intel Internet Exchange Architecture & Applications a Practical Guide to Intel’s network Processors” Intel press. [www.cisco.com](http://www.cisco.com)

**NE7007**

**NETWORK MANAGEMENT**

**L T P C**  
**3 0 0 3**

## OBJECTIVES

The objective of this course is to

- To understand the need for interoperable network management
- To learn to the concepts and architecture behind standards based network management
- To understand the concepts and terminology associated with SNMP and TMN
- To understand network management as a typical distributed application
- To study the current trends in network management technologies

### **UNIT I FUNDAMENTALS OF COMPUTER NETWORK TECHNOLOGY 9**

Network Topology, LAN, Network node components- Hubs, Bridges, Routers, Gateways, Switches, WAN, ISDN Transmission Technology, Communications protocols and standards. Network Management: Goals, Organization, and Functions, Network and System Management, Network Management System Platform, Current Status and future of Network

### **UNIT II OSI NETWORK MANAGEMENT 9**

OSI Network management model-Organizational model-Information model, communication model. Abstract Syntax Notation - Encoding structure, Macros Functional model CMIP/CMIS

### **UNIT III INTERNET MANAGEMENT(SNMP) 9**

SNMP(V1 and V2)-Organizational model-System Overview, The information model, communication model-Functional model, SNMP proxy server, Management information, protocol remote monitoring- , RMON SMI and MIB, RMON1,RMON2 - A Case Study of Internet Traffic Using RMON.

### **UNIT IV BROADBAND NETWORK MANAGEMENT 9**

Broadband networks and services, ATM Technology-VP,VC, ATM Packet, Integrated service, ATMLAN emulation, Virtual Lan. ATM Network Management-ATM Network reference model, integrated local management Interface. ATM Management Information base, Role of SNMD and ILMI in ATM Management, M1, M2, M3, M4 Interface. ATM Digital Exchange Interface Management- , TMN conceptual Model- TMN Architecture, TMN Management Service Architecture

## **UNIT V NETWORK MANAGEMENT APPLICATIONS**

**9**

Configuration management, Fault management, performance management, Event Correlation Techniques security Management, Accounting management, Report Management, Policy Based Management Service Level Management- Network Management Tools, Network Statistics Measurement Systems – Web Based Management, XML Based Network Management - : Future Directions.

**TOTAL: 45 PERIODS**

### **OUTCOMES:**

Upon completion of this course, the students will be able to

- Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets.
- Apply network management standards to manage practical networks.
- Formulate possible approaches for managing OSI network model.
- Use on SNMP for managing the network
- Use RMON for monitoring the behavior of the network
- Explore the possibilities of improving the speed of the network and managing them
- Identify the various components of network and formulate the scheme for the managing them

### **REFERENCES:**

1. Mani Subramanian, "Network Management Principles and practice ", Pearson Education, New Delhi, 2010.
2. STALLINGS, WILLIAM, "SNMP, SNMPv2, SNMPv3, and RMON 1 and 2," Pearson Education, 2012
3. Salah Aaidarous, Thomas Plevayk, "Telecommunications Network Management Technologies and Implementations ", eastern Economy Edition IEEE press, New Delhi, 1998.
4. Lakshmi G. Raman, "Fundamentals of Telecommunication Network Management ", Eastern Economy Edition IEEE Press, New Delhi, 1999.

**NC7201**

## **COMMUNICATION NETWORK SECURITY**

**L T P C**  
**3 0 0 3**

### **UNIT I DATA ENCRYPTION STANDARD**

**9**

Services – Mechanisms and Attacks – OSI security Architecture – Model for Network Security – Classical Encryption Techniques – Symmetric Cipher Model – Substitution Techniques – Transposition Techniques – Rotor Machines– Stenography – Block Ciphers and Data Encryption Standard – Simplified DES – Block Cipher Principles, Data Encryption Standard – Strength of DES – Differential and Linear Crypt Analysis, Block Cipher Design Principles – Block Cipher Modes of Operation.

### **UNIT II ADVANCED ENCRYPTION STANDARD**

**9**

Advanced Encryption Standard – Evaluation Criteria for AES, AES Cipher– Contemporary Symmetric Ciphers – Triple DES, Blowfish, RC5 – Characteristics of Advanced Symmetric Block Ciphers – RC4 Stream Cipher – Confidentiality using Symmetric Encryption – Placement of Encryption Function – Traffic Confidentiality – Key Distribution and Random Number Generation.

### **UNIT III PUBLIC KEY ENCRYPTION AND HASH FUNCTIONS**

**9**

Public Key Cryptography and RSA – Principles of Public Key Cryptosystems – RSA Algorithm – Key Management and other public key cryptosystems – Key Management– Diffie–Hellman Key Exchange – Elliptic Curve Arithmetic – Elliptic Curve Cryptography – Message Authentication and Hash Functions – Authentication Requirements – Authentication Functions – Message Authentication Codes – Hash Functions and MACs; Hash Algorithms – MD5 Message Digest Algorithm, Secure Hash Algorithm RIPEMD 160, HMAC– Digital Signatures and Authentication Protocols – Digital Signature Standards .

**UNIT IV NETWORK SECURITY PRACTICE 9**  
Authentication Applications – Kerberos – X.509 Authentication Service– Electronic Mail Security – Pretty Good Privacy – S/MIME– IP Security – IP Security Overview– IP Security Architecture – Authentication Header – Encapsulating Security Payload – Combining Security Associations – Web Security – Web Security Considerations – Secure Sockets Layer and Transport Layer Security – Secure Electronic Transaction .

**UNIT V WIRELESS NETWORK SECURITY 9**  
Security Attack issues specific to Wireless systems: Worm hole, Tunneling, DoS. WEP for Wi-Fi network, Security for 4G networks: Secure Ad hoc Network, Secure Sensor Network.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. William Stallings, “Network Security Essentials”, 2nd edition, Prentice Hall of India New Delhi, 2004.
2. Charlie Kaufman, “Network Security Private Communication in Public World” 2nd edition, Prentice Hall of India New Delhi, 2004.

**REFERENCES:**

1. William Stallings, “Cryptography and Network Security”, 3rd edition, Prentice Hall of India, New Delhi, 2004.
2. R.K.Nichols and P.C. Lekkas ,” Wireless Security” Mc Graw Hill 2002

**CU7009 NEURAL NETWORK AND APPLICATIONS L T P C  
3 0 0 3**

**UNIT I BASIC LEARNING ALGORITHMS 9**  
Biological Neuron – Artificial Neural Model - Types of activation functions – Architecture: Feedforward and Feedback – Learning Process: Error Correction Learning –Memory Based Learning – Hebbian Learning – Competitive Learning - Boltzman Learning – Supervised and Unsupervised Learning – Learning Tasks: Pattern Space – Weight Space – Pattern Association – Pattern Recognition – Function Approximation – Control – Filtering - Beamforming – Memory – Adaptation - Statistical Learning Theory – Single Layer Perceptron – Perceptron Learning Algorithm – Perceptron Convergence Theorem – Least Mean Square Learning Algorithm – Multilayer Perceptron – Back Propagation Algorithm – XOR problem – Limitations of Back Propagation Algorithm.

**UNIT II RADIAL-BASIS FUNCTION NETWORKS AND SUPPORT VECTOR MACHINES RADIAL BASIS FUNCTION NETWORKS 9**  
Cover’s Theorem on the Separability of Patterns - Exact Interpolator – Regularization Theory – Generalized Radial Basis Function Networks - Learning in Radial Basis Function Networks Applications: XOR Problem – Image Classification.

**SUPPORT VECTOR MACHINES**

Optimal Hyperplane for Linearly Separable Patterns and Nonseparable Patterns – Support Vector Machine for Pattern Recognition – XOR Problem - -insensitive Loss Function – Support Vector Machines for Nonlinear Regression

**UNIT III COMMITTEE MACHINES****9**

Ensemble Averaging - Boosting – Associative Gaussian Mixture Model – Hierarchical Mixture of Experts Model(HME) – Model Selection using a Standard Decision Tree – A Priori and Postpriori Probabilities – Maximum Likelihood Estimation – Learning Strategies for the HME Model - EMAlgorithm – Applications of EM Algorithm to HME Model

**NEURODYNAMICS SYSTEMS**

Dynamical Systems – Attractors and Stability – Non-linear Dynamical Systems- Lyapunov Stability – Neurodynamical Systems – The Cohen-Grossberg Theorem.

**UNIT IV ATTRACTOR NEURAL NETWORKS:****9**

Associative Learning – Attractor Neural Network Associative Memory – Linear Associative Memory – Hopfield Network – Content Addressable Memory – Strange Attractors and Chaos- Error Performance of Hopfield Networks - Applications of Hopfield Networks – Simulated Annealing – Boltzmann Machine – Bidirectional Associative Memory – BAM Stability Analysis – Error Correction in BAMs - Memory Annihilation of Structured Maps in BAMS – Continuous BAMs – Adaptive BAMs – Applications

**ADAPTIVE RESONANCE THEORY:**

Noise-Saturation Dilemma - Solving Noise-Saturation Dilemma – Recurrent On-center –Off surround Networks – Building Blocks of Adaptive Resonance – Substrate of Resonance Structural Details of Resonance Model – Adaptive Resonance Theory – Applications

**UNIT V SELF ORGANISING MAPS:****9**

Self-organizing Map – Maximal Eigenvector Filtering – Sanger’s Rule – Generalized Learning Law – Competitive Learning - Vector Quantization – Mexican Hat Networks - Self-organizing Feature Maps – Applications

**PULSED NEURON MODELS:**

Spiking Neuron Model – Integrate-and-Fire Neurons – Conductance Based Models – Computing with Spiking Neurons.

**TOTAL: 45 PERIODS****REFERENCES:**

1. Satish Kumar, “Neural Networks: A Classroom Approach”, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2004.
2. Simon Haykin, “Neural Networks: A Comprehensive Foundation”, 2ed., Addison Wesley Longman (Singapore) Private Limited, Delhi, 2001.
3. Martin T.Hagan, Howard B. Demuth, and Mark Beale, “Neural Network Design”, Thomson Learning, New Delhi, 2003.
4. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Education (Singapore) Private Limited, Delhi, 2003.

**AFFILIATED INSTITUTIONS  
ANNA UNIVERSITY, CHENNAI  
REGULATIONS – 2013**

**M.E. EMBEDDED SYSTEM TECHNOLOGIES  
I TO IV SEMESTERS (FULL TIME) CURRICULUM AND SYLLABUS  
SEMESTER I**

Sl.No	CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	MA7163	Applied Mathematics for Electrical Engineers	3	1	0	4
2	ET7101	Advanced Digital System Design	3	0	0	3
3	ET7102	Microcontroller Based System Design	3	0	0	3
4	ET7103	Real Time Systems	3	0	0	3
5	ET7104	Design of Embedded Systems	3	0	0	3
6		Elective - I	3	0	0	3
<b>PRACTICAL</b>						
7	ET7111	Embedded System Laboratory I	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>1</b>	<b>3</b>	<b>21</b>

**SEMESTER II**

Sl.No	CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	ET7201	VLSI Architecture and Design Methodologies	3	0	0	3
2	ET7202	Embedded Networking	3	1	0	4
3	ET7203	Wireless and Mobile Communication	3	0	0	3
4	ET7204	Software for Embedded Systems	3	0	0	3
5		Elective - II	3	0	0	3
6		Elective - III	3	0	0	3
<b>PRACTICAL</b>						
7	ET7211	Embedded System Laboratory II	0	0	3	2
<b>TOTAL</b>			<b>18</b>	<b>1</b>	<b>3</b>	<b>21</b>

**SEMESTER III**

Sl.No	CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1		Elective – IV	3	0	0	3
2		Elective – V	3	0	0	3
3		Elective – VI	3	0	0	3
<b>PRACTICAL</b>						
4	ET7311	Project Work (Phase I)	0	0	12	6
<b>TOTAL</b>			<b>9</b>	<b>0</b>	<b>12</b>	<b>15</b>

SEMESTER IV						
Sl.No	CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	ET7411	Project Work (Phase II)	0	0	24	12
<b>TOTAL</b>			<b>0</b>	<b>0</b>	<b>24</b>	<b>12</b>

**TOTAL NUMBER OF CREDITS = 69**

**ELECTIVES FOR M.E. EMBEDDED SYSTEM TECHNOLOGIES**

**ELECTIVE I**

Sl. No	CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	ET7001	Digital Instrumentation	3	0	0	3
2	ET7002	Real Time Operating Systems	3	0	0	3
3	ET7016	Parallel Processing Architecture	3	0	0	3

**ELECTIVE II & III**

4	ET7003	Design of Embedded Control Systems	3	0	0	3
5	ET7004	Programming with VHDL	3	0	0	3
6	ET7005	Adhoc Networks	3	0	0	3
7	ET7006	Advanced Digital Signal Processing	3	0	0	3
8	CL7204	Soft Computing Techniques	3	0	0	3
9	ET7007	RISC Processor Architecture and Programming	3	0	0	3

**ELECTIVE IV ,V & VI**

10	ET7008	Advanced Embedded Systems	3	0	0	3
11	ET7009	Pervasive Devices and Technology	3	0	0	3
12	ET7010	Cryptography and Network Security	3	0	0	3
13	ET7011	Smart Meter and Smart Grid Communication	3	0	0	3
14	ET7012	Computer in Networking and Digital Control	3	0	0	3
15	ET7013	Distributed Embedded Computing	3	0	0	3
16	CL7004	Robotics and Control	3	0	0	3
17	ET7014	Application of MEMS Technology	3	0	0	3
18	ET7015	Digital Image Processing and Applications	3	0	0	3

**OBJECTIVES:**

- To develop the ability to apply the concepts of Matrix theory and Linear programming in Electrical Engineering problems.
- To achieve an understanding of the basic concepts of one dimensional random variables and apply in electrical engineering problems.
- To familiarize the students in calculus of variations and solve problems using Fourier transforms associated with engineering applications.

**UNIT I MATRIX THEORY****(9+3)**

The Cholesky decomposition - Generalized Eigen vectors, Canonical basis - QR factorization - Least squares method - Singular value decomposition.

**UNIT II CALCULUS OF VARIATIONS****(9+3)**

Concept of variation and its properties – Euler’s equation – Functional dependant on first and higher order derivatives – Functionals dependant on functions of several independent variables – Variational problems with moving boundaries – problems with constraints - Direct methods: Ritz and Kantorovich methods.

**UNIT III ONE DIMENSIONAL RANDOM VARIABLES****(9+3)**

Random variables - Probability function – moments – moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a Random Variable.

**UNIT IV LINEAR PROGRAMMING****(9+3)**

Formulation – Graphical solution – Simplex method – Two phase method - Transportation and Assignment Models

**UNIT V FOURIER SERIES****(9+3)**

Fourier Trigonometric series: Periodic function as power signals – Convergence of series – Even and odd function: cosine and sine series – Non-periodic function: Extension to other intervals - Power signals: Exponential Fourier series – Parseval’s theorem and power spectrum – Eigen value problems and orthogonal functions – Regular Sturm-Liouville systems – Generalized Fourier series.

**L:45 +T: 15 TOTAL: 60 PERIODS****REFERENCES:**

1. Richard Bronson, “Matrix Operation”, Schaum’s outline series, 2<sup>nd</sup> Edition, McGraw Hill, 2011.
2. Gupta, A.S., Calculus of Variations with Applications, Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
3. Oliver C. Ibe, “Fundamentals of Applied Probability and Random Processes, Academic Press, (An imprint of Elsevier), 2010.
4. Taha, H.A., “Operations Research, An introduction”, 10<sup>th</sup> edition, Pearson education, New Delhi, 2010.
5. Andrews L.C. and Phillips R.L., Mathematical Techniques for Engineers and Scientists, Prentice Hall of India Pvt.Ltd., New Delhi, 2005.
6. Elsgolts, L., Differential Equations and the Calculus of Variations, MIR Publishers, Moscow, 1973.
7. Grewal, B.S., Higher Engineering Mathematics, 42<sup>nd</sup> edition, Khanna Publishers, 2012.
8. O’Neil, P.V., Advanced Engineering Mathematics, Thomson Asia Pvt. Ltd., Singapore, 2003.

9. Johnson R. A. and Gupta C. B., "Miller & Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7<sup>th</sup> Edition, 2007.

**OBJECTIVES**

- To expose the students to the fundamentals of sequential system design, modelling
- To teach the fundamentals of Asynchronous circuits, switching errors
- To study on Fault identification in digital switching circuits
- To introduce logics for design of Programmable Devices
- To comparatively study the classification of commercial family of Programmable Devices

**UNIT I SEQUENTIAL CIRCUIT DESIGN****9**

Analysis of Clocked Synchronous Sequential Networks (CSSN) Modelling of CSSN – State Stable Assignment and Reduction – Design of CSSN – Design of Iterative Circuits – ASM Chart – ASM Realization.

**UNIT II ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN****9**

Analysis of Asynchronous Sequential Circuit (ASC) – Flow Table Reduction – Races in ASC – State Assignment Problem and the Transition Table – Design of ASC – Static and Dynamic Hazards – Essential Hazards – Data Synchronizers – Designing Vending Machine Controller – Mixed Operating Mode Asynchronous Circuits.

**UNIT III FAULT DIAGNOSIS AND TESTABILITY ALGORITHMS****9**

Fault Table Method – Path Sensitization Method – Boolean Difference Method – Kohavi Algorithm – Tolerance Techniques – The Compact Algorithm – Practical PLA's – Fault in PLA – Test Generation – Masking Cycle – DFT Schemes – Built-in Self Test.

**UNIT IV SYNCHRONOUS DESIGN USING PROGRAMMABLE DEVICES****9**

Programming Techniques -Re-Programmable Devices Architecture- Function blocks, I/Oblocks, Interconnects, Realize combinational, Arithmetic, Sequential Circuit with Programmable Array Logic; Architecture and application of Field Programmable Logic Sequence.

**UNIT V ARCHITECTURES AND PROGRAMMING PROGRAMMABLE LOGIC DEVICES****9**

Architecture with EPLD, PEEL – Realization State machine using PLD – FPGA-Aptix Field Programmable Interconnect – Xilinx FPGA – Xilinx 2000 - Xilinx 4000 family.VHDL based Designing with PLD-ROM,PAL,PLA,Sequential PLDs,Case study –Keypad Scanner.

**TOTAL : 45 PERIODS****REFERENCES:**

1. Donald G. Givone, "Digital principles and Design", Tata McGraw Hill 2002.
2. Stephen Brown and Zvonk Vranesic, "Fundamentals of Digital Logic with VHDL Deisgn", Tata McGraw Hill, 2002
3. Charles H. Roth Jr., "Digital Systems design using VHDL", Cengage Learning, 2010.
4. Mark Zwolinski, "Digital System Design with VHDL", Pearson Education, 2004
5. Parag K Lala, "Digital System design using PLD", BS Publications, 2003
6. John M Yarbrough, "Digital Logic applications and Design", Thomson Learning,2001
7. Nripendra N Biswas, "Logic Design Theory", Prentice Hall of India, 2001
8. Charles H. Roth Jr., "Fundamentals of Logic design", Thomson Learning, 2004.
9. John V.Oldfeld, Richard C.Dorf, "Field Programmable Gate Arrays", Wiley India Edition,2008

**OBJECTIVES**

- To expose the students to the fundamentals of microcontroller based system design.
- To teach I/O and RTOS role on microcontroller.
- To impart knowledge on PIC Microcontroller based system design.
- To introduce Microchip PIC 8 bit peripheral system Design
- To give case study experiences for microcontroller based applications.

**UNIT I 8051 ARCHITECTURE****9**

Architecture – memory organization – addressing modes – instruction set –Timers - Interrupts - I/O ports, Interfacing I/O Devices – Serial Communication.

**UNIT II 8051 PROGRAMMING****9**

Assembly language programming – Arithmetic Instructions – Logical Instructions –Single bit Instructions – Timer Counter Programming – Serial Communication Programming Interrupt Programming – RTOS for 8051 – RTOSLite – FullRTOS – Task creation and run – LCD digital clock/thermometer using FullRTOS

**UNIT III PIC MICROCONTROLLER****9**

Architecture – memory organization – addressing modes – instruction set – PIC programming in Assembly & C –I/O port, Data Conversion, RAM & ROM Allocation, Timer programming, MP-LAB.

**UNIT IV PERIPHERAL OF PIC MICROCONTROLLER****9**

Timers – Interrupts, I/O ports- I2C bus-A/D converter-UART- CCP modules -ADC, DAC and Sensor Interfacing –Flash and EEPROM memories.

**UNIT V SYSTEM DESIGN – CASE STUDY****9**

Interfacing LCD Display – Keypad Interfacing - Generation of Gate signals for converters and Inverters - Motor Control – Controlling DC/ AC appliances – Measurement of frequency - Stand alone Data Acquisition System.

**TOTAL : 45 PERIODS****REFERENCES:**

1. Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey ‘ PIC Microcontroller and Embedded Systems using Assembly and C for PIC18’, Pearson Education 2008
2. John Iovine, ‘PIC Microcontroller Project Book ’, McGraw Hill 2000
3. Myke Predko, “Programming and customizing the 8051 microcontroller”, Tata McGraw Hill 2001.
4. Muhammad Ali Mazidi, Janice G. Mazidi and Rolin D. McKinlay, ‘The 8051 Microcontroller and Embedded Systems’ Prentice Hall, 2005.
5. Rajkamal, “Microcontrollers-Architecture, Programming, Interfacing & System Design”, 2ed, Pearson, 2012.
6. I Scott Mackenzie and Raphael C.W. Phan, “The Micro controller”, Pearson, Fourth edition 2012

**OBJECTIVES**

- To expose the students to the fundamentals of Real Time systems
- To teach the fundamentals of Scheduling and features of programming languages
- To study the data management system for real time
- To introduce the fundamentals of real time communication
- To teach the different algorithms and techniques used for real time systems

**UNIT I INTRODUCTION****9**

Introduction – Issues in Real Time Computing – Structure of a Real Time System – Task classes – Performance Measures for Real Time Systems – Estimating Program Run Times – Task Assignment and Scheduling – Classical uniprocessor scheduling algorithms – Uniprocessor scheduling of IRIS tasks – Task assignment – Mode changes and Fault Tolerant Scheduling.

**UNIT II PROGRAMMING LANGUAGES AND TOOLS****9**

Programming Languages and Tools – Desired language characteristics – Data typing – Control structures – Facilitating Hierarchical Decomposition, Packages, Run time (Exception) Error handling – Overloading and Generics – Multitasking – Low level programming – Task Scheduling – Timing Specifications – Programming Environments – Run – time support.

**UNIT III REAL TIME DATABASES****9**

Real time Databases – Basic Definition, Real time Vs General Purpose Databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Two – phase Approach to improve Predictability – Maintaining Serialization Consistency – Databases for Hard Real Time Systems.

**UNIT IV COMMUNICATION****9**

Real – Time Communication – Communications media, Network Topologies Protocols, Fault Tolerant Routing. Fault Tolerance Techniques – Fault Types – Fault Detection. Fault Error containment Redundancy – Data Diversity – Reversal Checks – Integrated Failure handling.

**UNIT V . EVALUATION TECHNIQUES****9**

Reliability Evaluation Techniques – Obtaining parameter values, Reliability models for Hardware Redundancy – Software error models. Clock Synchronization – Clock, A Nonfault – Tolerant Synchronization Algorithm – Impact of faults – Fault Tolerant Synchronization in Hardware – Fault Tolerant Synchronization in software.

**TOTAL : 45 PERIODS****REFERENCES**

1. C.M. Krishna, Kang G. Shin, "Real – Time Systems", McGraw – Hill International Editions, 1997.
2. Rajib Mall, "Real-time systems: theory and practice", Pearson Education, 2007
3. Peter D.Lawrence, "Real Time Micro Computer System Design – An Introduction", McGraw Hill, 1988.
4. Stuart Bennett, "Real Time Computer Control – An Introduction", Prentice Hall of India, 1998.
5. S.T. Allworth and R.N.Zobel, "Introduction to real time software design", Macmillan,

2nd Edition, 1987.

6. R.J.A Buhur, D.L Bailey, "An Introduction to Real – Time Systems", Prentice – Hall International, 1999.

7. Philip.A.Laplante, "Real Time System Design and Analysis", Prentice Hall of India, 3<sup>rd</sup> Edition, April 2004

**ET7104**

**DESIGN OF EMBEDDED SYSTEMS**

**L T P C**  
**3 0 0 3**

### **OBJECTIVES**

- To provide a clear understanding on the basic concepts, Building Blocks for Embedded System
- To teach the fundamentals of System design with Partitioning
- To introduce on Embedded Process development Environment
- To study on Basic tool features for target configuration
- To introduce different EDLC Phases & Testing of embedded system

### **UNIT I EMBEDDED DESIGN WITH MICROCONTROLLERS 9**

Product specification – Hardware / Software partitioning – Detailed hardware and software design – Integration – Product testing – Microprocessor Vs Micro Controller – Performance tools – Bench marking – RTOS Micro Controller -issues in selection of processors.

### **UNIT II PARTITIONING DECISION 9**

Hardware / Software duality – Hardware-Software portioning- coding for Hardware- software development – ASIC revolution – Managing the Risk – Co-verification – execution environment – memory organization –memory enhancement – Firmware-speed and code density -System startup

### **UNIT III FUNCTIONALITIES FOR SYSTEM DESIGN 9**

Timers, Watch dog timers – RAM, Flash Memory basic toolset – Integration of Hardware & Firmware- InSystem Programming, InApplication Programming,,IDE-Target Configuration- Host based debugging – Remote debugging – ROM emulators – Logic analyser

### **UNIT IV IN CIRCUIT EMULATORS 9**

Buller proof run control – Real time trace – Hardware break points – Overlay memory – Timing constraints – Usage issues – Triggers.

### **UNIT V EMBEDDED DESIGN LIFE CYCLE & TESTING 9**

Objective, Need, different Phases & Modelling of the EDLC.choice of Target Architectures for Embedded Application Development-for Control Dominated-Data Dominated Systems- Software & Hardware Design, PCB Design, Manufacturing & PCB Assembly-Bug tracking – reduction of risks & costs – Performance – Unit testing – Regression testing – Choosing test cases – Functional tests – Coverage tests – Testing embedded software – Performance testing – Maintenance.

**TOTAL : 45 PERIODS**

## REFERENCES

1. James K. Peckol, "Embedded system Design", John Wiley & Sons, 2010
2. Elicia White, "Making Embedded Systems", O'Reilly Series, SPD, 2011
3. Rajkamal, "Embedded Systems", TMH, 2009.
4. Lyla B Das, "Embedded Systems-An Integrated Approach", Pearson 2013
5. Arnold S. Berger – "Embedded System Design", CMP books, USA 2002.
6. ARKIN, R.C., Behaviour-based Robotics, The MIT Press, 1998.

Sl.No.	Title	Requirement	Quantity
1	Programming with 8 bit Microcontrollers Both Assembly and C programming	8 bit Microcontrollers with peripherals;Board Support Software Tools	5 set
2	Programming with 8 bit Microcontrollers I/O Programming/ Timers/ Interrupts/ Serial port programming/PWM Generation/ Motor Control/ADC/DAC/ LCD/ RTC Interfacing/ Sensor Interfacing	8 bit Microconptrollers with peripherals;Board Support Software Tools, peripherals with interface DSO(2);Multimeters(6); 3 Types of Sensors(3 each);DC & AC Motors 2 each);interface supports(3 each)	2 set
3	Programming with 8 bit PIC/AVR Microcontrollers Both Assembly and C programming	8 bit PIC/AVR Microconptrollers with peripherals;Board Support Software Tools	5 set
4	Programming with PIC /AVR Microcontrollers I/O Programming/ Timers/ Interrupts/ Serial port programming/PWM Generation/ Motor Control/ADC/DAC/ LCD/ RTC Interfacing/ Sensor Interfacing	PIC /AVR Microconptrollers with peripherals;Board Support Software Tools, peripherals with interface DSO(2);Multimeters(6); 3 Types of Sensors(3 each);DC & AC Motors 2 each);interface supports(3 each)	2 set
5	Programming with 16 bit processors Both Assembly and C programming	16 bit processors with peripherals;Board Support Software Tools	2 set
6	Programming with 16 bit processors I/O Programming/ Timers/ Interrupts/ Serial port programming/PWM Generation/ Motor Control/ADC/DAC/ LCD/ RTC Interfacing/ Sensor Interfacing	16 bit Microconptrollers with peripherals;Board Support Software Tools with interface DSO(2);Multimeters(6); 3 Types of Sensors(3 each);DC & AC Motors 2 each);interface supports(3 each)	2 set
7	Design with CAD tools Design and Implementation of Combinational , Sequential Circuits in CAD simulators	Simulation Tools as SPICE/others	Multiple user
8	Study on incircuit Emulators, crosscompilers, debuggers	Microconptrollers with peripherals;IDE, Board Support Software Tools /Uc/OS-II/C Compiler/others	Multiple user
9	Simulation & Programming of sensor interface & measurement with using programming environments (MATLAB/LabVIEW/Simulation Tools)	Simulation Tools as MATLAB/ LABVIEW /others	Multiple user

10	Programming of TCP/IP protocol stack	Simulation & Experimenting set with IAR C/C++ Compiler, Assembler, peripherals; Board Support Software Tools	1 set
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**TOTAL: 45 PERIODS**

**ET7201**

**VLSI ARCHITECTURE AND DESIGN METHODOLOGIES**

**LT P C  
3 0 0 3**

**OBJECTIVES**

- To give an insight to the students about the significance of CMOS technology and fabrication process.
- To teach the importance and architectural features of programmable logic devices.
- To introduce the ASIC construction and design algorithms
- To teach the basic analog VLSI design techniques.
- To study the Logic synthesis and simulation of digital system with Verilog HDL.

**UNIT I CMOS DESIGN**

**9**

Overview of digital VLSI design Methodologies- Logic design with CMOS-transmission gate circuits-Clocked CMOS-dynamic CMOS circuits, Bi-CMOS circuits- Layout diagram, Stick diagram-IC fabrications – Trends in IC technology.

**UNIT II PROGRAMABLE LOGIC DEVICES**

**12**

Programming Techniques-Anti fuse-SRAM-EEPROM and EEPROM technology – Re-Programmable Devices Architecture- Function blocks, I/O blocks, Interconnects, Xilinx-XC9500, Cool Runner - XC-4000, XC5200, SPARTAN, Virtex - Altera MAX 7000-Flex 10K-Stratix.

**UNIT III BASIC CONSTRUCTION, FLOOR PLANNING, PLACEMENT AND ROUTING**

**6**

System partition – FPGA partitioning – Partitioning methods- floor planning – placement-physical design flow – global routing – detailed routing – special routing- circuit extraction – DRC.

**UNIT IV ANALOG VLSI DESIGN**

**6**

Introduction to analog VLSI- Design of CMOS 2stage-3 stage Op-Amp –High Speed and High frequency op-amps-Super MOS-Analog primitive cells-realization of neural networks.

**UNIT V LOGIC SYNTHESIS AND SIMULATION**

**12**

Overview of digital design with Verilog HDL, hierarchical modelling concepts, modules and port definitions, gate level modelling, data flow modelling, behavioural modelling, task & functions, Verilog and logic synthesis-simulation-Design examples, Ripple carry Adders, Carry Look ahead adders, Multiplier, ALU, Shift Registers, Multiplexer, Comparator, Test Bench.

**TOTAL 45 PERIODS**

## REFERENCES:

1. M.J.S Smith, "Application Specific integrated circuits",Addition Wesley Longman Inc.1997.
- 2.Kamran Eshraghian,Douglas A.pucknell and Sholeh Eshraghian,"Essentials of VLSI circuits and system", Prentice Hall India,2005.
3. Wayne Wolf, " Modern VLSI design " Prentice Hall India,2006.
4. Mohamed Ismail ,Terri Fiez, "Analog VLSI Signal and information Processing", McGraw Hill International Editions,1994.
- 5.Samir Palnitkar, "Veri Log HDL, A Design guide to Digital and Synthesis" 2<sup>nd</sup> Ed,Pearson,2005.
6. John P. Uyemera "Chip design for submicron VLSI cmos layout and simulation ", Cengage Learning India Edition", 2011.

**ET7202**

**EMBEDDED NETWORKING**

**L T P C**

**3 1 0 4**

## OBJECTIVES

To impart knowledge on

- Serial and parallel communication protocols
- Application Development using USB and CAN bus for PIC microcontrollers
- Application development using Embedded Ethernet for Rabbit processors.
- Wireless sensor network communication protocols.

## UNIT I EMBEDDED COMMUNICATION PROTOCOLS

**8**

Embedded Networking: Introduction – Serial/Parallel Communication – Serial communication protocols -RS232 standard – RS485 – Synchronous Serial Protocols -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I<sup>2</sup>C) – PC Parallel port programming -ISA/PCI Bus protocols - Firewire

## UNIT II USB AND CAN BUS

**10**

USB bus – Introduction – Speed Identification on the bus – USB States – USB bus communication: Packets –Data flow types –Enumeration –Descriptors –PIC 18 Microcontroller USB Interface – C Programs –CAN Bus – Introduction - Frames –Bit stuffing –Types of errors – Nominal Bit Timing – PIC microcontroller CAN Interface –A simple application with CAN

## UNIT III ETHERNET BASICS

**9**

Elements of a network – Inside Ethernet – Building a Network: Hardware options – Cables, Connections and network speed – Design choices: Selecting components –Ethernet Controllers – Using the internet in local and internet communications – Inside the Internet protocol

## UNIT IV EMBEDDED ETHERNET

**9**

Exchanging messages using UDP and TCP – Serving web pages with Dynamic Data – Serving web pages that respond to user Input – Email for Embedded Systems – Using FTP – Keeping Devices and Network secure.

**UNIT V WIRELESS EMBEDDED NETWORKING****9**

Wireless sensor networks – Introduction – Applications – Network Topology – Localization – Time Synchronization - Energy efficient MAC protocols –SMAC – Energy efficient and robust routing – Data Centric routing

**L = 45 T = 15 TOTAL = 60 PERIODS****REFERENCES**

1. Frank Vahid, Givargis 'Embedded Systems Design: A Unified Hardware/Software Introduction', Wiley Publications
2. Jan Axelson, 'Parallel Port Complete', Penram publications
3. Dogan Ibrahim, 'Advanced PIC microcontroller projects in C', Elsevier 2008
4. Jan Axelson 'Embedded Ethernet and Internet Complete', Penram publications
5. Bhaskar Krishnamachari, 'Networking wireless sensors', Cambridge press 2005

**ET7203****WIRELESS AND MOBILE COMMUNICATION****L T P C  
3 0 0 3****OBJECTIVES**

- To expose the students to the fundamentals of wireless communication technologies.
- To teach the fundamentals of wireless mobile network protocols
- To study on wireless network topologies
- To introduce network routing protocols
- To study the basis for classification of commercial family of wireless communication technologies

**UNIT I INTRODUCTION****9**

Wireless Transmission – signal propagation – spread spectrum – Satellite Networks – Capacity Allocation – FAMA – DAMA – MAC

**UNIT II MOBILE NETWORKS****9**

Cellular Wireless Networks – GSM – Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Handover – Security – GPRA

**UNIT III WIRELESS NETWORKS****9**

Wireless LAN – IEEE 802.11 Standard-Architecture – Services – AdHoc Network - Hiper Lan – Blue Tooth.

**UNIT IV ROUTING****9**

Mobile IP – DHCP – AdHoc Networks – Proactive and Reactive Routing Protocols – Multicast Routing

**UNIT V TRANSPORT AND APPLICATION LAYERS****9**

TCP over Adhoc Networks – WAP – Architecture – WWW Programming Model – WDP – WTLS – WTP – WSP – WAE – WTA Architecture – WML – WML scripts.

**REFERENCES**

1. Kaveh Pahlavan, Prasanth Krishnamoorthy, “ Principles of Wireless Networks’ PHI/Pearson Education, 2003
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “ Principles of Mobile computing”, Springer, New york, 2003.
3. C.K.Toh, “ AdHoc mobile wireless networks”, Prentice Hall, Inc, 2002.
4. Charles E. Perkins, “ Adhoc Networking”, Addison-Wesley, 2001.
5. Jochen Schiller, “ Mobile communications”, PHI/Pearson Education, Second Edition, 2003.
6. William Stallings, “ Wireless communications and Networks”, PHI/Pearson Education, 2002.

**ET7204**

**SOFTWARE FOR EMBEDDED SYSTEMS**

**L T P C  
3 0 0 3**

**OBJECTIVES**

- To expose the students to the fundamentals of embedded Programming.
- To Introduce the GNU C Programming Tool Chain in Linux.
- To study the basic concepts of embedded C and Embedded OS
- To introduce time driven architecture, Serial Interface with a case study.
- To introduce the concept of embedded Java for Web Enabling of systems.

**UNIT I EMBEDDED PROGRAMMING**

**9**

C and Assembly - Programming Style - Declarations and Expressions - Arrays, Qualifiers and Reading Numbers - Decision and Control Statements - Programming Process - More Control Statements - Variable Scope and Functions - C Preprocessor - Advanced Types - Simple Pointers - Debugging and Optimization – In-line Assembly.

**UNIT II C PROGRAMMING TOOLCHAIN IN LINUX**

**9**

C preprocessor - Stages of Compilation - Introduction to GCC - Debugging with GDB - The Make utility - GNU Configure and Build System - GNU Binary utilities - Profiling - using *gprof* - Memory Leak Detection with *valgrind* - Introduction to GNU C Library

**UNIT III EMBEDDED C AND EMBEDDED OS**

**9**

Adding Structure to ‘C’ Code: Object oriented programming with C, Header files for Project and Port, Examples. Meeting Real-time constraints: Creating hardware delays - Need for timeout mechanism - Creating loop timeouts - Creating hardware timeouts. Creating embedded operating system: Basis of a simple embedded OS, Introduction to sEOS, Using Timer 0 and Timer 1, Portability issue, Alternative system architecture, Important design considerations when using sEOS.

**UNIT IV TIME-DRIVEN MULTI-STATE ARCHITECTURE AND HARDWARE****9**

Multi-State systems and function sequences: Implementing multi-state (Timed) system - Implementing a Multi-state (Input/Timed) system. Using the Serial Interface: RS232 - The Basic RS-232 Protocol - Asynchronous data transmission and baud rates - Flow control - Software architecture - Using on-chip UART for RS-232 communication - Memory requirements - The serial menu architecture - Examples. Case study: Intruder alarm system.

**UNIT V EMBEDDED JAVA****9**

Introduction to Embedded Java and J2ME – Smart Card basics – Java card technology overview – Java card objects – Java card applets – working with APDUs – Web Technology for Embedded Systems.

**TOTAL : 45 PERIODS****REFERENCES**

1. Steve Oualline, 'Practical C Programming 3<sup>rd</sup> Edition', O'Reilly Media, Inc, 2006.
2. Stephen Kochan, "Programming in C", 3rd Edition, Sams Publishing, 2009.
3. Michael J Pont, "Embedded C", Pearson Education, 2007.
4. Zhiquan Chen, 'Java Card Technology for Smart Cards: Architecture and Programmer's Guide', Addison-Wesley Professional, 2000.

**ET7211****EMBEDDED SYSTEM LABORATORY II****L T P C  
0 0 3 2**

<b>Sl.No.</b>	<b>Title</b>	<b>Requirement</b>	<b>Quantity</b>
1	Programming with ARM Processors Both Assembly and C programming, I/O Programming/Timers/Interrupts, /ADC/DAC/ LCD /RTC Interfacing/ Sensor Interfacing/i/o device control	ARM family Processors With IDE, Board Support Packages & Peripherals DSO(2);Multimeters(6); 3 Types of Sensors(3 each);DC & AC Motors 2 each);interface supports(3 each)	Multiple user
2	Programming with Fixed Point & Floating Point DSP Processors Both Assembly /C programming/CCS Compilers- Programming with DSP processors for Correlation, Convolution, Arithmetic adder, Multiplier, Design of Filters - FIR based , IIR based	Fixed Point & Floating Point DSP Processors With IDE, Board Support Packages & Peripherals	2 set each

3	Design using Xilinx/Altera CPLD Design and Implementation of simple Combinational/Sequential Circuits	Xilinx/Altera CPLD Processor	Multiple set
4	Design using Xilinx/Altera FPGA Design and Implementation of simple Combinational/Sequential Circuits	Xilinx/Altera FPGA Processor	Multiple user
3	Interfacing: Motor Control/ADC/DAC/LCD / RTC Interfacing/ Sensor Interfacing	DSP/ARM/FPGA Processors With IDE, Board Support Packages & PDSO(2);Multimeters(6); 3 Types of Sensors(3 each);DC & AC Motors 2 each);interface supports(3 each) eripherals for interface	2 set
6	Study of one type of Real Time Operating Systems (RTOS) with ARM Processor/Microcontroller	ARMProcessor/Microcontroller	Multiple user
7	Network Simulators Communication Topology of network using NS2/simulators	NS2/simulators	Multiple user
8	Study on Embedded wireless network Topology	NS2/simulators	Multiple user
9	Simulation of digital controllers using programming environments	(MATLAB/LabVIEW/Simulators)	Multiple user
10	Simulation & Programming on DSP /Image Processing using programming environments	(MATLAB/LabVIEW/Simulators)	Multiple user

**TOTAL= 45 PERIODS**

#### REFERENCES :

1. Mohamammad Ali Mazidi & Mazidi ' 8051 Microcontroller and Embedded Systems', Pearson Education
2. Mohammad Ali Mazidi, Rolind Mckinley and Danny Causey, 'PIC Microcontroller and Embedded Systems' Pearson Education
3. UdayaShankara, "Modern Digital Signal Processing Includes Signals and Systems-MATLAB Programs, DSP Architecture with Assembly and C Programs", second edition, PHI Learning 2012.
4. Rashid," Introduction to PSPICE using Orcad for Circuits And Electronics"
5. Jan Axelson 'Embedded Ethernet and Internet Complete', Penram publications
6. Kraig Mitzner, 'Complete PCB Design using ORCAD Capture and Layout', Elsevier
7. Woon-Seng Gan, Sen M. Kuo, 'Embedded Signal Processing with the Micro Signal Architecture', John Wiley & Sons, Inc., Hoboken, New Jersey 2007
8. U. Meyer-Baese 'Digital Signal Processing using Field Programmable Gate Arrays', Springer
9. Dogan Ibrahim, 'Advanced PIC microcontroller projects in C', Elsevier 2008



## REFERENCES:

1. A.J. Bouwens, "Digital Instrumentation", TATA McGraw-Hill Edition, 1998.
2. N. Mathivanan, "Microprocessors, PC Hardware and Interfacing", Prentice-Hall India, 2005.
3. H S Kalsi, "Electronic Instrumentation" Second Edition, Tata McGraw-Hill, 2006.
4. Joseph J. Carr, "Elements of Electronic Instrumentation and Measurement" Third Edition, Pearson Education, 2003.
5. Buchanan, "Computer busses", Arnold, London, 2000.
6. Jonathan W Valvano, "Embedded Microcomputer systems", Asia Pvt. Ltd., Brooks/Cole, Thomson, 2001.

ET7002

REAL TIME OPERATING SYSTEMS

L T P C  
3 0 0 3

### OBJECTIVES

- To expose the students to the fundamentals of interaction of OS with a computer and User computation.
- To teach the fundamental concepts of how process are created and controlled with OS.
- To study on programming logic of modeling Process based on range of OS features
- To compare types and Functionalities in commercial OS
- To discuss the application development using RTOS

### UNIT I REVIEW OF OPERATING SYSTEMS

15

Basic Principles - Operating System structures – System Calls – Files – Processes – Design and Implementation of processes – Communication between processes – Introduction to Distributed operating system – issues in distributed system: states, events, clocks - Distributed scheduling - Fault & recovery.

### UNIT II OVERVIEW OF RTOS

9

RTOS Task and Task state – Multithreaded Preemptive scheduler - Process Synchronisation - Message queues – Mail boxes - pipes – Critical section – Semaphores – Classical synchronisation problem – Deadlocks

### UNIT III REAL TIME MODELS AND LANGUAGES

6

Event Based – Process Based and Graph based Models – Real Time Languages – RTOS Tasks – RT scheduling - Interrupt processing – Synchronization – Control Blocks – Memory Requirements.

### UNIT IV REAL TIME KERNEL

6

Principles – Design issues – Polled Loop Systems – RTOS Porting to a Target – Comparison and Basic study of various RTOS like – VX works – Linux supportive RTOS – C Executive.

## **UNIT V RTOS APPLICATION DOMAINS**

**9**

Case studies-RTOS for Image Processing – Embedded RTOS for Network communication – RTOS for fault-Tolerant Applications – RTOS for Control Systems.

**TOTAL : 45 PERIODS**

### **REFERENCES:**

1. Silberschatz, Galvin, Gagne” Operating System Concepts, 6<sup>th</sup> ed, John Wiley, 2003
2. D.M.Dhamdhere,” Operating Systems, A Concept-Based Approach, TMH, 2008
3. Raj Kamal, “Embedded Systems- Architecture, Programming and Design” Tata McGraw Hill, 2006.
4. Herma K., “Real Time Systems – Design for distributed Embedded Applications”, Kluwer Academic, 1997.
5. Charles Crowley, “Operating Systems-A Design Oriented approach” McGraw Hill 1997.
6. C.M. Krishna, Kang, G.Shin, “Real Time Systems”, McGraw Hill, 1997.
7. Raymond J.A.Bhur, Donald L.Bailey, “An Introduction to Real Time Systems”, PHI 1999.
8. Mukesh Sigal and N G Shi “Advanced Concepts in Operating System”, McGraw Hill 2000.

**ET7016**

**PARALLEL PROCESSING ARCHITECTURE**

**L T P C**

**3 0 0 3**

### **OBJECTIVES**

- To expose the students to the fundamentals of interaction of OS with a computer and User computation.
- To teach the fundamental Parallel Processing.
- To study on networking for memory
- To compare types and Functionalities in commercial OS
- To discuss the parallel models development using software

### **UNIT I THEORY OF PARALLELISM**

**9**

Parallel Computer models – the state of computing, Multiprocessors and Multicomputers and Multivectors and SIMD computers, PRAM and VLSI models, Architectural development tracks, Program and network properties – Conditions of parallelism.

### **UNIT II PARTITIONING AND SCHEDULING**

**9**

Program partitioning and scheduling, Program flow mechanisms, System interconnect architectures, Principles of scalable performance – performance matrices and measures, Parallel processing applications, speedup performance laws, scalability analysis and approaches.

### **UNIT III HARDWARE TECHNOLOGIES**

**9**

Processor and memory hierarchy advanced processor technology, superscalar and vector processors, memory hierarchy technology, virtual memory technology, bus cache and shared

memory – backplane bus systems, cache memory organizations, shared memory organizations, sequential and weak consistency models.

**UNIT IV PIPELINING AND SUPERSCALAR TECHNOLOGIES** **9**  
Parallel and scalable architectures, Multiprocessor and Multicomputers, Multivector and SIMD computers, Scalable, Multithreaded and data flow architectures.

**UNIT V SOFTWARE AND PARALLEL PROCESSING** **9**  
Parallel models, Languages and compilers, Parallel program development and environments, UNIX, MACH and OSF/1 for parallel computers.

**TOTAL : 45 PERIODS**

**REFERENCES:**

1. Kai Hwang “Advanced Computer Architecture”. McGraw Hill International 2001.
2. Dezso Sima, Terence Fountain, Peter Kacsuk, “Advanced computer Architecture – A design Space Approach”. Pearson Education,2003.
3. Carl Homacher, Zvonko Vranesic, Sefwat Zaky, “Computer Organisation”, 5<sup>th</sup> Edition, TMH, 2002.
4. David E. Culler, Jaswinder Pal Singh with Anoop Gupta “Parallel Computer Architecture” ,Elsevier, 2004.
5. John P. Shen. “Modern processor design Fundamentals of super scalar processors”, Tata McGraw Hill 2003.
6. Sajjan G. Shiva “Advanced Computer Architecture”, Taylor & Francis, 2008.
7. V.Rajaraman, C.Siva Ram Murthy, “Parallel Computers- Architecture and Programming”, Prentice Hall India, 2008.
8. John L. Hennessy, David A. Petterson, “Computer Architecture: A Quantitative Approach”, 4<sup>th</sup> Edition, Elsevier, 2007.
9. Harry F. Jordan Gita Alaghaband, “Fundamentals of Parallel Processing”. Pearson Education, 2003.
10. Richard Y. Kain, “Advanced computer architecture – A system Design Approach”, PHI, 2003.

**OBJECTIVES**

- To expose the students to the fundamentals of Embedded System Blocks
- To teach the fundamental RTOS.
- To study on interfacing for processor communication
- To compare types and Functionalities in commercial software tools
- To discuss the Applications development using interfacing

**UNIT I EMBEDDED SYSTEM ORGANIZATION****9**

Embedded computing – characteristics of embedded computing applications – embedded system design challenges; Build process of Realtime Embedded system – Selection of processor; Memory; I/O devices-Rs-485, MODEM, Bus Communication system using I<sup>2</sup>C, CAN, USB buses, 8 bit –ISA, EISA bus;

**UNIT II REAL-TIME OPERATING SYSTEM****9**

Introduction to RTOS; RTOS- Inter Process communication, Interrupt driven Input and Output - Nonmaskable interrupt, Software interrupt; Thread – Single, Multithread concept; Multitasking Semaphores.

**UNIT III INTERFACE WITH COMMUNICATION PROTOCOL****9**

Design methodologies and tools – design flows – designing hardware and software Interface . – system integration; SPI, High speed data acquisition and interface-SPI read/write protocol, RTC interfacing and programming;

**UNIT IV DESIGN OF SOFTWARE FOR EMBEDDED CONTROL****9**

Software abstraction using Mealy-Moore FSM controller, Layered software development, Basic concepts of developing device driver – SCI – Software - interfacing & porting using standard C & C++ ; Functional and performance Debugging with benchmarking Real-time system software – Survey on basics of contemporary RTOS – VXWorks, UC/OS-II

**UNIT V CASE STUDIES WITH EMBEDDED CONTROLLER****9**

Programmable interface with A/D & D/A interface; Digital voltmeter, control- Robot system; - PWM motor speed controller, serial communication interface.

**TOTAL : 45 PERIODS****REFERENCES:**

1. Steven F. Barrett, Daniel J. Pack, "Embedded Systems – Design and Applications with the 68HC 12 and HCS12", Pearson Education, 2008.
2. Raj Kamal, "Embedded Systems- Architecture, Programming and Design" Tata McGraw Hill, 2006.
3. Micheal Khevi, "The M68HC11 Microcontroller application in control,Instrumentation & Communication", PH NewJersy, 1997.
4. Chattopadhyay, "Embedded System Design",PHI Learning, 2011.

5. Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey, "PIC Microcontroller and Embedded Systems- Using Assembly and C for PIC18", Pearson Education,2008.
6. Steven F.Barrett,Daniel J.Pack,"Embedded Systems-Design & Application with the 68HC12 & HCS12", Pearson Education,2008.
7. Daniel W. Lewis, "Fundamentals of Embedded Software", Prentice Hall India, 2004.
8. Jack R Smith "Programming the PIC microcontroller with MBasic" Elsevier, 2007.  
Keneth J.Ayala, "The 8086 Microprocessor: Programming & Interfacing the PC", Thomson India edition,

**ET7004**

**PROGRAMMING WITH VHDL**

**L T P C  
3 0 0 3**

### **OBJECTIVES**

- To give an insight to the students about the significance of VHDL Programming
- To teach the importance and architectural modelling of programmable logic devices.
- To introduce the construction and design programming
- To teach the basic VLSI design configurations
- To study the Logic synthesis and simulation of digital system with PLD.

### **UNIT I VHDL FUNDAMENTALS**

**9**

Fundamental concepts- Modeling digital system-Domain and levels of modeling-modeling languages-VHDL modeling concepts-Scalar Data types and operations- constants and Variable-Scalar Types- Type Classification-Attributes and scalar types-expression and operators-Sequential statements.

### **UNIT II DATA TYPES AND BASIC MODELING CONSTRUCTS**

**9**

Arrays- unconstrained array types-array operations and referencing- records - Access Types-Abstract Date types- -basic modeling constructs-entity declarations-Architecture bodies-behavioral description-structural descriptions- design Processing, case study: A pipelined Multiplier accumulator.

### **UNIT III SUBPROGRAMS , PACKAGES AND FILES**

**9**

Procedures-Procedure parameters- Concurrent procedure call statements –Functions –Overloading –visibility of Declarations-packages and use clauses- Package declarations-package bodies-use clauses-Predefined aliases-Aliases for Data objects-Aliases for Non-Data items-Files- I/O-Files. Case study: A bit vector arithmetic Package.

### **UNIT IV SIGNALS, COMPONENTS, CONFIGURATIONS.**

**9**

Basic Resolved Signals-IEEE std\_Logic\_1164 resolved subtypes- resolved Signal Parameters -Generic Constants- Parameterizing behavior- Parameterizing structure-components and configurations-Generate Statements-Generating Iterative structure-Conditionally generating structure-Configuration of generate statements-case study: DLX computer Systems.

**UNIT V DESIGN WITH PROGRAMMABLE LOGIC DEVICES****9**

Realization of -Micro controller CPU.- Memories- I/O devices-MAC-Design,synthesis,simulation and testing.

**TOTAL : 45 PERIODS****REFERENCES**

1. Peter J.Ashenden, "The Designer's guide to VHDL", Morgan Kaufmann publishers,San Francisco,Second Edition, May 2001.
2. Zainalabedin navabi, "VHDL Analysis ans modeling of Digital Systems", McGraw Hill international Editions, Second Editions, 1998.
3. Charles H Roth, Jr. "Digital system Design using VHDL", Thomson ,2006.
4. Douglas Perry, "VHDL Programming by Example", Tata McGraw Hill,4<sup>th</sup> Edition 2002.
5. Navabi.Z., "VHDL Analysis and Modeling of Digital Systems", McGraw International, 1998.
6. Peter J Ashendem, "The Designers Guide to VHDL", Harcourt India Pvt Ltd, 2002
7. Skahill. K, "VHDL for Programmable Logic", Pearson education, 1996.

**ET7005****ADHOC NETWORKS****L T P C  
3 0 0 3****OBJECTIVES**

- To expose the students to the fundamentals of wireless communication technologies.
- To teach the fundamentals of wireless network routing protocols
- To study on wireless issues in network layers topologies
- To introduce energy management in network routing protocols
- To study the basis of performance metrics for N/W communication technologies

**UNIT I WIRELESS LAN, PAN, WAN AND MAN****9**

Characteristics of wireless channel, Fundamentals of WLANs, IEEE 802.11 standard, HIPERLAN Standard, First-, Second-, and third- generation cellular systems, WLL, Wireless ATM, IEEE 802.16 standard, HIPERACCESS, AdHoc Wireless Internet.

**UNIT II MAC, ROUTING AND MULTICAST ROUTING PROTOCOLS****9**

MAC Protocols: Design issues, goals and classification, Contention –based protocols with reservation and scheduling mechanisms, Protocols using directional antennas. Routing protocols: Design issues and classification, Table-driven, On-demand and Hybrid routing protocols, Routing protocols with efficient flooding mechanisms, Hierarchical and power-aware routing protocols. Multicast Routing Protocols: Design issues and operation, Architecture reference model, classification, Tree-based and Mesh-based protocols, Energy-efficient multicasting.



**UNIT I INTRODUCTION TO DIGITAL SIGNAL PROCESSING 12**  
Introduction, A Digital Signal-Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Decimation and Interpolation, Digital Filters, FIR Filters, IIR Filters.

**UNIT II WAVELET TRANSFORM 6**  
Introduction to continuous wavelet transform- discrete wavelet transform -orthogonal wavelet decomposition- Multiresolution Analysis-Wavelet function-DWT,bases,orthogonal Basis-Scaling function, Wavelet coefficients- ortho normal wavelets and their relationship to filter banks- Digital filtering interpolation (i) Decomposition filters, (ii) reconstruction, the signal- Example MRA- Haar & Daubechies wavelet.

**UNIT III ARCHITECTURES OF COMMERCIAL DIGITAL SIGNAL PROCESSORS 12**  
Introduction, catogorisation of DSP Processors, Fixed Point (Blackfin),Floating Point (SHARC),TI TMS 320c6xxx & OMAP processors TMS320C54X & 54xx on Basic Architecture – comparison : of functional variations of Computational building blocks, MAC, Bus Architecture and memory, Data Addressing, Parallelism and pipelining, Parallel I/O interface,Memory Interface, Interrupt, DMA (one example Architecture in each of these case studies).

**UNIT IV INTERFACING I/O PERIPHERALS FOR DSP BASED APPLICATIONS 6**  
Introduction, External Bus Interfacing Signals, Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I / O Direct Memory Access (DMA).-Introduction, Design of Decimation and Interpolation Filter, FFT Algorithm, PID Controller ,Application for Serial Interfacing, DSP based Power Meter, Position control , CODEC Interface .

**UNIT V VLSI IMPLEMENTATION 9**  
Low power Design-need for Low power VLSI chips-Basics of DSP system architecture design using VHDL programming, Mapping of DSP algorithm onto hardware, Realisation of MAC & Filter structure.

**TOTAL : 45 PERIODS**

**REFERENCES:**

1. John G. Proaks, Dimitris G. Manolakis, "Digital Signal Processing", Pearson Education 2002.
2. Avatar Sing, S. Srinivasan, "Digital Signal Processing- Implementation using DSP Microprocessors with Examples from TMS320C54xx", Thomson India,2004.
3. Lars Wanhammer, "DSP Integrated Circuits", Academic press, 1999,NewYork.
4. Lyla B Das," Embedded Systems-An Integrated Approach",Pearson2013
5. Ashok Ambardar,"Digital Signal Processing: A Modern Introduction",Thomson India edition, 2007.
6. Raghuvver M.Rao and Ajit S. Bapardikar, Wavelet transforms- Introduction to theory and applications, Pearson Education, 2000.
7. K.P. Soman and K.L. Ramchandran,Insight into WAVELETS from theory to practice, Eastern Economy Edition, 2008
8. Ifeachor E. C., Jervis B. W , "Digital Signal Processing: A practical approach, Pearson-Education, PHI/ 2002
9. B Venkataramani and M Bhaskar "Digital Signal Processors", TMH, 2<sup>nd</sup>, 2010
10. Peter Pirsch "Architectures for Digital Signal Processing", John Weily, 2007

11. Vinay K.Ingle,John G.Proakis,"DSP-A Matlab Based Approach",Cengage Learning,2010  
 12. Taan S.Elali,"Discrete Systems and Digital Signal Processing with Matlab",CRC Press2009.

**CL7204**

**SOFT COMPUTING TECHNIQUES**

**L T P C**  
**3 0 0 3**

**OBJECTIVES**

- To expose the concepts of feed forward neural networks.
- To provide adequate knowledge about feed back neural networks.
- To teach about the concept of fuzziness involved in various systems.
- To expose the ideas about genetic algorithm
- To provide adequate knowledge about of FLC and NN toolbox

**UNIT I INTRODUCTION AND ARTIFICIAL NEURAL NETWORKS 9**

Introduction of soft computing - soft computing vs. hard computing- various types of soft computing techniques- applications of soft computing-Neuron- Nerve structure and synapse- Artificial Neuron and its model- activation functions- Neural network architecture- single layer and multilayer feed forward networks- McCullochPitts neuron model- perceptron model- Adaline and Madaline- multilayer perception model- back propogation learning methods- effect of learning rule coefficient -back propogation algorithm- factors affecting back propogation training- applications.

**UNIT II ARTIFICIAL NEURAL NETWORKS 9**

Counter propagation network- architecture- functioning & characteristics of counter- Propagation network-Hopfield/ Recurrent network- configuration- stability constraints-associative memory- and characteristics- limitations and applications- Hopfield v/s Boltzman machine- Adaptive Resonance Theory- Architecture- classifications-Implementation and training-Associative Memory.

**UNIT III FUZZY LOGIC SYSTEM 9**

Introduction to crisp sets and fuzzy sets- basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control- Fuzzification- inferencingand defuzzification- Fuzzy knowledge and rule bases-Fuzzy modeling and control schemes for nonlinear systems. Self organizing fuzzy logic control- Fuzzy logic control for nonlinear time delay system.

**UNIT IV GENETIC ALGORITHM 9**

Basic concept of Genetic algorithm and detail algorithmic steps-adjustment of free Parameters- Solution of typical control problems using genetic algorithm- Concept on some other search techniques like tabu search and ant colony search techniques for solving optimization problems.

**UNIT V APPLICATIONS****9**

GA application to power system optimization problem- Case studies: Identification and control of linear and nonlinear dynamic systems using Matlab-Neural Network toolbox. Stability analysis of Neural Network interconnection systems- Implementation of fuzzy logic controller using Matlab fuzzy logic toolbox-Stability analysis of fuzzy control systems.

**TOTAL : 45 PERIODS****REFERENCES**

- 1.. Laurene V. Fausett, Fundamentals of Neural Networks: Architectures, Algorithms And Applications, Pearson Education,
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.
3. Zimmermann H.J. "Fuzzy set theory and its Applications" Springer international edition, 2011.
4. David E. Goldberg, "Genetic Algorithms in Search, Optimization, and Machine Learning", Pearson Education, 2009.
5. W.T.Miller, R.S.Sutton and P.J.Webrose, "Neural Networks for Control", MIT Press, 1996.

**ET7007 RISC PROCESSOR ARCHITECTURE AND PROGRAMMING****L T P C  
3 0 0 3****OBJECTIVES**

- To teach the architecture of 8 bit RISC processor
- To teach the architecture and programming of 16 bit RISC processor
- To teach the implementation of DSP in ARM processor
- To discuss on memory management in RISC processor
- To teach the application development with ARM processor

**UNIT I AVR MICROCONTROLLER ARCHITECTURE****9**

Architecture – memory organization – addressing modes – I/O Memory – EEPROM – I/O Ports –SRAM –Timer –UART – Interrupt Structure- Serial Communication with PC – ADC/DAC Interfacing.

**UNIT II ARM ARCHITECTURE AND PROGRAMMING****9**

Arcon RISC Machine – Architectural Inheritance – Core & Architectures -- The ARM Programmer's model -Registers – Pipeline - Interrupts – ARM organization - ARM processor family – Co-processors. Instruction set – Thumb instruction set – Instruction cycle timings

**UNIT III ARM APPLICATION DEVELOPMENT****9**

Introduction to DSP on ARM –FIR Filter – IIR Filter – Discrete Fourier transform – Exception Handling – Interrupts – Interrupt handling schemes- Firmware and bootloader – Example: Standalone - Embedded Operating Systems – Fundamental Components - Example Simple little Operating System

**UNIT IV MEMORY PROTECTION AND MANAGEMENT 9**  
Protected Regions-Initializing MPU, Cache and Write Buffer-MPU to MMU-Virtual Memory-Page Tables-TLB-Domain and Memory Access Permission-Fast Context Switch Extension.

**UNIT V DESIGN WITH ARM MICROCONTROLLERS 9**  
Assembler Rules and Directives- Simple ASM/C programs- Hamming Code- Division-Negation-Simple Loops –Look up table- Block copy- subroutines.

**TOTAL : 45 PERIODS**

#### REFERENCES

1. Steve Furber, 'ARM system on chip architecture', Addison Wesley
2. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield 'ARM System Developer's Guide Designing and Optimizing System Software', Elsevier 2007.
3. Trevor Martin, 'The Insider's Guide To The Philips ARM7-Based Microcontrollers, An Engineer's Introduction To The LPC2100 Series' Hitex (UK) Ltd.,
4. Dananjay V. Gadre 'Programming and Customizing the AVR microcontroller', McGraw Hill 2001
5. William Hohl, 'ARM Assembly Language' Fundamentals and Techniques.
5. ARM Architecture Reference Manual
6. LPC213x User Manual
7. R. Barnett , L. O' CULL and S. Cox " Embedded C Programming and Atmel AVR", Delmar Cengage Learning, India Edition , 2009.

**ET7008**

**ADVANCED EMBEDDED SYSTEMS**

**L T P C  
3 0 0 3**

#### OBJECTIVES

- *To teach the* Fundamentals on design attributes of functional units of a Processor
- To discuss on Hardware software partitioning in system design
- To teach intra & Inter processor Communications
- To discuss strategies for processor Communications
- To discuss on Co-Designs

**UNIT I INTRODUCTION TO EMBEDDED HARDWARE AND SOFTWARE 9**  
Terminology – Gates – Timing diagram – Memory – Microprocessor buses – Direct memory access – Interrupts – Built interrupts – Interrupts basis – Shared data problems – Interrupt latency - Embedded system evolution trends – Interrupt routines in an RTOS environment .

**UNIT II SYSTEM MODELLING WITH HARDWARE/SOFTWARE PARTITIONING 9**  
Embedded systems, Hardware/Software Co-Design, Co-Design for System Specification and modelling- Single-processor Architectures&,Multi-ProcessorArchitectures, comparison of Co-Design Approaches, Models of Computation, Requirements for Embedded System Specification, Hardware/Software Partitioning Problem, Hardware/Software Cost Estimation, Generation of Partitioning by Graphical modelling, Formulation of the HW/SW scheduling, Optimization.

**UNIT III    HARDWARE/SOFTWARE CO-SYNTHESIS****9**

The Co-Synthesis Problem, State-Transition Graph, Refinement and Controller Generation, Distributed System Co-Synthesis.

**UNIT IV    MEMORY AND INTERFACING****9**

Memory: Memory write ability and storage performance – Memory types – composing memory – Advance RAM interfacing communication basic – Microprocessor interfacing I/O addressing – Interrupts – Direct memory access – Arbitration multilevel bus architecture – Serial protocol – Parallel protocols – Wireless protocols – Digital camera example.

**UNIT V    CONCURRENT PROCESS MODELS AND HARDWARE SOFTWARE CO-DESIGN****9**

Modes of operation – Finite state machines – Models – HCFSL and state charts language – state machine models – Concurrent process model – Concurrent process – Communication among process –Synchronization among process – Implementation – Data Flow model. Design technology – Automation synthesis – Hardware software co-simulation – IP cores – Design Process Model.

**TOTAL : 45 PERIODS****REFERENCES**

1. David. E. Simon, "An Embedded Software Primer", Pearson Education, 2001.
2. Tammy Noergaard, "Embedded System Architecture, A comprehensive Guide for Engineers and Programmers", Elsevier, 2006
3. Raj Kamal, "Embedded Systems- Architecture, Programming and Design" Tata McGraw Hill, 2006.
4. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons, 2002.
5. Steve Heath, "Embedded System Design", Elsevier, Second Edition, 2004.
6. Ralf Niemann, "Hardware/Software Co-Design for Data Flow Dominated Embedded Systems", Kluwer Academic Pub, 1998.
7. Jorgen Staunstrup, Wayne Wolf, "Hardware/Software Co-Design:Principles and Practice", Kluwer Academic Pub, 1997.
8. Giovanni De Micheli, Rolf Ernst Morgon, "Reading in Hardware/Software Co-Design" Kaufmann Publishers, 2001.

**OBJECTIVES**

- To expose the students to the fundamentals of wireless sensor technology
- To teach the infrastructure of WSN processor and its functions
- To study on challenges in Network communication
- To discuss on interconnectivity of networks
- To study the classification of commercial family of wireless technology

**UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS****12**

Challenges for Wireless Sensor Networks- Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes –Imote, IRIS, Mica Mote, TelosB,-Physical layer and transceiver design considerations in WSNs, introduction to fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts - Contention-based protocols - Schedule-based protocols -the IEEE 802.15.4 MAC protocol- Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations-Applications of sensor networks

**UNIT II ISSUES IN PERVASIVE SENSOR NETWORK****9**

Single-Node Architecture - Hardware Components, constraints & challenges in resources- Energy Consumption of Sensor Nodes, Operating Systems for Wireless Sensor Networks – Introduction - Operating System Design Issues - Examples of Operating Systems – TinyOS, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts. Data Dissemination-Flooding and Gossiping-Data gathering Sensor Network Scenarios –Optimization, Goals and Figures of Merit – Design Principles for WSNs- Gateway Concepts – Need for gateway

**UNIT III PERVASIVE NETWORKING & COMPUTING****12**

Introduction, Networking Infrastructure and Architecture of PERV NET, Mobility management, service discovery, disconnected operation, Dynamic configuration, auto registration, content based routing, Backbone Technology: Electrical Backbone Networks – Optical Backbone Networks – Wireless Backbone Networks – Wireless Access Technology - Pervasive Web Application architecture- Access from PCs and PDAs - Access via WAP

**UNIT IV PERVASIVE DEVICES****6**

Introduction with Case study of - PDA - Mobile Phone:Elements – Mobile Information Architecture - Mobile Phone Design - Android Overview – The Stack – Android User Interface – Preferences, the File System, the Options Menu and Intents.

**UNIT V EMERGING WIRELESS TECHNOLOGIES****6**

Evolution and Deployment of Cellular Telephone Systems – 1G, 2G, 2.5G, 3G, 4G. Introduction to wireless LAN, Wireless PAN, Wireless MAN, Broadband Satellite and Microwave Systems – Emerging Wireless Technologies – IEEE 802.20 Mobile Broadband Wireless Access.

**TOTAL : 45 PERIODS**

## REFERENCES

1. Debashis saha, Amitava mukherjee ,”Networking Infrastructure for Pervasive Computing, Springer International edition, 2011 (unit 3)
2. Mullet,”Introduction to wireless telecommunications systems and networks”, cengage learning, 2010 (unit 5)
3. Frank Adelstein, Sandeep K S Gupta, Golden G Richard III, Loren Schwiebert, “Fundamentals of mobile and pervasive computing, TMH, 2007.
4. Brian Fling,”Mobile Design & Development,O’Reilly,2011 (unit 4)
5. Marko Gargenta,”Learning Android”, O’Reilly,2011 (unit 4)
6. Holger Karl & Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks” , John Wiley, 2005.
7. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach”, Elsevier, 2007.
8. Kazem Sohraby, Daniel Minoli and Taieb Znati, “ Wireless Sensor Networks Technology, Protocols, and Applications“, John Wiley & Sons, 2007.’
9. C.Britton Rorabaugh,”Simulating Wireless Communication Systems-Practical Models in C++”,Pearson Edu,2006.
10. Mohammad Ilyas And Imad Mahgaob,”Handbook Of Sensor Networks: Compact Wireless And Wired Sensing Systems”, CRC Press,2005
11. K. Akkaya and M. Younis, “A survey of routing protocols in wireless sensor networks”, Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325--349, 2005.
12. Philip Levis, “ TinyOS Programming”,2006 – [www.tinyos.net](http://www.tinyos.net)
13. Anna Ha´c, “Wireless Sensor Network Designs”, John Wiley & Sons Ltd, 2003.

ET7010

CRYPTOGRAPHY AND NETWORK SECURITY

L T P C  
3 0 0 3

**Pre-requisites:**Basics of Signal Processing, Mathematics of Transforms, microcontroller

### OBJECTIVES

- To expose the students to the fundamentals of data security.
- To teach the fundamentals of mathematical aspects in creating Encryption keys
- To teach the fundamentals of Security in data communication.
- To teach the fundamentals of Secured system operation.
- To teach the fundamentals of Security in wireless communication.

### UNIT I SYMMETRIC CIPHERS

9

Overview – classical Encryption Techniques – Block Ciphers and the Data Encryption standard – Introduction to Finite Fields – Advanced Encryption standard – Contemporary Symmetric Ciphers – Confidentiality using Symmetric Encryption.

### UNIT II PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS

9

Introduction to Number Theory – Public-Key Cryptography and RSA – Key Management – Diffie-Hellman Key Exchange – Elliptic Curve Cryptography – Message Authentication and Hash Functions – Hash Algorithms – Digital Signatures and Authentication Protocols.

### UNIT III NETWORK SECURITY PRACTICE

9

Authentication Applications – Kerberos – X.509 Authentication Service – Electronic mail

Security – Pretty Good Privacy – S/MIME – IP Security architecture – Authentication Header – Encapsulating Security Payload – Key Management.

**UNIT IV SYSTEM SECURITY 9**

Intruders – Intrusion Detection – Password Management – Malicious Software – Firewalls – Firewall Design Principles – Trusted Systems.

**UNIT V WIRELESS SECURITY 9**

Introduction to Wireless LAN Security Standards – Wireless LAN Security Factors and Issues.

**TOTAL : 45 PERIODS**

**TEXT BOOKS**

1. William Stallings, “Cryptography And Network Security – Principles And Practices”, Pearson Education, 3<sup>rd</sup> Edition, 2003.

**REFERENCES**

1. Atul Kahate, “Cryptography and Network Security”, Tata McGraw Hill, 2003.
2. Bruce Schneier, “Applied Cryptography”, John Wiley and Sons Inc, 2001.
3. Stewart S. Miller, “Wi-Fi Security”, McGraw Hill, 2003.  
Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security In Computing”, 3<sup>rd</sup> Edition, Pearson Education, 2003.
5. Mai, “Modern Cryptography: Theory and Practice”, First Edition, Pearson Education, 2003.

**ET7011 SMART METER AND SMART GRID COMMUNICATION L T P C  
3 0 0 3**

**Pre-requisites:** Basics in Instrumentation, Power system and communication

**OBJECTIVES**

- To teach the fundamentals of automated meters and Grids.
- To teach on functional components of Smart meters
- To discuss on need of smart grid for power systems
- To teach the significance of microgrid and its needs
- To teach the communication and protocols for power system

**UNIT I INTRODUCTION 9**

Introduction to Smart grid and metering technology- Smart energy management technical architecture-Functions of Smart Grid and smart meters, Opportunities and challenges-Difference between conventional and smart grid-meters, Concept of Resilient and Self Healing Grid, recent developments and International policies in Smart Grid. IEC 61850 protocol standards.

**UNIT II SMART METERS 9**

Smart metering-Smart Meters types- hardware architecture- software architecture-requirements- communication protocols- Real Time Pricing, Smart Appliances, Automatic Meter Reading- MEMS, Smart Sensors- Smart actuators- Advanced metering infrastructure- spectrum analyzer.

**UNIT III SMART GRID AND APPLICATIONS****9**

Outage Management System, Plug in Hybrid Electric Vehicles, Vehicle to Grid, Home and Building Automation- Smart Substations, Substation Automation, Feeder Automation-Geographic Information System(GIS), Intelligent Electronic Devices and their application for monitoring and protection- -Smart city- Wide Area Measurement System, Phase Measurement Unit- Power Quality and EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring and Power Quality Audit.

**UNIT IV MICROGRIDS****9**

Concept of microgrid, need and applications of microgrid, formation of microgrid, Issues of interconnection, protection and control of microgrid. Plastic and Organic solar cells, Thin film solar cells, Variable speed wind generators, fuelcells, microturbines, Captive power plants, Integration of renewable energy sources.

**UNIT V INFORMATION AND COMMUNICATION TECHNOLOGY FOR SMART GRID AND METERS****9**

Home Area Networks for smart grid - IEEE802.15.4- ITU G.hn-IEEE 802.11, Field Area Networks -power-line communications- IEEE P1901 /HomePlug, RF mesh, Wide-area Networks for Smart Grid- Fiber Optics, WiMAX, sensor networks, Information Management in Smart Grid - SCADA, CIM. Networking Issues in Smart Grid -Wireless Mesh Network-CLOUD Computing - Security and Privacy in Smart Grid and smart meters -Broadband over Power line.

**TOTAL : 45 PERIODS****TEXT BOOKS:**

1. Ali Keyhani, Mohammad N. Marwali, Min Dai "Integration of Green and Renewable Energy in Electric Power Systems", Wiley
2. Stuart Borlase, " Smart Grid: infrastructure, technology and Solutions".2012  
CRC Press
3. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley
4. Jean Claude Sabonnadière, Nouredine Hadjsaïd, "Smart Grids", Wiley Blackwell
5. Peter S. Fox Penner, "Smart Power: Climate Changes, the Smart Grid, and the Future of Electric Utilities", Island Press; 1 edition 8 Jun 2010
6. S. Chowdhury, S. P. Chowdhury, P. Crossley, "Microgrids and Active Distribution Networks." Institution of Engineering and Technology, 30 Jun 2009
7. Stuart Borlase, "Smart Grids (Power Engineering)", CRC Press

**REFERENCES:**

1. Andres Carvallo, John Cooper, "The Advanced Smart Grid: Edge Power Driving Sustainability: 1", Artech House Publishers July 2011
2. James Northcote, Green, Robert G. Wilson "Control and Automation of Electric Power Distribution Systems (Power Engineering)", CRC Press
3. Mladen Kezunovic, Mark G. Adamiak, Alexander P. Apostolov, Jeffrey George Gilbert "Substation Automation (Power Electronics and Power Systems)", Springer
4. R. C. Dugan, Mark F. McGranahan, Surya Santoso, H. Wayne Beaty, "Electrical Power System Quality", 2nd Edition, McGraw Hill Publication
5. Yang Xiao, "Communication and Networking in Smart Grids", CRC Press.

**Pre-requisites:** Digital Circuits, Computer Technology, Basic in Measurement & Instrumentation

### OBJECTIVES

- To discuss on the fundamentals of Network Layers for Data Communications
- To teach the digital data communication techniques
- To teach Graphical programming using GUI for instrument building
- To study on internet based communication standards and working principles
- The case studies to be developed/ discussed in Virtual Environment Tools

### UNIT I NETWORK FUNDAMENTALS 9

Data communication networking – Data transmission concepts – Communication networking - Overview of OSI- TCP/IP layers – IP addressing - DNS – Packet Switching – Routing –Fundamental concepts in SMTP, POP, FTP, Telnet, HTML, HTTP, URL, SNMP,ICMP.

### UNIT II DATA COMMUNICATION 9

Sensor data acquisition, Sampling, Quantization, Filtering ,Data Storage, Analysis using compression techniques, Data encoding – Data link control – Framing, Flow and Error control, Point to point protocol, Routers, Switches , Bridges – MODEMs, Network layer – Congestion control , Transport layer- Congestion control, Connection establishment.

### UNIT III VIRTUAL INSTRUMENTATION 9

Block diagram and Architecture – Data flow techniques – Graphical programming using GUI – Real time system – Embedded controller – Instrument drivers – Software and hardware simulation of I/O communication blocks – ADC/DAC – Digital I/O – Counter , Timer, Data communication ports.

### UNIT IV MEASUREMENT AND CONTROL THROUGH INTERNET 9

Web enabled measurement and control-data acquisition for Monitoring of plant parameters through Internet – Calibration of measuring instruments through Internet, Web based control – Tuning of controllers through Internet

### UNIT V VI BASED MEASUREMENT AND CONTROL 9

Simulation of signal analysis & controller logic modules for Virtual Instrument control – Case study of systems using VI for data acquisition, Signal analysis, controller design, Drives control.

**TOTAL : 45 PERIODS**

### REFERENCES:

1. Wayne Tomasi, "Introduction to Data communications and Networking" Pearson Education, 2007.
2. Al Williams, "Embedded Internet Design", Second Edition, TMH, 2007.
3. Douglas E.Comer, "Internetworking with TCP/IP, Vol. 1", Third Edition, Prentice Hall, 1999.
4. Cory L. Clark, "LabVIEW Digital Signal Processing and Digital Communication", TMH edition 2005.
5. Behrouza A Forouzan,"Data Communications and Networking" Fourth edition, TMH, 2007.



3. George Coulouris and Jean Dollimore, "Distributed Systems – concepts and design", Addison –Wesley 1988.
4. "Architecture and Design of Distributed Embedded Systems", edited by Bernd Kleinjohann C-lab, Universitat Paderborn, Germany, Kluwer Academic Publishers, Boston, April 2001, 248 pp.

**CL7004**

**ROBOTICS AND CONTROL**

**L T P C  
3 0 0 3**

**OBJECTIVES**

- To introduce robot terminologies and robotic sensors
- To educate direct and inverse kinematic relations
- To educate on formulation of manipulator Jacobians and introduce path planning techniques
- To educate on robot dynamics
- To introduce robot control techniques

**UNIT I INTRODUCTION AND TERMINOLOGIES: 9**

Definition-Classification-History- Robots components-Degrees of freedom-Robot joints-coordinates- Reference frames-workspace-Robot languages-actuators-sensors- Position, velocity and acceleration sensors-Torque sensors-tactile and touch sensors-proximity and range sensors- vision system-social issues

**UNIT II KINEMATICS 9**

Mechanism-matrix representation-homogenous transformation-DH representation-Inverse kinematics-solution and programming-degeneracy and dexterity

**UNIT III DIFFERENTIAL MOTION AND PATH PLANNING 9**

Jacobian-differential motion of frames-Interpretation-calculation of Jacobian-Inverse Jacobian- Robot Path planning

**UNIT IV DYNAMIC MODELLING 9**

Lagrangian mechanics- Two-DOF manipulator- Lagrange-Euler formulation – Newton-Euler formulation – Inverse dynamics

**UNIT V ROBOT CONTROL SYSTEM 9**

Linear control schemes- joint actuators- decentralized PID control- computed torque control – force control- hybrid position force control- Impedance/ Torque control.

**TOTAL : 45 PERIODS**

**REFERENCES**

1. R.K. Mittal and I J Nagrath, " Robotics and Control", Tata MacGrawHill, Fourth Reprint 2003.
2. Saeed B. Niku , "Introduction to Robotics ", Pearson Education, 2002
3. Fu, Gonzalez and Lee Mcgrahill , "Robotics ", international
4. R.D. Klafter, TA Chmielewski and Michael Negin, "Robotic Engineering, An Integrated approach", Prentice Hall of India, 2003.
5. Reza N.Jazar, Theory of Applied Robotics Kinematics, Dynamics and Control, Springer, Fist Indian Reprint 2010.

**PRE-REQUISITES:** Basic Instrumentation ,Material Science, Programming

### OBJECTIVES

- To teach the students properties of materials, microstructure and fabrication methods.
- To teach the design and modeling of Electrostatic sensors and actuators.
- To teach the characterizing thermal sensors and actuators through design and modeling
- To teach the fundamentals of piezoelectric sensors and actuators
- To give exposure to different MEMS and NEMS devices.

### UNIT I MEMS:MICRO-FABRICATION, MATERIALS AND ELECTRO-MECHANICAL CONEPTS 9

Overview of micro fabrication – Silicon and other material based fabrication processes – Concepts: Conductivity of semiconductors-Crystal planes and orientation-stress and strain-flexural beam bending analysis-torsional deflections-Intrinsic stress- resonant frequency and quality factor.

### UNIT II ELECTROSTATIC SENSORS AND ACTUATION 9

Principle, material, design and fabrication of parallel plate capacitors as electrostatic sensors and actuators-Applications

### UNIT III THERMAL SENSING AND ACTUATION 9

Principle, material, design and fabrication of thermal couples, thermal bimorph sensors, thermal resistor sensors-Applications.

### UNIT IV PIEZOELECTRIC SENSING AND ACTUATION 9

Piezoelectric effect-cantilever piezo electric actuator model-properties of piezoelectric materials-Applications.

### UNIT V CASE STUDIES 9

Piezoresistive sensors, Magnetic actuation, Micro fluidics applications, Medical applications, Optical MEMS.-NEMS Devices

**TOTAL : 45 PERIODS**

### REFERENCES

1. Chang Liu, "Foundations of MEMS", Pearson International Edition, 2006.
2. Marc Madou , "Fundamentals of microfabrication",CRC Press, 1997.
3. Boston , "Micromachined Transducers Sourcebook",WCB McGraw Hill, 1998.
4. M.H.Bao "Micromechanical transducers :Pressure sensors, accelerometers and gyroscopes", Elsevier, Newyork, 2000.
5. P. RaiChoudry" MEMS and MOEMS Technology and Applications", PHI, 2012.
6. Stephen D. Senturia, " Microsystem Design", Springer International Edition, 2011.

Pre-requisites: Signal Processing, Programming Techniques

**OBJECTIVES**

- To teach the students on fundamentals of image analysis.
- To teach the methods to improve image qualities.
- To teach the characterizing parameters for improve image qualities
- To teach the fundamentals of image size reduction
- To give exposure to different processing applications

**UNIT I FUNDAMENTALS OF IMAGE PROCESSING****9**

Introduction – Steps in image processing systems – Image acquisition – Sampling and Quantization – Pixel relationships – Color fundamentals and models, File formats, Image operations – Arithmetic, Geometric and Morphological.

**UNIT II IMAGE ENHANCEMENT****9**

Spatial Domain: Gray level Transformations – Histogram processing – Spatial filtering smoothing and sharpening. Frequency Domain: Filtering in frequency domain – DFT, FFT, DCT – Smoothing and sharpening filters – Homomorphic Filtering.

**UNIT III IMAGE SEGMENTATION AND FEATURE ANALYSIS****9**

Detection of Discontinuities – Edge operators – Edge linking and Boundary Detection – Thresholding – Region based segmentation – Morphological Watersheds – Motion Segmentation, Feature Analysis and Extraction.

**UNIT IV MULTI RESOLUTION ANALYSIS AND COMPRESSIONS****9**

Multi Resolution Analysis: Image Pyramids – Multi resolution expansion – Wavelet Transforms, Image compression: Fundamentals – Models – Elements of Information Theory – Error free compression – Lossy Compression – Compression Standards.

**UNIT V APPLICATION OF IMAGE PROCESSING****9**

Image classification – Image recognition – Image understanding – Video motion analysis – Image fusion – Steganography – Digital compositing Mosaics – Colour Image Processing.

**TOTAL : 45 PERIODS****REFERENCES :**

1. Rafael C.Gonzalez and Richard E.Woods, "Digital Image Processing", 2<sup>nd</sup> Edition, Pearson Education, 2003.
2. Milan Sonka, Valclav Halavac and Roger Boyle, "Image Processing, Analysis and Machine Vision", 2<sup>nd</sup> Edition, Thomson Learning, 2001.
3. Anil K.Jain, "Fundamentals of Digital Image Processing". Pearson Education, 2003.



**NEHRU INSTITUTE OF ENGINEERING & TECHNOLOGY**  
**T. M. Palayam, Coimbatore-641105**  
**(Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai)**  
**Accredited by NAAC, Recognized by UGC with 2(f) and 12(B)**  
**NBA Accredited UG Courses: AERO, CSE, MECH**



# **Regulation 2017**

AFFILIATED INSTITUTIONS

REGULATIONS 2017

CHOICE BASED CREDIT SYSTEM

Common to all B.E. / B.Tech. Full-Time Programmes

(For the students admitted to B.E. / B.Tech. Programme at various Affiliated Institutions)

**DEGREE OF BACHELOR OF ENGINEERING / BACHELOR OF TECHNOLOGY**

This Regulations is applicable to the students admitted to B.E./B.Tech. Programmes at all Engineering Colleges affiliated to Anna University, Chennai (other than Autonomous Colleges) and to all the University Colleges of Engineering of Anna University, Chennai from the academic year 2017-2018 onwards.

**1. PRELIMINARY DEFINITIONS AND NOMENCLATURE**

In these Regulations, unless the context otherwise requires:

- I) “**Programme**” means Degree Programme, that is B.E./B.Tech. Degree Programme.
- II) “**Discipline**” means specialization or branch of B.E./B.Tech. Degree Programme, like Civil Engineering, Textile Technology, etc.
- III) “**Course**” means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, etc.
- IV) “**Director, Academic Courses**” means the authority of the University who is responsible for all academic activities of the Academic Programmes for implementation of relevant rules of this Regulations pertaining to the Academic Programmes.
- V) “**Chairman**” means the Head of the Faculty.
- VI) “**Head of the Institution**” means the Principal of the College.
- VII) “**Head of the Department**” means head of the Department concerned.
- VIII) “**Controller of Examinations**” means the authority of the University who is responsible for all activities of the University Examinations.
- IX) “**University**” means ANNA UNIVERSITY, CHENNAI.

## 2. ADMISSION

2.1 Candidates seeking admission to the first semester of the eight semester B.E. / B.Tech. Degree Programme:

Should have passed the Higher Secondary Examinations of (10+2) Curriculum (Academic Stream) prescribed by the Government of Tamil Nadu with Mathematics, Physics and Chemistry as three of the four subjects of study under Part-III or any examination of any other University or authority accepted by the Syndicate of Anna University as equivalent thereto.

(OR)

Should have passed the Higher Secondary Examination of Vocational stream (Vocational groups in Engineering / Technology) as prescribed by the Government of Tamil Nadu.

### 2.2 Lateral entry admission

(i) The candidates who possess the Diploma in Engineering / Technology awarded by the State Board of Technical Education, Tamilnadu or its equivalent are eligible to apply for Lateral entry admission to the third semester of B.E. / B.Tech. in the branch corresponding to the branch of study.

(OR)

(ii) The candidates who possess the Degree in Science (B.Sc.) (10+2+3 stream) with Mathematics as a subject at the B.Sc. Level are eligible to apply for Lateral entry admission to the third semester of B.E. / B.Tech.

Such candidates shall undergo two additional Engineering subject(s) in the **third and fourth semesters** as prescribed by the University.

## 3. PROGRAMMES OFFERED

B.E. / B.Tech. Programmes under the Faculty of Civil Engineering, Faculty of Mechanical Engineering, Faculty of Electrical Engineering, Faculty of Information and Communication Engineering and Faculty of Technology.

## 4. STRUCTURE OF PROGRAMMES

### 4.1 Categorization of Courses

Every B.E. / B. Tech. Programme will have a curriculum with syllabi consisting of theory and practical courses that shall be categorized as follows:

- i. **Humanities and Social Sciences (HS)** courses include Technical English, Engineering Ethics and Human Values, Communication skills, Environmental Science and Engineering.
- ii. **Basic Sciences (BS)** courses include Mathematics, Physics, Chemistry, Biology, etc.
- iii. **Engineering Sciences (ES)** courses include Engineering practices, Engineering Graphics, Basics of Electrical / Electronics / Mechanical / Computer Engineering, Instrumentation etc.
- iv. **Professional Core (PC)** courses include the core courses relevant to the chosen specialization/branch.
- v. **Professional Elective (PE)** courses include the elective courses relevant to the chosen specialization/ branch.

- vi. **Open Elective (OE)** courses include the courses from other branches which a student can choose from the list specified in the curriculum of the students B.E. / B. Tech. / B. Arch. Programmes.
- vii. **Employability Enhancement Courses (EEC)** include Project Work and/or Internship, Seminar, Professional Practices, Case Study and Industrial/Practical Training.

#### 4.2 Personality and Character Development

All students shall enroll, on admission, in any one of the personality and character development programmes (NCC/NSS/NSO/YRC) and undergo training for about 80 hours and attend a camp of about seven days. The training shall include classes on hygiene and health awareness and also training in first-aid.

**National Cadet Corps (NCC)** will have about 20 parades.

**National Service Scheme (NSS)** will have social service activities in and around the College / Institution.

**National Sports Organization (NSO)** will have sports, Games, Drills and Physical exercises.

**Youth Red Cross (YRC)** will have activities related to social services in and around College/Institutions.

While the training activities will normally be during weekends, the camp will normally be during vacation period.

#### 4.3 Number of courses per semester

Each semester curriculum shall normally have a blend of lecture courses not exceeding **7** and Laboratory courses and Employability Enhancement Course(s) not exceeding **4**. Each Employability Enhancement Course may have credits assigned as per clause 4.4. However, the total number of courses per semester shall not exceed 10.

#### 4.4 Credit Assignment

Each course is assigned certain number of credits based on the following:

Contact period per week	CREDITS
1 Lecture Period	1
2 Tutorial Periods	1
2 Laboratory Periods (also for EEC courses like / Seminar / Project Work / Case study / etc.)	1

The Contact Periods per week for Tutorials and Practical can only be in multiples of 2.

#### 4.5. Industrial Training / Internship

The students may undergo Industrial training for a period as specified in the Curriculum during summer / winter vacation. In this case the training has to be undergone continuously for the entire period.

The students may undergo Internship at Research organization / University (after due approval from the Department Consultative Committee) for the period prescribed in the curriculum during summer / winter vacation, in lieu of Industrial training.

#### 4.6 Industrial Visit

Every student is required to go for at least one Industrial Visit every year starting from the second year of the Programme. The Heads of Departments shall ensure that necessary arrangements are made in this regard.

#### 4.7 Value Added Courses

The Students may optionally undergo Value Added Courses and the credits earned through the Value Added Courses shall be over and above the total credit requirement prescribed in the curriculum for the award of the degree. One / Two credit courses shall be offered by a Department **of an institution with the prior approval from the Head of the Institution**. The details of the syllabus, time table and faculty may be sent to the Centre for Academic Courses and the Controller of Examinations after approval from the **Head of the Institution** concerned atleast one month before the course is offered. **Students can take a maximum of two one credit courses / one two credit course** during the entire duration of the Programme.

#### 4.8 Online Courses

4.8.1 Students may be permitted to credit only one online course of 3 credits with the approval of **Head of the Institution** and Centre for Academic Courses.

4.8.2 Students may be permitted to credit one online course (which are provided with certificate) subject to a maximum of three credits. The approved list of online courses will be provided by the Centre for Academic courses from time to time. The student needs to obtain certification or credit to become eligible for writing the End Semester Examination to be conducted by Controller of Examinations, Anna University. The details regarding online courses taken up by students should be sent to the Controller of Examinations, Anna University and Centre for Academic Courses one month before the commencement of End Semester Examination.

4.9 The students satisfying the following conditions shall be permitted to carry out their final semester Project work for six months in industry/research organizations.

The student should not have current arrears and shall have CGPA of 7.50 and above.

The student shall undergo the eighth semester courses in the sixth and seventh semesters. The Head of Department, in consultation with the faculty handling the said courses shall forward the proposal recommended by the Head of Institution to the Controller of Examinations through the Director, Centre for Academic courses for approval at least 4 weeks before the commencement of the sixth semester of the programme for approval.

#### 4.10 Medium of Instruction

The medium of instruction is English for all courses, examinations, seminar presentations and project / thesis / dissertation reports except for the programmes offered in Tamil Medium.

#### 5. DURATION OF THE PROGRAMME

- 5.1 A student is ordinarily expected to complete the B.E. / B.Tech. Programme in 8 semesters (four academic years) but in any case not more than 14 Semesters for HSC (or equivalent) candidates and not more than 12 semesters for Lateral Entry Candidates.
- 5.1.1 A student is ordinarily expected to complete the B.E. Mechanical Engineering (Sandwich) Programme in 10 semesters (five academic years) but in any case not more than 18 Semesters for HSC (or equivalent) candidates.
- 5.2 Each semester shall normally consist of 75 working days or 540 periods of 50 minutes each. The Head of the Institution shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course being taught.
- 5.3 The Head of the Institution may conduct additional classes for improvement, special coaching, conduct of model test etc., over and above the specified periods. But for the purpose of calculation of attendance requirement for writing the end semester examinations (as per clause 6) by the students, following method shall be used.

$$\text{Percentage of Attendance} = \frac{\text{Total no. of periods attended in all the courses per semester}}{(\text{No. of periods / week as prescribed in the curriculum}) \times 15 \text{ taken together for all courses of the semester}} \times 100$$

The University Examination will ordinarily follow immediately after the last working day of the semester commencing from I semester as per the academic schedule prescribed from time to time.

- 5.4 The total period for completion of the programme reckoned from the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5.1 irrespective of the period of break of study (vide clause 18) in order that he/she may be eligible for the award of the degree (vide clause 16).

#### 6. COURSE REGISTRATION

- 6.1 The Institution is responsible for registering the courses that each student is proposing to undergo in the ensuing semester. Each student has to register for all courses to be undergone in the curriculum of a particular semester (with the facility to drop courses to a maximum of 6 credits (vide clause 6.2)). The student can also register for courses for which the student has failed in the earlier semesters.

The registration details of the candidates may be approved by the Head of the Institution and forwarded to the Controller of Examinations. This registration is for undergoing the course as well as for writing the End Semester Examinations. No Elective course shall be offered by any department of any institution unless a minimum 10 students register for the course. However, if the students admitted in the associated Branch and Semester is less than 10, this minimum will not be applicable.

##### **The courses that a student registers in a particular semester may include**

- i. Courses of the current semester.
- ii. The core (Theory/Lab /EEC) courses that the student has not cleared in the previous semesters.
- iii. Elective courses which the student failed (either the same elective or a different elective instead).

## 6.2 Flexibility to Drop courses

- 6.2.1 A student has to earn the total number of credits specified in the curriculum of the respective Programme of study in order to be eligible to obtain the degree.
- 6.2.2 From the III to final semesters, the student has the option of dropping existing courses in a semester during registration. Total number of credits of such courses cannot exceed 6.
- 6.2.3 The student shall register for the project work in the final semester only.

## 7. ATTENDANCE REQUIREMENTS FOR COMPLETION OF THE SEMESTER

- 7.1 A Candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester.

Ideally every student is expected to attend all classes of all the courses and secure 100% attendance. However, in order to give provision for certain unavoidable reasons such as Medical / participation in sports, the student is expected to attend atleast 75% of the classes.

Therefore, he/she shall **secure not less than 75%** (after rounding off to the nearest integer) of overall attendance as calculated as per clause 5.3.

- 7.2 However, a candidate who secures overall attendance between 65% and 74% in the current semester due to medical reasons (prolonged hospitalization / accident / specific illness) / Participation in Sports events may be permitted to appear for the current semester examinations subject to the condition that the candidate shall submit the medical certificate / sports participation certificate attested by the Head of the Institution. The same shall be forwarded to the Controller of Examinations for record purposes.
- 7.3 Candidates who **secure less than 65% overall attendance and candidates who do not satisfy the clause 7.1 and 7.2** shall not be permitted to write the University examination at the end of the semester and not permitted to move to the next semester. They are required to repeat the incomplete semester in the next academic year, as per the norms prescribed.

## 8. CLASS ADVISOR

There shall be a class advisor for each class. The class advisor will be one among the (course-instructors) of the class. He / She will be appointed by the HoD of the department concerned. The class advisor is the ex-officio member and the Convener of the class committee. The responsibilities for the class advisor shall be:

- To act as the channel of communication between the HoD and the students of the respective class.
- To collect and maintain various statistical details of students.
- To help the chairperson of the class committee in planning and conduct of the class committee meetings.
- To monitor the academic performance of the students including attendance and to inform the class committee.
- To attend to the students' welfare activities like awards, medals, scholarships and industrial visits.

## 9. CLASS COMMITTEE

- 9.1. Every class shall have a class committee consisting of teachers of the class concerned, student representatives and a chairperson who is not teaching the class. It is like the 'Quality Circle' (more commonly used in industries) with the overall goal of improving the teaching-learning process. The functions of the class committee include
  - Solving problems experienced by students in the class room and in the laboratories.

- **Clarifying the regulations of the degree programme and the details of rules therein particularly (clause 5 and 7) which should be displayed on college Notice-Board.**
- Informing the student representatives, the academic schedule including the dates of assessments and the syllabus coverage for each assessment.
- Informing the student representatives the details of Regulations regarding weightage used for each assessment. In the case of practical courses (laboratory / drawing / project work / seminar etc.) the breakup of marks for each experiment / exercise / module of work, should be clearly discussed in the class committee meeting and informed to the students.
- Analyzing the performance of the students of the class after each test and finding the ways and means of solving problems, if any.
- Identifying the weak students, if any, and requesting the teachers concerned to provide some additional help or guidance or coaching to such weak students.

9.2 The class committee for a class under a particular branch is normally constituted by the Head of the Department. However, if the students of different branches are mixed in a class (like the first semester which is generally common to all branches), the class committee is to be constituted by the Head of the Institution.

9.3 The class committee shall be constituted within the first week of each semester.

9.4 At least 4 student representatives (usually 2 boys and 2 girls) shall be included in the class committee.

9.5 The Chairperson of the class committee may invite the Class adviser(s) and the Head of the Department to the class committee meeting.

9.6 The Head of the Institution may participate in any class committee of the institution.

9.7 The chairperson is required to prepare the minutes of every meeting, submit the same to Head of the Institution within two days of the meeting and arrange to circulate it among the students and teachers concerned. If there are some points in the minutes requiring action by the management, the same shall be brought to the notice of the Management by the Head of the Institution.

9.8 The first meeting of the class committee shall be held within one week from the date of commencement of the semester, in order to inform the students about the nature and weightage of assessments within the framework of the Regulations. Two or three subsequent meetings may be held in a semester at suitable intervals. **The Class Committee Chairman shall put on the Notice Board the cumulative attendance particulars of each student at the end of every such meeting to enable the students to know their attendance details to satisfy the clause 6 of this Regulation.** During these meetings the student members representing the entire class, shall meaningfully interact and express the opinions and suggestions of the other students of the class in order to improve the effectiveness of the teaching-learning process.

## 10. COURSE COMMITTEE FOR COMMON COURSES

Each common theory course offered to more than one discipline or group, shall have a "Course Committee" comprising all the teachers teaching the common course with one of them nominated as Course Coordinator. The nomination of the Course Coordinator shall be made by the Head of the Department / Head of the Institution depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The 'Course committee' shall meet in order to arrive at a common scheme of evaluation for the test and shall ensure a uniform evaluation of the tests. Wherever feasible, the course committee may also prepare a common question paper for the internal assessment test(s).

## **11. SYSTEM OF EXAMINATION**

11.1 Performance in each course of study shall be evaluated based on (i) continuous internal assessment throughout the semester and (ii) University examination at the end of the semester.

11.2 Each course, both theory and practical (including project work & viva voce Examinations) shall be evaluated for a maximum of 100 marks.

For all theory and practical courses including project work, the continuous internal assessment will carry **20 marks** while the End - Semester University examination will carry **80 marks**.

11.3 Industrial training and seminar shall carry 100 marks and shall be evaluated through internal assessment only.

11.4 The University examination (theory and practical) of 3 hours duration shall ordinarily be conducted between October and December during the odd semesters and between April and June during the even semesters.

11.5 The University examination for project work shall consist of evaluation of the final report submitted by the student or students of the project group (of not exceeding 4 students) by an external examiner and an internal examiner, followed by a viva-voce examination conducted separately for each student by a committee consisting of the external examiner, the supervisor of the project group and an internal examiner.

11.6 For the University examination in both theory and practical courses including project work the internal and external examiners shall be appointed by the Controller of Examinations.

## **12. PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT**

For all theory and practical courses (including project work) the continuous assessment shall be for a maximum of 20 marks. The above continuous assessment shall be awarded as per the procedure given below:

### **12.1 THEORY COURSES**

Three tests each carrying 100 marks shall be conducted during the semester by the Department / College concerned. The total marks obtained in all tests put together out of 300, shall be proportionately reduced for 20 marks and rounded to the nearest integer (This also implies equal weightage to all the three tests).

### **12.2 LABORATORY COURSES**

The maximum marks for Internal Assessment shall be 20 in case of practical courses. Every practical exercise / experiment shall be evaluated based on conduct of experiment / exercise and records maintained. There shall be at least one test. The criteria for arriving at the Internal Assessment marks of 20 is as follows: 75 marks shall be awarded for successful completion of all the prescribed experiments done in the Laboratory and 25 marks for the test. The total mark shall be reduced to 20 and rounded to the nearest integer.

### **12.3 THEORY COURSES WITH LABORATORY COMPONENT**

If there is a theory course with Laboratory component, there shall be three tests: the first two tests (each 100 marks) will be from theory portions and the third test (maximum mark 100) will be for laboratory component. The sum of marks of first two tests shall be reduced to 60 marks and the third test mark shall be reduced to 40 marks. The sum of these 100 marks may then be arrived at for 20 and rounded to the nearest integer.

## 12.4 PROJECT WORK

Project work may be allotted to a single student or to a group of students not exceeding 4 per group.

The Head of the Institutions shall constitute a review committee for project work for each branch of study. There shall be three reviews during the semester by the review committee. The student shall make presentation on the progress made by him / her before the committee. The total marks obtained in the three reviews shall be **reduced for 20 marks** and rounded to the nearest integer (as per the scheme given in 12.4.1).

- 12.4.1 The project report shall carry a maximum 30 marks. The project report shall be submitted as per the approved guidelines as given by Director, Academic Courses. Same mark shall be awarded to every student within the project group for the project report. The viva-voce examination shall carry 50 marks. Marks are awarded to each student of the project group based on the individual performance in the viva-voce examination.

Review I	Review II	Review III	End semester Examinations				
			Thesis Submission (30)		Viva-Voce (50)		
5	7.5	7.5	Internal	External	Internal	External	Supervisor
			15	15	15	20	15

- 12.4.2 If a candidate fails to submit the project report on or before the specified deadline, he/she is deemed to have failed in the Project Work and shall re-register for the same in a subsequent semester.

## 12.5 OTHER EMPLOYABILITY ENHANCEMENT COURSES

- (a) The seminar / Case study is to be considered as purely INTERNAL (with 100% internal marks only). Every student is expected to present a minimum of 2 seminars per semester before the evaluation committee and for each seminar, marks can be equally apportioned. The three member committee appointed by Head of the Institution will evaluate the seminar and at the end of the semester the marks can be consolidated and taken as the final mark. The evaluation shall be based on the seminar paper (40%), presentation (40%) and response to the questions asked during presentation (20%).
- (b) The Industrial / Practical Training, Summer Project, Internship, shall carry 100 marks and shall be evaluated through internal assessment only. At the end of Industrial / Practical training / internship / Summer Project, the candidate shall submit a certificate from the organization where he / she has undergone training and a brief report. The evaluation will be made based on this report and a Viva-Voce Examination, conducted internally by a three member Departmental Committee constituted by the Head of the Institution. The certificates (issued by the organization) submitted by the students shall be attached to the mark list sent by the Head of the Institution to the Controller of Examinations.

## 12.6 ASSESSMENT FOR VALUE ADDED COURSE

The one / two credit course shall carry 100 marks and shall be evaluated through **continuous assessments only**. Two Assessments shall be conducted during the semester by the Department concerned. The total marks obtained in the tests shall be reduced to 100 marks and rounded to the nearest integer. A committee consisting of the Head of the Department, staff handling the course and a senior Faculty member nominated by the Head of the Institution shall monitor the evaluation process. The list of students along with the marks and the grades earned may be forwarded to the Controller of Examinations for appropriate action at least one month before the commencement of End Semester Examinations.

## 12.7 ASSESSMENT FOR ONLINE COURSES

Students may be permitted to credit one online course (which are provided with certificate) subject to a maximum of three credits. The approved list of online courses will be provided by the Centre for Academic courses from time to time. **This online course of 3 credits can be considered instead of one elective course.** The student needs to obtain certification or credit to become eligible for writing the End Semester Examination to be conducted by Anna University. **The course shall be evaluated through the End Semester Examination only conducted by Controller of Examinations, Anna University.**

**12.8. Internal marks approved by the Head of the Institution shall be displayed by the respective HODs within 5 days from the last working day.**

## 12.9 Attendance Record

Every teacher is required to maintain an 'ATTENDANCE AND ASSESSMENT RECORD' which consists of attendance marked in each lecture or practical or project work class, the test marks and the record of class work (topic covered), separately for each course. This should be submitted to the Head of the department periodically (at least three times in a semester) for checking the syllabus coverage and the records of test marks and attendance. The Head of the department will put his signature and date after due verification. At the end of the semester, the record should be verified by the Head of the Institution who will keep this document in safe custody (for five years). The University or any inspection team appointed by the University may verify the records of attendance and assessment of both current and previous semesters.

## 13. REQUIREMENTS FOR APPEARING FOR UNIVERSITY EXAMINATIONS

A candidate shall normally be permitted to appear for the University Examinations for all the courses registered in the current semester (vide clause 6) if he/she has satisfied the semester completion requirements (subject to Clause 7).

A candidate who has already appeared for any subject in a semester and passed the examination is not entitled to reappear in the same subject for improvement of grades.

## 14. PASSING REQUIREMENTS

14.1 A candidate who secures not less than 50% of total marks prescribed for the course [Internal Assessment + End semester University Examinations] with a minimum of 45% of the marks prescribed for the end-semester University Examination, shall be declared to have passed the course and acquired the relevant number of credits. This is applicable for both theory and practical courses (including project work).

14.2 If a student fails to secure a pass in theory courses in the current semester examination, he/she is allowed to write arrear examinations for the next three consecutive semesters and their internal marks shall be carried over for the above mentioned period of three consecutive semesters. If a student fails to secure a pass in a course even after three consecutive arrear attempts, the student has to redo the course in the semester in which it is offered along with regular students.

That is, the students should have successfully completed the courses of (n minus 4)<sup>th</sup> semester to register for courses in n<sup>th</sup> semester.

Based on the above, the following prerequisites shall be followed for completing the degree programme:

- i. To enter into Semester V, the student should have no arrear in Semester I. Failing which the student shall redo the Semester I course/courses along with the regular students.

- ii. To enter into Semester VI, the student should have no arrear in Semester II. Failing which the student shall redo the Semester II course/courses along with the regular students.
- iii. To enter into Semester VII, the student should have no arrear in Semester III. Failing which the student shall redo the Semester III course/courses along with the regular students.
- iv. To enter into Semester VIII, the student should have no arrear in Semester IV. Failing which the student shall redo the Semester IV course/courses along with the regular students.

In case, if he/she has not successfully completed all the courses of semester V at the end of semester VIII, he/she shall redo the Semester V courses along with regular students. For the subsequent semesters of VI, VII and VIII, the same procedure shall be followed, subject to the maximum permissible period for this programme.

**Note:**

- The students who are admitted in **2017-2018 and 2018 – 2019** are permitted to appear for arrears upto VI semesters and will be allowed to move to VII semester only on completion of all the courses in the I semester.

In addition the following prerequisites shall be followed for completing the degree programme.

- i. To enter into Semester VII, the student should have no arrear in Semester I. Failing which the student shall redo the Semester I course/courses along with the regular students.
- ii. To enter into Semester VIII, the student should have no arrear in Semester II. Failing which the student shall redo the Semester II course/courses along with the regular students.

In case, if he/she has not successfully completed all the courses of semester III at the end of semester VIII, he/she shall redo the Semester III courses along with regular students. For the subsequent semesters of IV, V, VI, VII and VIII, the same procedure shall be followed, subject to the maximum permissible period for this programme.

- 14.3 If a student fails to secure a pass in a laboratory course, **the student shall register** for the course again, when offered next.
- 14.4 If a student fails to secure a pass in project work, **the student shall register** for the course again, when offered next.
- 14.5 The passing requirement for the courses which are assessed only through purely internal assessments (EEC courses except project work), is 50% of the internal assessment (continuous assessment) marks only.
- 14.6 A student can apply for revaluation of the student's semester examination answer paper in a theory course, within 2 weeks from the declaration of results, on payment of a prescribed fee along with prescribed application to the COE through the Head of the Institution. The COE will arrange for the revaluation and the results will be intimated to the student concerned through the Head of the Institution. Revaluation is not permitted for laboratory course and project work.

## 15. AWARD OF LETTER GRADES

- 15.1 All assessments of a course will be evaluated on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the candidate in each subject as detailed below:

Letter Grade	Grade Points	Marks Range
O (Outstanding)	10	91 - 100
A + (Excellent)	9	81 - 90
A (Very Good)	8	71 - 80
B + (Good)	7	61 - 70
B (Average)	6	50 - 60
RA	0	<50
SA (Shortage of Attendance)	0	
W	0	

A student is deemed to have passed and acquired the corresponding credits in a particular course if he/she obtains any one of the following grades: "O", "A+", "A", "B+", "B".

'SA' denotes shortage of attendance (as per clause 7.3) and hence prevention from writing the end semester examinations. 'SA' will appear only in the result sheet.

"RA" denotes that the student has failed to pass in that course. "W" denotes **withdrawal** from the exam for the particular course. The grades RA and W will figure both in Marks Sheet as well as in Result Sheet). In both cases the student has to earn Continuous Assessment marks and appear for the End Semester Examinations.

If the grade W is given to course, the attendance requirement need not be satisfied.

If the grade RA is given to a core **theory course**, the attendance requirement need not be satisfied, but if the grade RA is given to a **Laboratory Course/ Project work / Seminar and any other EEC course**, the attendance requirements (vide clause 7) should be satisfied.

- 15.2 For the Co-curricular activities such as National Cadet Corps (NCC)/ National Service Scheme (NSS) / NSO / YRC, a satisfactory / not satisfactory grading will appear in the mark sheet. Every student shall put in a minimum of 75% attendance in the training and attend the camp compulsorily. The training and camp shall be completed during the first year of the programme. However, for valid reasons, the Head of the Institution may permit a student to complete this requirement in the second year. **A satisfactory grade in the above co-curricular activities is compulsory for the award of degree.**
- 15.3 The grades O, A+, A, B+, B obtained for the one credit course shall figure in the Mark sheet under the title '**Value Added Courses**'. The Courses for which the grades are RA, SA **will not figure in the mark sheet.**

## Grade sheet

After results are declared, Grade Sheets will be issued to each student which will contain the following details:

- The college in which the candidate has studied
- The list of courses enrolled during the semester and the grade scored.
- The Grade Point Average (GPA) for the semester and
- The Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

GPA for a semester is the ratio of the sum of the products of the number of credits for courses acquired and the corresponding points to the sum of the number of credits for the courses acquired in the semester.

CGPA will be calculated in a similar manner, considering all the courses registered from first semester. RA grades will be excluded for calculating GPA and CGPA.

$$\text{GPA / CGPA} = \frac{\sum_{i=1}^n C_i GP_i}{\sum_{i=1}^n C_i}$$

where  $C_i$  is the number of Credits assigned to the course

$GP_i$  is the point corresponding to the grade obtained for each course

$n$  is number of all courses successfully cleared during the particular semester in the case of GPA and during all the semesters in the case of CGPA.

## 16 ELIGIBILITY FOR THE AWARD OF THE DEGREE

**16.1** A student shall be declared to be eligible for the award of the B.E. / B.Tech. Degree provided the student has

- Successfully gained the required number of total credits as specified in the curriculum corresponding to the student's programme within the stipulated time.
- Successfully completed the course requirements, appeared for the End-Semester examinations and passed all the subjects prescribed in all the 8 semesters / (10 Semesters for B.E. Mechanical Engineering (Sandwich)) within a maximum period of 7 years (9 years in case of B.E. Mechanical Engineering (Sandwich) and 6 years in the case of Lateral Entry) reckoned from the commencement of the first (third in the case of Lateral Entry) semester to which the candidate was admitted.
- Successfully passed any additional courses prescribed by the Director, Academic Courses whenever readmitted under regulations R-2017 (vide clause 18.3)
- Successfully completed the NCC / NSS / NSO / YRC requirements.
- No disciplinary action pending against the student.
- The award of Degree must have been approved by the Syndicate of the University.

## 16.2 CLASSIFICATION OF THE DEGREE AWARDED

### 16.2.1 FIRST CLASS WITH DISTINCTION

A student who satisfies the following conditions shall be declared to have passed the examination in First class with Distinction:

- Should have passed the examination in all the courses of all the eight semesters (10 Semesters in case of Mechanical (Sandwich) and 6 semesters in the case of Lateral Entry) in the student's First Appearance within **five** years (Six years in the case of Mechanical (Sandwich) and Four years in the case of Lateral Entry). Withdrawal from examination (vide Clause 17) will not be considered as an appearance.
- Should have secured a CGPA of not less than **8.50**.
- One year authorized break of study (if availed of) is included in the five years (Six years in the case of Mechanical (Sandwich) and four years in the case of lateral entry) for award of First class with Distinction.
- Should NOT have been prevented from writing end semester examination due to lack of attendance in any semester.

#### 16.2.2 **FIRST CLASS:**

A student who satisfies the following conditions shall be declared to have passed the examination in **First class**:

- Should have passed the examination in all the courses of all eight semesters (10 Semesters in case of Mechanical (Sandwich) and 6 semesters in the case of Lateral Entry) **within Six years**. (Seven years in case of Mechanical (Sandwich) and Five years in the case of Lateral Entry)
- One year authorized break of study (if availed of) or prevention from writing the End Semester examination due to lack of attendance (if applicable) is included in the duration of six years (Seven years in case of Mechanical (Sandwich) and five years in the case of lateral entry) for award of First class
- Should have secured a CGPA of not less than **7.00**.

#### 16.2.3 **SECOND CLASS:**

All other students (not covered in clauses 16.2.1 and 16.2.2) who qualify for the award of the degree (vide Clause 16.1) shall be declared to have passed the examination in **Second Class**.

**16.3** A candidate who is absent in end semester examination in a course / project work after having registered for the same shall be considered to have appeared in that examination for the purpose of classification. (subject to clause 17 and 18)

#### **16.4 Photocopy / Revaluation**

A candidate can apply for photocopy of his/her semester examination answer paper in a theory course, within 2 weeks from the declaration of results, on payment of a prescribed fee through proper application to the Controller of Examinations through the Head of Institutions. The answer script is to be valued and justified by a faculty member, who handled the subject and recommend for revaluation with breakup of marks for each question. Based on the recommendation, the candidate can register for the revaluation through proper application to the Controller of Examinations. The Controller of Examinations will arrange for the revaluation and the results will be intimated to the candidate concerned through the Head of the Institutions. Revaluation is not permitted for practical courses and for project work.

A candidate can apply for revaluation of answer scripts for not exceeding 5 subjects at a time.

#### **16.5 Review**

Candidates not satisfied with Revaluation can apply for Review of his/ her examination answer paper in a theory course, within the prescribed date on payment of a prescribed fee through proper application to Controller of Examination through the Head of the Institution.

Candidates applying for Revaluation only are eligible to apply for Review.

## 17. PROVISION FOR WITHDRAWAL FROM END-SEMESTER EXAMINATION

- 17.1 A student may, for valid reasons, (medically unfit / unexpected family situations / sports approved by Chairman, sports board and HOD) be granted permission to withdraw from appearing for the end semester examination in any course or courses in **ANY ONE** of the semester examinations during the entire duration of the degree programme. The application shall be sent to Director, Student Affairs through the Head of the Institutions with required documents.
- 17.2 Withdrawal application is valid if the student is otherwise eligible to write the examination (Clause 7) and if it is made within TEN days prior to the commencement of the examination in that course or courses and recommended by the Head of the Institution and approved by the Controller of Examinations.
- 17.2.1 Notwithstanding the requirement of mandatory 10 days notice, applications for withdrawal for special cases under extraordinary conditions will be considered on the merit of the case.
- 17.3 In case of withdrawal from a course / courses (Clause 13) the course will figure both in Marks Sheet as well as in Result Sheet. **Withdrawal essentially requires the student to register for the course/courses** The student has to register for the course, fulfill the attendance requirements (vide clause 7), earn continuous assessment marks and attend the end semester examination. However, withdrawal shall not be construed as an appearance for the eligibility of a candidate for First Class with Distinction.
- 17.4 Withdrawal is permitted for the end semester examinations in the final semester only if the period of study the student concerned does not exceed 5 years as per clause 16.2.1.

## 18. PROVISION FOR AUTHORISED BREAK OF STUDY

- 18.1 A student is permitted to go on break of study for a maximum period of one year as a single spell.
- 18.2 Break of Study shall be granted only once for valid reasons for a maximum of one year during the entire period of study of the degree programme. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for break of study. If a candidate intends to temporarily discontinue the programme in the middle of the semester for valid reasons, and to rejoin the programme in a subsequent year, permission may be granted based on the merits of the case provided he / she applies to the Director, Student Affairs in advance, but not later than the last date for registering for the end semester examination of the semester in question, through the Head of the Institution stating the reasons therefore and the probable date of rejoining the programme.
- 18.3 The candidates permitted to rejoin the programme after break of study / prevention due to lack of attendance, shall be governed by the Curriculum and Regulations in force at the time of rejoining. The students rejoining in new Regulations shall apply to the Director, Academic Courses in the prescribed format through Head of the Institution at the beginning of the readmitted semester itself for prescribing additional courses, if any, from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.
- 18.4 The authorized break of study would not be counted towards the duration specified for passing all the courses for the purpose of classification (vide Clause 16.2).
- 18.5 The total period for completion of the Programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5.1 irrespective of the period of break of study in order that he/she may be eligible for the award of the degree.
- 18.6 If any student is prevented for want of required attendance, the period of prevention shall not be considered as authorized 'Break of Study' (Clause 18.1)

**19. DISCIPLINE**

- 19.1 Every student is required to observe disciplined and decorous behavior both inside and outside the college and not to indulge in any activity which will tend to bring down the prestige of the University / College. The Head of Institution shall constitute a disciplinary committee consisting of Head of Institution, Two Heads of Department of which one should be from the faculty of the student, to enquire into acts of indiscipline and notify the University about the disciplinary action recommended for approval. In case of any serious disciplinary action which leads to suspension or dismissal, then a committee shall be constituted including one representative from Anna University, Chennai. In this regard, the member will be nominated by the University on getting information from the Head of the Institution.
- 19.2 If a student indulges in malpractice in any of the University / internal examination he / she shall be liable for punitive action as prescribed by the University from time to time.

**20. REVISION OF REGULATIONS, CURRICULUM AND SYLLABI**

The University may from time to time revise, amend or change the Regulations, Curriculum, Syllabus and scheme of examinations through the Academic Council with the approval of Syndicate.

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**ANNA UNIVERSITY, CHENNAI**  
**AFFILIATED INSTITUTIONS**  
**B.E. AERONAUTICAL ENGINEERING**  
**REGULATIONS – 2017**  
**CHOICE BASED CREDIT SYSTEM**

**PROGRAMME EDUCATIONAL OBJECTIVES:**

The graduates after completion of the degree will be able to

1. Apply knowledge in emerging and varied areas of Aerospace Engineering for higher studies, research, employment and product development.
2. Communicate their skills and have a sense of responsibility to protect the environment and have ethical conduct towards their profession and commitment to serve the society.
3. Exhibit managerial skills and leadership qualities while understanding the need for lifelong learning to be competent professionals

**PROGRAMME OUTCOMES:**

- a. Ability to solve the engineering problems of mathematics, science and engineering
- b. An engineering acumen in identifying, formulating, analyzing and solving complex engineering problems.
- c. Developing processes, solutions to the problems which are safe socially, culturally and environmentally.
- d. Ability to model, analyze and simulate operations of aircraft components and parts.
- e. Capability of exhibiting sound theoretical and practical knowledge in core domains like aircraft structures, aerodynamics and propulsion and are able to solve problems related to airflow over fixed and rotary wing aircrafts.
- f. Understanding of the impact of engineering solutions in a global, economic, environmental, and societal context
- g. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- h. Commitment to professional ethics and responsibilities and norms as prescribed by the Aviation bodies such as DGCA .
- i. Ability to work in team and have practical exposure in modeling of UAV, hovercrafts.
- j. Ability to communicate effectively with the aerospace community using reports, presentations and documentations.
- k. Ability to manage the projects in various aerospace fields of structure, propulsion, avionics.
- l. A readiness to engage in lifelong learning and understanding of contemporary issues in aviation industry.

**PEO / PO Mapping**

PEO / PO	a	b	c	d	e	f	g	h	i	j	k	l
1	√	√	√	√	√		√					
2			√	√	√	√	√	√	√	√	√	√
3				√		√	√		√		√	√

**Semester Course wise PO mapping**

		<b>Course Title</b>	<b>a</b>	<b>b</b>	<b>c</b>	<b>d</b>	<b>e</b>	<b>f</b>	<b>g</b>	<b>h</b>	<b>i</b>	<b>j</b>	<b>k</b>	<b>l</b>	
<b>YEAR I</b>	<b>SEMESTER I</b>	Communicative English						√				√		√	
		Engineering Mathematics I	√	√	√	√									
		Engineering Physics	√	√	√	√	√			√					
		Engineering Chemistry	√	√	√	√	√			√					
		Problem Solving and Python Programming	√	√	√	√									
		Engineering Graphics	√	√	√	√	√			√		√		√	
		Problem Solving and Python Programming Laboratory	√	√	√	√	√	√		√					
		Physics and Chemistry Laboratory	√	√	√	√	√	√		√					
	<b>SEMESTER II</b>	Technical English							√				√		√
		Engineering Mathematics II	√	√	√	√									
		Materials Science	√		√			√	√	√					
		Basic Electrical, Electronics and Instrumentation Engineering	√		√					√					√
		Environmental Science and Engineering			√				√						
		Engineering Mechanics	√	√	√			√		√					
Engineering Practices Laboratory		√	√	√			√		√						
Basic Electrical, Electronics and Instrumentation Engineering Laboratory		√		√					√					√	
<b>YEAR II</b>	<b>SEMESTER III</b>	Transforms and Partial Differential Equations	√	√	√	√									
		Manufacturing Technology	√		√		√	√	√						
		Aero Engineering Thermodynamics	√	√	√	√	√							√	
		Fluid Mechanics and Machinery	√	√	√	√	√							√	
		Strength of Materials for Mechanical Engineers	√	√	√	√	√							√	

YEAR III		Elements of Aeronautical Engineering			√		√	√			√			√	
		Strength of Materials and Fluid Mechanics & Machinery Laboratory	√	√	√	√	√							√	
		Thermodynamics Laboratory	√	√	√	√	√							√	
		Interpersonal Skills / Listening & Speaking						√				√			√
	SEMESTER IV	Numerical Methods	√	√	√	√									
		Aerodynamics - I	√	√	√	√	√							√	
		Aircraft Systems and Instruments			√		√	√	√		√				
		Mechanics of Machines	√	√	√			√							
		Aircraft Structures - I	√	√	√	√	√							√	
		Propulsion - I	√	√	√	√	√				√			√	
		Computer Aided Machine Drawing				√			√					√	
		Aerodynamics Laboratory	√	√	√	√	√							√	
	YEAR III	SEMESTER V	Flight Dynamics	√	√	√	√		√			√			
			Aircraft Structures - II	√	√	√	√	√							√
Aerodynamics - II			√	√	√	√	√							√	
Propulsion - II			√	√	√	√	√							√	
Control Engineering			√	√	√									√	
Open Elective - I															
Aircraft Structures Laboratory			√	√	√	√	√							√	
Propulsion Laboratory			√	√	√	√	√							√	
Professional Communication									√				√		√
SEM VI		Finite Element Methods	√	√	√	√	√	√	√		√		√	√	
Experimental Aerodynamics		√				√				√		√			

		Composite Materials and Structures	√	√	√		√		√					
		Experimental Stress Analysis	√	√			√			√		√		
		Aircraft Design		√		√	√	√	√	√		√	√	
		Professional Elective – I												
		Aero Engine and Airframe Laboratory			√				√				√	
		Computer Aided Simulation Laboratory		√	√	√	√	√	√	√		√	√	
		Aircraft Design Project - I		√		√	√	√	√	√		√	√	
<b>YEAR IV</b>	<b>SEMESTER VII</b>	Total Quality Management						√			√		√	
		Avionics		√	√					√		√		
		Computational Fluid Dynamics	√	√	√	√	√	√	√		√		√	√
		Open Elective - II												
		Professional Elective – II												
		Professional Elective – III												
		Flight Integration Systems and Control Laboratory		√	√					√		√		
		Aircraft Systems Laboratory			√					√				√
		Aircraft Design Project - II		√		√	√	√	√	√		√	√	
	<b>SEMESTER VIII</b>	Professional Elective – IV												
Professional Elective – V														
Project Work		√	√	√	√	√	√	√	√	√	√	√		

**ANNA UNIVERSITY, CHENNAI**  
**AFFILIATED INSTITUTIONS**  
**B.E. AERONAUTICAL ENGINEERING**  
**REGULATIONS – 2017**  
**CHOICE BASED CREDIT SYSTEM**  
**I TO VIII SEMESTERS CURRICULA AND SYLLABI**

**SEMESTER I**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	HS8151	Communicative English	HS	4	4	0	0	4
2.	MA8151	Engineering Mathematics - I	BS	4	4	0	0	4
3.	PH8151	Engineering Physics	BS	3	3	0	0	3
4.	CY8151	Engineering Chemistry	BS	3	3	0	0	3
5.	GE8151	Problem Solving and Python Programming	ES	3	3	0	0	3
6.	GE8152	Engineering Graphics	ES	6	2	0	4	4
<b>PRACTICALS</b>								
7.	GE8161	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
8.	BS8161	Physics and Chemistry Laboratory	BS	4	0	0	4	2
<b>TOTAL</b>				<b>31</b>	<b>19</b>	<b>0</b>	<b>12</b>	<b>25</b>

**SEMESTER II**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	HS8251	Technical English	HS	4	4	0	0	4
2.	MA8251	Engineering Mathematics - II	BS	4	4	0	0	4
3.	PH8251	Materials Science	BS	3	3	0	0	3
4.	BE8253	Basic Electrical, Electronics and Instrumentation Engineering	ES	3	3	0	0	3
5.	GE8291	Environmental Science and Engineering	HS	3	3	0	0	3
6.	GE8292	Engineering Mechanics	ES	5	3	2	0	4
<b>PRACTICALS</b>								
7.	GE8261	Engineering Practices Laboratory	ES	4	0	0	4	2
8.	BE8261	Basic Electrical, Electronics and Instrumentation Engineering Laboratory	ES	4	0	0	4	2
<b>TOTAL</b>				<b>30</b>	<b>20</b>	<b>2</b>	<b>8</b>	<b>25</b>

### SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MA8353	Transforms and Partial Differential Equations	BS	4	4	0	0	4
2.	ME8392	Manufacturing Technology	PC	3	3	0	0	3
3.	AE8301	Aero Engineering Thermodynamics	PC	3	3	0	0	3
4.	CE8394	Fluid Mechanics and Machinery	ES	4	4	0	0	4
5.	CE8395	Strength of Materials for Mechanical Engineers	ES	3	3	0	0	3
6.	AE8302	Elements of Aeronautical Engineering	PC	3	3	0	0	3
<b>PRACTICAL</b>								
7.	CE8381	Strength of Materials and Fluid Mechanics & Machinery Laboratory	ES	4	0	0	4	2
8.	AE8311	Thermodynamics Laboratory	PC	4	0	0	4	2
9.	HS8381	Interpersonal Skills/Listening & Speaking	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>30</b>	<b>20</b>	<b>0</b>	<b>10</b>	<b>25</b>

### SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MA8491	Numerical Methods	BS	4	4	0	0	4
2.	AE8401	Aerodynamics - I	PC	3	3	0	0	3
3.	AE8402	Aircraft Systems and Instruments	PC	3	3	0	0	3
4.	PR8451	Mechanics of Machines	PC	3	3	0	0	3
5.	AE8403	Aircraft Structures - I	PC	5	3	2	0	4
6.	AE8404	Propulsion - I	PC	5	3	2	0	4
<b>PRACTICAL</b>								
7.	ME8381	Computer Aided Machine Drawing	PC	4	0	0	4	2
8.	AE8411	Aerodynamics Laboratory	PC	2	0	0	2	1
<b>TOTAL</b>				<b>29</b>	<b>19</b>	<b>4</b>	<b>8</b>	<b>24</b>

**SEMESTER V**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	AE8501	Flight Dynamics	PC	5	3	2	0	4
2.	AE8502	Aircraft Structures - II	PC	5	3	2	0	4
3.	AE8503	Aerodynamics - II	PC	3	3	0	0	3
4.	AE8504	Propulsion - II	PC	3	3	0	0	3
5.	AE8505	Control Engineering	PC	3	3	0	0	3
6.		Open Elective - I	OE	3	3	0	0	3
<b>PRACTICAL</b>								
7.	AE8511	Aircraft Structures Laboratory	PC	4	0	0	4	2
8.	AE8512	Propulsion Laboratory	PC	2	0	0	2	1
9.	HS8581	Professional Communication	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>30</b>	<b>18</b>	<b>4</b>	<b>8</b>	<b>24</b>

**SEMESTER VI**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	AE8601	Finite Element Methods	PC	3	3	0	0	3
2.	AE8602	Experimental Aerodynamics	PC	3	3	0	0	3
3.	AE8603	Composite Materials and Structures	PC	3	3	0	0	3
4.	AE8604	Aircraft Design	PC	3	3	0	0	3
5.	AE8605	Experimental Stress Analysis	PC	3	3	0	0	3
6.		Professional Elective – I	PE	3	3	0	0	3
<b>PRACTICAL</b>								
7.	AE8611	Aero Engine and Airframe Laboratory	PC	4	0	0	4	2
8.	AE8612	Computer Aided Simulation Laboratory	PC	4	0	0	4	2
9.	AE8613	Aircraft Design Project - I	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>28</b>	<b>18</b>	<b>0</b>	<b>10</b>	<b>23</b>

**SEMESTER VII**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	GE8077	Total Quality Management	HS	3	3	0	0	3
2.	AE8751	Avionics	PC	3	3	0	0	3
3.	ME8093	Computational Fluid Dynamics	PC	3	3	0	0	3
4.		Open Elective - II	OE	3	3	0	0	3
5.		Professional Elective – II	PE	3	3	0	0	3
6.		Professional Elective – III	PE	3	3	0	0	3
<b>PRACTICAL</b>								
7.	AE8711	Aircraft Systems Laboratory	PC	4	0	0	4	2
8.	AE8712	Flight Integration Systems and Control Laboratory	PC	4	0	0	4	2
9.	AE8713	Aircraft Design Project - II	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>28</b>	<b>18</b>	<b>0</b>	<b>10</b>	<b>23</b>

**SEMESTER VIII**

<b>SL. NO.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>CONTACT PERIODS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>								
1.		Professional Elective – IV	PE	3	3	0	0	3
2.		Professional Elective – V	PE	3	3	0	0	3
<b>PRACTICAL</b>								
3.	AE8811	Project Work	EEC	20	0	0	20	10
<b>TOTAL</b>				<b>26</b>	<b>6</b>	<b>0</b>	<b>20</b>	<b>16</b>

**TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 185**

### HUMANITIES AND SOCIAL SCIENCES (HS)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	HS8151	Communicative English	HS	4	4	0	0	4
2.	HS8251	Technical English	HS	4	4	0	0	4
3.	GE8291	Environmental Science and Engineering	HS	3	3	0	0	3
4.	GE8077	Total Quality Management	HS	3	3	0	0	3

### BASIC SCIENCE (BS)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MA8151	Engineering Mathematics I	BS	4	4	0	0	4
2.	PH8151	Engineering Physics	BS	3	3	0	0	3
3.	CY8151	Engineering Chemistry	BS	3	3	0	0	3
4.	BS8161	Physics and Chemistry Laboratory	BS	4	0	0	4	2
5.	MA8251	Engineering Mathematics II	BS	4	4	0	0	4
6.	PH8251	Materials Science	BS	3	3	0	0	3
7.	MA8353	Transforms and Partial Differential Equations	BS	4	4	0	0	4
8.	MA8491	Numerical Methods	BS	4	4	0	0	4

### ENGINEERING SCIENCES (ES)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	GE8151	Problem Solving and Python Programming	ES	3	3	0	0	3
2.	GE8152	Engineering Graphics	ES	6	2	0	4	4
3.	GE8161	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
4.	BE8253	Basic Electrical, Electronics and Instrumentation Engineering	ES	3	3	0	0	3
5.	GE8292	Engineering Mechanics	ES	5	3	2	0	4
6.	GE8261	Engineering Practices Laboratory	ES	4	0	0	4	2
7.	BE8261	Basic Electrical, Electronics and Instrumentation Engineering Laboratory	ES	4	0	0	4	2
8.	CE8394	Fluid Mechanics and Machinery	ES	4	4	0	0	4
9.	CE8395	Strength of Materials for Mechanical Engineers	ES	3	3	0	0	3
10.	CE8381	Strength of Materials and Fluid Mechanics and Machinery Laboratory	ES	4	0	0	4	2

**PROFESSIONAL CORE (PC)**

<b>SL. NO.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>CONTACT PERIODS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1.	ME8392	Manufacturing Technology	PC	3	3	0	0	3
2.	AE8301	Aero Engineering Thermodynamics	PC	3	3	0	0	3
3.	AE8302	Elements of Aeronautical Engineering	PC	3	3	0	0	3
4.	AE8311	Thermodynamics Laboratory	PC	4	0	0	4	2
5.	AE8401	Aerodynamics - I	PC	3	3	0	0	3
6.	AE8402	Aircraft Systems and Instruments	PC	3	3	0	0	3
7.	PR8451	Mechanics of Machines	PC	3	3	0	0	3
8.	AE8403	Aircraft Structures - I	PC	5	3	2	0	4
9.	AE8404	Propulsion - I	PC	5	3	2	0	4
10.	ME8381	Computer Aided Machine Drawing	PC	4	0	0	4	2
11.	AE8411	Aerodynamics Laboratory	PC	2	0	0	2	1
12.	AE8501	Flight Dynamics	PC	5	3	2	0	4
13.	AE8502	Aircraft Structures - II	PC	5	3	2	0	4
14.	AE8503	Aerodynamics - II	PC	3	3	0	0	3
15.	AE8504	Propulsion - II	PC	3	3	0	0	3
16.	AE8505	Control Engineering	PC	3	3	0	0	3
17.	AE8511	Aircraft Structures Laboratory	PC	4	0	0	4	2
18.	AE8512	Propulsion Laboratory	PC	2	0	0	2	1
19.	AE8601	Finite Element Methods	PC	3	3	0	0	3
20.	AE8602	Experimental Aerodynamics	PC	3	3	0	0	3
21.	AE8603	Composite Materials and Structures	PC	3	3	0	0	3
22.	AE8604	Aircraft Design	PC	3	3	0	0	3
23.	AE8611	Aero Engine and Airframe Laboratory	PC	4	0	0	4	2
24.	AE8612	Computer Aided Simulation Laboratory	PC	4	0	0	4	2
25.	AE8751	Avionics	PC	3	3	0	0	3
26.	ME8093	Computational Fluid Dynamics	PC	3	3	0	0	3
27.	AE8605	Experimental Stress Analysis	PC	3	3	0	0	3
28.	AE8711	Aircraft Systems Laboratory	PC	4	0	0	4	2
29.	AE8712	Flight Integration Systems and Control Laboratory	PC	4	0	0	4	2

**PROFESSIONAL ELECTIVES FOR B.E. AERONAUTICAL ENGINEERING**

**SEMESTER VI, ELECTIVE – I**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	PR8072	New Product Development	PE	3	3	0	0	3
2.	AE8001	Space Mechanics	PE	3	3	0	0	3
3.	AE8002	Aircraft General Engineering and Maintenance Practices	PE	3	3	0	0	3
4.	AE8003	Heat Transfer	PE	3	3	0	0	3
5.	GE8075	Intellectual Property Rights	PE	3	3	0	0	3
6.	GE8073	Fundamentals of Nanoscience	PE	3	3	0	0	3

**SEMESTER VII, ELECTIVES– II**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	AE8004	Helicopter Theory	PE	3	3	0	0	3
2.	AE8005	Aero Engine Maintenance and Repair	PE	3	3	0	0	3
3.	AE8006	UAV Systems	PE	3	3	0	0	3
4.	AE8007	Aircraft Materials	PE	3	3	0	0	3
5.	AE8008	Vibration and Elements of Aeroelasticity	PE	3	3	0	0	3
6.	GE8071	Disaster Management	PE	3	3	0	0	3

**SEMESTER VII, ELECTIVES – III**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	AE8009	Airframe Maintenance and Repair	PE	3	3	0	0	3
2.	AE8010	Fatigue and Fracture	PE	3	3	0	0	3
3.	PR8071	Lean Six Sigma	PE	3	3	0	0	3
4.	ME8097	Non Destructive Testing and Evaluation	PE	3	3	0	0	3
5.	GE8072	Foundation Skills in Integrated Product Development	PE	3	3	0	0	3
6.	GE8074	Human Rights	PE	3	3	0	0	3

**SEMESTER VIII, ELECTIVES – IV**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	AE8011	Hypersonic Aerodynamics	PE	3	3	0	0	3
2.	AE8012	Wind Tunnel Techniques	PE	3	3	0	0	3
3.	AE8013	Rockets and Missiles	PE	3	3	0	0	3
4.	AE8014	Structural Dynamics	PE	3	3	0	0	3
5.	AE8015	Industrial Aerodynamics	PE	3	3	0	0	3

**SEMESTER VIII, ELECTIVES – V**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	PR8491	Computer Integrated Manufacturing	PE	3	3	0	0	3
2.	AE8016	Flight Instrumentation	PE	3	3	0	0	3
3.	AE8017	Theory of Elasticity	PE	3	3	0	0	3
4.	AE8018	Air Traffic Control and Planning	PE	3	3	0	0	3
5.	MG8591	Principles of Management	PE	3	3	0	0	3
6.	GE8076	Professional Ethics in Engineering	PE	3	3	0	0	3

**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	HS8381	Interpersonal Skills/Listening & Speaking	EEC	2	0	0	2	1
2.	HS8581	Professional Communication	EEC	2	0	0	2	1
3.	AE8613	Aircraft Design Project - I	EEC	2	0	0	2	1
4.	AE8713	Aircraft Design Project - II	EEC	2	0	0	2	1
5.	AE8811	Project Work	EEC	20	0	0	20	10

**SUMMARY**

<b>B.E. AERONAUTICAL ENGINEERING</b>												
SL. NO.	Subject Area	Credits per semester								Credits Total	Percentage %	
		I	II	III	IV	V	VI	VII	VIII			
1	Humanities Sciences	4	7	0	0	0	0	3	0	14	<b>7.57</b>	
2	Basic Sciences	12	7	4	4	0	0	0	0	27	<b>14.59</b>	
3	Engineering Sciences	9	11	9	0	0	0	0	0	29	<b>15.14</b>	
4	Professional Core	0	0	11	20	20	19	10	0	80	<b>43.24</b>	
5	Professional Elective	0	0	0	0	0	3	6	6	15	<b>8.11</b>	
6	Open Elective	0	0	0	0	3	0	3	0	6	<b>3.24</b>	
7	Employability Enhancement Courses	-	-	1	0	1	1	1	10	14	<b>8.11</b>	
	<b>Total</b>	<b>25</b>	<b>25</b>	<b>25</b>	<b>24</b>	<b>24</b>	<b>23</b>	<b>23</b>	<b>16</b>	<b>185</b>		
8	<b>Non Credit/Mandatory</b>											

HS8151

**COMMUNICATIVE ENGLISH**

**L T P C**  
**4 0 0 4**

**OBJECTIVES:**

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

**UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS 12**

Reading- short comprehension passages, practice in skimming-scanning and predicting- Writing-completing sentences- - developing hints. Listening- short texts- short formal and informal conversations. Speaking- introducing oneself - exchanging personal information- Language development- Wh- Questions- asking and answering-yes or no questions- parts of speech. Vocabulary development-- prefixes- suffixes- articles.- count/ uncount nouns.

**UNIT II GENERAL READING AND FREE WRITING 12**

Reading - comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- Writing – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –Listening- telephonic conversations. Speaking – sharing information of a personal kind—greeting – taking leave- Language development – prepositions, conjunctions Vocabulary development- guessing meanings of words in context.

**UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12**

Reading- short texts and longer passages (close reading) Writing- understanding text structure-use of reference words and discourse markers-coherence-jumbled sentences Listening – listening to longer texts and filling up the table- product description- narratives from different sources. Speaking- asking about routine actions and expressing opinions. Language development- degrees of comparison- pronouns- direct vs indirect questions- Vocabulary development – single word substitutes- adverbs.

**UNIT IV READING AND LANGUAGE DEVELOPMENT 12**

Reading- comprehension-reading longer texts- reading different types of texts- magazines Writing- letter writing, informal or personal letters-e-mails-conventions of personal email- Listening-listening to dialogues or conversations and completing exercises based on them. Speaking-speaking about oneself- speaking about one's friend- Language development- Tenses- simple present-simple past- present continuous and past continuous- Vocabulary development-synonyms-antonyms- phrasal verbs

**UNIT V EXTENDED WRITING 12**

Reading- longer texts- close reading –Writing- brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing-Listening – listening to talks-conversations- Speaking – participating in conversations- short group conversations-Language development-modal verbs- present/ past perfect tense - Vocabulary development-collocations-fixed and semi-fixed expressions

**TOTAL: 60 PERIODS**

**OUTCOMES: At the end of the course, learners will be able to:**

- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English.

**TEXT BOOKS:**

1. Board of Editors. Using English A Course book for Undergraduate Engineers and Technologists. Orient Black Swan Limited, Hyderabad: 2015
2. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.

**REFERENCES**

- 1 Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge, 2011.
- 2 Means, L. Thomas and Elaine Langlois. English & Communication For Colleges. Cengage Learning , USA: 2007
- 3 Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student's Book & Workbook) Cambridge University Press, New Delhi: 2005
- 4 Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011
- 5 Dutt P. Kiranmai and Rajeevan Geeta. Basic Communication Skills, Foundation Books: 2013

**MA8151****ENGINEERING MATHEMATICS – I**

L	T	P	C
4	0	0	4

**OBJECTIVES :**

The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

**UNIT I DIFFERENTIAL CALCULUS****12**

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

**UNIT II FUNCTIONS OF SEVERAL VARIABLES****12**

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

**UNIT III INTEGRAL CALCULUS****12**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

**UNIT IV            MULTIPLE INTEGRALS****12**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

**UNIT V            DIFFERENTIAL EQUATIONS****12**

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

**TOTAL : 60 PERIODS****OUTCOMES :**

After completing this course, students should demonstrate competency in the following skills:

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.

**TEXT BOOKS :**

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43<sup>rd</sup> Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7<sup>th</sup> Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

**REFERENCES :**

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10<sup>th</sup> Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3<sup>rd</sup> Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
5. Weir, M.D and Joel Hass, "Thomas Calculus", 12<sup>th</sup> Edition, Pearson India, 2016.



**TEXT BOOKS:**

1. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. "Engineering Physics". Cengage Learning India, 2012.

**REFERENCES:**

1. Halliday, D., Resnick, R. & Walker, J. "Principles of Physics". Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. "Physics for Scientists and Engineers". Cengage Learning, 2010.
3. Tipler, P.A. & Mosca, G. "Physics for Scientists and Engineers with Modern Physics". W.H. Freeman, 2007.

**CY8151****ENGINEERING CHEMISTRY****L T P C  
3 0 0 3****OBJECTIVES:**

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

**UNIT I WATER AND ITS TREATMENT****9**

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

**UNIT II SURFACE CHEMISTRY AND CATALYSIS****9**

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions – adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – kinetics of surface reactions, unimolecular reactions, Langmuir - applications of adsorption on pollution abatement.

Catalysis: Catalyst – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis– Michaelis – Menten equation.

**UNIT III ALLOYS AND PHASE RULE****9**

Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

**UNIT IV FUELS AND COMBUSTION****9**

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel. Combustion of fuels: Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

**UNIT V ENERGY SOURCES AND STORAGE DEVICES****9**

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H<sub>2</sub>-O<sub>2</sub> fuel cell.

**TOTAL: 45 PERIODS****OUTCOMES:**

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

**TEXT BOOKS:**

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

**REFERENCES:**

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

**GE8151****PROBLEM SOLVING AND PYTHON PROGRAMMING****L T P C**  
**3 0 0 3****OBJECTIVES:**

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures — lists, tuples, dictionaries.
- To do input/output with files in Python.

**UNIT I ALGORITHMIC PROBLEM SOLVING****9**

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

**UNIT II DATA, EXPRESSIONS, STATEMENTS****9**

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

**UNIT III CONTROL FLOW, FUNCTIONS****9**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.



**UNIT I PLANE CURVES AND FREEHAND SKETCHING 7+12**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

**UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12**

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

**UNIT III PROJECTION OF SOLIDS 5+12**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

**UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+12**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

**UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

**TOTAL: 90 PERIODS**

**OUTCOMES:**

On successful completion of this course, the student will be able to

- familiarize with the fundamentals and standards of Engineering graphics
- perform freehand sketching of basic geometrical constructions and multiple views of objects.
- project orthographic projections of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- visualize and to project isometric and perspective sections of simple solids.

**TEXT BOOKS:**

1. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.

**REFERENCES:**

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50<sup>th</sup> Edition, 2010.
2. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N S Parthasarathy and Vela Murali, “Engineering Graphics”, Oxford University, Press, New

Delhi, 2015.

6. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2<sup>nd</sup> Edition, 2009.

**Publication of Bureau of Indian Standards:**

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

**Special points applicable to University Examinations on Engineering Graphics:**

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

**GE8161 PROBLEM SOLVING AND PYTHON PROGRAMMING  
LABORATORY**

**L T P C  
0 0 4 2**

**OBJECTIVES:**

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

**LIST OF PROGRAMS**

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

**PLATFORM NEEDED**

Python 3 interpreter for Windows/Linux

**OUTCOMES:**

**Upon completion of the course, students will be able to**

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

**TOTAL :60 PERIODS**

**BS8161 PHYSICS AND CHEMISTRY LABORATORY**

**L T P C**

**OBJECTIVES:**

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

**LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)**

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser  
(b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

**TOTAL: 30 PERIODS**

**OUTCOMES:**

Upon completion of the course, the students will be able to

- apply principles of elasticity, optics and thermal properties for engineering applications.

**CHEMISTRY LABORATORY: (Any seven experiments to be conducted)**

**OBJECTIVES:**

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
  - To acquaint the students with the determination of molecular weight of a polymer by viscometry.
1. Estimation of HCl using  $\text{Na}_2\text{CO}_3$  as primary standard and Determination of alkalinity in water sample.
  2. Determination of total, temporary & permanent hardness of water by EDTA method.
  3. Determination of DO content of water sample by Winkler's method.
  4. Determination of chloride content of water sample by argentometric method.
  5. Estimation of copper content of the given solution by Iodometry.
  6. Determination of strength of given hydrochloric acid using pH meter.
  7. Determination of strength of acids in a mixture of acids using conductivity meter.
  8. Estimation of iron content of the given solution using potentiometer.
  9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
  10. Estimation of sodium and potassium present in water using flame photometer.
  11. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
  12. Pseudo first order kinetics-ester hydrolysis.
  13. Corrosion experiment-weight loss method.
  14. Determination of CMC.
  15. Phase change in a solid.
  16. Conductometric titration of strong acid vs strong base.

**OUTCOMES:**

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

**TOTAL: 30 PERIODS**

**TEXTBOOKS:**

1. Vogel's Textbook of Quantitative Chemical Analysis (8<sup>TH</sup> edition, 2014)

HS8251

TECHNICAL ENGLISH

L	T	P	C
4	0	0	4

**OBJECTIVES:**

The Course prepares second semester Engineering and Technology students to:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations , participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

**UNIT I INTRODUCTION TECHNICAL ENGLISH 12**

Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- Speaking –Asking for and giving directions- Reading – reading short technical texts from journals- newspapers- Writing- purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-Vocabulary Development- technical vocabulary Language Development –subject verb agreement - compound words.

**UNIT II READING AND STUDY SKILLS 12**

Listening- Listening to longer technical talks and completing exercises based on them-Speaking – describing a process-Reading – reading longer technical texts- identifying the various transitions in a text- paragraphing- Writing- interpreting charts, graphs- Vocabulary Development-vocabulary used in formal letters/emails and reports Language Development- impersonal passive voice, numerical adjectives.

**UNIT III TECHNICAL WRITING AND GRAMMAR 12**

Listening- Listening to classroom lectures/ talks on engineering/technology -Speaking – introduction to technical presentations- Reading – longer texts both general and technical, practice in speed reading; Writing-Describing a process, use of sequence words- Vocabulary Development- sequence words- Misspelled words. Language Development- embedded sentences

**UNIT IV REPORT WRITING 12**

Listening- Listening to documentaries and making notes. Speaking – mechanics of presentations- Reading – reading for detailed comprehension- Writing- email etiquette- job application – cover letter –Résumé preparation( via email and hard copy)- analytical essays and issue based essays- -Vocabulary Development- finding suitable synonyms-paraphrasing-. Language Development- clauses- if conditionals.

**UNIT V GROUP DISCUSSION AND JOB APPLICATIONS 12**

Listening- TED/Ink talks; Speaking –participating in a group discussion -Reading– reading and understanding technical articles Writing– Writing reports- minutes of a meeting- accident and survey-Vocabulary Development- verbal analogies Language Development- reported speech

**TOTAL : 60 PERIODS**

**OUTCOMES: At the end of the course learners will be able to:**

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

**TEXT BOOKS:**

1. Board of editors. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.

**REFERENCES**

1. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice. Oxford University Press: New Delhi,2014.
2. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
3. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
4. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007
5. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007

**Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.**

**MA8251****ENGINEERING MATHEMATICS – II**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**OBJECTIVES :**

This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

**UNIT I            MATRICES****12**

Eigen values and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigen values and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

**UNIT II            VECTOR CALCULUS****12**

Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

**UNIT III            ANALYTIC FUNCTIONS****12**

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions  $w = z + c, cz, \frac{1}{z}, z^2$  - Bilinear transformation.

**UNIT IV            COMPLEX INTEGRATION****12**

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour.

**UNIT V            LAPLACE TRANSFORMS****12**

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

**TOTAL: 60 PERIODS**





**UNIT I ELECTRICAL CIRCUITS 9**

Basic circuit components - Ohms Law - Kirchoff's Law – Instantaneous Power – Inductors - Capacitors – Independent and Dependent Sources - steady state solution of DC circuits - Nodal analysis, Mesh analysis- Thevenin's Theorem, Norton's Theorem, Maximum Power transfer theorem- Linearity and Superposition Theorem.

**UNIT II AC CIRCUITS 9**

Introduction to AC circuits – waveforms and RMS value – power and power factor, single phase and three-phase balanced circuits – Three phase loads - housing wiring, industrial wiring, materials of wiring

**UNIT III ELECTRICAL MACHINES 9**

Principles of operation and characteristics of ; DC machines, Transformers (single and three phase ) ,Synchronous machines , three phase and single phase induction motors.

**UNIT IV ELECTRONIC DEVICES & CIRCUITS 9**

Types of Materials – Silicon & Germanium- N type and P type materials – PN Junction –Forward and Reverse Bias –Semiconductor Diodes –Bipolar Junction Transistor – Characteristics –Field Effect Transistors – Transistor Biasing –Introduction to operational Amplifier –Inverting Amplifier – Non Inverting Amplifier –DAC – ADC .

**UNIT V MEASUREMENTS & INSTRUMENTATION 9**

Introduction to transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect and Mechanical - ,Classification of instruments - Types of indicating Instruments - multimeters –Oscilloscopes- – three-phase power measurements– instrument transformers (CT and PT )

**TOTAL : 45 PERIODS**

**OUTCOMES:**

Ability to

- Understand electric circuits and working principles of electrical machines
- Understand the concepts of various electronic devices
- Choose appropriate instruments for electrical measurement for a specific application

**TEXT BOOKS**

1. D P Kothari and I.J Nagarath, "Electrical Machines "Basic Electrical and Electronics Engineering", McGraw Hill Education(India) Private Limited, Third Reprint ,2016
2. Leonard S Bobrow, " Foundations of Electrical Engineering", Oxford University Press, 2013
3. Thereja .B.L., "Fundamentals of Electrical Engineering and Electronics", S. Chand & Co. Ltd., 2008

**REFERENCES**

1. A.E.Fitzgerald, David E Higginbotham and Arvin Grabel, "Basic Electrical Engineering", McGraw Hill Education(India) Private Limited, 2009
2. Allan S Moris, "Measurement and Instrumentation Principles", Elsevier, First Indian Edition, 2006
3. Del Toro, "Electrical Engineering Fundamentals", Pearson Education, New Delhi, 2007
4. John Bird, "Electrical Circuit Theory and Technology", Elsevier, First Indian Edition, 2006
5. N K De, Dipu Sarkar, "Basic Electrical Engineering", Universities Press (India)Private Limited 2016
6. Rajendra Prasad, "Fundamentals of Electrical Engineering", Prentice Hall of India, 2006

**OBJECTIVES:**

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14**

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

**UNIT II ENVIRONMENTAL POLLUTION 8**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

**UNIT III NATURAL RESOURCES 10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

**UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. –

wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

**UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

**TEXT BOOKS:**

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2<sup>nd</sup> edition, Pearson Education, 2004.

**REFERENCES :**

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hyderabad, 2015.
3. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.
4. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.

**GE8292**

**ENGINEERING MECHANICS**

**L T P C  
3 2 0 4**

**OBJECTIVES:**

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

**UNIT I STATICS OF PARTICLES 9+6**

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vectorial representation of forces – Vector operations of forces - additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

**UNIT II EQUILIBRIUM OF RIGID BODIES 9+6**

Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions



**OBJECTIVES:**

To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

**GROUP A (CIVIL & MECHANICAL)****I CIVIL ENGINEERING PRACTICE****13****Buildings:**

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

**Plumbing Works:**

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.

(b) Study of pipe connections requirements for pumps and turbines.

(c) Preparation of plumbing line sketches for water supply and sewage works.

(d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

(e) Demonstration of plumbing requirements of high-rise buildings.

**Carpentry using Power Tools only:**

(a) Study of the joints in roofs, doors, windows and furniture.

(b) Hands-on-exercise:

Wood work, joints by sawing, planing and cutting.

**II MECHANICAL ENGINEERING PRACTICE****18****Welding:**

(a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.

(b) Gas welding practice

**Basic Machining:**

(a) Simple Turning and Taper turning

(b) Drilling Practice

**Sheet Metal Work:**

(a) Forming & Bending:

(b) Model making – Trays and funnels.

(c) Different type of joints.

**Machine assembly practice:**

(a) Study of centrifugal pump

(b) Study of air conditioner

**Demonstration on:**

(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.

(b) Foundry operations like mould preparation for gear and step cone pulley.

(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

## GROUP B (ELECTRICAL & ELECTRONICS)

- III ELECTRICAL ENGINEERING PRACTICE** **13**
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
  2. Fluorescent lamp wiring.
  3. Stair case wiring
  4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
  5. Measurement of energy using single phase energy meter.
  6. Measurement of resistance to earth of an electrical equipment.
- IV ELECTRONICS ENGINEERING PRACTICE** **16**
1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
  2. Study of logic gates AND, OR, EX-OR and NOT.
  3. Generation of Clock Signal.
  4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
  5. Measurement of ripple factor of HWR and FWR.

**TOTAL: 60 PERIODS**

### **OUTCOMES:**

On successful completion of this course, the student will be able to

- fabricate carpentry components and pipe connections including plumbing works.
- use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundry and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

### **LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

#### **CIVIL**

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
2. Carpentry vice (fitted to work bench) 15 Nos.
3. Standard woodworking tools 15 Sets.
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools: (a) Rotary Hammer 2 Nos  
(b) Demolition Hammer 2 Nos  
(c) Circular Saw 2 Nos  
(d) Planer 2 Nos  
(e) Hand Drilling Machine 2 Nos  
(f) Jigsaw 2 Nos

#### **MECHANICAL**

1. Arc welding transformer with cables and holders 5 Nos.
2. Welding booth with exhaust facility 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2 Nos.
5. Centre lathe 2 Nos.

6. Hearth furnace, anvil and smithy tools	2 Sets.
7. Moulding table, foundry tools	2 Sets.
8. Power Tool: Angle Grinder	2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner	One each.

#### **ELECTRICAL**

1. Assorted electrical components for house wiring	15 Sets
2. Electrical measuring instruments	10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp	1 each
4. Megger (250V/500V)	1 No.
5. Power Tools: (a) Range Finder	2 Nos
(b) Digital Live-wire detector	2 Nos

#### **ELECTRONICS**

1. Soldering guns	10 Nos.
2. Assorted electronic components for making circuits	50 Nos.
3. Small PCBs	10 Nos.
4. Multimeters	10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply	

### **BE8261 BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING LABORATORY**

**L T P C  
0 0 4 2**

#### **OBJECTIVE:**

- To train the students in performing various tests on electrical drives, sensors and circuits.

#### **LIST OF EXPERIMENTS:**

1. Load test on separately excited DC generator
2. Load test on Single phase Transformer
3. Load test on Induction motor
4. Verification of Circuit Laws
5. Verification of Circuit Theorems
6. Measurement of three phase power
7. Load test on DC shunt motor.
8. Diode based application circuits
9. Transistor based application circuits
10. Study of CRO and measurement of AC signals
11. Characteristics of LVDT
12. Calibration of Rotometer
13. RTD and Thermistor

**Minimum of 10 Experiments to be carried out :-**

**TOTAL: 60 PERIODS**

#### **OUTCOMES:**

- Ability to determine the speed characteristic of different electrical machines
- Ability to design simple circuits involving diodes and transistors
- Ability to use operational amplifiers

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

<b>S.No.</b>	<b>NAME OF THE EQUIPMENT</b>	<b>Qty.</b>
1	D. C. Motor Generator Set	2
2	D.C. Shunt Motor	2
3	Single Phase Transformer	2
4	Single Phase Induction Motor	2
5	Ammeter A.C and D.C	20
6	Voltmeters A.C and D.C	20
7.	Watt meters LPF and UPF	4
8.	Resistors & Breadboards	-
9.	Cathode Ray Oscilloscopes	4
10.	Dual Regulated power supplies	6
11.	A.C. Signal Generators	4
12.	Transistors (BJT, JFET)	-

**MA8353**

**TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS**

**L T P C**  
**4 0 0 4**

**OBJECTIVES :**

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

**UNIT I PARTIAL DIFFERENTIAL EQUATIONS**

**12**

Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

**UNIT II FOURIER SERIES**

**12**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

**UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS**

**12**

Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

**UNIT IV FOURIER TRANSFORMS**

**12**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

**UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS****12**

Z-transforms - Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems - Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

**TOTAL : 60 PERIODS****OUTCOMES:**

Upon successful completion of the course, students should be able to:

- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

**TEXT BOOKS :**

1. Grewal B.S., "Higher Engineering Mathematics", 43<sup>rd</sup> Edition, Khanna Publishers, New Delhi, 2014.
2. Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

**REFERENCES :**

1. B.V Ramana.., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2. Erwin Kreyszig, "Advanced Engineering Mathematics ", 10<sup>th</sup> Edition, John Wiley, India, 2016.
3. G. James, "Advanced Modern Engineering Mathematics", 3<sup>rd</sup> Edition, Pearson Education, 2007.
4. L.C Andrews, L.C and Shivamoggi, B, "Integral Transforms for Engineers" SPIE Press, 1999.
5. N.P. Bali. and Manish Goyal, "A Textbook of Engineering Mathematics", 9<sup>th</sup> Edition, Laxmi Publications Pvt. Ltd, 2014.
6. R.C. Wylie, and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

**ME8392****MANUFACTURING TECHNOLOGY****L T P C****3 0 0 3****OBJECTIVE:**

- The automobile components such as piston, connecting rod, crankshaft, engine block, front axle, frame, body etc., are manufactured by various types of production processes involving casting, welding, machining, metal forming, power metallurgy etc.

**UNIT I CASTING****8**

Casting types, procedure to make sand mould, types of core making, moulding tools, machine moulding, special moulding processes – CO<sub>2</sub> moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

**UNIT II WELDING****8**

Classification of welding processes. Principles of Oxy-acetylene gas welding. A.C metal arc welding, resistance welding, submerged arc welding, tungsten inert gas welding, metal inert gas welding, plasma arc welding, thermit welding, electron beam welding, laser beam welding, defects in welding, soldering and brazing.

**UNIT III MACHINING****13**

General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines. General principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining and Laser beam machining.

**UNIT IV FORMING AND SHAPING OF PLASTICS****7**

Types of plastics - Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of - Injection moulding – Plunger and screw machines – Blow moulding – Rotational moulding – Film blowing – Extrusion - Typical industrial applications – Thermoforming – Processing of Thermosets – Working principles and typical applications - Compression moulding – Transfer moulding – Bonding of Thermoplastics – Fusion and solvent methods – Induction and Ultrasonic methods

**UNIT V METAL FORMING AND POWDER METALLURGY****9**

Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing and Spinning, Powder metallurgy – Principal steps involved advantages, disadvantages and limitations of powder metallurgy.

**TOTAL: 45 PERIODS****OUTCOME:**

- The Students can able to use different manufacturing process and use this in industry for component production

**TEXT BOOKS**

1. Hajra Choudhury, "Elements of Workshop Technology", Vol. I and II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2005.
2. Nagendra Parashar B.S. and Mittal R.K., "Elements of Manufacturing Processes", Prentice-Hall of India Private Limited, 2007.

**REFERENCES**

1. Adithan. M and Gupta. A.B., "Manufacturing Technology", New Age, 2006.
2. "H.M.T. Production Technology – Handbook", Tata McGraw-Hill, 2000.
3. Jain. R.K. and S.C. Gupta, "Production Technology", Khanna Publishers. 16<sup>th</sup> Edition, 2001.
4. Roy. A. Linberg, "Process and Materials of Manufacture", PHI, 2000.
5. Serope Kalpajian, Steven R.Schmid, "Manufacturing Processes for Engineering Materials", Fourth Edition, Pearson Education, Inc. 2007.

**AE8301****AERO ENGINEERING THERMODYNAMICS****L T P C  
3 0 0 3****OBJECTIVES:**

- Aero Thermodynamics study includes quantitative analysis of machine and processes for transformation of energy and between work and heat.
- Laws of thermodynamics would be able to quantify through measurement of related properties, to these energies and their interactions.
- To develop basic concept of air cycle, gas turbine engines and heat transfer.

<b>UNIT I</b>	<b>FUNDAMENTAL CONCEPT AND FIRST LAW</b>	<b>9</b>
Concept of continuum, macroscopic approach, thermodynamic systems – closed, open and isolated. Property, state, path and process, quasi-static process, work, internal energy, enthalpy, specific heat capacities and heat transfer, SFEE, application of SFEE to jet engine components, First law of thermodynamics, relation between pressure, volume and temperature for various processes, Zeroth law of thermodynamics.		
<b>UNIT II</b>	<b>SECOND LAW AND ENTROPY</b>	<b>9</b>
Second law of thermodynamics – Kelvin Planck and Clausius statements of second law. Reversibility and Irreversibility, Thermal reservoir, Carnot theorem. Carnot cycle, Reversed Carnot cycle, efficiency, COP, Thermodynamic temperature scale - Clausius inequality, Concept of entropy, Entropy change for various processes. Mixing of fluids.		
<b>UNIT III</b>	<b>AIR STANDARD CYCLES</b>	<b>8</b>
Otto, Diesel, Dual, Ericsson, Atkinson, Stirling and Brayton cycles - air standard efficiency - mean effective pressure.		
<b>UNIT IV</b>	<b>FUNDAMENTALS OF VAPOUR POWER CYCLES</b>	<b>9</b>
Properties of pure substances – solid, liquid and vapour phases, phase rule, p-v, p-T, T-v, T-s, h-s diagrams, p-v-T surfaces, thermodynamic properties of steam - calculations of work done and heat transfer in non-flow and flow processes - standard Rankine cycle, Reheat and Regeneration cycle. Heat rate, Specific steam consumption, Tonne of refrigeration.		
<b>UNIT V</b>	<b>BASICS OF PROPULSION AND HEAT TRANSFER</b>	<b>10</b>
Classification of jet engines - basic jet propulsion arrangement – Engine station number, thrust equation – Specific thrust, SFC, TSFC, specific impulse, actual cycles, isentropic efficiencies of jet engine components, polytropic efficiency, conduction in parallel, radial and composite wall, basics of convective and radiation heat transfer.		

**TOTAL: 45 PERIODS**

#### **OUTCOMES**

- Able to relate laws of thermodynamics to jet engine components.
- Understands principle operation of piston engine and jet engines.
- Able to identify efficient cycle of air and jet engines.
- Capable to illustrate condition of working medium.
- Eligible to recognize and calculate heat transfer in complex systems involving several heat transfer mechanisms.

#### **TEXT BOOKS:**

1. Nag.P.K., “Engineering Thermodynamics”, Tata McGraw-Hill, New Delhi, 2013.
2. Rathakrishnan E., “Fundamentals of Engineering Thermodynamics”, Prentice-Hall India, 2005.
3. Yunus A. Cengel and Michael A. Boles, “Thermodynamics: An Engineering Approach” McGraw-Hill Science/Engineering/Math; 7<sup>th</sup>edition 2010.

#### **REFERENCES:**

1. Arora C.P., “ Thermodynamics”, Tata McGraw-Hill, New Delhi, 2003.
2. Holman.J.P., “Thermodynamics”, 3rd Edition, McGraw-Hill, 2007.
3. Merala C, Pother, Craig W, Somerton, “Thermodynamics for Engineers”, Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.
4. Ramalingam K.K. “Thermodynamics”, Sci-Tech Publications, 2006
5. Venwylen and Sontag, “Classical Thermodynamics”, Wiley Eastern, 1987

**OBJECTIVES:**

- The properties of fluids and concept of control volume are studied
- The applications of the conservation laws to flow through pipes are studied.
- To understand the importance of dimensional analysis
- To understand the importance of various types of flow in pumps.
- To understand the importance of various types of flow in turbines.

**UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 12**

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

**UNIT II FLOW THROUGH CIRCULAR CONDUITS 12**

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli- Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation – friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

**UNIT III DIMENSIONAL ANALYSIS 12**

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

**UNIT IV PUMPS 12**

Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump– working principle – Rotary pumps –classification.

**UNIT V TURBINES 12**

Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

**TOTAL: 60 PERIODS****OUTCOMES:**

Upon completion of this course, the students will be able to

- Apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Can analyse and calculate major and minor losses associated with pipe flow in piping networks.
- Can mathematically predict the nature of physical quantities
- Can critically analyse the performance of pumps
- Can critically analyse the performance of turbines.

**TEXT BOOK:**

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2013.

**REFERENCES:**

1. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2016
3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", 2011.
4. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010

**OBJECTIVES:**

- To understand the concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To determine stresses and deformation in circular shafts and helical spring due to torsion.
- To compute slopes and deflections in determinate beams by various methods.
- To study the stresses and deformations induced in thin and thick shells.

**UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9**

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains – Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress.

**UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9**

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending– bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

**UNIT III TORSION 9**

Torsion formulation stresses and deformation in circular and hollow shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

**UNIT IV DEFLECTION OF BEAMS 9**

Double Integration method – Macaulay's method – Area moment method for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell's reciprocal theorems.

**UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS 9**

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lamé's theorem.

**TOTAL: 45 PERIODS****OUTCOMES:**

Students will be able to

- Understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.
- Understand the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.
- Apply basic equation of simple torsion in designing of shafts and helical spring
- Calculate the slope and deflection in beams using different methods.
- Analyze and design thin and thick shells for the applied internal and external pressures.

**TEXT BOOKS:**

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2007
2. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2007

**REFERENCES:**

1. Egor. P. Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2002
2. Ferdinand P. Beer, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing 'co. Ltd., New Delhi, 2005.
3. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2013
4. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2010.

**AE8302****ELEMENTS OF AERONAUTICAL ENGINEERING****L T P C**  
**3 0 0 3****OBJECTIVES:**

- Understand the Historical evaluation of Airplanes
- Study the different component systems and functions
- Understand the basic properties and principles behind the flight
- Study the different structures & construction
- Study the various types of power plants used in aircrafts

**UNIT I HISTORY OF FLIGHT****8**

Balloon flight-ornithopters-Early Airplanes by Wright Brothers, biplanes and monoplanes, Developments in aerodynamics, materials, structures and propulsion over the years.

**UNIT II AIRCRAFT CONFIGURATIONS AND ITS CONTROLS****10**

Different types of flight vehicles, classifications-Components of an airplane and their functions-Conventional control, powered control- Basic instruments for flying-Typical systems for control actuation.

**UNIT III BASICS OF AERODYNAMICS****9**

Physical Properties and structures of the Atmosphere, Temperature, pressure and altitude relationships, Newton's Law of Motions applied to Aeronautics-Evolution of lift, drag and moment. Aerofoils, Mach number, Maneuvers.

**UNIT IV BASICS OF PROPULSION****9**

Basic ideas about piston, turboprop and jet engines – use of propeller and jets for thrust production- Comparative merits, Principle of operation of rocket, types of rocket and typical applications, Exploration into space.

**UNIT V BASICS OF AIRCRAFT STRUCTURES****9**

General types of construction, Monocoque, semi-monocoque and geodesic constructions, typical wing and fuselage structure. Metallic and non-metallic materials. Use of Aluminium alloy, titanium, stainless steel and composite materials. Stresses and strains-Hooke's law- stress-strain diagrams-elastic constants-Factor of Safety.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Learn the history of aircraft & developments over the years
- Ability to identify the types & classifications of components and control systems
- Understand the basic concepts of flight & Physical properties of Atmosphere
- An ability to differentiate the types of fuselage and constructions.
- Different types of Engines and principles of Rocket

**TEXT BOOKS**

1. Anderson, J.D., Introduction to Flight, McGraw-Hill; 8th edition , 2015
2. Stephen.A. Brandt, Introduction to aeronautics: A design perspective, 2<sup>nd</sup> edition, AIAA Education Series, 2004.

**REFERENCE**

1. Kermode, A.C. Flight without Formulae, Pearson Education; Eleven edition, 2011

<b>CE8381</b>	<b>STRENGTH OF MATERIALS AND FLUID MECHANICS &amp; MACHINERY LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**OBJECTIVES:**

- To study the mechanical properties of materials when subjected to different types of loading.
- To verify the principles studied in Fluid Mechanics theory by performing experiments in lab.

**STRENGTH OF MATERIALS****30****LIST OF EXPERIMENTS**

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminum rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
  - (i) Unhardened specimen
  - (ii) Quenched Specimen and
  - (iii) Quenched and tempered specimen.
11. Microscopic Examination of
  - (i) Hardened samples and
  - (ii) Hardened and tempered samples.

**OUTCOME:**

- Ability to perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.

**LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS**

<b>S.No.</b>	<b>NAME OF THE EQUIPMENT</b>	<b>Qty.</b>
1	Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity	1
2	Torsion Testing Machine (60 NM Capacity)	1
3	Impact Testing Machine (300 J Capacity)	1
4	Brinell Hardness Testing Machine	1
5	Rockwell Hardness Testing Machine	1
6	Spring Testing Machine for tensile and compressive loads (2500 N)	1
7	Metallurgical Microscopes	3
8	Muffle Furnace (800 C)	1

**LIST OF EXPERIMENTS**

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump / submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

Upon completion of this course, the students will be able to:

- Perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.
- Use the measurement equipments for flow measurement.
- Perform test on different fluid machinery.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S. NO.	NAME OF THE EQUIPMENT	Qty.
1	Orifice meter setup	1
2	Venturi meter setup	1
3	Rotameter setup	1
4	Pipe Flow analysis setup	1
5	Centrifugal pump/submergible pump setup	1
6	Reciprocating pump setup	1
7	Gear pump setup	1
8	Pelton wheel setup	1
9	Francis turbine setup	1
10	Kaplan turbine setup	1

**OBJECTIVE:**

- To enhance the basic knowledge in applied thermodynamics

**LIST OF EXPERIMENTS**

1. Performance test on a 4-stroke engine
2. Valve timing of a 4 – stroke engine and port timing of a 2 stroke engine
3. Determination of effectiveness of a parallel flow heat exchanger
4. Determination of effectiveness of a counter flow heat exchanger
5. Determination of heating value of a fuel
6. Determination of specific heat of solid
7. Determination of thermal conductivity of solid.
8. Determination of thermal resistance of a composite wall.
9. COP test on a vapour compression refrigeration test rig
10. COP test on a vapour compression air-conditioning test rig

**TOTAL: 60 PERIODS**

**OUTCOMES:**

- Ability to perform test on diesel/petrol engine
- Ability to explain the characteristics of the diesel/Petrol engine
- Ability to determine the properties of the fuels.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

Sl.No	Details of Equipments	Qty Req.	Experiment No.
1.	4 stroke twin cylinder diesel engine	1	1
2.	Cut section model of 4 stroke diesel engine and cut section model of 2 stroke petrol engine	1	2
3.	Parallel and counter flow heat exchanger test rig	1	3,4
4.	Bomb Calorimeter	1	5
5.	Vapour compression refrigeration test rig	1	9
6.	Vapour compression air-conditioning test rig	1	10
7.	Conductive heat transfer set up	1	7
8.	Composite wall	1	8

**HS8381****INTERPERSONAL SKILLS/LISTENING & SPEAKING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**OBJECTIVES:****The Course will enable learners to:**

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- improve general and academic listening skills
- Make effective presentations.

**UNIT I**

Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

**UNIT II**

Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

**UNIT III**

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail

**UNIT IV**

Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

## UNIT V

Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

**TOTAL : 30 PERIODS**

### OUTCOMES: At the end of the course Learners will be able to:

- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal

### TEXT BOOKS:

1. Brooks, Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.
2. Richards, C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

### REFERENCES

1. Bhatnagar, Nitin and Mamta Bhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.
2. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
3. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014
4. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
5. Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013.

**MA8491**

**NUMERICAL METHODS**

L	T	P	C
4	0	0	4

### OBJECTIVES:

- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals in real life situations.
- To acquaint the student with understanding of numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.
- To understand the knowledge of various techniques and methods of solving various types of partial differential equations.

### UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

### UNIT II INTERPOLATION AND APPROXIMATION 12

Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Difference operators and relations - Interpolation with equal intervals - Newton's forward and backward difference formulae.

**UNIT III                    NUMERICAL DIFFERENTIATION AND INTEGRATION                    12**

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's Method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

**UNIT IV                    INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12**

Single step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge - Kutta method for solving first order equations - Multi step methods - Milne's and Adams - Bash forth predictor corrector methods for solving first order equations.

**UNIT V                    BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL                    12**  
**DIFFERENTIAL EQUATIONS**

Finite difference methods for solving second order two - point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

**TOTAL : 60 PERIODS**

**OUTCOMES:**

Upon successful completion of the course, students should be able to:

- Understand the basic concepts and techniques of solving algebraic and transcendental equations.
- Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations.
- Apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

**TEXT BOOKS :**

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9<sup>th</sup> Edition, Cengage Learning, 2016.
2. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10<sup>th</sup> Edition, New Delhi, 2015.

**REFERENCES :**

1. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education, Asia, New Delhi, 2007.
2. Gerald. C. F. and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6<sup>th</sup> Edition, New Delhi, 2006.
3. Mathews, J.H. "Numerical Methods for Mathematics, Science and Engineering", 2<sup>nd</sup> Edition, Prentice Hall, 1992.
4. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, 3<sup>rd</sup> Edition, New Delhi, 2007.
5. Sastry, S.S, "Introductory Methods of Numerical Analysis", PHI Learning Pvt. Ltd, 5<sup>th</sup> Edition, 2015

**OBJECTIVES:**

- To introduce the concepts of mass, momentum and energy conservation relating to aerodynamics.
- To make the student understand the concept of vorticity, irrotationality, theory of airfoils and wing sections.
- To introduce the basics of viscous flow.

**UNIT I INTRODUCTION TO LOW SPEED FLOW****9**

Euler equation, incompressible bernoulli's equation. circulation and vorticity, green's lemma and stoke's theorem, barotropic flow, kelvin's theorem, streamline, stream function, irrotational flow, potential function, equipotential lines, elementary flows and their combinations.

**UNIT II TWO DIMENSIONAL INVISCID INCOMPRESSIBLE FLOW****9**

Ideal Flow over a circular cylinder, D'Alembert's paradox, magnus effect, Kutta joukowski's theorem, starting vortex, kutta condition, real flow over smooth and rough cylinder.

**UNIT III AIRFOIL THEORY****9**

Cauchy-riemann relations, complex potential, methodology of conformal transformation, kutta-joukowski transformation and its applications, thin airfoil theory and its applications.

**UNIT IV SUBSONIC WING THEORY****9**

Vortex filament, biot and savart law, bound vortex and trailing vortex, horse shoe vortex, lifting line theory and its limitations.

**UNIT V INTRODUCTION TO BOUNDARY LAYER THEORY****9**

Boundary layer and boundary layer thickness, displacement thickness, momentum thickness, energy thickness, shape parameter, boundary layer equations for a steady, two dimensional incompressible flow, boundary layer growth over a flat plate, critical reynolds number, blasius solution, basics of turbulent flow.

**TOTAL: 45 PERIODS****OUTCOMES**

- An ability to apply airfoil theory to predict airfoil performance
- Analyze and optimize wing performance
- A knowledge of incompressible flow
- A knowledge of subsonic wing theory
- Apply propeller theory to predict blade performance
- An exposure to Boundary layer theory

**TEXT BOOKS:**

1. Anderson, J.D., "Fundamentals of Aerodynamics", McGraw Hill Book Co., 2010
2. Houghton, E.L., and Caruthers, N.B., "Aerodynamics for Engineering students", Edward Arnold Publishers Ltd., London, 1989.

**REFERENCES:**

1. Clancey, L J., " Aerodynamics", Pitman, 1986
2. John J Bertin., "Aerodynamics for Engineers", Pearson Education Inc, 2002
3. Kuethe, A.M and Chow, C.Y, "Foundations of Aerodynamics", Fifth Edition, John Wiley & Sons, 2000.
4. Milne Thomson, L.H., "Theoretical Aerodynamics", Macmillan, 1985

**OBJECTIVE:**

- To impart knowledge of the hydraulic and pneumatic systems components and types of instruments and its operation including navigational instruments to the students

**UNIT I AIRCRAFT SYSTEMS****9**

Hydraulic systems – Study of typical systems – components – Hydraulic systems controllers – Modes of operation – Pneumatic systems – Working principles – Typical Pneumatic Power system – Brake system – Components, Landing Gear Systems – Classification – Shock absorbers – Retractive mechanism.

**UNIT II AIRPLANE CONTROL SYSTEMS****10**

Conventional Systems – Power assisted and fully powered flight controls – Power actuated systems – Engine control systems – Push pull rod system – operating principles – Modern control systems – Digital fly by wire systems – Auto pilot system, Active Control Technology.

**UNIT III ENGINE SYSTEMS****9**

Piston and Jet Engines- Fuel systems – Components - Multi-engine fuel systems, lubricating systems – Starting and Ignition systems.

**UNIT IV AIRCONDITIONING AND PRESSURIZING SYSTEM****8**

Basic Air Cycle systems – Vapour Cycle Systems, Boot-strap air cycle system – Evaporative vapour cycle systems – Evaporation air cycle systems – Oxygen systems – Fire extinguishing system and smoke detection system, Deicing and anti-icing system.

**UNIT V AIRCRAFT INSTRUMENTS****9**

Flight Instruments and Navigation Instruments – Accelerometers, Air speed Indicators – Mach Meters – Altimeters - Gyroscopic Instruments– Principles and operation – Study of various types of engine instruments – Tachometers – Temperature and Pressure gauges.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Compare the features of various flight control systems.
- Describe the principle and working of different aircraft systems.
- Analyze the performance of various aircraft engine systems.
- Acquire and interpret data from various aircraft instruments.
- Identify the various cockpit controls.

**TEXT BOOKS**

- Mekinley, J.L. and R.D. Bent, Aircraft Power Plants, McGraw Hill 1993.
- Pallet, E.H.J. Aircraft Instruments & Principles, Pitman & Co 1993.

**REFERENCES**

- Handbooks of Airframe and Power plant Mechanics, US dept. of Transportation, Federal, Aviation Administration, the English Book Store, New Delhi, 1995.
- McKinley, J.L. and Bent R.D. Aircraft Maintenance & Repair, McGraw Hill, 1993.
- Teager, S, "Aircraft Gas Turbine technology, McGraw Hill 1997.

**OBJECTIVES:**

- To understand the principles in the formation of mechanisms and their kinematics.
- To understand the effect of friction in different machine elements.
- To understand the importance of balancing and vibration.

**UNIT I KINEMATICS OF MACHINES****9**

Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain – kinematics analysis in simple mechanisms – velocity and acceleration polygons – Cam and followers – classifications – displacement diagrams - layout of plate cam profiles – derivatives of followers motion

**UNIT II GEARS AND GEAR TRAINS****9**

Spur gear – law of toothed gearing – involute gearing – Interchangeable gears – Gear tooth action interference and undercutting – nonstandard teeth – gear trains – parallel axis gears trains – epicyclic gear trains.

**UNIT III FRICTION****9**

Types of friction – Friction Drives -friction in screw threads – bearings – Friction clutches – Belt drives

**UNIT IV BALANCING and MECHANISM FOR CONTROL****9**

Static and Dynamic balancing – Balancing of revolving and reciprocating masses – Balancing machines -Balancing a single cylinder engine – Balancing of Multi-cylinder inline, V-engines – Partial balancing in engines- Governors and Gyroscopic effects.

**UNIT V VIBRATION****9**

Free, forced and damped vibrations of single degree of freedom systems – force transmitted to supports – vibration Isolation – vibration absorption – torsional vibration of shafts – single and multirotor systems – geared shafts – critical speed of shafts.

**TOTAL: 45 PERIODS****OUTCOMES:**

Student will be able to

- Understand the principles in the formation of mechanisms and their kinematics.
- Understand the construction features of Gears and Gear Trains.
- Understand the effect of friction in different machine elements.
- Understand the importance of balancing.
- Understand the importance of Governors and Gyroscopic effects.
- Understand the importance of vibration.

**TEXT BOOKS:**

1. Ambekar A.G., Mechanism and Machine Theory Prentice Hall of India, New Delhi, 2007
2. Shigley J.E., Pennock G.R and Uicker J.J., Theory of Machines and Mechanisms , Oxford University Press, 2003

**REFERENCES:**

1. Ghosh.A, and A.K.Mallick, Theory and Machine , Affiliated East-West Pvt. Ltd., New Delhi, 1988.
2. Ramamurthi. V., "Mechanisms of Machine", Narosa Publishing House, 2005.
3. Rao.J.S. and Dukkippatti R.V. Mechanisms and Machines , Wiley-Eastern Ltd., New Delhi, 1998.
4. Robert L.Norton, "Design of Machinery", McGraw-Hill, 2012.
5. Thomas Bevan, Theory of Machines , CBS Publishers and Distributors, 2010.

**OBJECTIVES:**

- To provide the students an understanding on the linear static analysis of determinate and indeterminate aircraft structural components.
- To provide the design process using different failure theories.

**UNIT I           STATICALLY DETERMINATE & INDETERMINATE STRUCTURES           9+6**

Plane truss analysis – method of joints – method of sections – method of shear – 3-D trusses – principle of super position, Clapeyron's 3 moment equation and moment distribution method for indeterminate beams.

**UNIT II           ENERGY METHODS           9+6**

Strain Energy in axial, bending, torsion and shear loadings. Castigliano's theorems and their applications. Energy theorems – dummy load & unit load methods – energy methods applied to statically determinate and indeterminate beams, frames, rings & trusses.

**UNIT III           COLUMNS           9+6**

Euler's column curve – inelastic buckling – effect of initial curvature – Southwell plot – columns with eccentricity – use of energy methods – theory of beam columns – beam columns with different end conditions – stresses in beam columns.

**UNIT IV           FAILURE THEORIES           9+6**

Ductile and brittle materials – maximum principal stress theory - maximum principal strain theory - maximum shear stress theory - distortion energy theory – octahedral shear stress theory.

**UNIT V           INDUCED STRESSES           9+6**

Thermal stresses – impact loading – Fatigue – Creep - Stress Relaxation

**TOTAL :75 PERIODS**

**OUTCOMES:**

- Ability to perform linear static analysis of determinate and indeterminate aircraft structural components
- Ability to design the component using different theories of failure
- Calculate the response of statically indeterminate structures under various loading conditions.
- Calculate the reactions of structures using strain energy concept.
- Create a structure to carry the given load.
- Examine the structural failures using failure theories

**TEXT BOOKS:**

1. 'Mechanics of Materials' by James M. Gere & Barry J Goodno, cengage Learning Custom Publishing; 8<sup>th</sup> edition, 2012.
2. Megson T M G, 'Aircraft Structures for Engineering students' Butterworth-Heinemann publisher, 5<sup>th</sup> edition, 2012.
3. N.C. Pandya, C.S. Shah, "Elements of Machine Design", Charotar Publishing House, 15<sup>th</sup> edition, 2009.

**REFERENCES:**

1. Bruhn E F, 'Analysis and Design of Flight Vehicle Structures', Tri-State Off-set Company, USA, 1985
2. Donaldson, B.K., 'Analysis of Aircraft Structures - An Introduction' Cambridge University Press publishers, 2<sup>nd</sup> edition , 2008
3. Peery, D.J., and Azar, J.J., Aircraft Structures, 2<sup>nd</sup> edition, McGraw – Hill, N.Y., 1999.

**OBJECTIVE:**

- To establish fundamental approach and application of jet engine components. Also analysis of flow phenomenon and estimation of thrust developed by jet engine.

**UNIT I PRINCIPLES OF AIR BREATHING ENGINES 9+6**

Operating principles of piston engines – thermal efficiency calculations – classification of piston engines - illustration of working of gas turbine engines – factors affecting thrust – methods of thrust augmentation – performance parameters of jet engines.

**UNIT II JET ENGINE INTAKES AND EXHAUST NOZZLES 9+6**

Ram effect, Internal flow and Stall in subsonic inlets – relation between minimum area ratio and external deceleration ratio – diffuser performance – modes of operation - supersonic inlets – starting problem on supersonic inlets – shock swallowing by area variation – real flow through nozzles and nozzle efficiency – losses in nozzles – ejector and variable area nozzles - interaction of nozzle flow with adjacent surfaces – thrust reversal.

**UNIT III JET ENGINE COMBUSTION CHAMBERS 9+6**

Chemistry of combustion, Combustion equations, Combustion process, classification of combustion chambers – combustion chamber performance – effect of operating variables on performance – flame stabilization, Cooling process, Materials, Aircraft fuels, HHV, LHV, Orsat apparatus

**UNIT IV JET ENGINE COMPRESSORS 9+6**

Euler's turbo machinery equation, Principle operation of centrifugal compressor, Principle operation of axial flow compressor– Work done and pressure rise – velocity diagrams – degree of reaction – free vortex and constant reaction designs of axial flow compressor – performance parameters axial flow compressors– stage efficiency.

**UNIT V JET ENGINE TURBINES 9+6**

Principle of operation of axial flow turbines– limitations of radial flow turbines- Work done and pressure rise – Velocity diagrams – degree of reaction – constant nozzle angle designs – performance parameters of axial flow turbine– turbine blade cooling methods – stage efficiency calculations – basic blade profile design considerations – matching of compressor and turbine

**TOTAL :75 PERIODS****OUTCOMES:**

- To be able to apply control volume and momentum equation to estimate the forces produced by aircraft propulsion systems
- To be able to describe the principal figures of merit for aircraft engine
- To be able to describe the principal design parameters and constraints that set the performance of gas turbine engines.
- To apply ideal and actual cycle analysis to a gas turbine engine to relate thrust and fuel burn to component performance parameters.
- Understanding the workings of multistage compressor or turbine, and to be able to use velocity triangles and the Euler Turbine Equation to estimate the performance of a compressor or turbine stage.

**TEXT BOOK:**

- Hill, P.G. & Peterson, C.R. "Mechanics & Thermodynamics of Propulsion" Pearson education (2009)

**REFERENCES:**

1. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. "Gas Turbine Theory", Pearson Education Canada; 6th edition, 2008.
2. Mathur, M.L. and Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", Standard Publishers & Distributors, Delhi, 2nd edition 2014.
3. Oates, G.C., "Aero thermodynamics of Aircraft Engine Components", AIAA Education Series, New York, 1985.
4. "Rolls Royce Jet Engine", Rolls Royce; 4th revised edition, 1986.

**ME8381****COMPUTER AIDED MACHINE DRAWING****L T P C  
0 0 4 2****OBJECTIVES:**

- To make the students understand and interpret drawings of machine components
- To prepare assembly drawings both manually and using standard CAD packages
- To familiarize the students with Indian Standards on drawing practices and standard components
- To gain practical experience in handling 2D drafting and 3D modeling software systems.

**UNIT I DRAWING STANDARDS & FITS AND TOLERANCES****12**

Code of practice for Engineering Drawing, BIS specifications – Welding symbols, riveted joints, keys, fasteners – Reference to hand book for the selection of standard components like bolts, nuts, screws, keys etc. - Limits, Fits – Tolerancing of individual dimensions – Specification of Fits – Preparation of production drawings and reading of part and assembly drawings, basic principles of geometric dimensioning & tolerancing.

**UNIT II INTRODUCTION TO 2D DRAFTING****16**

- Drawing, Editing, Dimensioning, Layering, Hatching, Block, Array, Detailing, Detailed drawing.
- Bearings - Bush bearing, Plummer block
- Valves – Safety and non-return valves.

**UNIT III 3D GEOMETRIC MODELING AND ASSEMBLY****32**

Sketcher - Datum planes – Protrusion – Holes - Part modeling – Extrusion – Revolve – Sweep – Loft – Blend – Fillet - Pattern – Chamfer - Round - Mirror – Section - Assembly

- Couplings – Flange, Universal, Oldham's, Muff, Gear couplings
- Joints – Knuckle, Gib & cotter, strap, sleeve & cotter joints
- Engine parts – Piston, connecting rod, cross-head (vertical and horizontal), stuffing box, multi-plate clutch
- Miscellaneous machine components – Screw jack, machine vice, tail stock, chuck, vane and gear pump

**TOTAL:60 PERIODS**

**Note:** 25% of assembly drawings must be done manually and remaining 75% of assembly drawings must be done by using any CAD software. The above tasks can be performed manually and using standard commercial 2D / 3D CAD software

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

CO1 Follow the drawing standards, Fits and Tolerances

CO2 Re-create part drawings, sectional views and assembly drawings as per standards

**TEXT BOOK:**

1. Gopalakrishna K.R., "Machine Drawing", 22nd Edition, Subhas Stores Books Corner, Bangalore, 2013

**REFERENCES:**

1. Junnarkar, N.D., "Machine Drawing", 1st Edition, Pearson Education, 2004
2. N. D. Bhatt and V.M. Panchal, "Machine Drawing", 48th Edition, Charotar Publishers, 2013
3. N. Siddeshwar, P. Kanniah, V.V.S. Sastri, "Machine Drawing", published by Tata McGraw Hill, 2006
4. S. Trymbaka Murthy, "A Text Book of Computer Aided Machine Drawing", CBS Publishers, New Delhi, 2007

**AE8411****AERODYNAMICS LABORATORY****L T P C  
0 0 2 1****OBJECTIVE:**

- To predict different aerodynamic propulsion used in aero application

**LIST OF EXPERIMENTS**

1. Calibration of a subsonic Wind tunnel.
2. Determination of lift for the given airfoil section.
3. Pressure distribution over a smooth circular cylinder.
4. Pressure distribution over a rough circular cylinder.
5. Pressure distribution over a symmetric aerofoil.
6. Pressure distribution over a cambered aerofoil.
7. Force measurement using wind tunnel balancing set up.
8. Flow over a flat plate at different angles of incidence.
9. Flow visualization studies in low speed flows over cylinders.
10. Flow visualization studies in low speed flows over airfoil with different angle of incidence.

**TOTAL: 30 PERIODS****OUTCOMES:**

- Describe the fundamental aerodynamic and geometrical properties related to external flows over airfoils, wings, and bluff bodies.
- Calculate the aerodynamic forces and moments experienced by airfoils, wings and bluff bodies.
- Use thin aerofoil theory to evaluate the performance of thin airfoils and the effects of angle of attack and camber.
- Use wind tunnel instrumentation to measure flow velocity and lift and drag.
- Visualize the flow and pressure distribution over 2D and 3D bodies by water flow and smoke methods.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

Sl. No.	Name of the Equipment	Quantity	Experiment No.
1	Subsonic Wind tunnel	1	1,2,4,5,6,7,8,9,10
2	Models(aerofoil, rough and smooth cylinder , flat plate)	2	5,6,7,8,9,10
3	Angle of incidence changing mechanism	1 No.	8,10
4	Multi tube Manometer	1 No.	2,3,4,5,6
5	Pitot-Static Tubes	1 No.	1
6	Cylinder models (Rough and Smooth)	2 Nos.	3,4
7	Wind Tunnel balances (3 or 6 components)	1 No.	7
8	Smoke Generator	1 No.	8,9,10
9	Water flow channel	1 No.	8,9,10

**OBJECTIVE:**

To study the performance of airplanes under various operating conditions and the static and dynamic response of aircraft for both voluntary and involuntary changes in flight conditions

**UNIT I CRUISING FLIGHT PERFORMANCE 9+6**

Forces and moments acting on a flight vehicle - Equation of motion of a rigid flight vehicle - Different types of drag –estimation of parasite drag co-efficient by proper area method- Drag polar of vehicles from low speed to high speeds - Variation of thrust, power with velocity and altitudes for air breathing engines . Performance of airplane in level flight - Power available and power required curves. Maximum speed in level flight - Conditions for minimum drag and power required

**UNIT II MANOEUVERING FLIGHT PERFORMANCE 9+6**

Range and endurance - Climbing and gliding flight (Maximum rate of climb and steepest angle of climb, minimum rate of sink and shallowest angle of glide) – Takeoff and landing - Turning performance (Turning rate turn radius). Bank angle and load factor – limitations on turn - V-n diagram and load factor.

**UNIT III STATIC LONGITUDINAL STABILITY 9+6**

Degree of freedom of rigid bodies in space - Static and dynamic stability - Purpose of controls in airplanes -Inherently stable and marginal stable airplanes – Static, Longitudinal stability - Stick fixed stability - Basic equilibrium equation - Stability criterion - Effects of fuselage and nacelle - Influence of CG location - Power effects - Stick fixed neutral point - Stick free stability-Hinge moment coefficient - Stick free neutral points-Symmetric maneuvers - Stick force gradients - Stick force per 'g' - Aerodynamic balancing.

**UNIT IV LATERAL AND DIRECTIONAL STABILITY 9+6**

Dihedral effect - Lateral control - Coupling between rolling and yawing moments - Adverse yaw effects - Aileron reversal - Static directional stability - Weather cocking effect - Rudder requirements - One engine inoperative condition - Rudder lock.

**UNIT V DYNAMIC STABILITY 9+6**

Introduction to dynamic longitudinal stability: - Modes of stability, effect of freeing the stick - Brief description of lateral and directional. dynamic stability - Spiral, divergence, Dutch roll, auto rotation and spin.

**TOTAL : 75 PERIODS****OUTCOMES:**

- Know about the forces and moments that are acting on an aircraft, the different types of drag, drag polar, ISA, variation of thrust, power, SFC with velocity and altitude.
- Have understanding about performance in level flight, minimum drag and power required, climbing, gliding and turning flight, v-n diagram and load factor.
- Knowledge about degrees of stability, stick fixed and stick free stability, stability criteria, effect of fuselage and CG location, stick forces, aerodynamic balancing.
- Understanding about lateral control, rolling and yawing moments, static directional stability, rudder and aileron control requirements and rudder lock.
- Understanding about dynamic longitudinal stability, stability derivatives, modes and stability criterion, lateral and directional dynamic stability.

**TEXT BOOKS:**

1. Mc Cornick. W., "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, NY, 1979.
2. Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 2004.
3. Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son:, Inc, NY, 1988.

## REFERENCES :

1. Babister, A.W., "Aircraft Dynamic Stability and Response", Pergamon Press, Oxford, 1980.
2. Dommasch, D.O., Sherby, S.S., and Connolly, T.F., "Aeroplane Aero dynamics", Third Edition, Issac Pitman, London, 1981.
3. Etkin, B., "Dynamics of Flight Stability and Control", Edn. 2, John Wiley, NY, 1982.
4. Mc Cornick B. W, "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, NY, 1995.

**AE8502**

**AIRCRAFT STRUCTURES - II**

**L T P C**  
**3 2 0 4**

## OBJECTIVES:

- To provide the behavior of loads experience of aircraft indigenous components.
- To provide the students adopt with various methods for analysis of aircraft wings and fuselage.
- To provide conception design of major aircraft structural components.
- To provide the better understatement of the low weight structures.

## UNIT I UNSYMMETRICAL BENDING

**9+6**

Bending of symmetric beams subject to skew loads - bending stresses in beams of unsymmetrical sections – generalized k-method, neutral axis method, principal axis method, Advantages and Disadvantages of three methods.

## UNIT II SHEAR FLOW IN OPEN SECTIONS

**9+6**

Thin walled beams – concept of shear flow – the shear centre and its determination – shear flow distribution in symmetrical and unsymmetrical thin-walled sections – structural idealization – shear flow variation in idealized sections-Applications of shear flow calculations.

## UNIT III SHEAR FLOW IN CLOSED SECTIONS

**9+6**

Bredt - Batho theory – single-cell and multi-cell tubes subject to torsion – shear flow distribution in thin-walled single & multi-cell structures subject to combined bending and torsion – with walls effective and ineffective in bending-Importance of shear flow & shear center determination.

## UNIT IV BUCKLING OF PLATES

**9+6**

Bending of thin plates - local buckling stress of thin walled sections – crippling strength estimation-thin skin stringer panel-effective skin width –inter rivet buckling-skin stringer panel-Integrally stiffened panels-cutouts- Lightly loaded beams.

## UNIT V STRESS ANALYSIS OF WING AND FUSELAGE

**9+6**

Aircraft loads- classification – the V-n diagram – shear force and bending moment distribution over the aircraft wing and fuselage – shear flow in thin-webbed beams with parallel and non-parallel flanges – complete tension field beams – semi-tension field beam theory.

**TOTAL : 75 PERIODS**

## OUTCOMES

- Ability to understand loads acting on an aircraft.
- Ability to identify & resolve the structural design & its limitations .
- Ability to improvise distribution of their loads on aircraft member with safer limits.
- Ability to understand the design of low weight to high strength panel member.
- Ability to analyze the aircraft real structural components such as wings and fuselage.

## TEXT BOOKS:

1. Bruhn. E.H., "Analysis and Design of Flight Vehicles Structures", Tri-state off-set Company, USA, 1985.
2. Megson T M G , "Aircraft Structures for Engineering Students", Elsevier Ltd, 2012
3. Michael Chun-Yung Niu, "Airframe structural Design ", Conmilit Press Ltd, 1998

**REFERENCES:**

1. Howard D Curtis, "Fundamentals of Aircraft Structural Analysis", WCB-McGraw Hill, 1997
2. Rivello, R.M., "Theory and Analysis of Flight Structures", McGraw Hill, 1993.
3. Peery, D.J., and Azar, J.J., "Aircraft Structures", 2nd edition, McGraw – Hill, N.Y., 1999

**AE8503****AERODYNAMICS – II****L T P C  
3 0 0 3****OBJECTIVES:**

- To introduce the concepts of compressibility,
- To make the student understand the theory behind the formation of shocks and expansion fans in Supersonic flows.
- To introduce the methodology of measurements in Supersonic flows.

**UNIT I ONE DIMENSIONAL COMPRESSIBLE FLOW 10**

Energy, Momentum, continuity and state equations, velocity of sound, adiabatic steady state flow equations, Flow through convergent- divergent passage, Performance under various back pressures.

**UNIT II NORMAL AND OBLIQUE SHOCKS 12**

Prandtl equation and Rankine – Hugoniot relation, Normal shock equations, Pitot static tube, corrections for subsonic and supersonic flows, Oblique shocks and corresponding equations, Hodograph and pressure turning angle, shock polar, flow past wedges and concave corners, strong, weak and detached shocks,

**UNIT III EXPANSION WAVES AND METHOD OF CHARACTERISTICS 8**

Flow past convex corners, Expansion hodograph, Reflection and interaction of shocks and expansion, waves. Method of Characteristics Two dimensional supersonic nozzle contours. Rayleigh and Fanno Flows.

**UNIT IV DIFFERENTIAL EQUATIONS OF MOTION FOR STEADY COMPRESSIBLE FLOWS 7**

Small perturbation potential theory, solutions for supersonic flows, Mach waves and Mach angles, Prandtl-Glauert rule - affine transformation relations for subsonic flows, Linearised two dimensional supersonic flow theory - Lift, drag, pitching moment and center of pressure of supersonic profiles.

**UNIT V TRANSONIC FLOW OVER WING 8**

Lower and upper critical Mach numbers, Lift and drag, divergence, shock induced separation, Characteristics of swept wings, Effects of thickness, camber and aspect ratio of wings, Transonic area rule. Introduction to Hypersonic Aerodynamics.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Calculate the compressible flow through a duct of varying cross section.
- Use quasi one-dimensional theory to analyze compressible flow problems.
- Estimate fluid properties in Rayleigh and Fanno type flows.
- Estimate the properties across normal and oblique shock waves.
- Predict the properties of hypersonic flows.

**TEXT BOOKS:**

1. Anderson Jr., D., – “Modern compressible flows”, McGraw-Hill Book Co., New York, 1999.
2. L.J. Clancy, “Aerodynamics” Sterling Book House, 2006



**TEXT BOOKS:**

1. Mathur, M.L., and Sharma, R.P., "Gas Turbine, Jet and Rocket Propulsion", Standard Publishers and Distributors, Delhi, 2014.
2. Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 8th Edition, 2010.

**REFERENCE:**

1. Robert G. Jahn, "Physics of Electric Propulsion", Dover Publications, 2006.

**AE8505****CONTROL ENGINEERING****L T P C  
3 0 0 3****OBJECTIVES:**

- To introduce the mathematical modeling of systems, open loop and closed loop systems and analyses in time domain and frequency domain.
- To impart the knowledge on the concept of stability and various methods to analyze stability in both time and frequency domain.
- To introduce sampled data control system.

**UNIT I INTRODUCTION****9**

Historical review, Simple pneumatic, hydraulic and thermal systems, Series and parallel system, Analogies, mechanical and electrical components, Development of flight control systems.

**UNIT II OPEN AND CLOSED LOOP SYSTEMS****9**

Feedback control systems – Control system components - Block diagram representation of control systems, Reduction of block diagrams, Signal flow graphs, Output to input ratios.

**UNIT III CHARACTERISTIC EQUATION AND FUNCTIONS****9**

Laplace transformation, Response of systems to different inputs viz., Step impulse, pulse, parabolic and sinusoidal inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuit.

**UNIT IV CONCEPT OF STABILITY****9**

Necessary and sufficient conditions, Routh-Hurwitz criteria of stability, Root locus and Bode techniques, Concept and construction, frequency response.

**UNIT V SAMPLED DATA SYSTEMS****9**

Z-Transforms Introduction to digital control system, Digital Controllers and Digital PID controllers

**TOTAL: 45 PERIODS****OUTCOMES:**

- Ability to apply mathematical knowledge to model the systems and analyse the frequency domain
- Ability to check the stability of the both time and frequency domain
- Ability to solve simple pneumatic, hydraulic and thermal systems, Mechanical and electrical component analogies based problems.
- Ability to solve the Block diagram representation of control systems, Reduction of block diagrams, Signal flow graph and problems based on it.
- Ability to understand the digital control system, Digital Controllers and Digital PID Controllers.

**TEXT BOOKS:**

1. Azzo, J.J.D. and C.H. Houpis Feed back control system analysis and synthesis, McGraw-Hill international 3rs Edition, 1998.
2. OGATO, Modern Control Engineering, Prentice-Hall of India Pvt. Ltd., New Delhi, 1998.

**REFERENCES:**

1. Houpis, C.H. and Lamont, G.B. "Digital control Systems", McGraw Hill Book co., New York, U.S.A. 1995.
2. Kuo, B.C. "Automatic control systems", Prentice-Hall of India Pvt. Ltd., New Delhi, 1998.
3. Naresh K Sinha, "Control Systems", New Age International Publishers, New Delhi, 1998.

**AE8511****AIRCRAFT STRUCTURES LABORATORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**OBJECTIVES:**

- To enable the students understand the behavior of aircraft structural components under different loading conditions.
- To provide the Principle involved in photo elasticity and its applications in stress analysis for composite laminates.

**LIST OF EXPERIMENTS**

1. Deflection of Beams
2. Verification of superposition theorem
3. Verification of Maxwell's reciprocal theorem
4. Buckling load estimation of slender eccentric columns
5. Determination of flexural rigidity of composite beams
6. Unsymmetrical Bending of a Cantilever Beam
7. Combined bending and Torsion of a Hollow Circular Tube
8. Material Fringe Constant of a Photo elastic Models
9. Shear Centre of a Channel Section
10. Free Vibration of a Cantilever Beam
11. Forced Vibration of a cantilever Beam
12. Fabrication of a Composite Laminate.
13. Determination of Elastic constants for a Composite Tensile Specimen.
14. Determination of Elastic constants for a Composite Flexural Specimen.
15. Tension field beam

Any 10 experiments can be chosen

**TOTAL: 60 PERIODS****OUTCOMES:**

At the end of the course

- students can understand the behavior of materials subjected to various types of loadings
- Students will be in a position to fabricate a composite laminates.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

<b>Sl. No.</b>	<b>Name of the Equipment</b>	<b>Quantity</b>	<b>Experiment No.</b>
1	100 kN Universal Testing Machine	1	13,14
2	Beams with weight hangers and dial gauges	6	1,2,3
3	Column set up with dial gauges	2	4
4	Photo elasticity set up	1	8
5	Vibration set up with accessories	1	10,11
6	Wagner beam	1	15
7	Unsymmetrical bending set up	1	6
8	Set up for combined bending and torsion	1	7

**OBJECTIVES:**

- To explore practically components of aircraft piston and gas turbine engines and their working principles.
- To impart practical knowledge of flow phenomenon of subsonic and supersonic jets.
- To determine practically thrust developed by rocket propellants.

**LIST OF EXPERIMENTS**

1. Study of aircraft piston and gas turbine engines
2. Velocity profiles of free jets.
3. Velocity profiles of wall jets.
4. Wall pressure measurements of a subsonic diffusers and ramjet ducts.
5. Flame stabilization studies using conical and hemispherical flame holders.
6. Cascade testing of compressor blades.
7. Velocity and pressure measurements high speed jets.
8. Wall Pressure measurements of supersonic nozzle.
9. Flow visualization of supersonic flow.
10. Study experiments

**TOTAL:30 PERIODS****OUTCOMES**

- Capable to identify components and information of piston and gas turbine engine.
- Able to analyze behavior of flow through ducts and jet engine components.
- Ability to visualize flow phenomenon in supersonic flow.
- Recognizes performance parameters of rocket propellants.
- To be able to distinguish subsonic and supersonic flow characteristics.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

SI.No.	Name of the Equipment	Quantity	Experiment No.
1	Jet engine	1	1
2	Piston engine	1	1
3	Jet facility with compressor and storage tank	1	2,3,,8,9,10
4	Multitube manometer	3	2,3,4,6,8,9
5	Wind tunnel	1	6
6	0-5 bar pressure transducer with pressure indicator OR DSA pressure scanner	8 1	8,9
7	Ramjet facility	1	4
8	Conical flame holder model	1	5
9	Hemispherical flame holder model	1	5
10	Water flow channel	1	5
11	Compressor blade set	1	6
12	Schlieren or Shadowgraph set up	1	10
13	Convergent nozzle	1	8
14	Convergent divergent nozzle	1	7,8,9,10
15	Thruster with load cells	1	7

HS8581

**PROFESSIONAL COMMUNICATION**

L	T	P	C
0	0	2	1

**OBJECTIVES: The course aims to:**

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

**UNIT I**

Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

**UNIT II**

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

**UNIT III**

Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -- questioning and clarifying –GD strategies- activities to improve GD skills

**UNIT IV**

Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

**UNIT V**

Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

**TOTAL : 30 PERIODS**

**OUTCOMES: At the end of the course Learners will be able to:**

- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

**Recommended Software**

1. Open Source Software
2. Win English

**REFERENCES:**

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Interact English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

**OBJECTIVE:**

- To give exposure various methods of solution and in particular the finite element method. Gives exposure to the formulation and the procedure of the finite element method and its application to varieties of problems.

**UNIT I INTRODUCTION****8**

Review of various approximate methods – variational approach and weighted residual approach- application to structural mechanics problems. finite difference methods- governing equation and convergence criteria of finite element method.

**UNIT II DISCRETE ELEMENTS****10**

Bar elements, uniform section, mechanical and thermal loading, varying section, 2D and 3D truss element. Beam element - problems for various loadings and boundary conditions – 2D and 3D Frame elements - longitudinal and lateral vibration. Use of local and natural coordinates.

**UNIT III CONTINUUM ELEMENTS****8**

Plane stress, plane strain and axisymmetric problems. Derivation of element matrices for constant and linear strain triangular elements and axisymmetric element.

**UNIT IV ISOPARAMETRIC ELEMENTS****9**

Definitions, Shape function for 4, 8 and 9 nodal quadrilateral elements, stiffness matrix and consistent load vector, evaluation of element matrices using numerical integration.

**UNIT V FIELD PROBLEM AND METHODS OF SOLUTIONS****10**

Heat transfer problems, steady state fin problems, derivation of element matrices for two dimensional problems, torsion problems. bandwidth- elimination method and method of factorization for solving simultaneous algebraic equations – Features of software packages, sources of error.

**TOTAL (L:45): 45 PERIODS****OUTCOMES:**

- Write flow chart of finite element steps and understand the convergence of the problem
- Solve stiffness matrix for bar, beam and frame problems using suitable boundary condition.
- Plane stress and plane strain condition are used to understand 2d structures.
- Modelling of 2d and 3d structures using isoparametric elements
- Apply the concepts of finite element methods to solve fluid flow and heat transfer problems.

**TEXT BOOKS:**

- Reddy J.N., "An Introduction to Finite Element Method", McGraw Hill, third edition, 2005.
- Tirupathi.R. Chandrapatha and Ashok D. Belegundu, "Introduction to Finite Elements in Engineering", Prentice Hall India, Fourth edition, 2012.

**REFERENCES:**

- Bathe, K.J. and Wilson, E.L., "Numerical Methods in Finite Elements Analysis", Prentice Hall of India, 1985.
- Krishnamurthy, C.S., "Finite Element Analysis", Tata McGraw Hill, 2000.
- Rao. S.S., "Finite Element Methods in Engineering," Butterworth and Heinemann, 2001.

**OBJECTIVE:**

- To provide extensive treatment of the operating principles and limitations of pressure and temperature measurements. To cover both operating and application procedures of hot wire anemometer. To describe flow visualization techniques and to highlight in depth discussion of analog methods.

**UNIT I BASIC MEASUREMENTS IN FLUID MECHANICS****7**

Objective of experimental studies – Fluid mechanics measurements – Properties of fluids – Measuring instruments – Performance terms associated with measurement systems – Direct measurements - Analogue methods – Flow visualization – Components of measuring systems – Importance of model studies.

**UNIT II WIND TUNNEL MEASUREMENTS****10**

Characteristic features, operation and performance of low speed, transonic, supersonic and special tunnels - Power losses in a wind tunnel – Instrumentation and calibration of wind tunnels – Turbulence- Wind tunnel balance – Wire balance – Strut-type – Platform-type – Yoke-type – Pyramid type – Strain gauge balance – Balance calibration.

**UNIT III FLOW VISUALIZATION AND ANALOGUE METHODS****9**

Visualization techniques – Smoke tunnel – Hele-Shaw apparatus - Interferometer – Fringe-Displacement method – Schlieren system – Shadowgraph - Hydraulic analogy – Hydraulic jumps – Electrolytic tank.

**UNIT IV PRESSURE, VELOCITY AND TEMPERATURE MEASUREMENTS****9**

Pitot - static tube characteristics - Velocity measurements - Hot-wire anemometry – Constant current and Constant temperature Hot-Wire anemometer – Pressure measurement techniques - Pressure transducers – Temperature measurements.

**UNIT V SPECIAL FLOWS AND UNCERTAINTY ANALYSIS****10**

Experiments on Taylor-Proudman theorem and Ekman layer – Measurements in boundary layers - Data acquisition and processing – Signal conditioning – Uncertainty analysis – Estimation of measurement errors – External estimate of the error – Internal estimate of the error – Uncertainty calculation - Uses of uncertainty analysis.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Knowledge on measurement techniques in aerodynamic flow.
- Acquiring basics of wind tunnel measurement systems
- Specific instruments for flow parameter measurement like pressure, velocity.
- Use measurement techniques involved in Aerodynamic testing.
- Analyze the model measurements, Lift and drag measurements through various techniques and testing of different models.
- Apply the Wind tunnel boundary corrections and Scale effects

**TEXT BOOKS:**

- Rathakrishnan, E., "Instrumentation, Measurements, and Experiments in Fluids," CRC Press – Taylor & Francis, 2007.
- Robert B Northrop, "Introduction to Instrumentation and Measurements", Second Edition, CRC Press, Taylor & Francis, 2006.

**REFERENCES:**

- Bradsaw "Experimental Fluid Mechanics", Elsevier, 2<sup>nd</sup> edition, 1970.
- Pope, A., and Goin, L., "High Speed Wind Tunnel Testing", John Wiley, 1985.

**OBJECTIVE:**

- To make the student understand the analysis of composite laminates under different loading conditions and different environmental conditions.

**UNIT I MICROMECHANICS****10**

Introduction - advantages and application of composite materials – types of reinforcements and matrices - micro mechanics – mechanics of materials approach, elasticity approach- bounding techniques – fiber volume ratio – mass fraction – density of composites. effect of voids in composites.

**UNIT II MACROMECHANICS****10**

Generalized Hooke's Law - elastic constants for anisotropic, orthotropic and isotropic materials - macro mechanics – stress-strain relations with respect to natural axis, arbitrary axis – determination of in plane strengths of a lamina - experimental characterization of lamina. failure theories of a lamina. hygrothermal effects on lamina.

**UNIT III LAMINATED PLATE THEORY****10**

Governing differential equation for a laminate. stress – strain relations for a laminate. different types of laminates. in plane and flexural constants of a laminate. hygrothermal stresses and strains in a laminate. failure analysis of a laminate. impact resistance and interlaminar stresses. netting analysis

**UNIT IV FABRICATION PROCESS AND REPAIR METHODS****8**

Various open and closed mould processes, manufacture of fibers, importance of repair and different types of repair techniques in composites – autoclave and non-autoclave methods.

**UNIT V SANDWICH CONSTRUCTIONS****7**

Basic design concepts of sandwich construction - materials used for sandwich construction - failure modes of sandwich panels - bending stress and shear flow in composite beams.

**TOTAL: 45 PERIODS****OUTCOMES**

- Understanding the mechanics of composite materials
- Ability to analyse the laminated composites for various loading cases
- Knowledge gained in manufacture of composites.
- Should analyze sandwich and laminated plates
- Should be able to construct and analysis different composite technique

**TEXT BOOKS:**

- Autar K Kaw, 'Mechanics of Composite Materials', CRC Press, 2<sup>nd</sup> edition, 2005.
- Isaac M. Daniel & Ori Ishai, "Mechanics of Composite Materials," OUP USA publishers, 2<sup>nd</sup> edition, 2005.
- Madhujit Mukhopadhyay, Mechanics of Composite Materials and Structures, University Press, 2004

**REFERENCES:**

- Agarwal, B.D., and Broutman, L.J., "Analysis and Performance of Fibre Composites," John Wiley & Sons, 3rd edition, July 2006.
- Allen Baker, Composite Materials for Aircraft Structures, AIAA Series, 2<sup>nd</sup> Edition, 2004.
- Calcote, L R. "The Analysis of laminated Composite Structures", Von – Nostrand Reinhold Company, New York 1998.
- Lubing, Handbook on Advanced Plastics and Fibre Glass, Von Nostran Reinhold Co., New York, 1989.
- Michael F. Ashley, "Material Selection in Mechanical Design", 5<sup>th</sup> edition, Butterworth-Heiner, 2016

**OBJECTIVE:**

- To make the student understand the choice of the selection of design parameters, Fixing the geometry and to investigate the performance and stability characteristics of airplanes.

**UNIT I INTRODUCTION****6**

State of art in airplane design, Purpose and scope of airplane design, Classification of airplanes based on purpose and configuration. Factors affecting configuration, Merits of different plane layouts. Stages in Airplane design. Designing for manufacturability, Maintenance, Operational costs, Interactive designs.

**UNIT II PRELIMINARY DESIGN PROCEDURE****9**

Data collection and 3-view drawings, their purpose, weight estimation, Weight equation method – Development & procedures for evaluation of component weights. Weight fractions for various segments of mission. Choice of wind loading and thrust. Loading .

**UNIT III POWER PLANT SELECTION****10**

Choices available, comparative merits, Location of power plants, Functions dictating the locations.

**UNIT IV DESIGN OF WING, FUSELAGE AND EMPHANAGE****10**

Selection of aerofoil. Selection of Wing parameters, selection of sweep, Effect of Aspect ratio, Wing Design and Airworthiness requirements, V-n diagram, loads, Structural features. Elements of fuselage design, Loads on fuselage, Fuselage Design. Fuselage and tail sizing. Determination of tail surface areas, Tail design, Structural features, Check for nose wheel lift off.

**UNIT V DESIGN OF LANDING GEAR AND CONTROL SURFACE****10**

Landing Gear Design, Loads on landing gear, Preliminary landing gear design. Elements of Computer Aided and Design, Special consideration in configuration lay-out, Performance estimation. Stability aspects on the design of control surface.

**TOTAL: 45 PERIODS****OUTCOMES:**

Students will be able to

- Initiate the preliminary design of an aircraft starting from data collection to satisfy mission specifications;
- To get familiarized with the estimation of geometric and design parameters of an airplane
- Understanding the procedure involved in weight estimation, power plant selection, estimation of the performance parameters, stability aspects, design of structural components of the airplane, stability of structural elements, estimation of critical loads etc.
- Initiate the design of a system, component, or process to meet requirements for aircraft systems;
- Complete the design of an aircraft to a level of sufficient detail to demonstrate that it satisfies given mission specifications
- Work in a multidisciplinary environment involving the integration of engineering practices in such subjects as aerodynamics, structures, propulsion, and flight mechanics

**TEXT BOOKS:**

1. Raymer, D.P. Aircraft conceptual Design, AIAA series, 5<sup>th</sup> edition, 2012.
2. Torenbeck, E. Synthesis of Subsonic Airplane Design, Delft University Press, U.K. 1986.

**REFERENCE:**

1. Kuechemann, D, “ The Aerodynamic Design of Aircraft, American Institute of Aeronautics publishers, 2012

**OBJECTIVE:**

- To study the various experimental techniques involved for measuring displacements, stresses, strains in structural components.

**UNIT I      EXTENSOMETERS AND DISPLACEMENT SENSORS****8**

Principles of measurements, Accuracy, Sensitivity and range of measurements, Mechanical, Optical, Acoustical and Electrical extensometers and their uses, Advantages and disadvantages, Capacitance gauges, Laser displacement sensors.

**UNIT II      ELECTRICAL RESISTANCE STRAIN GAUGES****12**

Principle of operation and requirements, Types and their uses, Materials for strain gauges, Calibration and temperature compensation, cross sensitivity, Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators, Rosette analysis, stress gauges, load cells, Data acquisition, six component balance.

**UNIT III      PHOTOELASTICITY****11**

Two dimensional photo elasticity, Photo elastic materials, Concept of light - photoelastic effects, stress optic law, Transmission photoelasticity, Jones calculus, plane and circular polariscopes, Interpretation of fringe pattern, Calibration of photoelastic materials, Compensation and separation techniques, Introduction to three dimensional photo elasticity.

**UNIT IV      BRITTLE COATING AND MOIRE TECHNIQUES****7**

Relation between stresses in coating and specimen, use of failure theories in brittle coating, Moire method of strain analysis.

**UNIT V      NON – DESTRUCTIVE TESTING****7**

Fundamentals of NDT, Acoustic Emission Technique, Radiography, Thermography, Ultrasonics, Eddy Current testing, Fluorescent Penetrant Testing,

**TOTAL: 45 PERIODS****OUTCOMES**

- Knowledge of stress and strain measurements in loaded components.
- Acquiring information's the usage of strain gauges and photo elastic techniques of measurement .
- Formulate and solve general three dimensional problems of stress-strain analysis especially fundamental problems of elasticity.
- Analyze the strain gauge data under various loading condition by using gauge rosette method.
- Experimentally evaluate the location and size of defect in solid and composite materials by using various Non-destructive Testing methods.

**TEXT BOOKS:**

- Dally, J.W., and Riley, W.F., "Experimental Stress Analysis", McGraw Hill Inc., New York 1998.
- Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G., Pant B., and Ramachandra, K., "Experimental Stress Analysis", Tata McGraw Hill, New Delhi, 1984.
- Sadhu Singh, "Experimental Stress Analysis", Khanna Publishers, New Delhi, 1996.

**REFERENCES:**

- Durelli. A.J., "Applied Stress Analysis", Prentice Hall of India Pvt Ltd., New Delhi, 1970
- Hetenyi, M., "Hand book of Experimental Stress Analysis", John Wiley and Sons Inc., New York, 1972.
- Max Mark Frocht, "Photo Elasticity", John Wiley and Sons Inc., New York, 1968
- Pollock A.A., Acoustic Emission in Acoustics and Vibration Progress, Ed. Stephens R.W.B., Chapman and Hall, 1993.
- Ramesh, K., Digital Photoelasticity, Springer, New York, 2000.

**OBJECTIVE:**

- To introduce the knowledge of the maintenance and repair procedures followed for overhaul of aero engines.

**LIST OF EXPERIMENTS**

- Dismantling and reassembling of an aircraft piston engine.
- Study of Camshaft operation, firing order and magneto, valve timing
- Study of lubrication and cooling system
- Study of auxiliary systems, pumps and carburetor
- Aircraft wood gluing-single & double scarf joints
- Welded single & double V-joints.
- Fabric & Riveted Patch repairs
- Tube bending and flaring
- Sheet metal forming
- Preparation of glass epoxy of composite laminates and specimens.

**TOTAL: 60 PERIODS****OUTCOME:**

- Ability to maintain and repair the aero engines.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

Sl. No	Equipments	Qty
1	Aircraft Piston engines	1
2	Set of basic tools for dismantling and assembly	1 set
3	NDT equipment	1 set
4	Micrometers, depth gauges, vernier calipers	2 sets
5	Valve timing disc	1
6	Shear cutter pedestal type	1
7	Drilling Machine	1
8	Bench Vices	1
9	Radius Bend bars	1
10	Pipe Flaring Tools	1
11	Welding machine	1
12	Glass fibre, epoxy resin	1
13	Strain gauges and strain indicator	1

**OBJECTIVE:**

- To make the students familiarize with computational fluid dynamics and structural analysis software tools. By employing these tools for Aerospace applications students will have an opportunity to expose themselves to simulation software.

**LIST OF EXPERIMENTS**

- Grid independence study and convergence test using any simple case like pipe flow, diffuser flow, flow over a cylinder, aero foil etc.
- Simulation of flow over backward facing step.
- Simulation of Karman vortex trail (vortex shedding) using circular cylinder.
- External flow simulation of subsonic and supersonic aero foils.
- Internal flow simulation of subsonic, sonic and supersonic flow through a CD nozzle.
- Structural analysis of bar, beam and truss.
- Structural analysis of tapered wing.
- Structural analysis of fuselage structure.
- Analysis of composite laminate structures.
- Heat transfer analysis of structures.

**OUTCOMES:**

- Ability to Mesh various geometries and to do grid independence study.
- Simulate and analyze fluid flow for internal and external flow problems.
- Analyze the basic mechanism of different structural elements behavior.
- Analyze the variation of mechanical properties over a composite beam.
- Analyze the apparent stress distribution over structural component

**TOTAL : 60 PERIODS****LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

Sl.No	Equipments	Qty
1	Internal server (or) Work station	1
2	Computers	30
3	Standard Modelling and analysis packages	30 licenses
4	UPS	1
5	Printer	1

**AE8613****AIRCRAFT DESIGN PROJECT - I****L T P C  
0 0 2 1****OBJECTIVE:**

- To make the student work in groups and understand the Concepts involved in Aerodynamic design, Performance analysis and stability aspects of different types of airplanes
1. Comparative studies of different types of airplanes and their specifications and performance details with reference to the design work under taken.
  2. Preliminary weight estimation, Selection of design parameters, power plant selection, aerofoil selection, fixing the geometry of Wing, tail, control surfaces Landing gear selection.
  3. Preparation of layout drawing, construction of balance and three view diagrams of the airplane under consideration.
  4. Drag estimation, Performance calculations, Stability analysis and V-n diagram.

**TOTAL : 30 PERIODS****OUTCOME:**

- Upon completion of the Aircraft Design Project I students will be in a position to design aircraft and demonstrate the performance of the design.

**GE8077****TOTAL QUALITY MANAGEMENT****L T P C  
3 0 0 3****OBJECTIVE:**

- To facilitate the understanding of Quality Management principles and process.

**UNIT I INTRODUCTION****9**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

**UNIT II TQM PRINCIPLES****9**

Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

**UNIT III TQM TOOLS AND TECHNIQUES I 9**

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

**UNIT IV TQM TOOLS AND TECHNIQUES II 9**

Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

**UNIT V QUALITY MANAGEMENT SYSTEM 9**

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--**ENVIRONMENTAL MANAGEMENT SYSTEM:** Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

**TEXT BOOK:**

1. Dale H.Besterfield, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

**REFERENCES:**

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8<sup>th</sup> Edition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. ISO 9001-2015 standards

**AE8751**

**AVIONICS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To introduce the basic of avionics and its need for civil and military aircrafts
- To impart knowledge about the avionic architecture and various avionics data buses
- To gain more knowledge on various avionics subsystems

**UNIT I INTRODUCTION TO AVIONICS 9**

Need for avionics in civil and military aircraft and space systems – integrated avionics and weapon systems – typical avionics subsystems, design, technologies – Introduction to digital computer and memories.

**UNIT II DIGITAL AVIONICS ARCHITECTURE 9**

Avionics system architecture – data buses – MIL-STD-1553B – ARINC – 420 – ARINC – 629.

**UNIT III FLIGHT DECKS AND COCKPITS 9**

Control and display technologies: CRT, LED, LCD, EL and plasma panel – Touch screen – Direct voice input (DVI) – Civil and Military Cockpits: MFDS, HUD, MFK, HOTAS.

**UNIT IV INTRODUCTION TO NAVIGATION SYSTEMS 9**  
 Radio navigation – ADF, DME, VOR, LORAN, DECCA, OMEGA, ILS, MLS – Inertial Navigation Systems (INS) – Inertial sensors, INS block diagram – Satellite navigation systems – GPS.

**UNIT V AIR DATA SYSTEMS AND AUTO PILOT 9**  
 Air data quantities – Altitude, Air speed, Vertical speed, Mach Number, Total air temperature, Mach warning, Altitude warning – Auto pilot – Basic principles, Longitudinal and lateral auto pilot.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Ability to built Digital avionics architecture
- Ability to Design Navigation system
- Ability to design and perform analysis on air system.
- Integrate avionics systems using data buses.
- Analyze the performance of various cockpit display technologies.
- Design autopilot for small aircrafts using MATLAB

**TEXT BOOKS:**

1. Albert Helfrick.D., "Principles of Avionics", Avionics Communications Inc., 2004
2. Collinson.R.P.G. "Introduction to Avionics", Chapman and Hall, 1996.

**REFERENCES:**

1. Middleton, D.H., Ed., "Avionics systems, Longman Scientific and Technical", Longman Group UK Ltd., England, 1989.
2. Pallet.E.H.J., "Aircraft Instruments and Integrated Systems", Pearsons, Indian edition 2011.
3. Spitzer, C.R. "Digital Avionics Systems", Prentice-Hall, Englewood Cliffs, N.J.,U.S.A. 1993.
4. Spitzer. C.R. "The Avionics Hand Book", CRC Press, 2000

<b>ME8093</b>	<b>COMPUTATIONAL FLUID DYNAMICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To introduce Governing Equations of viscous fluid flows
- To introduce numerical modeling and its role in the field of fluid flow and heat transfer
- To enable the students to understand the various discretization methods, solution procedures and turbulence modeling.
- To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers.

**UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 9**  
 Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behaviour of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

**UNIT II FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION 9**  
 Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – Finite volume formulation for steady state One, Two and Three -dimensional diffusion problems –Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations – Use of Finite Difference and Finite Volume methods.

**UNIT III FINITE VOLUME METHOD FOR CONVECTION DIFFUSION 9**

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes properties of discretization schemes – Conservativeness, Boundedness, Transportiveness, Hybrid, Power-law, QUICK Schemes.

**UNIT IV FLOW FIELD ANALYSIS 9**

Finite volume methods -Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants – PISO Algorithms.

**UNIT V TURBULENCE MODELS AND MESH GENERATION 9**

Turbulence models, mixing length model, Two equation (k- ) models – High and low Reynolds number models – Structured Grid generation – Unstructured Grid generation – Mesh refinement – Adaptive mesh – Software tools.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Derive the governing equations and boundary conditions for Fluid dynamics
- CO2 Analyze Finite difference and Finite volume method for Diffusion
- CO3 Analyze Finite volume method for Convective diffusion
- CO4 Analyze Flow field problems
- CO5 Explain the Turbulence models and Mesh generation techniques

**TEXT BOOKS:**

1. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw Hill Publishing Company Ltd., 2017.
2. Versteeg, H.K., and Malalasekera, W., "An Introduction to Computational Fluid Dynamics: The finite volume Method", Pearson Education Ltd, Second Edition, 2007.

**REFERENCES:**

1. Anil W. Date "Introduction to Computational Fluid Dynamics" Cambridge University Press, 2005.
2. Chung, T.J. "Computational Fluid Dynamics", Cambridge University, Press, 2002.
3. Ghoshdastidar P.S., "Heat Transfer", Oxford University Press, 2005
4. Muralidhar, K., and Sundararajan, T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi, 2014.
5. Patankar, S.V. "Numerical Heat Transfer and Fluid Flow", Hemisphere Publishing Corporation, 2004

**AE8711**

**AIRCRAFT SYSTEMS LABORATORY**

**L T P C  
0 0 4 2**

**OBJECTIVE:**

- To train the students "ON HAND" experience in maintenance of various air frame systems in aircraft and rectification of common snags.

**LIST OF EXPERIMENTS**

1. Aircraft "Jacking Up" procedure
2. Aircraft "Levelling" procedure
3. Control System "Rigging check" procedure
4. Aircraft "Symmetry Check" procedure
5. "Flow test" to assess of filter element clogging
6. "Pressure Test" To assess hydraulic External/Internal Leakage
7. "Functional Test" to adjust operating pressure
8. "Pressure Test" procedure on fuel system components
9. "Brake Torque Load Test" on wheel brake units
10. Maintenance and rectification of snags in hydraulic and fuel systems.

**TOTAL: 60 PERIODS**

**OUTCOME:**

- Ability to understand to procedure involved in maintenance of various air frame systems

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S.No.	Items	Quantity	Experiment No.
1.	Serviceable aircraft with all above systems	1	1,2,3,4,5,6,7,8,9,10
2.	Hydraulic Jacks (Screw Jack)	5	1,2,4,8
3.	Trestle adjustable	5	1,2,4,8
4.	Spirit Level	2	8
5.	Levelling Boards	2	8
6.	Cable Tensiometer	1	8
7.	Adjustable Spirit Level	1	8
8.	Plumb Bob	1	8

**AE8712****FLIGHT INTEGRATION SYSTEMS AND CONTROL LABORATORY****L T P C****0 0 4 2****OBJECTIVE:**

- This laboratory is to train students, to study about basic digital electronics circuits, various microprocessor applications in Control surface, Displays fault tolerant computers, to study the stability analysis and design using MATLAB.

**LIST OF EXPERIMENTS**

1. Addition/Subtraction of 8 bit and 16 bit data for control surface deflection.
2. Sorting of Data in Ascending & Descending order for voting mechanism.
3. Sum of a given series with and without carry for identifying flap data.
4. Greatest in a given series & Multi-byte addition in BCD mode.
5. Addition/Subtraction of binary numbers using adder and Subtractor circuits.
6. Multiplexer & Demultiplexer Circuits
7. Encoder and Decoder circuits.
8. Stability analysis using Root locus, Bode plot techniques.
9. Design of lead, lag and lead –lag compensator for aircraft dynamics.
10. Performance Improvement of Aircraft Dynamics by Pole placement technique.

**TOTAL: 60 PERIODS****OUTCOMES:**

- Ability to understand digital electronics circuits.
- Ability to use microprocessor in Flight control
- Ability to perform stability analysis

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S.No	Details of Equipments	Quantity	Experiment Nos.
1.	Microprocessor 8085 Kit	10	1,2,3,4
2.	Adder/Subtractor Binary bits Kit	10	5
3.	Encoder Kit	10	7
4.	Decoder Kit	10	7
5.	Multiplexer Kit	10	6
6.	Demultiplexer Kit	10	6
7.	computers	10	8,9,10
8.	Regulated power supply	10	5,6,7
9.	Standard Mathematical analysis software	-	8,9,10

**OBJECTIVES:**

Each group of students is assigned to continue the structural design part of the airplane. The following are the assignments are to be carried out.

1. Preliminary design of an aircraft wing – Shrenck's curve, structural load distribution, shear force, bending moment and torque diagrams
2. Detailed design of an aircraft wing – Design of spars and stringers, bending stress and shear flow calculations – buckling analysis of wing panels
3. Preliminary design of an aircraft fuselage – load distribution on an aircraft fuselage
4. Detailed design of an aircraft fuselage – design of bulkheads and longerons – bending stress and shear flow calculations – buckling analysis of fuselage panels
5. Design of control surfaces - balancing and maneuvering loads on the tail plane and aileron, rudder loads
6. Design of wing-root attachment
7. Landing gear design
8. Preparation of a detailed design report with CAD drawings

**TOTAL: 30 PERIODS****OUTCOME:**

- On completion of Aircraft design project II the students will be in a position to design aircraft wings, fuselage, loading gears etc., and also able to angle the design in terms of structural point of view.

**OBJECTIVE:**

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL: 300 PERIODS****OUTCOME:**

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

**OBJECTIVES:**

- This course aims at introducing the students to the basic concepts of engineering design and product development with focus on the front end processes.
- At the end of this course the student is expected to demonstrate an understanding of the overview of all the product development processes and knowledge of concept generation and selection tools.

**UNIT I INTRODUCTION****9**

Need for developing products – the importance of engineering design – types of design –the design process – relevance of product lifecycle issues in design –designing to codes and standards- societal considerations in engineering design –generic product development process – various phases of product development-planning for products –establishing markets- market segments- relevance of market research

**UNIT II CUSTOMER NEEDS****9**

Identifying customer needs –voice of customer –customer populations- hierarchy of human needs- need gathering methods – affinity diagrams – needs importance- establishing engineering characteristics-competitive benchmarking- quality function deployment- house of quality- product design specification-case studies

**UNIT III CREATIVE THINKING****9**

Creative thinking –creativity and problem solving- creative thinking methods- generating design concepts-systematic methods for designing –functional decomposition – physical decomposition – functional representation –morphological methods-TRIZ- axiomatic design

**UNIT IV DECISION MAKING AND PRODUCT ARCHITECTURE****9**

Decision making –decision theory –utility theory –decision trees –concept evaluation methods – Pugh concept selection method- weighted decision matrix –analytic hierarchy process – introduction to embodiment design –product architecture – types of modular architecture –steps in developing product architecture

**UNIT V DESIGN AND COST ANALYSIS****9**

Industrial design – human factors design –user friendly design – design for serviceability – design for environment – prototyping and testing – cost evaluation –categories of cost – overhead costs – activity based costing –methods of developing cost estimates – manufacturing cost –value analysis in costing

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. Anita Goyal, Karl T Ulrich, Steven D Eppinger, "Product Design and Development ", 4th Edition, 2009, Tata McGraw-Hill Education, ISBN-10-007-14679-9
2. Kevin Otto, Kristin Wood, "Product Design", Indian Reprint 2015, Pearson Education,ISBN 9788177588217

**REFERENCES**

1. Clive L.Dym, Patrick Little, "Engineering Design: A Project-based Introduction", 3rd Edition, John Wiley & Sons, 2009, ISBN 978-0-470-22596-7.
2. George E.Dieter, Linda C.Schmidt, "Engineering Design", McGraw-Hill International Edition, 4th Edition, 2009, ISBN 978-007-127189-9.
3. Yousef Haik, T. M. M. Shahin, "Engineering Design Process", 2nd Edition Reprint, Cengage Learning, 2010, ISBN 0495668141

**OBJECTIVE:**

- To introduce concepts of satellite injection and satellite perturbations, trajectory computation for interplanetary travel and flight of ballistic missiles based on the fundamental concepts of orbital mechanics.

**UNIT I SPACE ENVIRONMENT****8**

Peculiarities of space environment and its description– effect of space environment on materials of spacecraft structure and astronauts- manned space missions – effect on satellite life time

**UNIT II BASIC CONCEPTS AND THE GENERAL N- BODY PROBLEM****10**

The solar system – reference frames and coordinate systems – terminology related to the celestial sphere and its associated concepts – Kepler’s laws of planetary motion and proof of the laws – Newton’s universal law of gravitation - the many body problem - Lagrange-Jacobi identity – the circular restricted three body problem – libration points – the general N-body problem – two body problem – relations between position and time.

**UNIT III SATELLITE INJECTION AND SATELLITE PERTURBATIONS****10**

General aspects of satellite injection – satellite orbit transfer – various cases – orbit deviations due to injection errors – special and general perturbations – Cowell’s method and Encke’s method – method of variations of orbital elements – general perturbations approach.

**UNIT IV INTERPLANETARY TRAJECTORIES****8**

Two-dimensional interplanetary trajectories – fast interplanetary trajectories – three dimensional interplanetary trajectories – launch of interplanetary spacecraft – trajectory estimation about the target planet – concept of sphere of influence – Lambert’s theorem

**UNIT V BALLISTIC MISSILE TRAJECTORIES****9**

Introduction to ballistic missile trajectories – boost phase – the ballistic phase – trajectory geometry – optimal flights – time of flight – re-entry phase – the position of impact point – influence coefficients.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Ability to perform satellite injection, satellite perturbations and trajectory control
- Apply orbital mechanics to control ballistic missile.
- Estimate the trajectory/orbit of a space vehicle or a satellite in a suitable coordinate system.
- Calculate the delta-v required for transferring a spacecraft from one orbit to another.
- Perform orbit perturbation analysis for satellite orbits.

**TEXT BOOKS:**

1. Cornilisse, J.W., “Rocket Propulsion and Space Dynamics”, J.W. Freeman & Co.,Ltd, London, 1982
2. Parker, E.R., “Materials for Missiles and Spacecraft”, Mc.Graw Hill Book Co. Inc., 1982.

**REFERENCE:**

1. Sutton, G.P., “Rocket Propulsion Elements”, John Wiley & Sons Inc., New York, 5<sup>th</sup> Edition, 1993.

**OBJECTIVE**

- To teach the students about the basic concepts of aircraft general engineering and maintenance practices.

**UNIT I AIRCRAFT GROUND HANDLING AND SUPPORT EQUIPMENT 9**

Mooring, jacking, leveling and towing operations – Preparation – Equipment – precautions – Engine starting procedures – Piston engine, turboprops and turbojets – Engine fire extinguishing – Ground power unit.

**UNIT II GROUND SERVICING OF VARIOUS SUB SYSTEMS 9**

Air conditioning and pressurization – Oxygen and oil systems – Ground units and their maintenance.

**UNIT III MAINTENANCE OF SAFETY AND AIRCRAFT SYSTEM PROCESSES 9**

Shop safety – Environmental cleanliness – Precautions- Hand tools – Precision instruments – Special tools and equipments in an airplane maintenance shop – Identification terminology

**UNIT IV INSPECTION 9**

Process – Purpose – Types – Inspection intervals – Techniques – Checklist – Special inspection – Publications, bulletins, various manuals – FAR Air worthiness directives – Type certificate Data sheets – ATA Specifications

**UNIT V AIRCRAFT HARDWARE, MATERIALS, SYSTEM PROCESSES 9**

Specification and correct use of various aircraft hardware (i.e. nuts, bolts, rivets, screws) – American and British systems of specifications – Threads, gears, bearings, – Drills, tapes and reamers – Identification of all types of fluid line fittings. Materials, metallic and non-metallic Plumbing connectors – Cables – Swaging procedures, tests, Advantages of swaging over splicing.

**TOTAL :45 PERIODS**

**OUTCOMES**

- Knowledge in various ground support system for aircraft operations
- Ability to carryout ground servicing of critical aircraft systems
- Knowledge in specifications standards of aircraft hardware systems.
- Grasp the ground handling procedures and types of equipments with special maintenance
- Ability to do shop safety, Environment cleanliness in an aircraft materials shop
- Understand the FAA airworthiness regulations and the checklist involved in each inspection of aircraft

**TEXT BOOK**

- Kroes Watkins Delp, "Aircraft Maintenance and Repair", McGraw Hill, New York, 1993

**REFERENCES**

- A&P Mechanics, "Aircraft Hand Book", F A A Himalayan Book House, New Delhi, 1996
- A&P Mechanics, "General Hand Book", F A A Himalayan Bok House, New Delhi, 1996

**OBJECTIVE:**

- To impart knowledge on various modes of heat transfer and methods of solving problems. Also to give exposure to numerical methods employed to solve heat transfer problems.

**UNIT I CONDUCTION****8**

Governing equation in cartesian, cylindrical and spherical coordinates. 1-D steady state heat conduction with and without heat generation. composite wall- electrical analogy – critical thickness of insulation – heat transfer from extended surface – effect of temperature on conductivity- 1-D transient analysis

**UNIT II CONVECTION****12**

Review of basic equations of fluid flow – dimensional analysis- forced convection – laminar flow over flat plate and flow through pipes-flow across tube banks. turbulent flow over flat plate and flow through pipes – free convection – heat transfer from vertical plate using integral method – empirical relations - types of heat exchangers – overall heat transfer coefficient – LMTD and NTU methods of analysis.

**UNIT III RADIATION****9**

Basic definitions – concept of black body - laws of black body radiation-radiation between black surfaces – radiation heat exchange between grey surfaces – radiation shielding – shape factor- electrical network analogy in thermal radiation systems.

**UNIT IV NUMERICAL METHODS IN HEAT TRANSFER****12**

1-D and 2-D steady and unsteady state heat conduction – composite walls-heat generation-variable thermal conductivity- extended surfaces analysis using finite difference method- Convective heat transfer- Stream function - vorticity method- creeping flow analysis-convection-diffusion 1-D, 2-D analysis using finite difference approximation. Numerical methods applicable to radiation heat transfer.

**UNIT V HEAT TRANSFER PROBLEMS IN AEROSPACE ENGINEERING****4**

Heat transfer problems in gas turbines, rocket thrust chambers- aerodynamic heating – ablative heat transfer

**TOTAL: 45 PERIODS****OUTCOMES:**

- Understand the difference between various modes of Heat Transfer and the Resistance Concept used in Heat Conduction.
- Learn to use the basic methods in Conduction. Understand the concept of Lump Parameter analysis and when it is applicable and earn the concepts of boundary layer.
- Learn to apply various correlation used in Convective Heat Transfer and Understand the concepts of Black Body, Grey Body, View factor, Radiation shielding.
- Design/size Heat Exchanger and understand the concept of Mass transfer, its types & laws associated with it.
- Learn to apply various technique used for high speed flow heat transfer.

**TEXT BOOKS:**

- Holman,J.P., "Heat Transfer", McGraw Hill Book Co.,Inc., New York, Sixth Edition,1991.
- Sachdeva,S.C., "Fundamentals of Engineering Heat and Mass Transfer", Wiley Eastern Ltd., New Delhi,1981.
- Yunus,A.Cengel, "Heat Transfet-A Practical Approach", Tata McGraw Hill, Second edition, 2003.

**REFERENCES:**

- Lienhard,J.H., A Heat Transfer Text Book, Prentice Hall Inc., 1981.

2. Mathur, M. and Sharma, R.P., Gas Turbine and Jet and Rocket Propulsion, Standard Publishers, New Delhi, 1988.
3. Sutton, G.P., Rocket Propulsion Elements, John Wiley and Sons, Fifth Edition, 1986.

**GE8075**

**INTELLECTUAL PROPERTY RIGHTS**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

- To give an idea about IPR, registration and its enforcement.

**UNIT I INTRODUCTION**

**9**

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO – TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

**UNIT II REGISTRATION OF IPRs**

**10**

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

**UNIT III AGREEMENTS AND LEGISLATIONS**

**10**

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

**UNIT IV DIGITAL PRODUCTS AND LAW**

**9**

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

**UNIT V ENFORCEMENT OF IPRs**

**7**

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

**TOTAL :45 PERIODS**

**OUTCOME:**

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

**TEXT BOOKS**

1. S.V. Satakar, Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002.
2. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012.

**REFERENCES**

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.
3. Prabuddha Ganguli, "Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.

**OBJECTIVE:**

To learn about basis of nanomaterial science, preparation method, types and application

**UNIT I INTRODUCTION****8**

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

**UNIT II GENERAL METHODS OF PREPARATION****9**

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

**UNIT III NANOMATERIALS****12**

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO<sub>2</sub>, MgO, ZrO<sub>2</sub>, NiO, nanoalumina, CaO, AgTiO<sub>2</sub>, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

**UNIT IV CHARACTERIZATION TECHNIQUES****9**

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques-AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

**UNIT V APPLICATIONS****7**

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

**TEXT BOOKS :**

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale Charecterisation of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

**REFERENCES:**

1. Akhlesh Lakhtakia, "The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.
2. G Timp, "Nanotechnology", AIP press/Springer, 1999.

**OBJECTIVE:**

- To make the student familiarize with the principles involved in helicopters and to study the performance and stability aspects of Helicopter under different operating conditions.

**UNIT I INTRODUCTION****9**

Helicopter as an aircraft, Basic features, Layout, Generation of lift, Main rotor, Gearbox, tail rotor, power plant, considerations on blade, flapping and feathering, Rotor controls and various types of rotor, Blade loading, Effect of solidity, profile drag, compressibility etc., Blade area required, number of Blades, Blade form, Power losses, Rotor efficiency.

**UNIT II AERODYNAMICS OF ROTOR BLADE****9**

Aerofoil characteristics in forward flight, Hovering and Vortex ring state, Blade stall, maximum lift of the helicopter calculation of Induced Power, High speed limitations; parasite drag, power loading, ground effect.

**UNIT III POWER PLANTS AND FLIGHT PERFORMANCE****9**

Piston engines, Gas turbines, Ramjet principle, Comparative performance, Horsepower required, Range and Endurance, Rate of Climb, Best Climbing speed, Ceiling in vertical climb, Autorotation.

**UNIT IV STABILITY AND CONTROL****9**

Physical description of effects of disturbances, Stick fixed Longitudinal and lateral dynamic stability, lateral stability characteristics, control response. Differences between stability and control of airplane and helicopter.

**UNIT V ROTOR VIBRATIONS****9**

Dynamic model of the rotor, Motion of the rigid blades, flapping motion, lagging motion, feathering motion, Properties of vibrating system, phenomenon of vibration, fuselage response, vibration absorbers, Measurement of vibration in flight. Rotor Blade Design: General considerations, Airfoil selection, Blade construction, Materials, Factors affecting weight and cost, Design conditions, Stress analysis.

**TOTAL: 45 PERIODS****OUTCOMES:**

- To perform the Aerodynamics calculation of Rotor blade
- To perform stability and control characteristics of Helicopter
- To perform and control Rotor vibration
- Apply Momentum and simple blade element theories to helicopter's rotor blades.
- Analyze the power requirements in forward flight and associated stability problems of helicopter.

**TEXT BOOKS:**

- John Fay, "The Helicopter and How It Flies", Himalayan Books 1995
- Lalit Gupta, "Helicopter Engineering", Himalayan Books New Delhi 1996

**REFERENCES:**

- Joseph Schafer, "Basic Helicopter Maintenance", Jeppesen 1980
- R W Prouty, Helicopter Aerodynamics, Phillips Pub Co, 1993.

**OBJECTIVES:**

- To make the students to familiarize with the Aircraft engine maintenance procedure and practice.
- Must have knowledge of basics of Aeronautics and engine components.

**UNIT I PISTON ENGINES****9**

Carburation and Fuel injection systems for small and large engines - Ignition system components - spark plug detail - Engine operating conditions at various altitudes – Engine power measurements – Classification of engine lubricants and fuels – Induction, Exhaust and cooling system - Maintenance and inspection check to be carried out. Inspection and maintenance and trouble shooting - Inspection of all engine components - Daily and routine checks - Overhaul procedures - Compression testing of cylinders - Special inspection schedules - Engine fuel, control and exhaust systems - Engine mount and super charger - Checks and inspection procedures.

**UNIT II PROPELLERS****9**

Propeller theory - operation, construction assembly and installation - Pitch change mechanism- Propeller axially system- Damage and repair criteria - General Inspection procedures - Checks on constant speed propellers - Pitch setting, Propeller Balancing, Blade cuffs, Governor/Propeller operating conditions – Damage and repair criteria.

**UNIT III JET ENGINES****9**

Types of jet engines – Fundamental principles – Bearings and seals - Inlets - compressors- turbines-exhaust section – classification and types of lubrication and fuels- Materials used - Details of control, starting around running and operating procedures – Inspection and Maintenance- permissible limits of damage and repair criteria of engine components- internal inspection of engines- compressor washing- field balancing of compressor fans- Component maintenance procedures - Systems maintenance procedures - use of instruments for online maintenance - Special inspection procedures-Foreign Object Damage - Blade damage .

**UNIT IV TESTING AND INSPECTION****9**

Symptoms of failure - Fault diagnostics - Case studies of different engine systems - Rectification during testing equipments for overhaul: Tools and equipments requirements for various checks and alignment during overhauling - Tools for inspection - Tools for safety and for visual inspection - Methods and instruments for non destructive testing techniques - Equipment for replacement of parts and their repair. Engine testing: Engine testing procedures and schedule preparation - Online maintenance.

**UNIT V OVERHAULING****9**

Engine Overhaul - Overhaul procedures - Inspections and cleaning of components - Repairs schedules for overhaul - Balancing of Gas turbine components. Trouble Shooting: Procedures for trouble shooting - Condition monitoring of the engine on ground and at altitude - engine health monitoring and corrective methods.

**TOTAL:45 PERIODS****OUTCOMES:**

- Apply maintenance procedure to Aircraft Engines
- Identify the engine components and faults
- Apply non destructive testing procedures to identify the defects
- Apply overhauling procedure to new engines

**TEXT BOOK:**

1. Kroes & Wild, "Aircraft Power plants ", 7th Edition - McGraw Hill, New York, 1994.

**REFERENCES:**

1. Turbomeca, " Gas Turbine Engines ", The English Book Store ", New Delhi, 1993.
2. United Technologies Pratt & Whitney, "The Aircraft Gas turbine Engine and its Operation", The English Book Store, New Delhi.

**OBJECTIVE:**

- To make the students to understand the basic concepts of UAV systems design.

**UNIT I INTRODUCTION TO UAV****9**

History of UAV –classification – Introduction to Unmanned Aircraft Systems--models and prototypes – System Composition-applications

**UNIT II THE DESIGN OF UAV SYSTEMS****9**

Introduction to Design and Selection of the System- Aerodynamics and Airframe Configurations- Characteristics of Aircraft Types- Design Standards and Regulatory Aspects-UK,USA and Europe- Design for Stealth--control surfaces-specifications.

**UNIT III AVIONICS HARDWARE****9**

Autopilot – AGL-pressure sensors-servos-accelerometer –gyros-actuators- power supply-processor, integration, installation, configuration, and testing

**UNIT IV COMMUNICATION PAYLOADS AND CONTROLS****9**

Payloads-Telemetry-tracking-Aerial photography-controls-PID feedback-radio control frequency range –modems-memory system-simulation-ground test-analysis-trouble shooting

**UNIT V THE DEVELOPMENT OF UAV SYSTEMS****9**

Waypoints navigation-ground control software- System Ground Testing- System In-flight Testing- Future Prospects and Challenges-Case Studies – Mini and Micro UAVs.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Ability to design UAV system
- Ability to identify different hardware for UAV
- Prepare preliminary design requirements for an unmanned aerial vehicle.
- Perform system testing for unmanned aerial vehicles.
- Integrate various systems of unmanned aerial vehicle.
- Design micro aerial vehicle systems by considering practical limitations.

**TEXT BOOKS:**

1. Paul G Fahlstrom, Thomas J Gleason, "Introduction to UAV Systems", UAV Systems, Inc, 1998
2. Reg Austin "Unmanned Aircraft Systems UAV design, development and deployment", Wiley, 2010.

**REFERENCES:**

1. Dr. Armand J. Chaput, "Design of Unmanned Air Vehicle Systems", Lockheed Martin Aeronautics Company, 2001
2. Kimon P. Valavanis, "Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy", Springer, 2007
3. Robert C. Nelson, Flight Stability and Automatic Control, McGraw-Hill, Inc, 1998.



**OBJECTIVES:**

- To study the effect of time dependent forces on mechanical systems and to get the natural characteristics of system with more degree of freedom systems.
- To study the aeroelastic effects of aircraft wing.

**UNIT I SINGLE DEGREE OF FREEDOM SYSTEMS 10**

Introduction to simple harmonic motion, D'Alembert's principle, free vibrations – damped vibrations – forced vibrations, with and without damping – support excitation – transmissibility - vibration measuring instruments.

**UNIT II MULTI DEGREE OF FREEDOM SYSTEMS 10**

Two degrees of freedom systems - static and dynamic couplings - vibration absorber- Multi degree of freedom systems - principal co-ordinates - principal modes and orthogonal conditions - Eigen value problems - Hamilton's principle - Lagrangean equations and application.

**UNIT III CONTINUOUS SYSTEMS 8**

Vibration of elastic bodies - vibration of strings – longitudinal, lateral and torsional vibrations

**UNIT IV APPROXIMATE METHODS 9**

Approximate methods - Rayleigh's method - Dunkerley's method – Rayleigh-Ritz method, matrix iteration method.

**UNIT V ELEMENTS OF AEROELASTICITY 8**

Vibration due to coupling of bending and torsion - aeroelastic problems - Collars triangle - wing divergence - aileron control reversal – flutter – buffeting. – elements of servo elasticity

**TOTAL: 45 PERIODS****OUTCOMES**

- Gaining understanding of single and multi degree vibrating systems
- Ability to use numerical techniques for vibration problems
- Knowledge acquired in aero elasticity and fluttering.
- Differentiate types of vibrations according to dampness and particle motion.
- Solve Rayleigh and Holzer method to find natural frequency of an object.
- Understand the formation of Aileron reversal, flutter and wing divergence.

**TEXT BOOKS:**

1. Grover. G.K., "Mechanical Vibrations", 7<sup>th</sup> Edition, Nem Chand Brothers, Roorkee, India, 2003
2. Leonard Meirovitch, "Elements of Vibration Analysis". McGraw Hill International Edition, 2007
3. Thomson W T, 'Theory of Vibration with Application' - CBS Publishers, 1990.

**REFERENCES:**

1. Bisplinghoff R.L., Ashely H and Hogman R.L., "Aeroelasticity", Addison Wesley Publication, New York, 1983.
2. Den Hartog, "Mechanical Vibrations" Crastre Press, 2008.
3. TSE. F.S., Morse, I.F., Hinkle, R.T., "Mechanical Vibrations" – Prentice Hall, New York, 1984.
4. William W Seto, "Mechanical Vibrations" – McGraw Hill, Schaum Series.
5. William Weaver, Stephen P. Timoshenko, Donovan H. Yound, Donovan H. Young. 'Vibration Problems in Engineering' – John Wiley and Sons, New York, 2001

**OBJECTIVES:**

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

**UNIT I INTRODUCTION TO DISASTERS 9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

**UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

**UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

**UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

**UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

**TOTAL: 45 PERIODS****OUTCOMES:**

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management.

**TEXT BOOKS:**

1. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
2. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IAS and Sage Publishers, New Delhi, 2010.
3. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
4. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]

**REFERENCES**

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy, 2009.

**AE8009****AIRFRAME MAINTENANCE AND REPAIR****L T P C  
3 0 0 3****OBJECTIVE:**

- To make the students to understand the Airframe components and the tools used to maintain the components. Defect investigation, methods to carry out investigation and the detailed maintenance and practice procedures.

**UNIT I MAINTENANCE OF AIRCRAFT STRUCTURAL COMPONENTS 9**

Equipments used in welding shop and their maintenance - Ensuring quality welds - Welding jigs and fixtures - Soldering and brazing – laser welding.

Sheet metal repair and maintenance: Selection of materials; Repair schemes; Fabrication of replacement patches; Tools - power/hand; Repair techniques; Peening - Close tolerance fasteners; Sealing compounds; forming/shaping; Calculation of weight of completed repair; Effect of weight - change on surrounding structure. Sheet metal inspection - N.D.T. Testing. Riveted repair design - Damage investigation - Reverse engineering.

**UNIT II PLASTICS AND COMPOSITES IN AIRCRAFT 9**

Review of types of plastics used in airplanes - Maintenance and repair of plastic components - Repair of cracks and holes - various repairs schemes - Scopes.

Cleaning of fibre reinforced plastic (FRP) materials prior to repair; Break test - Repair Schemes; FRP/honeycomb sandwich materials; laminated FRP structural members and skin panels; Tools/equipment; Vacuum-bag process. Special precautions – Autoclaves

**UNIT III AIRCRAFT JACKING, ASSEMBLY AND RIGGING 9**

Airplane jacking and weighing and C.G. Location. Balancing of control surfaces - Inspection maintenance. Helicopter flight controls. Tracking and balancing of main rotor.

**UNIT IV REVIEW OF HYDRAULIC AND PNEUMATIC SYSTEM 10**

Trouble shooting and maintenance practices - Service and inspection - Inspection and maintenance of landing gear systems. - Inspection and maintenance of air-conditioning and pressurization system, water and waste system. Installation and maintenance of Instruments - handling - Testing - Inspection. Inspection and maintenance of auxiliary systems - Rain removal system - Position and warning system - Auxiliary Power Units (APUs).

**UNIT V SAFETY PRACTICES 8**

Hazardous materials storage and handling, Aircraft furnishing practices - Equipments. Trouble shooting. Theory and practices.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Students who successfully complete this course will be able to:

- Identify and apply the principles of function and safe operation to aircraft as per FAA
- Understand general airframe structural repairs, the structural repair manual and structural control programme.
- Understand the nature of airframe structural component inspection, corrosion repair and non-destructive inspection
- Understand aircraft component disassembly, reassembly and troubleshooting
- Know about aircraft adhesives, sealants, bonding techniques, repair procedures and the types and detection of defects in aircraft composite materials
- Identify, install, inspect, fabricate and repair aircraft sheet metal and synthetic, material structures.

**TEXT BOOK:**

1. Kroes, Watkins, Delp, "Aircraft Maintenance and Repair", McGraw Hill, New York, 1992.

**REFERENCES:**

1. Brimm D.J. Bogges H.E., "Aircraft Maintenance", Pitman Publishing corp., New York, 1940.
2. Delp. Bent and Mckinely "Aircraft Maintenance Repair", McGraw Hill, New York, 1987.
3. Larry Reithmeir, "Aircraft Repair Manual", Palamar Books, Marquette, 1992.

**AE8010****FATIGUE AND FRACTURE****L T P C**  
**3 0 0 3****OBJECTIVE:**

- To understand the basic concepts involved in fatigue analysis and to study the importance of fracture mechanics in aerospace applications.

**UNIT I FATIGUE OF STRUCTURES****7**

S.N. curves - Endurance limits - Effect of mean stress, Goodman, Gerber and Soderberg relations and diagrams - Notches and stress concentrations - Neuber's stress concentration factors - Plastic stress concentration factors - Notched S.N. curves – Fatigue of composite materials.

**UNIT II STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR****10**

Low cycle and high cycle fatigue - Coffin - Manson's relation - Transition life - cyclic strain hardening and softening - Analysis of load histories - Cycle counting techniques -Cumulative damage - Miner's theory - Other theories.

**UNIT III PHYSICAL ASPECTS OF FATIGUE****10**

Phase in fatigue life - Crack initiation - Crack growth - Final Fracture - Dislocations - fatigue fracture surfaces.

**UNIT IV FRACTURE MECHANICS****10**

Strength of cracked bodies - Potential energy and surface energy - Griffith's theory - Irwin - Orwin extension of Griffith's theory to ductile materials - stress analysis of "cracked bodies - Effect of thickness on fracture toughness" - stress intensity factors for typical 'geometries.

**UNIT V FATIGUE DESIGN AND TESTING****8**

Safe life and Fail-safe design philosophies - Importance of Fracture Mechanics in aerospace structures - Application to composite materials and structures.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Ability to apply mathematical knowledge to define fatigue behaviors
- Ability to perform fatigue design

- Ability to analyse the fracture due to fatigue
- Analyze for cumulative damage due to fatigue.
- Analyze for crack initiation & crack growth.
- Analyze damage tolerant structures

**TEXT BOOKS:**

1. Barrois W, Ripely, E.L., "Fatigue of aircraft structure," Pergamon press. Oxford, 1983.
2. Prasanth Kumar, "Elements of fracture mechanics", Wheeter publication, 1999.

**REFERENCES:**

1. Kare Hellan ,'Introduction to Fracture Mechanics', McGraw Hill, Singapore, 1985
2. Knott, J.F., "Fundamentals of Fracture Mechanics," - Buterworth & Co., Ltd., London, 1983.
3. Sih C.G., "Mechanics of fracture." Vol - I, Sijthoff and w Noordhoff International Publishing Co., Netherlands, 1989.

**OBJECTIVE:**

- To gain insights about the importance of lean manufacturing and six sigma practices.

**UNIT I LEAN & SIX SIGMA BACKGROUND AND FUNDAMENTALS 9**

Historical Overview – Definition of quality – What is six sigma -TQM and Six sigma - lean manufacturing and six sigma- six sigma and process tolerance – Six sigma and cultural changes – six sigma capability – six sigma need assessments - implications of quality levels, Cost of Poor Quality (COPQ), Cost of Doing Nothing – assessment questions

**UNIT II THE SCOPE OF TOOLS AND TECHNIQUES 9**

Tools for definition – IPO diagram, SIPOC diagram, Flow diagram, CTQ Tree, Project Charter – Tools for measurement – Check sheets, Histograms, Run Charts, Scatter Diagrams, Cause and effect diagram, Pareto charts, Control charts, Flow process charts, Process Capability Measurement, Tools for analysis – Process Mapping, Regression analysis, RU/CS analysis, SWOT, PESTLE, Five Whys, interrelationship diagram, overall equipment effectiveness, TRIZ innovative problem solving – Tools for improvement – Affinity diagram, Normal group technique, SMED, 5S, mistake proofing, Value stream Mapping, forced field analysis – Tools for control – Gantt chart, Activity network diagram, Radar chart, PDCA cycle, Milestone tracker diagram, Earned value management.

**UNIT III SIX SIGMA METHODOLOGIES 9**

Design For Six Sigma (DFSS), Design For Six Sigma Method - Failure Mode Effect Analysis (FMEA), FMEA process - Risk Priority Number (RPN)- Six Sigma and Leadership, committed leadership – Change Acceleration Process (CAP)- Developing communication plan – Stakeholder.

**UNIT IV SIX SIGMA IMPLEMENTATION AND CHALLENGES 9**

Tools for implementation – Supplier Input Process Output Customer (SIPOC) – Quality Function Deployment or House of Quality (QFD) – alternative approach –implementation – leadership training, close communication system, project selection – project management and team – champion training – customer quality index – challenges – program failure, CPQ vs six sigma, structure the deployment of six sigma – cultural challenge – customer/internal metrics.

**UNIT V EVALUATION AND CONTINUOUS IMPROVEMENT METHODS 9**

Evaluation strategy – the economics of six sigma quality, Return on six Sigma (ROSS), ROI , poor project estimates – continuous improvement – lean manufacturing – value, customer focus, Perfection, focus on waste, overproduction – waiting, inventory in process (IIP), processing waste, transportation, motion, making defective products, underutilizing people – Kaizen – 5S.

**TOTAL: 45 PERIODS****OUTCOMES:**

Upon completion of this course student can able to

- Understand the fundamentals of Lean and Six sigma.
- Understand the tools and techniques used in analysis.
- Understand the six sigma methodologies.
- Understand the implementation and challenges in six sigma.
- Understand the evaluation and continuous improvement methods.

**REFERENCES:**

- Forrest W. Breyfogle, III, James M. Cupello, Becki Meadows, Managing Six Sigma:A Practical
- Fred Soleimannejed , Six Sigma, Basic Steps and Implementation, Author House, 2004  
Guide to Understanding, Assessing, and Implementing the Strategy That Yields Bottom-Line Success, John Wiley & Sons, 2000 .
- James P. Womack, Daniel T.Jones, Lean Thinking, Free Press Business, 2003
- Michael L.George, David Rownalds, Bill Kastle, What is Lean Six Sigma, McGraw – Hill 2003
- Thomas Pyzdek, The Six Sigma Handbook, McGraw-Hill, 2000.

<b>ME8097</b>	<b>NON DESTRUCTIVE TESTING AND EVALUATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVE:**

- To study and understand the various Non Destructive Evaluation and Testing methods, theory and their industrial applications.

**UNIT I OVERVIEW OF NDT 9**

NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterisation. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT., Visual inspection – Unaided and aided.

**UNIT II SURFACE NDE METHODS 9**

Liquid Penetrant Testing - Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results. Magnetic Particle Testing- Theory of magnetism, inspection materials Magnetisation methods, Interpretation and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism.

**UNIT III THERMOGRAPHY AND EDDY CURRENT TESTING (ET) 9**

Thermography- Principles, Contact and non contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation - infrared radiation and infrared detectors, Instrumentations and methods, applications. Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.

**UNIT IV ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION (AE) 9**

Ultrasonic Testing-Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A/Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight Diffraction. Acoustic Emission Technique –Principle, AE parameters, Applications

**UNIT V RADIOGRAPHY (RT) 9**

Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of films - graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Computed Radiography, Computed Tomography

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Explain the fundamental concepts of NDT
- CO2 Discuss the different methods of NDE
- CO3 Explain the concept of Thermography and Eddy current testing
- CO4 Explain the concept of Ultrasonic Testing and Acoustic Emission
- CO5 Explain the concept of Radiography

**TEXT BOOKS:**

- Baldev Raj, T.Jayakumar, M.Thavasimuthu “Practical Non-Destructive Testing”, Narosa Publishing House, 2014.
- Ravi Prakash, “Non-Destructive Testing Techniques”, 1st revised edition, New Age International Publishers, 2010



Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation - **Sustenance** -Maintenance and Repair – Enhancements - **Product EoL** - Obsolescence Management – Configuration Management - EoL Disposal

**UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY 9**

**The Industry** - Engineering Services Industry - Product Development in Industry versus Academia –**The IPD Essentials** - Introduction to Vertical Specific Product Development processes -Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and Software Systems – Product Development Trade-offs - Intellectual Property Rights and Confidentiality – Security and Configuration Management.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

**TEXTBOOKS:**

1. Book specially prepared by NASSCOM as per the MoU.
2. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2011.
3. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, 2005.

**REFERENCES:**

1. Hiriappa B, "Corporate Strategy – Managing the Business", Author House, 2013.
2. Peter F Drucker, "People and Performance", Butterworth – Heinemann [Elsevier], Oxford, 2004.
3. Vinod Kumar Garg and Venkita Krishnan N K, "Enterprise Resource Planning – Concepts", Second Edition, Prentice Hall, 2003.
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2013

**GE8074**

**HUMAN RIGHTS**

**L T P C  
3 0 0 3**

**OBJECTIVE :**

- To sensitize the Engineering students to various aspects of Human Rights.

**UNIT I**

**9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

**UNIT II**

**9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

**UNIT III**

**9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

**UNIT IV** **9**  
Human Rights in India – Constitutional Provisions / Guarantees.

**UNIT V** **9**  
Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

**TOTAL : 45 PERIODS**

**OUTCOME :**

- Engineering students will acquire the basic knowledge of human rights.

**REFERENCES:**

1. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
2. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

**AE8011** **HYPERSONIC AERODYNAMICS** **L T P C**  
**3 0 0 3**

**OBJECTIVE:**

- To introduce fundamental concepts and features peculiar to hypersonic flow to students to familiarize them with the aerodynamical aspects of hypersonic vehicles and the general hypersonic flow theory.

**UNIT I** **FUNDAMENTALS OF HYPERSONIC AERODYNAMICS** **9**

Introduction to hypersonic aerodynamics – differences between hypersonic aerodynamics and supersonic aerodynamics - concept of thin shock layers and entropy layers – hypersonic flight paths – hypersonic similarity parameters – shock wave and expansion wave relations of inviscid hypersonic flows.

**UNIT II** **SIMPLE SOLUTION METHODS FOR HYPERSONIC INVISCID FLOWS** **9**

Local surface inclination methods – Newtonian theory – modified Newtonian law – tangent wedge and tangent cone and shock expansion methods – approximate methods - hypersonic small disturbance theory – thin shock layer theory.

**UNIT III** **VISCOUS HYPERSONIC FLOW THEORY** **9**

Boundary layer equations for hypersonic flow – hypersonic boundary layers – self similar and non self similar boundary layers – solution methods for non self similar boundary layers – aerodynamic heating and its adverse effects on airframe.

**UNIT IV** **VISCOUS INTERACTIONS IN HYPERSONIC FLOWS** **9**

Introduction to the concept of viscous interaction in hypersonic flows - Strong and weak viscous interactions - hypersonic viscous interaction similarity parameter – introduction to shock wave boundary layer interactions.

**UNIT V** **HIGH TEMPERATURE EFFECTS in HYPERSONIC FLOWS** **9**

Nature of high temperature flows – chemical effects in air – real and perfect gases – Gibb’s free energy and entropy - chemically reacting boundary layers – recombination and dissociation.

**TOTAL: 45 PERIODS**

**OUTCOMES**

- Knowledge in basics of hypersonic and supersonic aerodynamics
- Acquiring knowledge in theory of hypersonic flow.
- Understanding of boundary layers of hypersonic flow and viscous interaction
- Role of chemical and temperature effects in hypersonic flow.

**TEXT BOOK:**

1. John D. Anderson. Jr., “Hypersonic and High Temperature Gas Dynamics”, Mc.Graw hill Series, New York, 1996.

**REFERENCES:**

1. John D. Anderson. Jr., “Modern Compressible flow with historical Perspective”, Mc.Graw Hill Publishing Company, New York, 1996.
2. John T. Bertin, “Hypersonic Aerothermodynamics”, published by AIAA Inc., Washington.D.C., 1994.

**AE8012**

**WIND TUNNEL TECHNIQUES**

**L T P C**  
**3 0 0 3**

**OBJECTIVE**

- The students are exposed to various types and techniques of Aerodynamic data generation on aerospace vehicle configurations in the aerospace industry.

**UNIT I LOW SPEED WIND TUNNELS**

**10**

Classification –non-dimensional numbers-types of similarities - Layout of open circuit and closed circuit subsonic wind tunnels – design parameters-energy ratio - HP calculations - Calibration methods.

**UNIT II HIGH SPEED WIND TUNNELS**

**9**

Blow down, in draft and induction tunnel layouts and their design features -Transonic, and supersonic tunnels- peculiar features of these tunnels and operational difficulties - sample design calculations and calibration methods.

**UNIT III SPECIAL WIND TUNNEL TECHNIQUES**

**8**

Types of Special Wind Tunnels – Hypersonic, Gun and Shock Tunnels – Design features and calibration methods- Intake tests – store carriage and separation tests - wind tunnel model design for these tests

**UNIT IV WIND TUNNEL INSTRUMENTATION**

**10**

Instrumentation and sensors required for both steady and unsteady measurements – Force measurements using three component and six component balances – calibration of measuring instruments – error estimation and uncertainty analysis.

**UNIT V FLOW VISUALIZATION and NON-INTRUSIVE FLOW DIAGNOSTICS**

**8**

Smoke and Tuft grid techniques – Dye injection special techniques – Oil flow visualization and PSP techniques - Optical methods of flow visualization – PIV and Laser Doppler techniques – Image processing and data deduction

**TOTAL: 45 PERIODS**

**OUTCOMES**

Ability to use various techniques of Aerodynamic data generation.

- Understand the working principle of Blow down, In draft tunnels and their specifications

- Knowledge about horizontal buoyancy, flow angularities while carrying out calibration
- Understand the working principle of component axis balance and internal balances
- Ability to carry out the smoke and tuft flow visualisation procedures in WT testing

**TEXT BOOKS:**

1. NAL-UNI Lecture Series 12:" Experimental Aerodynamics", NAL SP 98 01 April 1998
2. Rae, W.H. and Pope, A., "Low Speed Wind Tunnel Testing", John Wiley Publication, 1984.

**REFERENCES:**

1. Bradsaw "Experimental Fluid Mechanics".
2. Lecture course on Advanced Flow diagnostic techniques 17-19 September 2008 NAL, Bangalore
3. Pope, A., and Goin, L., "High Speed Wind Tunnel Testing", John Wiley, 1985.
4. Rathakrishnan, E., "Instrumentation, Measurements, and Experiments in Fluids," CRC Press – Taylor & Francis, 2007.
5. Short term course on Flow visualization techniques, NAL , 2009

**AE8013**

**ROCKETS AND MISSILES**

**L T P C**  
**3 0 0 3**

**OBJECTIVE**

- To give revelation on basic concepts of rocket motion, rocket aerodynamics, staging & control of rockets, materials and propulsion systems of rockets and missiles to students to augment their knowledge in the region of rockets and missile flight.

**UNIT I CLASSIFICATION OF ROCKETS AND MISSILES**

**6**

History of rockets and missiles, Various methods of classification of missiles and rockets – Basic aerodynamic characteristics of surface to surface, surface to air, air to surface and air to air missiles – Examples of various Indian space launch vehicles and missiles – Current status of Indian rocket and missile programme.

**UNIT II ROCKET MOTION IN FREE SPACE AND GRAVITATIONAL FIELD**

**10**

One Dimensional and Two Dimensional rocket Motions in Free Space and Homogeneous Gravitational Fields – description of Vertical, Inclined and Gravity Turn Trajectories – Determination of range and Altitude, Simple Approximations to Burnout Velocity and altitude-estimation of culmination time and altitude.

**UNIT III AERODYNAMICS OF ROCKETS AND MISSILES**

**10**

Airframe Components of Rockets and Missiles – Forces Acting on a Missile While Passing Through Atmosphere – Classification of Missiles – methods of Describing Aerodynamic Forces and Moments – Lateral Aerodynamic Moment – Lateral Damping Moment and Longitudinal Moment of a Rocket – lift and Drag Forces – Drag Estimation.

**UNIT IV STAGING AND CONTROL OF ROCKETS AND MISSILES**

**10**

Multistaging of rockets and ballistic missiles – Multistage Vehicle Optimization – Stage Separation Dynamics – Stage Separation Techniques in atmosphere and in space, Introduction to aerodynamic and jet control methods – various types of aerodynamic control methods for tactical and short range missiles- aerodynamic characteristics - various types of rocket thrust vector control methods.

**UNIT V ROCKET PROPULSION SYSTEMS AND MATERIALS FOR ROCKETS AND MISSILES**

**9**

Ignition System in rockets – types of Igniters– Design Consideration of liquid Rocket Combustion Chamber, Injector Propellant Feed Lines, Valves, Propellant Tanks Outlet and propellant feed

Systems – Propellant Slash and Propellant Hammer – Elimination of Geysering Effect in Missiles – Selection of Materials – Special Requirements of Materials to Perform under Adverse Conditions.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- To be able to know about the current scenario of rockets and missiles.
- To gain knowledge about the trajectory motion of rockets and missiles.
- Gaining information on aerodynamic characteristics of rockets and missiles.
- To expand the ability to design the staging and control of own rockets.
- Basic knowledge about the propulsion systems and materials used in rockets and missiles.

**TEXT BOOKS**

1. Cornelisse, J.W., “Rocket Propulsion and Space Dynamics”, J.W., Freeman & Co. Ltd., London, 1982.
2. Sutton, G.P., et al., “Rocket Propulsion Elements”, John Wiley & Sons Inc., New York, 1993.

**REFERENCES**

1. Mathur, M., and Sharma, R.P., “Gas Turbines and Jet and Rocket Propulsion”, Standard Publishers, New Delhi 1998.
2. Parker, E.R., “Materials for Missiles and Spacecraft”, McGraw-Hill Book Co. Inc., 1982.

**AE8014**

**STRUCTURAL DYNAMICS**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

- To study the effect of periodic and a periodic forces on mechanical systems with matrix approach and also to get the natural characteristics of large sized problems using approximate methods.

**UNIT I FORCE DEFLECTION PROPERTIES OF STRUCTURES 9**

Constraints and Generalized coordinates – Virtual work and generalized forces – Force – Deflection influence functions – stiffness and flexibility methods.

**UNIT II PRINCIPLES OF DYNAMICS 9**

Free and forced vibrations of systems with finite degrees of freedom – Response to periodic excitation – Impulse Response Function – Convolution Integral

**UNIT III NATURAL MODES OF VIBRATION 9**

Equations of motion for Multi degree of freedom Systems - Solution of Eigen value problems – Normal coordinates and orthogonality Conditions. Modal Analysis.

**UNIT IV ENERGY METHODS 9**

Rayleigh’s principle – Rayleigh – Ritz method – Coupled natural modes – Effect of rotary inertia and shear on lateral vibrations of beams – Natural vibrations of plates.

**UNIT V APPROXIMATE METHODS 9**

Approximate methods of evaluating the Eigen frequencies and eigen vectors by reduced, subspace, Lanczos, Power, Matrix condensation and QR methods.

**TOTAL: 45 PERIODS**

**OUTCOMES**

- Knowing various options of mathematical modeling of structures

- Method of evaluating the response of structures under various dynamically loaded conditions
- Knowledge in natural modes of vibration of structures
- Gaining knowledge in numerical and approximate methods of evaluating natural modes of vibration.

**TEXT BOOKS:**

1. Hurty. W.C. and M.F. Rubinstein, "Dynamics of Structures", Prentice Hall of India Pvt. Ltd., New Delhi 1987.
2. Tse. F.S., Morse. I.E. and Hinkle. H.T., "Mechanical Vibrations: Theory and Applications" , Prentice Hall of India Pvt. Ltd, New Delhi, 2004.

**REFERENCES:**

1. Ramamurthi. V., "Mechanical Vibration Practice and Noise Control" Narosa Publishing House Pvt. Ltd, 2008
2. Timoshenko. S.P., and D.H. Young, "Vibration Problems in Engineering", John Willey & Sons Inc., 1984.
3. Vierck. R.K., "Vibration Analysis", 2<sup>nd</sup> Edition, Thomas Y. Crowell & Co Harper & Row Publishers, New York, U.S.A. 1989.

**AE8015**

**INDUSTRIAL AERODYNAMICS**

**L T P C  
3 0 0 3**

**OBJECTIVE:**

- To familiarize the learner with non-aeronautical uses of aerodynamics such as road vehicle, building aerodynamics and problems of flow induced vibrations.

**UNIT I            ATMOSPHERE**

**9**

Types of winds, Causes of variation of winds, Atmospheric boundary layer, Effect of terrain on gradient height, Structure of turbulent flows.

**UNIT II            WIND ENERGY COLLECTORS**

**9**

Horizontal axis and vertical axis machines, Power coefficient, Betz coefficient by momentum theory.

**UNIT III          VEHICLE AERODYNAMICS**

**9**

Power requirements and drag coefficients of automobiles, Effects of cut back angle, Aerodynamics of trains and Hovercraft.

**UNIT IV          BUILDING AERODYNAMICS**

**9**

Pressure distribution on low rise buildings, wind forces on buildings. Environmental winds in city blocks, Special problems of tall buildings, Building codes, Building ventilation and architectural aerodynamics.

**UNIT V          FLOW INDUCED VIBRATIONS**

**9**

Effects of Reynolds number on wake formation of bluff shapes, Vortex induced vibrations, Galloping and stall flutter.

**TOTAL: 45 PERIODS**

**OUTCOMES**

- Use of aerodynamics for non- aerodynamics such as vehicle, building.
- Solve the problems and able to analyse vibrations during flow
- Identify the Atmospheric boundary layer and applications of wind energy collectors.
- Analyze the aerodynamics of road vehicles, buildings and problems of flow induced vibrations.

**TEXT BOOKS:**

1. M.Sovran (Ed), "Aerodynamics and drag mechanisms of bluff bodies and Road vehicles", Plenum press, New York, 1978.
2. Sachs. P., "Winds forces in Engineering", Pergamon Press, 1978.

**REFERENCES:**

1. Blevins. R.D., "Flow Induced Vibrations", Van Nostrand, 1990.
2. Calvent. N.G., "Wind Power Principles", Charles Griffin & Co., London, 1979.

**PR8491****COMPUTER INTEGRATED MANUFACTURING****L T P C  
3 0 0 3****OBJECTIVE:**

- To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

**UNIT I INTRODUCTION****9**

Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM – Concurrent Engineering-CIM concepts – Computerised elements of CIM system – Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance – Simple problems – Manufacturing Control – Simple Problems – Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In-Time Production.

**UNIT II PRODUCTION PLANNING AND CONTROL AND COMPUTER AIDED PROCESS PLANNING****9**

Process planning – Computer Aided Process Planning (CAPP) – Logical steps in Computer Aided Process Planning – Aggregate Production Planning and the Master Production Schedule – Material Requirement planning – Capacity Planning- Control Systems-Shop Floor Control-Inventory Control – Brief on Manufacturing Resource Planning-II (MRP-II) & Enterprise Resource Planning (ERP) - Simple Problems.

**UNIT III CELLULAR MANUFACTURING****9**

Group Technology(GT), Part Families – Parts Classification and coding – Simple Problems in Opitz Part Coding system – Production flow Analysis – Cellular Manufacturing – Composite part concept – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing – Rank Order Clustering Method - Arranging Machines in a GT cell – Hollier Method – Simple Problems.

**UNIT IV FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED GUIDED VEHICLE SYSTEM (AGVS)****9**

Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control– Quantitative analysis in FMS – Simple Problems. Automated Guided Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety.

**UNIT V INDUSTRIAL ROBOTICS****9**

Robot Anatomy and Related Attributes – Classification of Robots- Robot Control systems – End Effectors – Sensors in Robotics – Robot Accuracy and Repeatability - Industrial Robot Applications – Robot Part Programming – Robot Accuracy and Repeatability – Simple Problems.

**TOTAL : 45 PERIODS****OUTCOMES:**

Student will be able to

- Describe about the classical production system, the components of CIM .
- Explain the concept of Computer Aided Process Planning (CAPP) and Material Requirements Planning (MRP)
- Illustrate the cellular manufacturing using Rank order, Clustering and Hollier method

- Explain Flexible Manufacturing system and applications of Automated Guided Vehicles in the implementation of CIM..
- Describe the configurations of Industrial Robots, and their part programming.
- Understand the use of computers in various Manufacturing support systems.

**TEXT BOOKS:**

1. Mikell.P.Groover “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India, 2008.
2. Radhakrishnan P, Subramanyan S.and Raju V., “CAD/CAM/CIM”, 2nd Edition, New Age International (P) Ltd, New Delhi, 2004.

**REFERENCES:**

1. Gideon Halevi and Roland Weill, “Principles of Process Planning – A Logical Approach” Chapman & Hall, London, 1995.
2. Kant Vajpayee S, “Principles of Computer Integrated Manufacturing”, Prentice Hall India, 2003.
3. Rao. P, N Tewari &T.K. Kundra, “Computer Aided Manufacturing”, Tata McGraw Hill Publishing Company, 2000.

**AE8016**

**FLIGHT INSTRUMENTATION**

**L T P C**  
**3 0 0 3**

**UNIT I MEASUREMENT SCIENCE AND DISPLAYS 9**

Instrumentation brief review-Concept of measurement-Errors and error estimation- Functional elements of an instrument system –Transducers - classification - Static and dynamic characteristics- calibration - classification of aircraft instruments - Instrument displays panels and cockpit layout.

**UNIT II AIR DATA INSTRUMENTS AND SYNCHRO TRANSMISSION SYSTEMS 9**

Air data instruments-airspeed, altitude, Vertical speed indicators. Static Air temperature, Angle of attack measurement, Synchronous data transmission system

**UNIT III GYROSCOPIC INSTRUMENTS 9**

Gyroscope and its properties, gyro system, Gyro horizon, Direction gyro-direction indicator, Rate gyro-rate of turn and slip indicator, Turn coordinator, acceleration and turning errors.

**UNIT IV AIRCRAFT COMPASS SYSTEMS &FLIGHT MANAGEMENT SYSTEM 9**

Direct reading compass, magnetic heading reference system-detector element, monitored gyroscope system, DGU, RMI, deviation compensator. FMS- Flight planning-flight path optimization-operational modes-4D flight management

**UNIT V POWER PLANT INSTRUMENTS 9**

Pressure measurement, temperature measurement, fuel quantity measurement, engine power and control instruments-measurement of RPM, manifold pressure, torque, exhaust gas temperature, EPR, fuel flow, engine vibration, monitoring.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Understand the available basic concepts of Flight instruments to the engineers.
- Understand the necessary knowledge that are needed in significance and operations of Flight instruments.
- The students will also have an exposure to various topics such as measurement concepts, air data sensors and measurements, Flight Management Systems, and other instruments pertaining to Gyroscopic measurements and Engine data measurements
- Student will be able to deploy these skills effectively in understanding and analyzing the instrumentation methods in avionics engineering.

**REFERENCES:**

1. Doeblin.E.O, "Measurement Systems Application and Design", McGraw-Hill, New York, 1999.
2. HarryL.Stilz, "Aerospace Telemetry", Vol I to IV, Prentice-Hall Space Technology Series.
3. Murthy, D.V.S., "Transducers and Measurements", McGraw-Hill, 1995
4. Pallet, E.H.J. "Aircraft Instruments & Integrated systems", Longman Scientific and Technical, McGraw-Hill, 1992.

**AE8017**

**THEORY OF ELASTICITY**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

- To make the student understand the elastic behavior of different structural components under various loadings and boundary conditions.

**UNIT I BASIC EQUATIONS OF ELASTICITY 9**

Definition of Stress and Strain: Stress - Strain relationships - Equations of Equilibrium, Compatibility equations, Boundary Conditions, Saint Venant's principle - Principal Stresses, Stress Ellipsoid - Stress invariants

**UNIT II PLANE STRESS AND PLANE STRAIN PROBLEMS 9**

Airy's stress function, Bi-harmonic equations, Polynomial solutions, Simple two dimensional problems in Cartesian coordinates like bending of cantilever and simply supported beams.

**UNIT III POLAR COORDINATES 9**

Equations of equilibrium, Strain - displacement relations, Stress – strain relations, Airy's stress function, Axi – symmetric problems, Introduction to Dunder's table, Curved beam analysis, Lamé's, Kirsch, Michell's and Boussinesque problems – Rotating discs.

**UNIT IV TORSION 9**

Navier's theory, St. Venant's theory, Prandtl's theory on torsion, semi- inverse method and applications to shafts of circular, elliptical, equilateral triangular and rectangular sections. Membrane Analogy.

**UNIT V INTRODUCTION TO THEORY OF PLATES AND SHELLS 9**

Classical plate theory – Assumptions – Governing equations – Boundary conditions – Navier's method of solution for simply supported rectangular plates – Levy's method of solution for rectangular plates under different boundary conditions.

**TOTAL: 45 PERIODS**

**OUTCOMES**

- Ability to use mathematical knowledge to solve problem related to structural elasticity.
- Identify stress-strain relation in 3D, principal stress and principal strain.
- Analyze a structure using Elasticity concepts.
- Use analytical techniques to predict deformation, internal force and failure of simple solids and structural components.
- Solve aerospace-relevant problems in plane strain and plane stress in Cartesian and polar coordinates.

**TEXT BOOKS:**

1. Ansel C Ugural and Saul K Fenster, "Advanced Strength and Applied Elasticity", 4<sup>th</sup> Edition, Prentice Hall, New Jersey, 2003.

- Bhaskar, K., and Varadan, T. K., "Theory of Isotropic/Orthotropic Elasticity", CRC Press USA, 2009.
- Timoshenko, S., and Goodier, T.N., "Theory of Elasticity", McGraw – Hill Ltd., Tokyo, 1990.

**REFERENCES:**

- Barber, J. R., "Elasticity", Kluwer Academic Publishers, 2004
- Sokolnikoff, I. S., "Mathematical Theory of Elasticity", McGraw – Hill, New York, 1978.
- Volterra & J.H. Caines, "Advanced Strength of Materials", Prentice Hall, New Jersey, 1991
- Wang, C. T., "Applied Elasticity", McGraw – Hill Co., New York, 1993.

**AE8018**

**AIR TRAFFIC CONTROL AND PLANNING**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

- To study the procedure of the formation of aerodrome and its design and air traffic control.

**UNIT I BASIC CONCEPTS**

**9**

Objectives of air traffic control systems - Parts of ATC services – Scope and Provision of ATCs – VFR & IFR operations – Classification of ATS air spaces – Various kinds of separation – Altimeter setting procedures – Establishment, designation and identification of units providing ATS – Division of responsibility of control.

**UNIT II AIR TRAFFIC SYSTEMS**

**9**

Area control service, assignment of cruising levels - minimum flight altitude - ATS routes and significant points – RNAV and RNP – Vertical, lateral and longitudinal separations based on time / distance –ATC clearances – Flight plans – position report

**UNIT III FLIGHT INFORMATION SYSTEMS**

**10**

Radar service, Basic radar terminology – Identification procedures using primary / secondary radar – performance checks – use of radar in area and approach control services – assurance control and co-ordination between radar / non radar control – emergencies – Flight information and advisory service – Alerting service – Co-ordination and emergency procedures – Rules of the air.

**UNIT IV AERODROME DATA**

**9**

Aerodrome data - Basic terminology – Aerodrome reference code – Aerodrome reference point – Aerodrome elevation – Aerodrome reference temperature – Instrument runway, physical Characteristics; length of primary / secondary runway – Width of runways – Minimum distance between parallel runways etc. – obstacles restriction.

**UNIT V NAVIGATION AND OTHER SERVICES**

**8**

Visual aids for navigation Wind direction indicator – Landing direction indicator – Location and characteristics of signal area – Markings, general requirements – Various markings – Lights, general requirements – Aerodrome beacon, identification beacon – Simple approach lighting system and various lighting systems – VASI & PAPI - Visual aids for denoting obstacles; object to be marked and lighter – Emergency and other services.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Understanding the requirement of air traffic control systems and types of air traffic control system.
- Knowledge in flight information systems and rules of air traffic systems.
- Knowledge in direction indicator systems for air navigation.

**TEXT BOOK**

- AIP (India) Vol. I & II, "The English Book Store", 17-1, Connaught Place, New Delhi.

## REFERENCES

1. "Aircraft Manual (India) Volume I", latest Edition – The English Book Store, 17-1, Connaught Place, New Delhi.
2. "PANS – RAC – ICAO DOC 4444", Latest Edition, The English Book Store, 17-1, Connaught Place, New Delhi.

**MG8591**

## **PRINCIPLES OF MANAGEMENT**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **OBJECTIVE:**

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization

### **UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9**

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations, system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

### **UNIT II PLANNING 9**

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

### **UNIT III ORGANISING 9**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

### **UNIT IV DIRECTING 9**

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

### **UNIT V CONTROLLING 9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

**TOTAL: 45 PERIODS**

### **OUTCOME:**

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

### **TEXT BOOKS:**

1. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6<sup>th</sup> Edition, Pearson Education, 2004.
2. Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall (India) Pvt. Ltd., 10<sup>th</sup> Edition, 2009.

**REFERENCES:**

1. Harold Koontz & Heinz Weihrich, "Essentials of Management", Tata McGraw Hill, 1998.
2. Robert Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008.
3. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management", 7<sup>th</sup> Edition, Pearson Education, 2011.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata McGraw Hill, 1999

**GE8076****PROFESSIONAL ETHICS IN ENGINEERING****L T P C**  
**3 0 0 3****OBJECTIVE:**

- To enable the students to create an awareness on Engineering Ethics and Human Values to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

**UNIT I HUMAN VALUES****10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

**UNIT II ENGINEERING ETHICS****9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

**UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION****9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

**UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS****9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

**UNIT V GLOBAL ISSUES****8**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility.

**TOTAL: 45 PERIODS****OUTCOME:**

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

**TEXT BOOKS:**

1. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
2. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi,

2003.

**REFERENCES:**

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
4. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd., New Delhi, 2013.
6. World Community Service Centre, ' Value Education', Vethathiri publications, Erode, 2011.

**Web sources:**

1. [www.onlineethics.org](http://www.onlineethics.org)
2. [www.nspe.org](http://www.nspe.org)
3. [www.globalethics.org](http://www.globalethics.org)
4. [www.ethics.org](http://www.ethics.org)

**ANNA UNIVERSITY, CHENNAI**  
**AFFILIATED INSTITUTIONS**  
**B.TECH. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**REGULATIONS – 2017**  
**CHOICE BASED CREDIT SYSTEM**

**PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

1. To provide graduates with the proficiency to utilize the fundamental knowledge of basic sciences, mathematics, Artificial Intelligence, data science and statistics to build systems that require management and analysis of large volume of data.
2. To enrich graduates with necessary technical skills to pursue pioneering research in the field of AI and Data Science and create disruptive and sustainable solutions for the welfare of ecosystems.
3. To enable graduates to think logically, pursue lifelong learning and collaborate with an ethical attitude in a multidisciplinary team.
4. To enable the graduates to design and model AI based solutions to critical problem domains in the real world.
5. To enrich the innovative thoughts and creative ideas of the graduates for effective contribution towards economy building.

**PROGRAM OUTCOMES (POs) ENGINEERING GRADUATES WILL BE ABLE TO:**

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and Artificial Intelligence and Data Science basics to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### **Programme Specific Outcomes**

1. Graduates should be able to evolve AI based efficient domain specific processes for effective decision making in several domains such as business and governance domains.
2. Graduates should be able to arrive at actionable Fore sight, Insight, hind sight from data for solving business and engineering problems
3. Graduates should be able to create, select and apply the theoretical knowledge of AI and Data Analytics along with practical industrial tools and techniques to manage and solve wicked societal problems
4. Graduates should be capable of developing data analytics and data visualization skills, skills pertaining to knowledge acquisition, knowledge representation and knowledge engineering, and hence capable of coordinating complex projects.
5. Graduates should be able to carry out fundamental research to cater the critical needs of the society through cutting edge technologies of AI.

**ANNA UNIVERSITY, CHENNAI**  
**AFFILIATED INSTITUTIONS**  
**B.TECH. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**REGULATIONS – 2017**  
**CHOICE BASED CREDIT SYSTEM**  
**I - VIII SEMESTERS CURRICULUM**  
**SEMESTER I**

SI. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	HS8151	Communicative English	HS	4	4	0	0	4
2.	MA8151	Engineering Mathematics – I	BS	4	4	0	0	4
3.	PH8151	Engineering Physics	BS	3	3	0	0	3
4.	CY8151	Engineering Chemistry	BS	3	3	0	0	3
5.	GE8151	Problem Solving and Python Programming	ES	3	3	0	0	3
6.	GE8152	Engineering Graphics	ES	6	2	0	4	4
<b>PRACTICALS</b>								
7.	GE8161	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
8.	BS8161	Physics and Chemistry Laboratory	BS	4	0	0	4	2
<b>TOTAL</b>				<b>31</b>	<b>19</b>	<b>0</b>	<b>12</b>	<b>25</b>

**SEMESTER II**

SI. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	HS8251	Technical English	HS	4	4	0	0	4
2.	MA8252	Linear Algebra	BS	4	4	0	0	4
3.	AD8251	Data Structures Design	PC	3	3	0	0	3
4.	GE8291	Environmental Science and Engineering	BS	3	3	0	0	3
5.	BE8255	Basic Electrical, Electronics, and Measurement Engineering	ES	3	3	0	0	3
6.	AD8252	Digital Principles and Computer Organization	ES	5	3	0	2	4
<b>PRACTICALS</b>								
7.	GE8261	Engineering Practices Laboratory	ES	4	0	0	4	2
8.	AD8261	Data Structures Design Laboratory	PC	4	0	0	4	2
<b>TOTAL</b>				<b>30</b>	<b>20</b>	<b>0</b>	<b>10</b>	<b>25</b>

### SEMESTER III

SI. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MA8351	Discrete Mathematics	BS	4	4	0	0	4
2.	AD8301	Introduction to Operating Systems	PC	5	3	0	2	4
3.	AD8302	Fundamentals of Data Science	PC	3	3	0	0	3
4.	CS8392	Object Oriented Programming	PC	3	3	0	0	3
5.	AD8351	Design and Analysis of Algorithms	PC	5	3	0	2	4
<b>PRACTICALS</b>								
6.	AD8311	Data Science Laboratory	PC	4	0	0	4	2
7.	CS8383	Object Oriented Programming Laboratory	PC	4	0	0	4	2
8.	HS8381	Interpersonal Skills/Listening & Speaking	HS	2	0	0	2	1
<b>TOTAL</b>				<b>30</b>	<b>16</b>	<b>0</b>	<b>14</b>	<b>23</b>

### SEMESTER IV

SI. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MA8391	Probability and Statistics	BS	4	4	0	0	4
2.	AD8401	Database Design and Management	PC	3	3	0	0	3
3.	AD8402	Artificial Intelligence I	PC	3	3	0	0	3
4.	AD8403	Data Analytics	PC	3	3	0	0	3
5.		Professional Elective I	PE	3	3	0	0	3
<b>PRACTICALS</b>								
6.	AD8411	Database Design and Management Laboratory	PC	4	0	0	4	2
7.	AD8412	Data Analytics Laboratory	PC	4	0	0	4	2
8.	AD8413	Artificial Intelligence – I Laboratory	PC	4	0	0	4	2
9.	HS8461	Advanced Reading and Writing	HS	2	0	0	2	1
<b>TOTAL</b>				<b>30</b>	<b>16</b>	<b>0</b>	<b>14</b>	<b>23</b>

### SEMESTER V

Sl. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	AD8501	Optimization Techniques	PC	4	4	0	0	4
2.	CW8691	Computer Networks	PC	5	3	0	2	4
3.	AD8502	Data Exploration and Visualization	PC	5	3	0	2	4
4.	AD8551	Business Analytics	PC	3	3	0	0	3
5.	AD8552	Machine Learning	PC	3	3	0	0	3
6.		Open Elective I	OE	3	3	0	0	3
<b>PRACTICALS</b>								
7.	AD8511	Machine Learning Laboratory	PC	4	0	0	4	2
8.	AD8512	Mini Project on Data Sciences Pipeline	PC	4	0	0	4	2
<b>TOTAL</b>				<b>31</b>	<b>19</b>	<b>0</b>	<b>12</b>	<b>25</b>

### SEMESTER VI

Sl. No	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	AD8601	Artificial Intelligence II	PC	3	3	0	0	3
2.	AD8602	Data and Information Security	PC	3	3	0	0	3
3.	IT8501	Web Technology	PC	3	3	0	0	3
4.		Professional Elective II	PE	3	3	0	0	3
5.		Professional Elective III	PE	3	3	0	0	3
<b>PRACTICALS</b>								
6.	IT8511	Web Technology Laboratory	PC	4	0	0	4	2
7.	AD8611	Artificial Intelligence - II Laboratory	PC	4	0	0	4	2
8.	HS8581	Professional Communication	HS	2	0	0	2	1
9.	AD8612	Socially relevant Project	PC	4	0	0	4	2
<b>TOTAL</b>				<b>29</b>	<b>15</b>	<b>0</b>	<b>14</b>	<b>22</b>

**SEMESTER VII**

SI. No	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	AD8701	Deep Learning	PC	3	3	0	0	3
2.	AD8702	Text Analytics	PC	3	3	0	0	3
3.	AD8703	Basics of Computer Vision	PC	3	3	0	0	3
4.	AD8704	Big Data Management	PC	5	3	0	2	4
5.	AD8705	AI and Robotics	PC	5	3	0	2	4
6.		Open Elective II	OE	3	3	0	0	3
<b>PRACTICALS</b>								
7.	AD8711	Deep Learning Laboratory	PC	4	0	0	4	2
8.	AD8712	Mini Project on Analytics	PC	4	0	0	4	2
<b>TOTAL</b>				<b>30</b>	<b>18</b>	<b>0</b>	<b>12</b>	<b>24</b>

**SEMESTER VIII**

SI. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.		Professional Elective IV	PE	3	3	0	0	3
2.		Professional Elective V	PE	3	3	0	0	3
<b>PRACTICALS</b>								
3.	AD8811	Project Work	PC	20	0	0	20	10
<b>TOTAL</b>				<b>26</b>	<b>6</b>	<b>0</b>	<b>20</b>	<b>16</b>

**TOTAL NO. OF CREDITS: 183****PROFESSIONAL ELECTIVES (PE)****SEMESTER IV, ELECTIVE - I**

SI. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	EC8691	Microprocessors and Microcontrollers	PE	3	3	0	0	3
2.	AD8001	Software Development Processes	PE	3	3	0	0	3
3.	AD8002	Health care Analytics	PE	3	3	0	0	3
4.	AD8003	Mobile Applications Development	PE	3	3	0	0	3
5.	AD8004	Parallel Computing	PE	3	3	0	0	3

**SEMESTER VI, ELECTIVE - II**

SI. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	AD8005	Embedded Systems and Programming	PE	3	3	0	0	3
2.	CW8591	Software Architecture	PE	3	3	0	0	3
3.	AD8006	Engineering Predictive Analytics	PE	3	3	0	0	3
4.	CS8603	Distributed Systems	PE	3	3	0	0	3
5.	CS8072	Agile Methodologies	PE	3	3	0	0	3

**SEMESTER VI, ELECTIVE - III**

SI. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	CS8081	Internet of Things	PE	3	3	0	0	3
2.	AD8007	Software Testing and Quality Assurance	PE	3	3	0	0	3
3.	CS8791	Cloud Computing	PE	3	3	0	0	3
4.	CS8085	Social Network Analytics	PE	3	3	0	0	3
5.	AD8008	Web Services and API Design	PE	3	3	0	0	3

**SEMESTER VIII, ELECTIVE - IV**

SI. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	AD8009	Operations and Supply Chain Management	PE	3	3	0	0	3
2.	AD8010	Speech Processing and Analytics	PE	3	3	0	0	3
3.	AD8011	Cyber Security	PE	3	3	0	0	3
4.	AD8012	Nonlinear Optimization	PE	3	3	0	0	3
5.	AD8013	Ethics Of Artificial Intelligence	PE	3	3	0	0	3

**SEMESTER VIII, ELECTIVE - V**

SI. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	AD8014	Engineering Economics	PE	3	3	0	0	3
2.	AD8081	Cognitive Science and Analytics	PE	3	3	0	0	3
3.	MG8591	Principles of Management	PE	3	3	0	0	3
4.	AD8015	Bio-inspired Optimization Techniques	PE	3	3	0	0	3
5.	AD8016	Information Extraction and Retrieval	PE	3	3	0	0	3

**OBJECTIVES:**

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

**UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS 12**

**Reading-** short comprehension passages, practice in skimming-scanning and predicting- **Writing-** completing sentences- - developing hints. **Listening-** short texts- short formal and informal conversations. **Speaking-** introducing oneself - exchanging personal information- **Language development-** Wh- Questions- asking and answering-yes or no questions- parts of speech. **Vocabulary development--** prefixes- suffixes- articles.- count/ uncount nouns.

**UNIT II GENERAL READING AND FREE WRITING 12**

**Reading** - comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- **Writing** – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –**Listening-** telephonic conversations. **Speaking** – sharing information of a personal kind—greeting – taking leave- **Language development** – prepositions, conjunctions **Vocabulary development-** guessing meanings of words in context.

**UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12**

**Reading-** short texts and longer passages (close reading) **Writing-** understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences **Listening** – listening to longer texts and filling up the table- product description- narratives from different sources. **Speaking-** asking about routine actions and expressing opinions. **Language development-** degrees of comparison- pronouns- direct vs indirect questions- **Vocabulary development** – single word substitutes- adverbs.

**UNIT IV READING AND LANGUAGE DEVELOPMENT 12**

**Reading-** comprehension-reading longer texts- reading different types of texts- magazines **Writing-** letter writing, informal or personal letters-e-mails-conventions of personal email- **Listening-** listening to dialogues or conversations and completing exercises based on them. **Speaking-** speaking about oneself- speaking about one's friend- **Language development-** Tenses- simple present-simple past- present continuous and past continuous- **Vocabulary development-** synonyms-antonyms- phrasal verbs

**UNIT V EXTENDED WRITING****12**

**Reading-** longer texts- close reading –**Writing-** brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing-**Listening** – listening to talks- conversations- **Speaking** – participating in conversations- short group conversations-**Language development**-modal verbs- present/ past perfect tense - **Vocabulary development**-collocations- fixed and semi-fixed expressions.

**TOTAL: 60 PERIODS****OUTCOMES:****AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English.

**TEXT BOOKS:**

1. Board of Editors. **Using English** A Coursebook for Undergraduate Engineers and Technologists. Orient BlackSwan Limited, Hyderabad: 2015
2. Richards, C. Jack. **Interchange Students' Book-2** New Delhi: CUP, 2015.

**REFERENCES:**

1. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge,2011.
2. Means,L. Thomas and Elaine Langlois. English & Communication For Colleges. CengageLearning ,USA: 2007
3. Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student's Book & Workbook) Cambridge University Press, New Delhi: 2005
4. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011
5. Dutt P. Kiranmai and RajeevanGeeta. Basic Communication Skills, Foundation Books: 2013.

**MA8151****ENGINEERING MATHEMATICS – I**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**OBJECTIVES :**

- The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus.
- The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions.
- This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

**UNIT I DIFFERENTIAL CALCULUS****12**

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

**UNIT II      FUNCTIONS OF SEVERAL VARIABLES      12**

Partial differentiation – Homogeneous functions and Euler’s theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor’s series for functions of two variables – Maxima and minima of functions of two variables – Lagrange’s method of undetermined multipliers.

**UNIT III      INTEGRAL CALCULUS      12**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

**UNIT IV      MULTIPLE INTEGRALS      12**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

**UNIT V      DIFFERENTIAL EQUATIONS      12**

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler’s and Legendre’s type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**After completing this course, students should demonstrate competency in the following skills:**

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.

**TEXT BOOKS :**

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 43<sup>rd</sup> Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7<sup>th</sup> Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

**REFERENCES:**

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10<sup>th</sup> Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 3<sup>rd</sup> Edition, 2007.

- Narayanan, S. and Manicavachagom Pillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
- Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
- Weir, M.D and Joel Hass, "Thomas Calculus", 12<sup>th</sup> Edition, Pearson India, 2016.

<b>PH8151</b>	<b>ENGINEERING PHYSICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.
- To make the students in understanding the importance of mechanics.
- To equip the students on the knowledge of electromagnetic waves.
- To introduce the basics of oscillations, optics and lasers.

**UNIT I PROPERTIES OF MATTER 9**

Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.

**UNIT II WAVES AND FIBER OPTICS 9**

Oscillatory motion – forced and damped oscillations: differential equation and its solution – plane progressive waves – wave equation. Lasers: population of energy levels, Einstein’s A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) – losses associated with optical fibers - fibre optic sensors: pressure and displacement.

**UNIT III THERMAL PHYSICS 9**

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conduction in solids – thermal conductivity - Forbe’s and Lee’s disc method: theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.

**UNIT IV QUANTUM PHYSICS 9**

Black body radiation – Planck’s theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger’s wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – tunnelling (qualitative) - scanning tunnelling microscope.

**UNIT V CRYSTAL PHYSICS 9**

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

**TOTAL :45 PERIODS**

## OUTCOMES:

### Upon completion of this course,

- The students will gain knowledge on the basics of properties of matter and its applications,
- The students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
- The students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
- The students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
- The students will understand the basics of crystals, their structures and different crystal growth techniques.

## TEXT BOOKS:

1. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. "Engineering Physics". Cengage Learning India, 2012.

## REFERENCES:

1. Halliday, D., Resnick, R. & Walker, J. "Principles of Physics". Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. "Physics for Scientists and Engineers". Cengage Learning, 2010.
3. Tipler, P.A. & Mosca, G. "Physics for Scientists and Engineers with Modern Physics". W.H. Freeman, 2007.

CY8151

ENGINEERING CHEMISTRY

L T P C

3 0 0 3

## OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

## UNIT I WATER AND ITS TREATMENT

9

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

## UNIT II SURFACE CHEMISTRY AND CATALYSIS

9

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions – adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – kinetics of surface reactions, unimolecular reactions, Langmuir -

applications of adsorption on pollution abatement. Catalysis: Catalyst – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis– Michaelis – Menten equation.

### **UNIT III ALLOYS AND PHASE RULE**

**9**

Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

### **UNIT IV FUELS AND COMBUSTION**

**9**

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel. Combustion of fuels: Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

### **UNIT V ENERGY SOURCES AND STORAGE DEVICES**

**9**

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H<sub>2</sub>-O<sub>2</sub> fuel cell.

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

#### **TEXT BOOKS:**

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

#### **REFERENCES:**

4. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
5. PrasantaRath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
6. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

**OBJECTIVES:**

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures — lists, tuples, dictionaries.
- To do input/output with files in Python.

**UNIT I ALGORITHMIC PROBLEM SOLVING 9**

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

**UNIT II DATA, EXPRESSIONS, STATEMENTS 9**

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

**UNIT III CONTROL FLOW, FUNCTIONS 9**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

**UNIT IV LISTS, TUPLES, DICTIONARIES 9**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

**UNIT V FILES, MODULES, PACKAGES 9**

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

**TOTAL: 45 PERIODS****OUTCOMES:****Upon completion of the course, students will be able to**

- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.

## TEXT BOOKS:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2<sup>nd</sup> edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (<http://greenteapress.com/wp/think-python/>)
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

## REFERENCES:

1. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press, 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
4. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
5. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.

GE8152

ENGINEERING GRAPHICS

L T P C  
2 0 4 4

## OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

## CONCEPTS AND CONVENTIONS (Not for Examination)

1

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

## UNIT I PLANE CURVES AND FREEHAND SKETCHING

7+12

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

## UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE

6+12

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

## UNIT III PROJECTION OF SOLIDS

5+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis

is inclined to one of the principal planes by rotating object method.

**UNIT IV      PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES**

**5+12**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

**UNIT V      ISOMETRIC AND PERSPECTIVE PROJECTIONS**

**6+12**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

**TOTAL: 90 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the student will be able to:**

- Familiarize with the fundamentals and standards of Engineering graphics
- Perform freehand sketching of basic geometrical constructions and multiple views of objects.
- Project orthographic projections of lines and plane surfaces.
- Draw projections and solids and development of surfaces.
- Visualize and to project isometric and perspective sections of simple solids.

**TEXT BOOKS:**

1. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.

**REFERENCES:**

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50<sup>th</sup> Edition, 2010.
2. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N. S. Parthasarathy and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2<sup>nd</sup> Edition, 2009.

**Publication of Bureau of Indian Standards:**

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.

5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

**Special points applicable to University Examinations on Engineering Graphics:**

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only.
4. The students will be permitted to use appropriate scale to fit solution within A3 size.
5. The examination will be conducted in appropriate sessions on the same day

**GE8161      PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY      L T P C**  
**0 0 4 2**

**OBJECTIVES:**

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

**LIST OF PROGRAMS:**

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

**PLATFORM NEEDED**

Python 3 interpreter for Windows/Linux

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

BS8161

**PHYSICS AND CHEMISTRY LABORATORY**  
(Common to all branches of B.E. / B.Tech Programmes)

L T P C  
0 0 4 2

**OBJECTIVES:**

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

**LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)**

- Determination of rigidity modulus – Torsion pendulum
- Determination of Young's modulus by non-uniform bending method
- (a) Determination of wavelength, and particle size using Laser  
(b) Determination of acceptance angle in an optical fiber.
- Determination of thermal conductivity of a bad conductor – Lee's Disc method.
- Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
- Determination of wavelength of mercury spectrum – spectrometer grating
- Determination of band gap of a semiconductor
- Determination of thickness of a thin wire – Air wedge method

**TOTAL: 30 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to**

- Apply principles of elasticity, optics and thermal properties for engineering applications.

**CHEMISTRY LABORATORY: (Any seven experiments to be conducted)**

**OBJECTIVES:**

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
  - To acquaint the students with the determination of molecular weight of a polymer by viscometry.
- Estimation of HCl using  $\text{Na}_2\text{CO}_3$  as primary standard and Determination of alkalinity in water sample.
  - Determination of total, temporary & permanent hardness of water by EDTA method.
  - Determination of DO content of water sample by Winkler's method.
  - Determination of chloride content of water sample by argentometric method.
  - Estimation of copper content of the given solution by Iodometry.
  - Determination of strength of given hydrochloric acid using pH meter.
  - Determination of strength of acids in a mixture of acids using conductivity meter.
  - Estimation of iron content of the given solution using potentiometer.
  - Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
  - Estimation of sodium and potassium present in water using flame photometer.
  - Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
  - Pseudo first order kinetics-ester hydrolysis.
  - Corrosion experiment-weight loss method.
  - Determination of CMC.
  - Phase change in a solid.

16. Conductometric titration of strong acid vs strong base.

**OUTCOMES:**

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

**TOTAL: 30 PERIODS**

**TEXTBOOK:**

1. Vogel's Textbook of Quantitative Chemical Analysis (8<sup>TH</sup> edition, 2014).

HS8251

**TECHNICAL ENGLISH**

L	T	P	C
4	0	0	4

**OBJECTIVES:**

**The Course prepares second semester engineering and Technology students to:**

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization.

**UNIT I INTRODUCTION TECHNICAL ENGLISH**

**12**

**Listening-** Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- **Speaking** –Asking for and giving directions- **Reading** – reading short technical texts from journals- newspapers- **Writing-** purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-**Vocabulary Development-** technical vocabulary **Language Development** –subject verb agreement - compound words.

**UNIT II READING AND STUDY SKILLS**

**12**

**Listening-** Listening to longer technical talks and completing exercises based on them-**Speaking** – describing a process-**Reading** – reading longer technical texts- identifying the various transitions in a text- paragraphing- **Writing-** interpreting charts, graphs- **Vocabulary Development-** vocabulary used in formal letters/emails and reports**Language Development-** impersonal passive voice, numerical adjectives.

**UNIT III TECHNICAL WRITING AND GRAMMAR**

**12**

**Listening-** Listening to classroom lectures/ talks on engineering/technology -**Speaking** – introduction to technical presentations- **Reading** – longer texts both general and technical, practice in speed reading; **Writing-**Describing a process, use of sequence words- **Vocabulary Development-** sequence words- Misspelled words. **Language Development-** embedded sentences

**UNIT IV REPORT WRITING**

**12**

**Listening-** Listening to documentaries and making notes. **Speaking** – mechanics of presentations- **Reading** – reading for detailed comprehension- **Writing-** email etiquette- job



<b>UNIT - I</b>	<b>MATRICES AND SYSTEM OF LINEAR EQUATIONS</b>	<b>12</b>
Matrices - Row echelon form - Rank - System of linear equations - Consistency - Gauss elimination method - Gauss Jordan method.		
<b>UNIT - II</b>	<b>VECTOR SPACES</b>	<b>12</b>
Real and Complex fields - Vector spaces over Real and Complex fields - Subspace - Linear space - Linear independence and dependence - Basis and dimension.		
<b>UNIT - III</b>	<b>LINEAR TRANSFORMATION</b>	<b>12</b>
Linear transformation - Rank space and null space - Rank and nullity - Dimension theorem - Matrix representation of linear transformation - Eigenvalues and eigenvectors of linear transformation.		
<b>UNIT - IV</b>	<b>INNER PRODUCT SPACES</b>	<b>12</b>
Inner product and norms - Properties - Orthogonal, Orthonormal vectors - Gram Schmidt orthonormalization process - Least square approximation.		
<b>UNIT - V</b>	<b>EIGEN VALUE PROBLEMS AND MATRIX DECOMPOSITION</b>	<b>12</b>
Eigen value Problems : Power method, Jacobi rotation method - Singular value decomposition - QR decomposition.		
		<b>TOTAL : 60 PERIODS</b>

**COURSE OUTCOMES :**

After the completion of the course the student will be able to

1. Test the consistency and solve system of linear equations
2. Find the basis and dimension of vector space
3. Obtain the matrix of linear transformation and its eigenvalues and eigenvectors
4. Find orthonormal basis of inner product space and find least square approximation
5. Find eigenvalues of a matrix using numerical techniques and perform matrix decomposition

**TEXT BOOKS :**

1. Friedberg A.H, Insel A.J. and Spence L, Linear Algebra, Prentice Hall of India, New Delhi, 2004.
2. Faires J.D. and Burden R., Numerical Methods, Brooks/Cole (Thomson Publications), New Delhi, 2002.

**REFERENCES:**

1. Kumaresan S, Linear Algebra - A geometric approach, Prentice Hall of India, New Delhi, Reprint, 2010.
2. Strang G, Linear Algebra and its applications, Thomson (Brooks / Cole) New Delhi, 2005.
3. Gerald C.F. and Wheatley P.O, Applied Numerical Analysis, Pearson Educations, New Delhi, 2002.
4. Sundarapandian V, Numerical Linear Algebra, Prentice Hall of India, New Delhi, 2008.
5. Richard Branson, Matrix Operations, Schaum's outline series, 1989.
6. Bernard Kolman, David R. Hill, Introductory Linear Algebra, Pearson Educations, New Delhi, First Reprint, 2009.



2. Aho, Hopcroft, and Ullman, "Data Structures and Algorithms", Pearson Education, 1983.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms", Second Edition, McGraw Hill, 2002.
4. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Fourth Edition, Pearson Education, 2014

**GE8291**

**ENVIRONMENTAL SCIENCE AND ENGINEERING**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY**

**14**

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

**UNIT II ENVIRONMENTAL POLLUTION**

**8**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

**UNIT III NATURAL RESOURCES**

**10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems –

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

#### **UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT**

**7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

#### **UNIT V HUMAN POPULATION AND THE ENVIRONMENT**

**6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

#### **TEXTBOOKS:**

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2<sup>nd</sup> edition, Pearson Education, 2004.

#### **REFERENCES :**

1. Dharmendra S.Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press (I) PVT, LTD, Hyderabad, 2015.
3. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.
4. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.

**OBJECTIVES:**

- To understand the fundamentals of electronic circuit constructions.
- To learn the fundamental laws, theorems of electrical circuits and also to analyze them
- To study the basic principles of electrical machines and their performance
- To study the different energy sources, protective devices and their field applications
- To understand the principles and operation of measuring instruments and transducers

**UNIT I ELECTRICAL CIRCUITS ANALYSIS 9**

Ohms Law, Kirchhoff's Law-Instantaneous power- series and parallel circuit analysis with resistive, capacitive and inductive network - nodal analysis, mesh analysis- network theorems - Thevenins theorem, Norton theorem, maximum power transfer theorem and superposition theorem, three phase supply-Instantaneous, Reactive and apparent power-star delta conversion.

**UNIT II ELECTRICAL MACHINES 9**

DC and AC ROTATING MACHINES:Types, Construction, principle, Emf and torque equation, application Speed Control- Basics of Stepper Motor – Brushless DC motors- Transformers-Introduction- types and construction, working principle of Ideal transformer-Emf equation- All day efficiency calculation.

**UNIT III UTILIZATION OF ELECTRICAL POWER 9**

Renewable energy sources-wind and solar panels. Illumination by lamps- Sodium Vapour, Mercury vapour, Fluorescent tube. Domestic refrigerator and air conditioner-Electric circuit, construction and working principle. Batteries-NiCd, Pb Acid and Li ion–Charge and Discharge Characteristics. Protection-need for earthing, fuses and circuit breakers.Energy Tariff calculation for domestic loads.

**UNIT IV ELECTRONIC CIRCUITS 9**

PN Junction-VI Characteristics of Diode, zener diode, Transistors configurations - amplifiers. Op amps- Amplifiers, oscillator,rectifiers, differentiator, integrator, ADC, DAC. Multi vibrator using 555 Timer IC . Voltage regulator IC using LM 723,LM 317.

**UNIT V ELECTRICAL MEASUREMENT 9**

Characteristic of measurement-errors in measurement, torque in indicating instruments- moving coil and moving iron meters, Energy meter and watt meter. Transducers- classification-thermo electric, RTD, Strain gauge, LVDT, LDR and piezoelectric. Oscilloscope-CRO.

**TOTAL: 45 PERIODS****OUTCOMES:****Upon completion of the course, the students will be able to:**

- Discuss the essentials of electric circuits and analysis.
- Discuss the basic operation of electric machines and transformers
- Introduction of renewable sources and common domestic loads.
- Introduction to measurement and metering for electric circuits.

**TEXT BOOKS:**

1. D.P. Kotharti and I.J Nagarath, Basic Electrical and Electronics Engineering, Mc Graw Hill, 2016,Third Edition.



6. Implementation of functions using Multiplexers.
7. Implementation of any one of the synchronous counters.
8. Implementation of a Universal Shift register.
9. Simulator based study of Computer architecture.

**TOTAL :75 PERIODS**

**TEXT BOOK:**

1. M. Morris Mano, Michael D. Ciletti, "Digital Design", Fifth Edition, Pearson Education, 2013.
2. David A. Patterson, John L. Hennessy, "Computer Organization and Design, The Hardware/Software Interface", Fifth Edition, Morgan Kaufmann/Elsevier, 2013.

**REFERENCES:**

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2012.
2. William Stallings, "Computer Organization and Architecture – Designing for Performance", Tenth Edition, Pearson Education, 2016.
3. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2008.

**GE8261**

**ENGINEERING PRACTICES LABORATORY**

**L T P C**  
**0 0 4 2**

**OBJECTIVES:**

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

**GROUP A (CIVIL & MECHANICAL)**

**I CIVIL ENGINEERING PRACTICE**

**13**

**BUILDINGS:**

- (a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

**PLUMBING WORKS:**

- (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- (b) Study of pipe connections requirements for pumps and turbines.
- (c) Preparation of plumbing line sketches for water supply and sewage works.
- (d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

- (e) Demonstration of plumbing requirements of high-rise buildings.

**CARPENTRY USING POWER TOOLS ONLY:**

- (a) Study of the joints in roofs, doors, windows and furniture.
- (b) Hands-on-exercise:  
Wood work, joints by sawing, planing and cutting.

## II MECHANICAL ENGINEERING PRACTICE

18

### WELDING:

- (a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
- (b) Gas welding practice

### BASIC MACHINING:

- (a) Simple Turning and Taper turning
- (b) Drilling Practice

### SHEET METAL WORK:

- (a) Forming & Bending:
- (b) Model making – Trays and funnels.
- (c) Different type of joints.

### MACHINE ASSEMBLY PRACTICE:

- (a) Study of centrifugal pump
- (b) Study of air conditioner

### DEMONSTRATION ON:

- (a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
- (b) Foundry operations like mould preparation for gear and step cone pulley.
- (c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

## GROUP B (ELECTRICAL & ELECTRONICS)

## III ELECTRICAL ENGINEERING PRACTICE

13

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

## IV ELECTRONICS ENGINEERING PRACTICE

16

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

**TOTAL: 60 PERIODS**

## OUTCOMES:

### On successful completion of this course, the student will be able to

- Fabricate carpentry components and pipe connections including plumbing works.
- Use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundry and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

## LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

### CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
2. Carpentry vice (fitted to work bench) 15 Nos.
3. Standard woodworking tools 15 Sets.
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools: (a) Rotary Hammer 2 Nos  
(b) Demolition Hammer 2 Nos  
(c) Circular Saw 2 Nos  
(d) Planer 2 Nos  
(e) Hand Drilling Machine 2 Nos  
(f) Jigsaw 2 Nos

### MECHANICAL

1. Arc welding transformer with cables and holders 5 Nos.
2. Welding booth with exhaust facility 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2 Nos.
5. Centre lathe 2 Nos.
6. Hearth furnace, anvil and smithy tools 2 Sets.
7. Moulding table, foundry tools 2 Sets.
8. Power Tool: Angle Grinder 2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner One each.

### ELECTRICAL

1. Assorted electrical components for house wiring 15 Sets
2. Electrical measuring instruments 10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each
4. Megger (250V/500V) 1 No.
5. Power Tools: (a) Range Finder 2 Nos  
(b) Digital Live-wire detector 2 Nos

## **ELECTRONICS**

- |   |         |
|---|---------|
| 1. Soldering guns   | 10 Nos. |
| 2. Assorted electronic components for making circuits                 | 50 Nos. |
| 3. Small PCBs   | 10 Nos. |
| 4. Multimeters  | 10 Nos. |
| 5. Study purpose items: Telephone, FM radio, low-voltage power supply |         |

**AD8261**

**DATA STRUCTURES DESIGN LABORATORY**

**L T P C**  
**0 0 4 2**

### **OBJECTIVES:**

- To implement ADTs in Python
- To design and implement linear data structures – lists, stacks, and queues
- To implement sorting, searching and hashing algorithms
- To solve problems using tree and graph structures

1. Implement simple ADTs as Python classes
2. Implement recursive algorithms in Python
3. Implement List ADT using Python arrays
4. Linked list implementations of List
5. Implementation of Stack and Queue ADTs
6. Applications of List, Stack and Queue ADTs
7. Implementation of sorting and searching algorithms
8. Implementation of Hash tables
9. Tree representation and traversal algorithms
10. Implementation of Binary Search Trees
11. Implementation of Heaps
12. Graph representation and Traversal algorithms
13. Implementation of single source shortest path algorithm
14. Implementation of minimum spanning tree algorithms

### **OUTCOMES:**

At the end of the course, the student should be able to:

- implement ADTs as Python classes
- design, implement, and analyse linear data structures, such as lists, queues, and stacks, according to the needs of different applications
- design, implement, and analyse efficient tree structures to meet requirements such as searching, indexing, and sorting
- model problems as graph problems and implement efficient graph algorithms to solve them

**TOTAL:60 PERIODS**

### **TEXT BOOK:**

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, “Data Structures & Algorithms in Python”, John Wiley & Sons Inc., 2013

### **REFERENCES:**

1. Rance D. Necaie, “Data Structures and Algorithms Using Python”, John Wiley & Sons, 2011

2. Aho, Hopcroft, and Ullman, "Data Structures and Algorithms", Pearson Education, 1983.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms", Second Edition, McGraw Hill, 2002.
4. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Fourth Edition, Pearson Education, 2014

**MA8351**

**DISCRETE MATHEMATICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**OBJECTIVES:**

- To extend student's logical and mathematical maturity and ability to deal with abstraction.
- To introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
- To understand the basic concepts of combinatorics and graph theory.
- To familiarize the applications of algebraic structures.
- To understand the concepts and significance of lattices and boolean algebra which are widely used in computer science and engineering.

**UNIT I      LOGIC AND PROOFS**

**12**

Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.

**UNIT II      COMBINATORICS**

**12**

Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications

**UNIT III      GRAPHS**

**12**

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

**UNIT IV      ALGEBRAIC STRUCTURES**

**12**

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism's – Normal subgroup and cosets – Lagrange's theorem – Definitions and examples of Rings and Fields.

**UNIT V      LATTICES AND BOOLEAN ALGEBRA**

**12**

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**At the end of the course, students would:**

- Have knowledge of the concepts needed to test the logic of a program.
- Have an understanding in identifying structures on many levels.
- Be aware of a class of functions which transform a finite set into another finite set which relates to input and output functions in computer science.
- Be aware of the counting principles.

- Be exposed to concepts and properties of algebraic structures such as groups, rings and fields.

#### **TEXTBOOKS:**

1. Rosen, K.H., "Discrete Mathematics and its Applications", 7<sup>th</sup> Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.
2. Tremblay, J.P. and Manohar.R, " Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30<sup>th</sup> Reprint, 2011.

#### **REFERENCES:**

1. Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 4<sup>th</sup> Edition, Pearson Education Asia, Delhi, 2007.
2. Lipschutz, S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3<sup>rd</sup> Edition, 2010.
3. Koshy, T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.

### **AD8301 INTRODUCTION TO OPERATING SYSTEMS**

**L T P C**  
**3 0 2 4**

#### **COURSE OBJECTIVES**

- To understand the structure and functions of OS
- To learn about Processes, Threads and Scheduling algorithms
- To understand the principles of concurrency and Deadlocks
- To learn various memory management schemes
- To study I/O management and File systems.

#### **UNIT I OPERATING SYSTEMS OVERVIEW**

**9**

Computer System Overview: Basic elements – Instruction execution – Interrupts – Memory hierarchy – Cache memory – Direct memory access – Multiprocessor and multicore organization; Operating System Overview: Objectives and functions – Evolution of operating system; Computer system organization; Operating System Structure and Operations: System calls – System programs; Operating-System Design and Implementation; Operating-System Debugging

#### **UNIT II PROCESS MANAGEMENT**

**12**

Processes: Process concept – Process scheduling – Operations on processes – Interprocess communication; Threads: Overview – Multithreading models – Thread issues; CPU Scheduling: FCFS, SJF, Priority, Round robin, Rate Monotonic and EDF scheduling; Process synchronization – Critical section problem – Mutex locks – Semaphores; Deadlocks – Avoidance – Prevention – Detection and Recovery.

#### **UNIT III MEMORY MANAGEMENT**

**8**

Main Memory: Contiguous memory allocation – Segmentation – Paging – 32 and 64 bit architecture Examples; Virtual Memory: Demand paging – Page replacement algorithms – Allocation of Frames – Thrashing.

#### **UNIT IV STORAGE MANAGEMENT**

**9**

Mass Storage Structure: Overview – Disk scheduling and management; File System Storage: File concepts – Directory and disk structure – Sharing and protection; File System Implementation: File system structure – Directory structure – Allocation methods – Free space management.

**UNIT V****CASE STUDY****7**

Linux Vs Windows: Design principles – Process management – Scheduling – Memory management – File systems; Mobile OS: iOS and Android – Introduction and architecture.

**TOTAL: 45 PERIODS****SUGGESTIVE EXPERIMENTS:**

1. Implement the various CPU Scheduling Algorithms
2. Implement Semaphores
3. Implement Bankers Algorithm for Deadlock Avoidance
4. Develop an application using Threads
5. Implement the following Memory Allocation Methods for variable sized partition: a) First Fit b) Worst Fit c) Best Fit
6. Implement Paging Technique of Memory Management
7. Implement the following Page Replacement Algorithms a) FIFO b) LRU c) LFU
8. Implement the following File Allocation Strategies a) Sequential b) Indexed c) Linked
9. Implement Shared memory and IPC
10. Implement Shared memory and IPC

**PRACTICAL: 30 PERIODS****TOTAL: 75 PERIODS****COURSE OUTCOMES**

Upon completion of the course, students will be able to:

- Outline the basic services and functionalities of operating systems
- Analyse various scheduling algorithms, and understand the different deadlock, prevention and avoidance schemes
- Illustrate the different memory management schemes
- Outline the functionality of file systems
- Compare and contrast Linux, Windows and mobile operating systems

**TEXT BOOKS**

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc, 2012.
2. Neil Smyth, "iPhone iOS 4 Development Essentials - Xcode", 4th Edition, Payload media,2011.

**REFERENCES**

1. Ramez Elmasri, A Gil Carrick, David Levine, "Operating Systems A Spiral Approach", Tata McGraw Hill Edition, 2010.
2. Achyut S Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.
3. Andrew S Tanenbaum, "Modern Operating Systems", 2nd Edition, Pearson Education, 2004.
4. Harvey M Deitel, "Operating Systems", 3rd Edition, Pearson Education, 2004.
5. Daniel P Bovet, Marco Cesati, "Understanding the Linux Kernel", 3rd edition, O'Reilly,2005.

**HARDWARE:**

1. Standalone Desktops with Linux OS

**SOFTWARE:**

1. Python

**COURSE OBJECTIVES**

- Will gain knowledge in the basic concepts of Data Analysis
- To acquire skills in data preparatory and preprocessing steps
- To understand the mathematical skills in statistics
- To learn the tools and packages in Python for data science
- To gain understanding in classification and Regression Model
- To acquire knowledge in data interpretation and visualization techniques

**UNIT I INTRODUCTION 9**

Need for data science – benefits and uses – facets of data – data science process – setting the research goal – retrieving data – cleansing, integrating, and transforming data – exploratory data analysis – build the models – presenting and building applications

**UNIT II DESCRIBING DATA I 9**

Frequency distributions – Outliers – relative frequency distributions – cumulative frequency distributions – frequency distributions for nominal data – interpreting distributions – graphs – averages – mode – median – mean – averages for qualitative and ranked data – describing variability – range – variance – standard deviation – degrees of freedom – interquartile range – variability for qualitative and ranked data

**UNIT III PYTHON FOR DATA HANDLING 9**

Basics of Numpy arrays – aggregations – computations on arrays – comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – hierarchical indexing – combining datasets – aggregation and grouping – pivot tables

**UNIT IV DESCRIBING DATA II 9**

Normal distributions – z scores – normal curve problems – finding proportions – finding scores – more about z scores – correlation – scatter plots – correlation coefficient for quantitative data – computational formula for correlation coefficient – regression – regression line – least squares regression line – standard error of estimate – interpretation of  $r^2$  – multiple regression equations – regression toward the mean

**UNIT V PYTHON FOR DATA VISUALIZATION 9**

Visualization with matplotlib – line plots – scatter plots – visualizing errors – density and contour plots – histograms, binnings, and density – three dimensional plotting – geographic data – data analysis using statmodels and seaborn – graph plotting using Plotly – interactive data visualization using Bokeh

**COURSE OUTCOMES**

At the end of the course Students will be able to:

- Apply the skills of data inspecting and cleansing.
- Determine the relationship between data dependencies using statistics
- Can handle data using primary tools used for data science in Python
- Represent the useful information using mathematical skills
- Can apply the knowledge for data describing and visualization using tools.

**TOTAL:45 PERIODS**

## TEXT BOOKS

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (first two chapters for Unit I)
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017. (Chapters 1–7 for Units II and III)
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016. (Parts of chapters 2–4 for Units IV and V)

## REFERENCES

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

**CS8392**

**OBJECT ORIENTED PROGRAMMING**

**L T P C**  
**3 0 0 3**

### OBJECTIVES:

- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the principles of packages, inheritance and interfaces
- To define exceptions and use I/O streams
- To develop a java application with threads and generics classes
- To design and build simple Graphical User Interfaces

### **UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 10**

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File -Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages - JavaDoc comments.

### **UNIT II INHERITANCE AND INTERFACES 9**

Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning -inner classes, Array Lists - Strings

### **UNIT III EXCEPTION HANDLING AND I/O 9**

Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

### **UNIT IV MULTITHREADING AND GENERIC PROGRAMMING 8**

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.



#### **UNIT IV      BACKTRACKING , ITERATIVE IMPROVEMENT, AND BRANCH & BOUND      10**

Backtracking and permutations – N-queens problem – Hamilton circuits – best-first search --  
Iterative Improvement: Stable marriage -- Maximum matching in bipartite graphs – maximum flow -  
-- Branch and Bound: Knapsack problem -- Traveling salesman problem

#### **UNIT V      INTRACTABILITY      8**

Introduction to intractability -- Polynomial reductions – SAT and 3-SAT – NP-complete and NP-Hard problems -- Approximation algorithms: Traveling salesman problem -- Knapsack problem – Introduction to randomized and parallel algorithms

**THEORY PERIODS: 45**

#### **SUGGESTIVE EXERCISES**

1. Implementation of iterative and recursive algorithms for the given problem
2. Empirical analysis of algorithms
3. Implementation of divide-and-conquer sorting algorithms
4. Implementation of closest-pairs algorithm
5. Implementation of Huffman coding
6. Implementation of Dijkstra's and Prim's algorithms
7. Implementation of disjoint sets and Kruskal's algorithm
8. Implementation of dynamic programming algorithm for knapsack problem
9. Implementation of backtracking to solve n-Queens and Hamilton circuits problems
10. Implementation of iterative improvement strategy for stable marriage and maxflow problems
11. Implementation of Branch and Bound technique to solve knapsack and TSP problems
12. Implementation of approximation algorithms for knapsack and TSP problems

**PRACTICAL PERIODS: 30**

**TOTAL PERIODS: 75**

#### **OUTCOMES:**

At the end of the course, the students should be able to:

- Design algorithms for various computing problems.
- Analyze the time and space complexity of algorithms.
- Critically analyze the different algorithm design techniques for a given problem.
- Modify existing algorithms to improve efficiency
- Ability to implement techniques in solving real time problems

#### **TEXT BOOKS**

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, 2012.
2. Jon Kleinberg and Eva Tardos, "Algorithm Design", Pearson Education, 2006.

#### **REFERENCES**

1. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, PHI Learning Private Limited, 2012.
2. Steven S Skiena, "The Algorithm Design Manual", 2nd Edition, Springer, 2008.
3. S Dasgupta, C H Papadimitriou, U V Vazirani, "Algorithms", 1st Edition, McGraw Hill Education, 2017.
4. S. Sridhar, "Design and Analysis of Algorithms", Oxford University Press, 2015.
5. Sara Baase and Allen Van Gelder, Computer Algorithms, Third Edition, Pearson Education, 2000.
6. Dexter C. Kozen, The Design and Analysis of Algorithms, Springer-Verlag, 1992.

**COURSE OBJECTIVES**

- Understand the Python Programming packages Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh Language.
- To prepare data for data analysis through understanding its distribution.
- Exposure on data processing using NUMPY and PANDAS
- To acquire knowledge in plotting using visualization tools.
- To understand and implement classification and Regression Model.

**Tools:** Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh

1. Working with Numpy arrays
2. Working with Pandas data frames
3. Basic plots using Matplotlib
4. Frequency distributions
5. Averages
6. Variability
7. Normal curves
8. Correlation and scatter plots
9. Correlation coefficient
10. Regression

**TOTAL:60 PERIODS**

**COURSE OUTCOMES**

Upon completion of the course, the students will be able to

- Develop relevant programming abilities.
- Demonstrate knowledge of statistical data analysis techniques
- Exhibit proficiency to build and assess data-based models.
- Demonstrate skill in Data management & processing tasks using Python
- Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

**REFERENCES:**

1. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.
2. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.
3. Data Science From Scratch: First Principles with Python, Second Edition by Joel Grus, 2019

**OBJECTIVES**

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, arraylist, exception handling and file processing.
- To develop applications using generic programming and event handling.

## LIST OF EXPERIMENTS

1. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff.

If the type of the EB connection is domestic, calculate the amount to be paid as follows:

- First 100 units - Rs. 1 per unit
- 101-200 units - Rs. 2.50 per unit
- 201 -500 units - Rs. 4 per unit
- > 501 units - Rs. 6 per unit

If the type of the EB connection is commercial, calculate the amount to be paid as follows:

- First 100 units - Rs. 2 per unit
- 101-200 units - Rs. 4.50 per unit
- 201 -500 units - Rs. 6 per unit
- > 501 units - Rs. 7 per unit

2. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa) , time converter (hours to minutes, seconds and vice versa) using packages.
3. Develop a java application with Employee class with Emp\_name, Emp\_id, Address, Mail\_id, Mobile\_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
4. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.
5. Write a program to perform string operations using ArrayList. Write functions for the following
  - a. Append - add at end
  - b. Insert – add at particular index
  - c. Search
  - d. List all string starts with given letter
6. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
7. Write a Java program to implement user defined exception handling.
8. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.
9. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
10. Write a java program to find the maximum value from the given type of elements using a generic function.

11. Design a calculator using event-driven programming paradigm of Java with the following options.
  - a) Decimal manipulations
  - b) Scientific manipulations
12. Develop a mini project for any application using Java concepts.

**TOTAL : 60 PERIODS**

## OUTCOMES

**Upon completion of the course, the students will be able to**

- Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.
- Develop and implement Java programs with arraylist, exception handling and multithreading .
- Design applications using file processing, generic programming and event handling.

<b>HS8381</b>	<b>INTERPERSONAL SKILLS/LISTENING&amp;SPEAKING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

## OBJECTIVES:

**The Course will enable learners to:**

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- improve general and academic listening skills
- Make effective presentation

### UNIT I

Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

### UNIT II

Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

### UNIT III

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail

#### UNIT IV

Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

#### UNIT V

Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

**TOTAL :30PERIODS**

#### OUTCOMES:

**At the end of the course Learners will be able to:**

- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal

#### TEXT BOOKS:

1. Brooks, Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.
2. Richards, C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

#### REFERENCES:

1. Bhatnagar, Nitin and Mamta Bhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.
2. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
3. Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013.
4. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
5. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014

**MA8391**

**PROBABILITY AND STATISTICS**

**L T P C**

**4 0 0 4**

#### OBJECTIVES:

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To familiarize the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

#### UNIT I PROBABILITY AND RANDOM VARIABLES

**12**

Probability – The axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

**UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 12**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

**UNIT III TESTING OF HYPOTHESIS 12**

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

**UNIT IV DESIGN OF EXPERIMENTS 12**

One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design -  $2^2$  factorial design.

**UNIT V STATISTICAL QUALITY CONTROL 12**

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**Upon successful completion of the course, students will be able to:**

- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

**TEXT BOOKS:**

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.

**REFERENCES:**

1. Probability and Statistics for Engineering and the Sciences, 9E by Jay L. Devore, 2020.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8<sup>th</sup> Edition, 2014.
3. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4<sup>th</sup> Edition, New Delhi, 2010.
4. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3<sup>rd</sup> Edition, Elsevier, 2004.
5. Spiegel. M.R., Schiller. J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.

6. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8<sup>th</sup> Edition, 2007.

**AD8401**

**DATABASE DESIGN AND MANAGEMENT**

**L T P C**  
**3 0 0 3**

**COURSE OBJECTIVES:**

- To introduce database development life cycle and conceptual modelling
- To learn SQL for data definition, manipulation and querying a database
- To learn relational database design using conceptual mapping and normalization
- To learn transaction concepts and serializability of schedules
- To learn data model and querying in object-relational and No-SQL databases

**UNIT I CONCEPTUAL DATA MODELING 8**

Database environment – Database system development lifecycle – Requirements collection – Database design -- Entity-Relationship model – Enhanced-ER model – UML class diagrams.

**UNIT II RELATIONAL MODEL AND SQL 10**

Relational model concepts -- Integrity constraints -- SQL Data manipulation – SQL Data definition – Views -- SQL programming.

**UNIT III RELATIONAL DATABASE DESIGN AND NORMALIZATION 10**

ER and EER-to-Relational mapping – Update anomalies – Functional dependencies – Inference rules – Minimal cover – Properties of relational decomposition – Normalization (upto BCNF).

**UNIT IV TRANSACTION MANAGEMENT 8**

Transaction concepts – properties – Schedules – Serializability – Concurrency Control – Two-phase locking techniques.

**UNIT V OBJECT RELATIONAL AND NO-SQL DATABASES 9**

Mapping EER to ODB schema – Object identifier – reference types – rowtypes – UDTs – Subtypes and supertypes – user-defined routines – Collection types – Object Query Language; No-SQL: CAP theorem – Document-based: MongoDB data model and CRUD operations; Column-based: Hbase data model and CRUD operations.

**TOTAL : 45 PERIODS**

**COURSE OUTCOMES**

After the completion of this course, students will be able to:

- Understand the database development life cycle and apply conceptual modeling
- Apply SQL and programming in SQL to create, manipulate and query the database
- Apply the conceptual-to-relational mapping and normalization to design relational database
- Determine the serializability of any non-serial schedule using concurrency techniques
- Apply the data model and querying in Object-relational and No-SQL databases.

**TEXT BOOKS:**

1. Thomas M. Connolly, Carolyn E. Begg, *Database Systems – A Practical Approach to Design, Implementation, and Management*, Sixth Edition, Global Edition, Pearson Education, 2015.
2. Ramez Elmasri, Shamkant B. Navathe, *Fundamental of Database Systems*, 7<sup>th</sup> Edition,

Pearson, 2017.

## REFERENCES:

1. Toby Teorey, Sam Lightstone, Tom Nadeau, H. V. Jagadish, "DATABASE MODELING AND DESIGN - Logical Design", Fifth Edition, Morgan Kaufmann Publishers, 2011.
2. Carlos Coronel, Steven Morris, and Peter Rob, Database Systems: Design, Implementation, and Management, Ninth Edition, Cengage learning, 2012
3. Abraham Silberschatz, Henry F Korth, S Sudharshan, "Database System Concepts", 6th Edition, Tata Mc Graw Hill, 2011.
4. Hector Garcia-Molina, Jeffrey D Ullman, Jennifer Widom, "Database Systems:The Complete Book", 2<sup>nd</sup> edition, Pearson.
5. S Sumathi, S Esakkirajan, " Fundamentals of Relational Database Management Systems ", (Studies in Computational Intelligence), Springer-Verlag, 2007.
6. Raghu Ramakrishnan, "Database Management Systems", 4th Edition, Tata Mc Graw Hill, 2010.

**AD8402**

**ARTIFICIAL INTELLIGENCE I**

**L T P C**  
**3 0 0 3**

## OBJECTIVES:

The objective of this course is to enable the students to

- Understand the basic concepts of intelligent agents
- Develop general-purpose problem solving agents, logical reasoning agents, and agents that reason under uncertainty
- Employ AI techniques to solve some of today's real world problems.

### **UNIT I INTELLIGENT AGENTS**

**9**

Introduction to AI – Agents and Environments – Concept of rationality – Nature of environments – Structure of agents

Problem solving agents – search algorithms – uninformed search strategies

### **UNIT II PROBLEM SOLVING**

**9**

Heuristic search strategies – heuristic functions

Local search and optimization problems – local search in continuous space – search with non-deterministic actions – search in partially observable environments – online search agents and unknown environments

### **UNIT III GAME PLAYING AND CSP**

**9**

Game theory – optimal decisions in games – alpha-beta search – monte-carlo tree search – stochastic games – partially observable games

Constraint satisfaction problems – constraint propagation – backtracking search for CSP – local search for CSP – structure of CSP

### **UNIT IV LOGICAL AGENTS**

**9**

Knowledge-based agents – propositional logic – propositional theorem proving – propositional model checking – agents based on propositional logic

First-order logic – syntax and semantics – knowledge representation and engineering – inferences in first-order logic – forward chaining – backward chaining -- resolution

**UNIT V KNOWLEDGE REPRESENTATION AND PLANNING 9**

Ontological engineering – categories and objects – events – mental objects and modal logic – reasoning systems for categories – reasoning with default information

Classical planning – algorithms for classical planning – heuristics for planning – hierarchical planning – non-deterministic domains – time, schedule, and resources -- analysis

**COURSE OUTCOMES:**

**On successful completion of this course, the students will be able to**

1. Explain autonomous agents that make effective decisions in fully informed, partially observable, and adversarial settings
2. Choose appropriate algorithms for solving given AI problems
3. Design and implement logical reasoning agents
4. Design and implement agents that can reason under uncertainty

**TOTAL : 45 PERIODS**

**TEXT BOOK:**

1. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition, Pearson Education, 2020.

**REFERENCES:**

1. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007
2. Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill, 2008
3. Patrick H. Winston, "Artificial Intelligence", Third edition, Pearson Edition, 2006
4. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013 (<http://nptel.ac.in/>)
5. Artificial Intelligence by Example: Develop machine intelligence from scratch using real artificial intelligence use cases - by Dennis Rothman, 2018

**AD8403**

**DATA ANALYTICS**

**L T P C  
3 0 0 3**

**COURSE OBJECTIVES**

- To study the basic inferential statistics and sampling distribution.
- To understand the concept of estimation of parameters using fundamental tests and testing of hypotheses.
- To understand the techniques of analysis of variance.
- To gain knowledge in predictive analytics techniques.
- To perform a case study with any available sample data sets.

**UNIT I INFERENCE STATISTICS I 9**

Populations – samples – random sampling – probability and statistics

Sampling distribution – creating a sampling distribution – mean of all sample means – standard error of the mean – other sampling distributions

Hypothesis testing – z-test – z-test procedure – statement of the problem – null hypothesis – alternate hypotheses – decision rule – calculations – decisions - interpretations

**UNIT II INFERENCE STATISTICS II 9**

Why hypothesis tests? – Strong or weak decisions – one-tailed and two-tailed tests – case studies

Influence of sample size – power and sample size

Estimation – point estimate – confidence interval – level of confidence – effect of sample size

**UNIT III T-TEST 9**

t-test for one sample – sampling distribution of t – t-test procedure – degrees of freedom – estimating the standard error – case studies

t-test for two independent samples – statistical hypotheses – sampling distribution – test procedure – p-value – statistical significance – estimating effect size – meta analysis

t-test for two related samples

**UNIT IV ANALYSIS OF VARIANCE 9**

F-test – ANOVA – estimating effect size – multiple comparisons – case studies

Analysis of variance with repeated measures

Two-factor experiments – three f-tests – two-factor ANOVA – other types of ANOVA

Introduction to chi-square tests

**UNIT V PREDICTIVE ANALYTICS 9**

Linear least squares – implementation – goodness of fit – testing a linear model – weighted resampling

Regression using StatsModels – multiple regression – nonlinear relationships – logistic regression – estimating parameters – accuracy

Time series analysis – moving averages – missing values – serial correlation – autocorrelation

Introduction to survival analysis

**TOTAL: 45 PERIODS**

**COURSE OUTCOME**

- Understand the concept of sampling
- Apply the knowledge to derive hypotheses for given data
- Demonstrate the skills to perform various tests in the given data
- Ability to derive inference using Predictive Analytics
- Perform statistical analytics on a data set

**TEXT BOOKS**

1. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.
2. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014. [Unit V]

**REFERENCES**

1. David Spiegelhalter, “The Art of Statistics: Learning from Data”, Pelican Books, 2020.
2. Peter Bruce, Andrew Bruce, and Peter Gedek, “Practical Statistics for Data Scientists”, Second Edition, O’Reilly Publishers, 2020.
3. Charles R. Severance, “Python for Everybody: Exploring Data in Python 3”, Shroff Publishers, 2017.
4. Bradley Efron and Trevor Hastie, “Computer Age Statistical Inference”, Cambridge University Press, 2016.

**COURSE OBJECTIVES:**

- To understand the database development life cycle
- To learn database design using conceptual modelling, Normalization
- To implement database using Data definition, Querying using SQL manipulation and SQL programming
- To implement database applications using IDE/RAD tools
- To learn querying Object-relational databases

**SUGGESTIVE EXPERIMENTS**

1. Database Development Life cycle:  
Problem definition and Requirement analysis  
Scope and Constraints
2. Database design using Conceptual modeling (ER-EER) – top-down approach  
Mapping conceptual to relational database and validate using Normalization
3. Implement the database using SQL Data definition with constraints, Views
4. Query the database using SQL Manipulation
5. Querying/Managing the database using SQL Programming
  - Stored Procedures/Functions
  - Constraints and security using Triggers
6. Database design using Normalization – bottom-up approach
7. Develop database applications using IDE/RAD tools (Eg., NetBeans, VisualStudio)
8. Database design using EER-to-ODB mapping / UML class diagrams
9. Object features of SQL-UDTs and sub-types, Tables using UDTs, Inheritance, Method definition
10. Querying the Object-relational database using Object Query language

**COURSE OUTCOMES**

After the completion of this course, students will be able to:

- Understand the database development life cycle
- Design relational database using conceptual-to-relational mapping, Normalization
- Apply SQL for creation, manipulation and retrieval of data
- Develop a database applications for real-time problems
- Design and query object-relational databases

**TOTAL : 60 PERIODS****HARDWARE:**

- Standalone Desktops

**SOFTWARE:**

- PostgreSQL

**COURSE OBJECTIVES**

- To study and write simple programs using the basic packages for handling data
- To do various sampling and T,Z, Anova test in various samples
- To perform case study and design a system
- To demonstrate Time Series Analysis in any real time application

**Tools:** Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh

**Suggested Exercises:**

1. Random Sampling
2. Z-test case study
3. T-test case studies
4. ANOVA case studies
5. Regression
6. Logistic Regression
7. Time series Analysis

**COURSE OUTCOME**

- After the completion of this course, students will be able to:
- To become skilled to use various packages in Python
- Demonstrate the understanding of data distribution with various samples
- Ability to Implement T-Test ,Anova and Z-Test on sample data sets
- Understanding of Mathematical models in real world problems.
- Conduct time series analysis and draw conclusion.

**TOTAL : 60 PERIODS**

**REFERENCES:**

1. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.
2. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014.

**HARDWARE:**

- Standalone Desktops with Linux OS

**SOFTWARE:**

- Python with statistical Packages

**AD8413**

**ARTIFICIAL INTELLIGENCE – I LABORATORY**

**L T P C  
0 0 4 2**

**COURSE OBJECTIVES**

- To design and implement different techniques to develop simple autonomous agents that make effective decisions in fully informed, and partially observable, settings.
- To apply appropriate algorithms for solving given AI problems.
- To Design and implement logical reasoning agents.
- To Design and implement agents that can reason under uncertainty.
- To understand the Implementation of these reasoning systems using either backward or forward inference mechanisms

**LIST OF EXPERIMENTS:**

1. Develop PEAS descriptions for given AI tasks
2. Implement basic search strategies for selected AI applications
3. Implement A\* and memory bounded A\* algorithms
4. Implement genetic algorithms for AI tasks
5. Implement simulated annealing algorithms for AI tasks
6. Implement alpha-beta tree search
7. Implement backtracking algorithms for CSP

8. Implement local search algorithms for CSP
9. Implement propositional logic inferences for AI tasks
10. Implement resolution based first order logic inferences for AI tasks
11. Implement classical planning algorithms
12. Mini-Project

**TOTAL : 60 PERIODS**

### **COURSE OUTCOMES**

After the completion of this course, students will be able to:

- Implement simple PEAS descriptions for given AI tasks
- Develop programs to implement simulated annealing and genetic algorithms
- Demonstrate the ability to solve problems using searching and backtracking
- Ability to Implement simple reasoning systems using either backward or forward inference mechanisms
- Will be able to choose and implement a suitable technics for a given AI task

### **SOFTWARE:**

- C++ or Java Software

<b>HS8461</b>	<b>ADVANCED READING AND WRITING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **OBJECTIVES:**

- Strengthen the reading skills of students of engineering.
- Enhance their writing skills with specific reference to technical writing.
- Develop students' critical thinking skills.
- Provide more opportunities to develop their project and proposal writing skills.

#### **UNIT I 6**

**Reading** - Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title  
**Writing**-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence –Write a descriptive paragraph

#### **UNIT II 6**

**Reading**-Read for details-Use of graphic organizers to review and aid comprehension **Writing**- State reasons and examples to support ideas in writing- Write a paragraph with reasons and examples- Write an opinion paragraph

#### **UNIT III 6**

**Reading**- Understanding pronoun reference and use of connectors in a passage- speed reading techniques-**Writing**- Elements of a good essay-Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

#### **UNIT IV 6**

**Reading**- Genre and Organization of Ideas- **Writing**- Email writing- visumes – Job application- project writing-writing convincing proposals.

## UNIT V

6

**Reading-** Critical reading and thinking- understanding how the text positions the reader- identify

**Writing-** Statement of Purpose- letter of recommendation- Vision statement

**TOTAL: 30 PERIODS**

### OUTCOMES:

**At the end of the course Learners will be able to:**

- Write different types of essays.
- Write winning job applications.
- Read and evaluate texts critically.
- Display critical thinking in various professional contexts.

### TEXT BOOKS:

1. Gramer F. Margot and Colin S. Ward **Reading and Writing (Level 3)** Oxford University Press: Oxford, 2011
2. Debra Daise, Charlnorloff, and Paul Carne **Reading and Writing (Level 4)** Oxford University Press: Oxford, 2011

### REFERENCES:

1. Davis, Jason and Rhonda Llss. **Effective Academic Writing (Level 3)** Oxford University Press: Oxford, 2006
2. E. Suresh Kumar and et al. **Enriching Speaking and Writing Skills.** Second Edition. Orient Black swan: Hyderabad, 2012
3. Withrow, Jeans and et al. **Inspired to Write. Readings and Tasks to develop writing skills.** Cambridge University Press: Cambridge, 2004
4. Goatly, Andrew. **Critical Reading and Writing.** Routledge: United States of America, 2000
5. Petelin, Roslyn and Marsh Durham. **The Professional Writing Guide: Knowing Well and Knowing Why.** Business & Professional Publishing: Australia, 2004

**AD8501**

**OPTIMIZATION TECHNIQUES**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

### OBJECTIVES:

The objective of this course is to enable the student to

- Formulate and solve linear programming problems (LPP)
- Evaluate Integer Programming Problems, Transportation and Assignment Problems.
- Obtain solution to network problems using CPM and PERT techniques.
- Able to optimize the function subject to the constraints.
- Identify and solve problems under Markovian queuing models.

## UNIT I LINEAR MODELS

12

Introduction of Operations Research - mathematical formulation of LPP- Graphical Methods to solve LPP- Simplex Method- Big M method, Two-Phase method

<b>UNIT II INTEGER PROGRAMMING AND TRANSPORTATION PROBLEMS</b>	<b>12</b>
Integer programming: Branch and bound method- Transportation and Assignment problems - Travelling salesman problem.	
<b>UNIT III PROJECT SCHEDULING</b>	<b>12</b>
Project network -Diagram representation – Floats - Critical path method (CPM) – PERT- Cost considerations in PERT and CPM	
<b>UNIT IV CLASSICAL OPTIMISATION THEORY</b>	<b>12</b>
Unconstrained problems – necessary and sufficient conditions - Newton-Raphson method, Constrained problems – equality constraints – inequality constraints - Kuhn-Tucker conditions.	
<b>UNIT V QUEUING MODELS</b>	<b>12</b>
Introduction, Queuing Theory, Operating characteristics of a Queuing system, Constituents of a Queuing system, Service facility, Queue discipline, Single channel models, multiple service channels.	

**TOTAL PERIODS: 60**

**COURSE OUTCOMES:**

On successful completion of this course, the student will able to

- Formulate and solve linear programming problems (LPP)
- Evaluate Integer Programming Problems, Transportation and Assignment Problems.
- Obtain solution to network problems using CPM and PERT techniques.
- Able to optimize the function subject to the constraints.
- Identify and solve problems under Markovian queuing models

**TEXT BOOK:**

1. Hamdy A Taha, Operations Research: An Introduction, Pearson, 10<sup>th</sup> Edition, 2017.

**REFERENCES:**

1. ND Vohra, Quantitative Techniques in Management, Tata McGraw Hill, 4<sup>th</sup> Edition, 2011.
2. J. K. Sharma, Operations Research Theory and Applications, Macmillan, 5<sup>th</sup> Edition, 2012.
3. Hiller F.S, Liberman G.J, Introduction to Operations Research, 10<sup>th</sup> Edition McGraw Hill, 2017.
4. Jit. S. Chandran, Mahendran P. Kawatra, KiHoKim, Essentials of Linear Programming, Vikas Publishing House Pvt.Ltd. New Delhi, 1994.
5. Ravindran A., Philip D.T., and Solberg J.J., Operations Research, John Wiley, 2<sup>nd</sup> Edition, 2007.

**CW8691**

**COMPUTER NETWORKS**

**L T P C**  
**3 0 2 4**

**OBJECTIVES:**

- To understand the protocol layering and physical level communication
- To analyze the performance of a network
- To understand the various components required to build different networks
- To learn the functions of network layer and the various routing protocols
- To familiarize the functions and protocols of the Transport layer

**UNIT I INTRODUCTION AND PHYSICAL LAYER 9**

Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

**UNIT II DATA-LINK LAYER & MEDIA ACCESS 9**

Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – PPP – Media Access Control – Wired LANs: Ethernet – Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices.

**UNIT III NETWORK LAYER 9**

Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets – Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.

**UNIT IV TRANSPORT LAYER 9**

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol – SCTP.

**UNIT V APPLICATION LAYER 9**

WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP.

**LIST OF EXPERIMENTS :**

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and trace route PDUs using a network protocol analyzer and examine.
2. Write a HTTP web client program to download a web page using TCP sockets.
3. Applications using TCP sockets like:
  - a) Echo client and echo server
  - b) Chat
  - c) File Transfer
4. Simulation of DNS using UDP sockets.
5. Write a code simulating ARP /RARP protocols.
6. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
7. Study of TCP/UDP performance using Simulation tool.
8. Simulation of Distance Vector/ Link State Routing algorithm.
9. Performance evaluation of Routing protocols using Simulation tool.
10. Simulation of an error correction code (like CRC).

**SOFTWARE:**

- C/C++/JAVA/Equivalent compiler
- Network Simulator like NS2/OPNET/Wireshark

**OUTCOMES:**

**Upon completion of the course, the students should be able to :**

- Comprehend the basic layers and its functions in computer networks.
- Evaluate the performance of a network.
- Understand the basics of how data flows from one node to another.

- Analyze and design routing algorithms.
- Design protocols for various functions in the network.
- Understand the working of various application layer protocols.

<b>PRACTICALS</b>	<b>30 PERIODS</b>
<b>THEORY</b>	<b>45 PERIODS</b>
<b>TOTAL</b>	<b>75 PERIODS</b>

**TEXT BOOK:**

1. Behrouz A. Forouzan, Data Communications and Networking, **Fifth Edition TMH, 2013.**
2. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.

**REFERENCES:**

1. James F. Kurose, Keith W. Ross, “Computer Networking: A Top-Down Approach”, Seventh Edition, Pearson Education, 2017.
2. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
3. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
4. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011.

**AD8502**

**DATA EXPLORATION AND VISUALIZATION**

**L T P C**  
**3 0 2 4**

**OBJECTIVES:**

- To understand the basics of Data Explorations
- To understand the basic concepts of Data visualization
- To study the linear and non-linear ways of Data visualization
- To explore the data visualization using R language
- To apply various data visualization techniques for a variety of tasks

**UNIT I INTRODUCTION TO DATA EXPLORATION 9**

Introduction to Single variable: Distribution Variables - Numerical Summaries of Level and Spread - Scaling and Standardising – Inequality - Smoothing Time Series.

**UNIT II INTRODUCING TWO VARIABLE AND THIRD VARIABLE 9**

Relationships between Two Variables - Percentage Tables - Analysing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines – Transformations - Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data.

**UNIT III BASICS OF DATA VISUALIZATION 9**

The Seven Stages of Visualizing Data - Getting Started with Processing - Mapping - Time Series - Connections and Correlations - Scatterplot Maps - Trees, Hierarchies, and Recursion - Networks and Graphs – Acquiring Data – Parsing Data

**UNIT IV DATA EXPLORATION AND DATA VISUALIZATION IN R 9**

Introduction to R and RStudio - The Basics of Data Exploration - Loading Data into R - Transforming Data - Creating Tidy Data

**UNIT V TECHNIQUES AND APPLICATIONS OF DATA EXPLORATION AND VISUALIZATION IN R 9**

Basic Data Exploration Techniques - Basic Data Visualization Techniques - Visualizing Geographic Data with ggmap - R Markdown - Case Study – Wildfire Activity in the Western United States - Case Study – Single Family Residential Home and Rental Values

**LIST OF EXPERIMENTS:**

1. Install standalone R.
2. Use R tool to explore various commands for descriptive data analytics using bench mark datasets.
3. Explore various variable and row filters in R for cleaning data.
4. Use R commands for probability distributions and probability statistics.
5. Formulate real business problems scenarios to hypothesis and solve using R statistical testing features.
6. Apply various plot features in R on sample data sets and visualize.
7. Write and execute word count, word search and pattern search problems from large text files.
8. Explore various data preprocessing options using bench mark data sets.

**SOFTWARE:**

- R-Studio

<b>PRACTICALS</b>	<b>30 PERIODS</b>
<b>THEORY</b>	<b>45 PERIODS</b>
<b>TOTAL</b>	<b>75 PERIODS</b>

**OUTCOMES:**

- Understand the basics of Data Exploration
- Use Univariate and Multivariate Analysis for Data Exploration
- Explain various Data Visualization methods
- Apply the concept of Data Visualization on various datasets
- Apply the data visualization techniques using R language

**TEXT BOOKS**

1. Catherine Marsh, Jane Elliott, Exploring Data: An Introduction to Data Analysis for Social Scientists, Wiley Publications, 2nd Edition, 2008.
2. Visualizing Data: Exploring and Explaining Data with the processing Environment, O Reily Publications, 2007
3. Eric Pimpler, Data Visualization and Exploration with R, Geo Spatial Training service, 2017
4. Authors: Xiang Zhou, Sean, Yong Rui, Huang, Thomas S., Exploration of Visual Data, Springer Publications, 2003
5. Claus.O.Wlike, Fundamentals of Data Visualization, A primer on making informative and compelling Figures, O'Reily Publications, 2019

**OBJECTIVES:**

1. To understand the Analytics Life Cycle.
2. To comprehend the process of acquiring Business Intelligence
3. To understand various types of analytics for Business Forecasting
4. To model the supply chain management for Analytics.
5. To apply analytics for different functions of a business

**UNIT I INTRODUCTION TO BUSINESS ANALYTICS 9**

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration

**UNIT II BUSINESS INTELLIGENCE 9**

Data Warehouses and Data Mart - Knowledge Management – Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence – OLAP –, Analytic functions

**UNIT III BUSINESS FORECASTING 9**

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modeling – Machine Learning for Predictive analytics.

**UNIT IV HR & SUPPLY CHAIN ANALYTICS 9**

Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain

**UNIT V MARKETING & SALES ANALYTICS 9**

Marketing Strategy, Marketing Mix, Customer Behavior – selling Process – Sales Planning – Analytics applications in Marketing and Sales

**TOTAL: 45 PERIODS****COURSE OUTCOMES:**

- Explain the real world business problems and model with analytical solutions.
- Identify the business processes for extracting Business Intelligence
- Apply predictive analytics for business fore-casting
- Apply analytics for supply chain and logistics management
- Use analytics for marketing and sales.

**REFERENCES:**

1. R. Evans James, Business Analytics, 2017
2. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2016
3. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
4. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
5. Mahadevan B, “Operations Management -Theory and Practice”,3rd Edition, Pearson Education, 2018.

**OBJECTIVES:**

- To understand the basics of Machine Learning (ML)
- To understand the methods of Machine Learning
- To know about the implementation aspects of machine learning
- To understand the concepts of Data Analytics and Machine Learning
- To understand and implement usecases of ML

**UNIT I MACHINE LEARNING BASICS 8**

Introduction to Machine Learning (ML) - Essential concepts of ML – Types of learning – Machine learning methods based on Time – Dimensionality – Linearity and Non linearity – Early trends in Machine learning – Data Understanding Representation and visualization.

**UNIT II MACHINE LEARNING METHODS 11**

Linear methods – Regression -Classification –Perceptron and Neural networks – Decision trees – Support vector machines – Probabilistic models —Unsupervised learning – Featurization

**UNIT III MACHINE LEARNING IN PRACTICE 9**

Ranking – Recommendation System - Designing and Tuning model pipelines- Performance measurement – Azure Machine Learning – Open-source Machine Learning libraries – Amazon’s Machine Learning Tool Kit: Sagemaker

**UNIT IV MACHINE LEARNING AND DATA ANALYTICS 9**

Machine Learning for Predictive Data Analytics – Data to Insights to Decisions – Data Exploration – Information based Learning – Similarity based learning – Probability based learning – Error based learning – Evaluation – The art of Machine learning to Predictive Data Analytics.

**UNIT V APPLICATIONS OF MACHINE LEARNING 8**

Image Recognition – Speech Recognition – Email spam and Malware Filtering – Online fraud detection – Medical Diagnosis.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Understand the basics of ML
- Explain various ZMachine Learning methods
- Demonstrate various ML techniques using standard packages.
- Explore knowledge on Machine learning and Data Analytics
- Apply ML to various real time examples

**TEXT BOOKS:**

1. Ameet V Joshi, Machine Learning and Artificial Intelligence, Springer Publications, 2020
2. John D. Kelleher, Brain Mac Namee, Aoife D’ Arcy, Fundamentals of Machine learning for Predictive Data Analytics, Algorithms, Worked Examples and case studies, MIT press,2015

**REFERENCES:**

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer Publications, 2011
2. Stuart Jonathan Russell, Peter Norvig, John Canny, Artificial Intelligence: A Modern Approach, Prentice Hall, 2020
3. Machine Learning Dummies, John Paul Muller, Luca Massaron, Wiley Publications, 2021

**OBJECTIVES:**

- To get practical knowledge on implementing machine learning algorithms in real time problem for getting solutions
- To implement supervised learning and their applications
- To understand unsupervised learning like clustering and EM algorithms
- To understand the theoretical and practical aspects of probabilistic graphical models.

**LIST OF EXPERIMENTS:**

1. Implement the concept of decision trees with suitable data set from real world problem and classify the data set to produce new sample.
2. Detecting Spam mails using Support vector machine
3. Implement facial recognition application with artificial neural network
4. Study and implement amazon toolkit: Sagemaker
5. Implement character recognition using Multilayer Perceptron
6. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
7. Implement sentiment analysis using random forest optimization algorithm
8. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
9. Choose best machine learning algorithm to implement online fraud detection
10. Mini-project: students work in team on any socially relevant problem that needs a machine learning based solution, and evaluate the model performance.

**TOTAL : 60 PERIODS****OUTCOMES:**

- Understand the implementation procedures for the machine learning algorithms.
- Design Java/Python programs for various Learning algorithms.
- Apply appropriate Machine Learning algorithms to data sets
- Identify and apply Machine Learning algorithms to solve real world problems.

**REFERENCES**

1. Sebastain Raschka, "Python Machine Learning", Packt publishing (open source).
2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
3. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition, Pearson Education, 2020.

**SOFTWARE:**

- Python/Java with ML packages

**OBJECTIVES:**

- The students are expected to develop a mini project for solving real world problems with the concepts and tools they are familiar with.
- To use the Python packages for performing analytics.

- To learn using analytical tools for real world problems.
- The students are expected to use different platforms and tools that support data analysis, machine learning, deep learning, Apache Spark, R, Weka, Tensor Flow,

**LIST OF EXPERIMENTS:**

1. Use Twitter data for Sentiment Analysis
2. Mail classification for Spam Detection
3. Use of ML algorithms for Stock market Prediction
4. Designing a Recommendation System
5. Using Apache Spark for Time Series Forecasting
6. Implementation of Disease Prediction System
7. Usage of Image Segmentation
8. Design a Face recognition System
9. Use Natural Language Processing for short text Summarization

**TOTAL: 60 PERIODS**

**OUTCOMES:**

- Install analytical tools and configure distributed file system.
- Have skills in developing and executing analytical procedures in various distributed frameworks and databases.
- Develop, implement and deploy simple applications on very large datasets.
- Implement simple to complex data modeling in NoSQL databases.
- Implement real world applications by using suitable analytical framework and tools.

**REFERENCES:**

1. [www.kaggle.com](http://www.kaggle.com)
2. <https://amankharwal.medium.com/130-machine-learning-projects-solved-and-explained-605d188fb392>
3. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.
4. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014.
5. Data Science From Scratch: First Principles with Python, Second Edition by Joel Grus, 2019

**AD8601**

**ARTIFICIAL INTELLIGENCE II**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To know the underlying structure behind intelligence mathematically.
- To know the logical implications in probabilistic Reasoning.
- To know the automated learning techniques.
- To explore the techniques in Reinforcement Learning.
- To explore artificial intelligence techniques for Robotics.

**UNIT I      PROBABILISTIC REASONING I**

**9**

Acting under uncertainty – Bayesian inference – naïve bayes models

Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks

**UNIT II      PROBABILISTIC REASONING II      9**

Probabilistic reasoning over time – time and uncertainty – inference in temporal models – Hidden Markov Models – Kalman filters – Dynamic Bayesian networks  
Probabilistic programming

**UNIT III      DECISIONS UNDER UNCERTAINTY      9**

Basis of utility theory – utility functions – Multiattribute utility functions – decision networks – value of information – unknown preferences  
Sequential decision problems – MDPs – Bandit problems – partially observable MDPs  
Multiagent environments – non-cooperative game theory – cooperative game theory – making collective decisions

**UNIT IV      LEARNING PROBABILISTIC MODELS      9**

Statistical learning theory – maximum-likelihood parameter learning – naïve bayes models – generative and descriptive models – continuous models – Bayesian parameter learning – Bayesian linear regression – learning Bayesian net structures – density estimation  
EM Algorithm – unsupervised clustering – Gaussian mixture models – learning Bayes net parameters – learning HMM – learning Bayes net structures with hidden variables

**UNIT V      REINFORCEMENT LEARNING AND ROBOTICS      9**

Learning from rewards – passive reinforcement learning – active reinforcement learning – generalization in reinforcement learning – policy search – inverse reinforcement learning – applications  
Robots – robotic perception – planning movements – reinforcement learning in robotics – robotic frameworks -- applications of robotics  
Philosophy, ethics, and safety of AI – the future of AI

**TOTAL:45 PERIODS**

**OUTCOMES:**

**On completion of the course, the students will be able to:**

- Explain the probabilistic reasoning using Bayesian inference
- Apply appropriate Probabilistic reasoning techniques for solving uncertainty problems
- Explain use of game theory for decision making.
- Explain and apply probabilistic models for various use cases
- Apply AI techniques for robotics

**TEXT BOOK**

1. Stuart Russel and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Fourth Edition, Pearson Education, 2020.

**REFERENCES**

1. Dan W. Patterson, “Introduction to AI and ES”, Pearson Education, 2007
2. Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2008
3. Patrick H. Winston, "Artificial Intelligence", Third edition, Pearson Edition, 2006
4. Deepak Khemani, “Artificial Intelligence”, Tata McGraw Hill Education, 2013 (<http://nptel.ac.in/>)

**OBJECTIVES:**

- To understand the basics of Number Theory and Security
- To understand and analyze the principles of different encryption techniques
- To understand the security threats and attacks
- To understand and evaluate the need for the different security aspects in real time applications
- To learn the different applications of information security

**UNIT I FUNDAMENTALS OF SECURITY 9**

Computer Security Concepts - Threats, Attacks and Assets – Security Functional Requirements – Fundamental Security Design Principles – Attack Surfaces and Attack Trees. Computer Security Strategy– Number Theory: Prime Numbers and Factorization, Modular Arithmetic, GCD and Euclidean Algorithm, Chinese Remainder Theorem, Multiplication Modulo  $m$  and the Totient Function, Problems, Fermat and Euler Theorem. Primitive Roots and the Structure of  $F^*_p$ , Number in other Bases, Fast Computation of Powers in  $Z/mZ$ , Multiplicative Functions, Group Theory, Fields and Problems

**UNIT II ENCRYPTION TECHNIQUES AND KEY MANAGEMENT 9**

Symmetric Encryption Principles – Data Encryption Standard – Advanced Encryption Standard – Stream Ciphers and RC4 - Cipher Block Modes Operation – Digital Signatures - Key Distributions - Public Key Cryptosystem: RSA, Elliptic Curve Cryptography - Key Exchange Algorithms: Diffie Hellmen and ELGamal Key Exchange

**UNIT III AUTHENTICATION, INTEGRITY AND ACCESS CONTROL 9**

Authentication: Security Hash Function – HMAC – Electronic User Authentication Principles, Password Based Authentication, Token Based and Remote Authentication; Internet Authentication Applications: Kerberos X.509 – Public Key Infrastructure; Access Control: Access Control Principles - Subjects, Objects, and Access Rights - Discretionary Access Control - Example: UNIX File Access Control – Role Based Access Control - Attribute-Based Access Control - Identity, Credential, and Access Management - Trust Frameworks

**UNIT IV SECURITY 9**

System Security: Firewall, Viruses, Worms, Ransomware, Keylogger, Greyware, IDS, DDoS Network Security: SSL – TLs – HTTPS –IP Security; OS Security: Introduction to Operating System Security - System Security Planning - Operating Systems Hardening - Application Security - Security Maintenance - Linux/Unix Security - Windows Security - Virtualization Security; Wireless Security: Risks and Threats of Wireless- Wireless LAN Security- Wireless Security Policy-Wireless Security Architectures-Wireless security Tools

**UNIT V SECURITY APPLICATIONS 9**

IOT security: Introduction- Architectures- Security challenges- Security requirements- Trust, Data confidentiality, and privacy in IOT- Security in future IOT systems; Cloud Security: Security requirements - Security patterns and Architectural elements- Cloud Security Architecture- Security Management in the Cloud- Availability Management- SaaS Availability Management- PaaS Availability Management- IaaS Availability Management- Access control- Security Vulnerability, Patch and Configuration Management.

**OUTCOMES:**

- Understand the fundamentals of security and the significance of number theory in computer security
- Learn the public key cryptographic standards and authentication scheme
- Able to apply the security frameworks for real time applications
- Understand the security threats and attacks in IoT, Cloud.
- Able to develop appropriate security algorithms understanding the possible threats

**TOTAL:45 PERIODS****TEXT BOOKS:**

1. William Stallings, "Cryptography and Network Security Principles and Practice", Fifth Edition, 2011, Pearson Education International
2. William Stallings and Lawrie Brown, "Computer Security Principles and Practice", Third Edition, 2015, Pearson Education International

**REFERENCES:**

1. Tim Mather, Subra Kumaraswamy and Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance", 2009, Oreilly
2. Mikhail Gloukhovtsev, "IoT Security: Challenges, Solutions & Future Prospects", 2018, Knowledge Sharing Article, Dell Inc.
3. Pradip KumarDas, Hrudaya Kumar Tripathy, Shafiz Affendi Mohd yusuf, Privacy and Security Issues in Big Data, An Analytical View on Business Intelligence. Springer 2021.

**IT8501****WEB TECHNOLOGY**

L	T	P	C
3	0	0	3

**OBJECTIVES:**

- To understand about client-server communication and protocols used during communication.
- To design interactive web pages using Scripting languages.
- To learn server side programming using servlets and JSP.
- To develop web pages using XML/XSLT.

**UNIT I WEB SITE BASICS AND HTML****9**

Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols -The World Wide Web-HTTP request message-response message-Web Clients Web Servers. Markup Languages: XHTML. An Introduction to HTML History-Versions-Basic XHTML Syntax and Semantics-Some Fundamental HTML Elements-Relative URLs-Lists-tables-Frames-Forms-HTML 5.0.

**UNIT II CSS AND CLIENT SIDE SCRIPTING****9**

Style Sheets: CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-Style Sheets and HTML- Style Rule Cascading and Inheritance-Text Properties-Box Model Normal Flow Box Layout-Beyond the Normal Flow-CSS3.0. Client-Side Programming: The JavaScript Language-History and Versions Introduction JavaScript in Perspective-Syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers.

**UNIT III SERVER SIDE SCRIPTING****9**

Host Objects: Browsers and the DOM-Introduction to the Document Object Model DOM History and Levels-Intrinsic Event Handling-Modifying Element Style-The Document Tree-DOM Event Handling-

Accommodating Noncompliant Browsers Properties of window. Server-Side Programming: Java Servlets- Architecture -Overview-A Servlet-Generating Dynamic Content-Life Cycle- Parameter Data-Sessions-Cookies-URL Rewriting-Other Capabilities-Data Storage Servlets and Concurrency-Databases and Java Servlets.

**UNIT IV JSP AND XML 9**

Separating Programming and Presentation: JSP Technology Introduction-JSP and Servlets-Running JSP Applications Basic JSP-JavaBeans Classes and JSP-Tag Libraries and Files-Support for the Model-View-Controller Paradigm- Databases and JSP. Representing Web Data: XML-Documents and Vocabularies-Versions and Declaration-Namespaces- DOM based XML processing Event-oriented Parsing: SAX-Transforming XML Documents-Selecting XML Data: XPATH-Template based Transformations: XSLT-Displaying XML Documents in Browsers.

**UNIT V AJAX AND WEB SERVICES 9**

AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods. Web Services: JAX-RPC-Concepts-Writing a Java Web Service-Writing a Java Web Service Client-Describing Web Services: WSDL- Representing Data Types: XML Schema-Communicating Object Data: SOAP Related Technologies-Software Installation-Storing Java Objects as Files.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design simple web pages using markup languages like HTML and XHTML.
- Create dynamic web pages using DHTML and java script that is easy to navigate and use.
- Program server side web pages that have to process request from client side web pages.
- Represent web data using XML and develop web pages using JSP.
- Understand various web services and how these web services interact.

**TEXT BOOK:**

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.

**REFERENCES**

1. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007 .
2. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006.
3. Marty Hall and Larry Brown," Core Web Programming" Second Edition, Volume I and II, Pearson Education, 2001.
4. Bates, "Developing Web Applications", Wiley, 2006

**IT8511**

**WEB TECHNOLOGY LABORATORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**OBJECTIVES:**

- To design interactive web pages using Scripting languages.
- To learn server side programming using servlets and JSP.
- To develop web pages using XML/XSLT.

**LIST OF EXPERIMENTS:**

1. Create a web page with the following using HTML.
  - i) To embed an image map in a web page.
  - ii) To fix the hot spots.
  - iii) Show all the related information when the hot spots are clicked
2. Create a web page with all types of Cascading style sheets.
3. Client Side Scripts for Validating Web Form Controls using DHTML.
4. Installation of Apache Tomcat web server.
5. Write programs in Java using Servlets:
  - To invoke servlets from HTML forms.
  - Session Tracking.
6. Write programs in Java to create three-tier applications using JSP and Databases
  - For conducting on-line examination.
  - For displaying student mark list. Assume that student information is available in a database which has been stored in a database server.
7. Programs using XML – Schema – XSLT/XSL.
8. Programs using DOM and SAX parsers.
9. Programs using AJAX.
10. Consider a case where we have two web Services- an airline service and a travel agent and the travel agent is searching for an airline. Implement this scenario using Web Services and Data base.

**TOTAL: 60 PERIODS****OUTCOMES:****Upon Completion of the course, the students will be able to:**

- Design simple web pages using markup languages like HTML and XHTML.
- Create dynamic web pages using DHTML and java script that is easy to navigate and use.
- Program server side web pages that have to process request from client side web pages.
- Represent web data using XML and develop web pages using JSP.
- Understand various web services and how these web services interact.

**SOFTWARE REQUIRED:**

- Dream Weaver or Equivalent, MySQL or Equivalent, Apache Server, WAMP/XAMPP

AD8611

**ARTIFICIAL INTELLIGENCE – II LABORATORY**

L	T	P	C
0	0	4	2

**OBJECTIVES:**

- To impart knowledge about Artificial Intelligence.
- To understand the main abstractions and reasoning for intelligent systems.
- To understand the use of Artificial Intelligence in various applications

**LIST OF EXPERIMENTS:**

1. To implement Bayesian Belief networks
2. Approximate inferences in Bayesian network
3. To implement decision problems for various real-world applications
4. To learn various Bayesian parameters
5. Implementation of Hidden Markov Models
6. Implement EM algorithm for HMM

7. Implement the Reinforcement learning for various reward based applications
8. Mini-Project

**OUTCOMES:**

**TOTAL PERIODS:60**

- Solve basic AI based problems.
- Implement the concept of Bayesian Network.
- Apply AI techniques to real-world problems to develop intelligent systems
- Implement HMM for real-world application.
- Use Reinforcement Learning to implement various intelligent systems.

**SOFTWARE:**

- **Python/Java with Machine Learning packages.**

**REFERENCES:**

1. [aimacode · GitHub \(https://github.com/aimacode\)](https://github.com/aimacode)
2. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007
3. Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill, 2008
4. Patrick H. Winston, "Artificial Intelligence", Third edition, Pearson Edition, 2006
5. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013  
(<http://nptel.ac.in/>)

**HS8581**

**PROFESSIONAL COMMUNICATION**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**OBJECTIVES:**

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

**UNIT I**

Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

**UNIT II**

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

**UNIT III**

Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -- questioning and clarifying –GD strategies- activities to improve GD skills

**UNIT IV**

Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

## UNIT V

Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

**TOTAL:30 PERIODS**

### OUTCOMES:

**At the end of the course Learners will be able to:**

- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

### RECOMMENDED SOFTWARE

1. Open Source Software
2. Win English

### REFERENCES:

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Interact English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

**AD8612**

**SOCIALLY RELEVANT PROJECT**

**L T P C**  
**0 0 4 2**

### OBJECTIVES:

- The students are expected to develop solution for socially existing problems with the concepts and tools they are familiar with.
- A few broad areas related to the course are presented below.
- The list below is only a guideline for the students and the students are motivated to build the projects to portray their own creativity.

### PRACTICAL EXERCISES:

1. Solve social problems using Statistical and Mathematical Concepts
2. Solving Big Data related Concepts
3. Solving Business Intelligence related Concepts
4. Solving problems with Machine Learning Algorithms.
5. Solving problems with Deep Learning Algorithms
6. Solving any Security Related Problems.
7. Solving health Related Problems.
9. problems related to Data wrangling

**TOTAL: 60 PERIODS**

### OUTCOMES:

- The students are expected to use different platforms and tools like SAS, Python, R, Scala.
- Big Data: Hadoop Ecosystem (Hive, Pig, Sqoop, Flume), Big Data Lakes,No SQL, Apache

- Spark, Spark MLlib, HPC, Storm.
- Business Intelligence : SQL, Microsoft Power BI, SAP BI, Tableau, Oracle Fusion,
- Machine Learning and Deep Learning : TensorFlow, Keras, Artificial Neural Networks, Deep Neural Networks, Convolution Neural Networks, Auto encoders.

#### REFERENCES:

- <https://www.jeremyjordan.me/ml-projects-guide/>
- Problems listed in Smart India Hackathon : [www.sih.gov.in](http://www.sih.gov.in)

AD8701

### DEEP LEARNING

L T P C  
3 0 0 3

#### OBJECTIVES:

- To understand the basics of deep neural networks
- To understand CNN architectures of deep neural networks
- To understand the concepts of Artificial Neural Networks
- To learn the basics of Data science in Deep learning
- To learn about applications of deep learning in AI and Data Science

#### UNIT I DEEP NETWORKS BASICS

9

Linear Algebra: Scalars -- Vectors -- Matrices and tensors; Probability Distributions -- Gradient-based Optimization -- Machine Learning Basics: Capacity -- Overfitting and underfitting -- Hyperparameters and validation sets -- Estimators -- Bias and variance -- Stochastic gradient descent -- Challenges motivating deep learning; Deep Networks: Deep feedforward networks; Regularization -- Optimization.

#### UNIT II CONVOLUTIONAL NEURAL NETWORKS

9

Convolution Operation -- Sparse Interactions -- Parameter Sharing -- Equivariance -- Pooling -- Convolution Variants: Strided -- Tiled -- Transposed and dilated convolutions; CNN Learning: Nonlinearity Functions -- Loss Functions -- Regularization -- Optimizers -- Gradient Computation.

#### UNIT III DEEP LEARNING ALGORITHMS FOR AI

9

Artificial Neural Networks -- Linear Associative Networks -- Perceptrons -The Backpropagation Algorithm - Hopfield Nets - Boltzmann Machines - Deep RBMs - Variational Autoencoders - Deep Backprop Networks- Autoencoders

#### UNIT IV DATA SCIENCE AND DEEP LEARNING

9

Data science fundamentals and responsibilities of a data scientist - life cycle of data science -- Data science tools - Data modeling, and featurization - How to work with data variables and data science tools - How to visualize the data - How to work with machine learning algorithms and Artificial Neural Networks

#### UNIT V APPLICATIONS OF DEEP LEARNING

9

Detection in chest X-ray images -object detection and classification -RGB and depth image fusion - NLP tasks - dimensionality estimation - time series forecasting -building electric power grid for controllable energy resources - guiding charities in maximizing donations and robotic control in industrial environments.

**TOTAL:45 PERIODS**

## OUTCOMES:

- CO1: Explain the basics in deep neural networks (K2)
- CO2: Apply Convolution Neural Network for image processing (K3)
- CO3: Explain the basics of Artificial Intelligence using deep learning (K2)
- CO4: Apply deep learning algorithms for data science
- CO5: Apply deep learning algorithms for variety applications

## TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, ``Deep Learning'', MIT Press, 2016
2. Stone, James. (2019). Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning, Sebtel Press, United States, 2019
3. Vance, William , Data Science: A Comprehensive Beginners Guide to Learn the Realms of Data Science (Hardcover - 2020), Joiningthedotstv Limited
4. Wani, M.A., Raj, B., Luo, F., Dou, D. (Eds.), Deep Learning Applications, Volume 3, Springer Publications 2022
5. Charu C. Aggarwal, ``Neural Networks and Deep Learning: A Textbook'', Springer International Punlishing, 2018.

**AD8702**

**TEXT ANALYTICS**

**L T P C**  
**3 0 0 3**

## OBJECTIVES:

- 1: To understand the methods for keyword extraction from documents.
- 2: To learn clustering methods for grouping of documents.
- 3: To explore the methods for classification of documents and E-mails.
- 4: To explore text visualization techniques and anomaly detection.
- 5: To learn about Events and trends in text streams

## **UNIT I TEXT EXTRACTION**

**9**

Introduction- Rapid automatic keyword extraction: candidate keywords, keyword scores, adjoining keywords, extracted keywords-Benchmark evaluation: precision and recall, efficiency, stoplist generation, Evaluation on new articles.

## **UNIT II DOCUMENT CLUSTERING**

**9**

Multilingual document clustering: Multilingual LSA, Tucker1 method, PARAFAC2 method, LSA with term alignments, LMSA, LMSA with term alignments; Constrained clustering with k-means type algorithms.

## **UNIT III CONTENT BASED CLASSIFICATION**

**8**

Classification algorithms for Document Classification, Content-based spam email classification, Utilizing nonnegative matrix factorization for email classification problems.

## **UNIT IV ANOMALY AND TREND DETECTION**

**9**

Text visualization techniques: Visualization in text analysis, Tag clouds, tag clouds, authorship and change tracking, Data Exploration and the search for noval patterns, sentiment tracking, visual analytics and FutureLens, scenario discovery.

adaptive threshold setting for novelty mining: Introduction, adaptive threshold for anomaly detection, Experimental study.

**UNIT V TEXT STREAMS****10**

Events and trends in text streams: Introduction, Text streams, Feature extraction and data reduction, Event detection, Trend detection, Event and trend descriptions. Embedding semantics in LDA topic models: Introduction, vector space modeling, latent semantic analysis, probabilistic latent semantic analysis, Latent Dirichlet allocation, embedding external semantics from Wikipedia, data-driven semantic embedding.

**TOTAL:45 PERIODS****OUTCOMES:**

**After the completion of this course, students will be able to:**

- CO1: Design text extraction techniques
- CO2: Devise clustering techniques for text mining
- CO3: Design classification techniques for text mining
- CO4: Apply visualization techniques and perform anomaly & trend detection
- CO5: Perform Event operations in Text streams

**REFERENCES**

1. Michael W. Berry & Jacob Kogan, "Text Mining Applications and Theory", Wiley publications, 2010.
2. Aggarwal, Charu C., and ChengXiangZhai, eds., "Mining text data", Springer Science & Business Media, 2012.
3. Miner, Gary, et al., "Practical text mining and statistical analysis for non-structured text data applications", Academic Press, 2012.
4. Srivastava, Ashok N., and MehranSahami, "Text mining: Classification, clustering, and applications", Chapman and Hall/CRC, 2009.
5. Buitelaar, Paul, Philipp Cimiano, and Bernardo Magnini, eds., "Ontology learning from text: methods, evaluation and applications", Vol. 123. IOS press, 2005.

**AD8703****BASICS OF COMPUTER VISION**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- 1:** To review image processing techniques for computer vision.
- 2:** To understand various features and recognition techniques
- 3:** To learn about histogram and binary vision
- 4:** Apply three-dimensional image analysis techniques
- 5:** Study real world applications of computer vision algorithms

**UNIT I INTRODUCTION****9**

Image Processing, Computer Vision ,What is Computer Vision - Low-level, Mid-level, High-level ; Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.

**UNIT II FEATURE EXTRACTION AND FEATURE SEGMENTATION****9**

Feature Extraction -Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space

Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.  
Image Segmentation -Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation.

**UNIT III IMAGES, HISTOGRAMS, BINARY VISION 9**

Simple pinhole camera model – Sampling – Quantisation – Colour images – Noise – Smoothing – 1D and 3D histograms - Histogram/Image Equalisation - Histogram Comparison - Back-projection - k-means Clustering – Thresholding - Threshold Detection Methods - Variations on Thresholding - Mathematical Morphology – Connectivity.

**UNIT IV 3D VISION AND MOTION 9**

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion–spline-based motion- optical flow – layered motion.

**UNIT V APPLICATIONS 9**

Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing , Virtual Reality and Augmented Reality.

**OUTCOMES:**

- Explain low level processing of image and transformation techniques applied to images.
- Explain the feature extraction, segmentation and object recognition methods.
- Apply Histogram transform for detection of geometric shapes like line, ellipse and objects.
- Illustrate 3D vision process and motion estimation techniques.
- Apply vision techniques to real time applications.

**TOTAL:45 PERIODS**

**TEXT BOOKS:**

1. D. A. Forsyth, J. Ponce, “Computer Vision: A Modern Approach”, Pearson Education, 2003.
2. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer Verlag London Limited,2011.

**REFERENCES:**

1. B. K. P. Horn -Robot Vision, McGraw-Hill.
2. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012.
3. Mark Nixon and Alberto S. Aquado, Feature Extraction & Image Processing for Computer Vision, Third Edition, Academic Press, 2012.
4. E. R. Davies, (2012), “Computer & Machine Vision”, Fourth Edition, Academic Press.
5. Concise Computer Vision: An Introduction into Theory and Algorithms, by Reinhard Klette, 2014

**OBJECTIVES:**

1. To understand about big data.
2. To learn and use NoSQL big data management.
3. To learn mapreduce analytics using Hadoop and related tools.
4. To work with map reduce applications
5. To understand the usage of Hadoop related tools for Big Data Analytics

**UNIT I UNDERSTANDING BIG DATA 9**

What is big data – why big data – convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data – big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.

**UNIT II NOSQL DATA MANAGEMENT 9**

Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – distribution models – sharding – master-slave replication – peer-peer replication – sharding and replication – consistency – relaxing consistency – version stamps – map-reduce – partitioning and combining – composing map-reduce calculations.

**UNIT III BASICS OF HADOOP 9**

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures.

**UNIT IV MAPREDUCE APPLICATIONS 9**

MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats.

**UNIT V HADOOP RELATED TOOLS 9**

Hbase – data model and implementations – Hbase clients – Hbase examples – praxis.Cassandra – cassandra data model – cassandra examples – cassandra clients – Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

**TOTAL:45 PERIODS****OUTCOMES:**

After the completion of this course, students will be able to:

- Describe big data and use cases from selected business domains.
- Explain NoSQL big data management.
- Install, configure, and run Hadoop and HDFS.
- Perform map-reduce analytics using Hadoop.
- Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

**LIST OF EXPERIMENTS:  
PERIODS**

**PRACTICALS:15**

1. Downloading and installing Hadoop; Understanding different Hadoop modes. Startup scripts, Configuration files.
2. Hadoop Implementation of file management tasks, such as Adding files and directories, retrieving files and Deleting files
3. Implement of Matrix Multiplication with Hadoop Map Reduce
4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
5. Installation of Hive along with practice examples.
7. Installation of HBase, Installing thrift along with Practice examples
8. Patrice importing and exporting data from various data bases.

**Software Requirements:**

Hadoop, Java, Hive and HBase.

**TOTAL:75 PERIODS**

**TEXT BOOKS:**

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.

**REFERENCES:**

1. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
2. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
3. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
4. Alan Gates, "Programming Pig", O'Reilley, 2011.

**AD8705**

**AI AND ROBOTICS**

**L T P C  
3 0 2 4**

**OBJECTIVES:**

1. To study the Robot Locomotion and types of robots.
2. To explore the kinematic models and constraints
3. To Learn sensors of robots and image processing for robotics.
4. To understand the methods for mobile robot Localization
5. To study the Path planning and Navigation of Robots.

**UNIT I ROBOT LOCOMOTION**

**9**

Introduction to AI and Robotics – robot locomotion – legged mobile robots – wheeled mobile robots – aerial mobile robots.

**UNIT II MOBILE ROBOT KINEMATICS**

**9**

Kinematic models and constraints – mobile robot maneuverability – mobile robot workspace – advanced kinematics – motion control.

**UNIT III ROBOT PERCEPTION**

**9**

Sensors for mobile robots – computer vision for robots – image processing for robotics – place recognition – range data.

**UNIT IV MOBILE ROBOT LOCALIZATION 9**

Introduction to localization – noise and aliasing – localization-based navigation – belief representation – map representation – probabilistic map-based localization – autonomous map building.

**UNIT V ROBOT PLANNING AND NAVIGATION 9**

Planning and navigation – planning and reacting – path planning – obstacle avoidance – navigation architectures.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**After the completion of this course, students will be able to:**

- CO1: Explain the types of Robots
- CO2: Narrate the kinematics of Robots
- CO3: Implement image processing algorithms
- CO4: Devise Localization algorithms
- CO5: Devise Path planning methods for navigation

**LIST OF EXPERIMENTS:  
PERIODS**

**PRACTICALS:15**

1. Line tracing bot
2. Gesture controlled bot
3. 4(Four) DOF Robotic Arm
4. Home Security System using NodeMCU
5. RF Controlled or WiFi controlled Navigation bot
6. Pick and place bot with Object Detetction
7. Wall Following bot
8. Maze solving Robot
9. Forward and reverse kinematics based experiment using open source platforms
10. Computer Visio based robotic tasks execution

**Software Requirements:**

Open Source Software

**TOTAL:75 PERIODS**

**TEXT BOOKS:**

1. R. Siegwart, I. R. Nourbaksh, and D. Scarramuzza, "Introduction to Autonomous Mobile Robots", Second Edition, MIT Press, 2011.
2. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition, Pearson Education, 2020.

**AD8711**

**DEEP LEARNING LABORATORY**

**L T P C  
0 0 4 2**

**OBJECTIVES:**

- 1: To learn deep neural networks and apply for simple problems
- 2: To Learn and apply Convolution Neural Network for image processing
- 3: To Learn and apply Recurrent Neural Network and its variants for text analysis
- 4: To augment data using generative models

5: To explore real world applications with deep neural networks

### LIST OF EXPERIMENTS:

1. Solving XOR problem using Multilayer perceptron
2. Implement character and Digit Recognition using ANN.
3. Implement the analysis of X-ray image using autoencoders
4. Implement Speech Recognition using NLP
5. Develop a code to design object detection and classification for traffic analysis using CNN
6. Implement online fraud detection of share market data using any one of the data analytics tools.
7. Implement image augmentation using deep RBM.
8. Implement Sentiment Analysis using LSTM.
9. Mini Project: Number plate recognition of traffic video analysis.

### Hardware/Software Requirements

#### Software:

- Understanding on Working of Colab and Transfer Learning Networks
- High end GPU Systems ( Huge Computation)

### OUTCOMES:

- CO1: Apply deep neural network for simple problems
- CO2: Apply Convolution Neural Network for image processing
- CO3: Apply Recurrent Neural Network and its variants for text analysis
- CO4: Apply generative models for data augmentation
- CO5: Develop a real world application using suitable deep neural networks

**TOTAL:60 PERIODS**

### REFERENCES

1. Wani, M.A., Raj, B., Luo, F., Dou, D. (Eds.), "Deep Learning Applications", Volume 3, Springer Publications 2022.
2. Stone, James. (2019), " Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning", Sebtel Press, United States, 2019

**EC8691**

**MICROPROCESSORS AND MICROCONTROLLERS**

**L T P C**  
**3 0 0 3**

### OBJECTIVES:

- To understand the Architecture of 8086 microprocessor.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To interface microprocessors with supporting chips.
- To study the Architecture of 8051 microcontroller.
- To design a microcontroller based system

### UNIT I THE 8086 MICROPROCESSOR

**9**

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.



**OBJECTIVES:**

- 1: To acquire knowledge on software process management
- 2: To acquire managerial skills for software project development.
- 3: To understand software economics
- 4: To acquire knowledge about real time software development scenarios.

**UNIT I SOFTWARE PROCESS 9**

Software Process Maturity Software maturity Framework, Principles of Software Process Change, Software Process Assessment, The Initial Process, The Repeatable Process, The Defined Process, The Managed Process, The Optimizing Process. Process Reference Models Capability Maturity Model (CMM), CMMI, PCMM, PSP, TSP).

**UNIT II SOFTWARE ECONOMICS AND LIFECYCLE 9**

Software Project Management Renaissance Conventional Software Management, Evolution of Software Economics, Improving Software Economics, The old way and the new way. Life-Cycle Phases and Process artifacts Engineering and Production stages, inception phase, elaboration phase, construction phase, transition phase, artifact sets, management artifacts, engineering artifacts and pragmatic artifacts, model-based software architectures.

**UNIT III SOFTWARE PROCESSES PLANNING 9**

Workflows and Checkpoints of process Software process workflows, Iteration workflows, Major milestones, minor milestones, periodic status assessments. Process Planning Work breakdown structures, Planning guidelines, cost and schedule estimating process, iteration planning process, Pragmatic planning.

**UNIT IV PROJECT MANAGEMENT AND METRICS 9**

Project Organizations Line-of- business organizations, project organizations, evolution of organizations, process automation. Project Control and process instrumentation The seven-core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic software metrics, metrics automation.

**UNIT V UNIT TITLE 9**

CCPDS-R Case Study and Future Software Project Management Practices Modern Project Profiles, Next-Generation software Economics, Modern Process Transitions.

**OUTCOMES:**

- CO1: Understand the software process phases in the cycle of software development.
- CO2: Gain knowledge of software economics, project organization, project control and process instrumentation
- CO3: Analyze the major and minor milestones, artifacts and metrics from management and technical perspective.
- CO4: Design and develop software product using conventional and modern principles of software project management
- CO5: Analyze the real time software development processes.

**TOTAL:45 PERIODS****TEXT BOOKS:**

1. Managing the Software Process, Watts S. Humphrey, Pearson Education
2. Software Project Management, Walker Royce, Pearson Education

## REFERENCES:

1. An Introduction to the Team Software Process, Watts S. Humphrey, Pearson Education, 2000 Process Improvement essentials, James R. Persse, O'Reilly, 2006
2. Software Project Management, Bob Hughes & Mike Cotterell, fourth edition, TMH, 2006
3. Applied Software Project Management, Andrew Stellman & Jennifer Greene, O'Reilly, 2006.
4. Head First PMP, Jennifer Greene & Andrew Stellman, O'Reilly, 2007
5. Software Engineering Project Management, Richard H. Thayer & Edward Yourdon, 2 nd edition, Wiley India, 2004.
6. Agile Project Management, Jim Highsmith, Pearson education, 2004.

AD8002

## HEALTH CARE ANALYSIS

L T P C  
3 0 0 3

### OBJECTIVES:

- 1: Understand the health data formats, health care policy and standards
- 2: Learn the significance and need of data analysis and data visualization
- 3: Understand the health data management frameworks
- 4: Learn the use of machine learning and deep learning algorithms in healthcare
- 5: Apply healthcare analytics for critical care applications

### UNIT I INTRODUCTION TO HEALTHCARE ANALYSIS 9

Overview - History of Healthcare Analysis Parameters on medical care systems- Health care policy- Standardized code sets – Data Formats – Machine Learning Foundations: Tree Like reasoning , Probabilistic reasoning and Bayes Theorem, Weighted sum approach.

### UNIT II ANALYTICS ON MACHINE LEARNING 9

Machine Learning Pipeline – Pre-processing –Visualization – Feature Selection – Training model parameter – Evaluation model : Sensitivity , Specificity , PPV ,NPV, FPR ,Accuracy , ROC , Precision Recall Curves , Valued target variables –Python: Variables and types, Data Structures and containers , Pandas Data Frame :Operations – Scikit –Learn : Pre-processing , Feature Selection.

### UNIT III HEALTH CARE MANAGEMENT 9

IOT- Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database – Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram bin Shifting and Rc6 Encryption – Clinical Prediction Models – Visual Analytics for Healthcare.

### UNIT IV HEALTHCARE AND DEEP LEARNING 9

Introduction on Deep Learning – DFF network CNN- RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System.

### UNIT V CASE STUDIES 9

Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT –Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG Data Analysis.

## OUTCOMES:

- CO1: Use machine learning and deep learning algorithms for health data analysis
- CO2: Apply the data management techniques for healthcare data
- CO3: Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications
- CO4: Design health data analytics for real time applications
- CO5: Design emergency care system using health data analysis

**TOTAL:45 PERIODS**

## REFERENCES:

1. Chandan K.Reddy, Charu C. Aggarwal, "Health Care data Analysis", First edition, CRC, 2015.
2. Vikas Kumar, "Health Care Analysis Made Simple", Packt Publishing, 2018.
3. Nilanjan Dey, Amira Ashour , Simon James Fong, Chintan Bhatl, "Health Care Data Analysis and Management, First Edition, Academic Press, 2018.
4. Hui Jang, Eva K.Lee, "HealthCare Analysis : From Data to Knowledge to Healthcare Improvement", First Edition, Wiley, 2016.
5. Kulkarni , Siarry, Singh ,Abraham, Zhang, Zomaya , Baki, "Big Data Analytics in HealthCare", Springer, 2020.

**AD8003**

**MOBILE APPLICATIONS DEVELOPMENT**

**L T P C**  
**3 0 0 3**

## OBJECTIVES:

1. Understand system requirements for mobile applications
2. Generate suitable design using specific mobile development frameworks
3. Generate mobile application design
4. Implement the design using specific mobile development frameworks
5. Deploy the mobile applications in marketplace for distribution

### **UNIT I INTRODUCTION TO MOBILE APPLICATIONS 9**

Web Vs mobile App – Cost of Development – Myths - Mobile Applications – Marketing - Mobile User Interface Design - Effective Use of Screen – Mobile Users - Mobile Information Design - Mobile Platforms - Tools of Mobile Interface Design

### **UNIT II ANDROID USER INTERFACE DESIGN 9**

Android Architecture – Android SDK Tools - Application Components - Intents - Content providers - Broadcast receivers – Services - User Interface Design - Views - View Groups – Layouts - Event Handling – Listeners – Adapters – Menus - Action Bars – Notifications - Android Localization

### **UNIT III ANDROID DATA STORAGE 9**

Content Providers – Uri - CRUD access –Browser – CallLog – Contacts – Media Store - Data Access and Storage - Shared Preferences - Storage External - Network Connection - SQLite Databases

### **UNIT IV ANDROID NATIVE CAPABILITIES 9**

Camera – Audio - Sensors and Bluetooth - Playing audio/video - Media recording - Sensors - Listening to sensor readings – Bluetooth - Android Communications – GPS - Working with

Location Manager, Working with Google Maps extensions - Maps via intent - Map Activity - Location based Services - Location Updates - Location Providers - Selecting a Location Provider - Finding Location

**UNIT V IOS DESIGN 9**

iPhone Craze – iOS Features – iOS Tools - iOS Project – Objective C Basics – Building iOS App – Actions and Outlets – Delegates - User Interface Elements – Accelerometer – Location Handling - SQLite Database

**OUTCOMES:**

- CO1:** Describe the requirements for mobile applications
- CO2:** Design user interface for mobile applications
- CO3:** Store mobile data of android applications
- CO4:** Evaluate native capabilities of android applications
- CO5:** Design iOS applications with tools

**TOTAL:45 PERIODS**

**REFERENCES:**

1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012.
2. Reto Meier, "Professional Android 4 Development", John Wiley and Sons, 2012.
3. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.

**AD8004 PARALLEL COMPUTING L T P C 3 0 0 3**

**OBJECTIVES:**

- 1:** To understand different parallelism techniques.
- 2:** To know parallel architecture.
- 3:** To learn about parallel algorithm design
- 4:** Understand parallel programming
- 5:** Learn about the interpretation of parallel programming

**UNIT I INTRODUCTION 9**

Historical progression leading to current state – types of parallelism including temporal, data and functional. Instructional level parallelism – pipelined processors – super scalar processors – VLIW processors – multithreaded processors – proposed future processors including trace, multiscalar and super flow – case studies

**UNIT II PARALLEL ARCHITECTURES 9**

Classification – inter connection networks – vector computers – shared memory parallel computers – cache coherence – distributed shared memory parallel computers – message passing parallel computers – cluster of workstations.

**UNIT III PARALLEL ALGORITHMS PLATFORM 9**

Preliminaries – decomposition techniques – characteristics of tasks and interactions – mapping techniques for load balancing – methods for containing interaction overheads – parallel algorithm models.

**UNIT IV PARALLEL PROGRAMMING DESGN 9**

Trends in microprocessor architectures - limitations of memory system performance – parallel computing platforms – communication costs in parallel machines – routing mechanisms for interconnection networks.

**UNIT V COMPILER TRANSFORMATIONS AND PERFORMANCE EVALUATION 9**

Dependence analysis loop transformations – transformations for parallel computers including data layouts, computational and communication optimization. Performance Metrics –performance lows – scalability – performance measurement books.

**OUTCOMES:**

- CO1:** Understand different parallel computing technique
- CO2:** Learn parallel computing architecture
- CO3:** Learn to design parallel algorithms
- CO4:** Understand how to develop parallel program
- CO5:** Know compiler interpretation of parallel programming

**TOTAL:45 PERIODS**

**TEXT BOOKS:**

1. V. Rajaraman and C. Siva Ram Murthy, “Parallel Computers – Architecture and Programming”, Prentice-Hall of India, 2003.
2. Ananth Grama, Anshul gupta, George Karypis and Vipin Kumar, “Introduction to Parallel Computing”, Pearson Education, Second edition, 2004.

**REFERENCES:**

1. Selim G.Akl – The design and analysis of parallel algorithms – Prentice Hall International Inc, 1989.
2. Hwang K. Briggs F.A. – Computer Architecture and parallel processing – MCGraw Hill – 1985
3. Shameem Akhter and Jason Roberts, “Multi-core Programming”, Intel Press, 2006.

**AD 8005 EMBEDDED SYSTEMS AND PROGRAMMING L T P C  
3 0 0 3**

**OBJECTIVES:**

- To understand the architecture of embedded processors, microcontrollers and peripheral devices
- To learn programming the embedded processor in assembly
- To understand the challenges in developing operating systems for embedded systems
- To learn programming the embedded systems in high level language such as C
- To understand the Real time operating systems

**UNIT I INTRODUCTION TO EMBEDDED SYSTEM 9**

Components of Embedded System – Classification - Characteristic of embedded system- Microprocessors & Micro controllers- Introduction to embedded processors - Embedded software architectures: Simple control loop - Interrupt controlled system - Cooperative multitasking - Preemptive multitasking or multi-threading - Micro kernels and kernels - Monolithic kernels - Exotic custom operating systems.



**UNIT I INTRODUCTION 9**

Basic concepts of software architecture – Context of Software Architecture – ABC cycle – What software architecture is and what it isn't – Architectural patterns – Good Architecture- Reference models – Architectural structures and views-Introduction to styles – Decentralized Architectures

**UNIT II DESIGN METHODOLOGIES 9**

Structured design- Design practices-Stepwise refinement – Incremental design- Structured system analysis and design –Jackson structured programming – Jackson system Development.

**UNIT III ARCHITECTURAL DESCRIPTION DOCUMENTATION AND EVALUATION 9**

Early architecture description languages-Domain and style specific ADL's- Extensible ADL's – Documenting software architecture – Uses and Audiences for Architecture Documentation – Views – Choosing Views – Combining Views –Architecture evaluation – Evaluation Factors – Architecture Tradeoff Analysis Method – Lightweight Architecture Evaluation – ATAM.

**UNIT IV ARCHITECTURE DESIGN 9**

Typical architectural design-Dataflow-Independent components-Call and return – Using styles in design – Architectural design space-Design space of architectural elements – Design space of architectural styles.

**UNIT V IMPLEMENTATION AND CONFORMANCE TO ARCHITECTURE 9**

Understanding quality attributes- Implementation of Quality attributes in Architecture – Architecture and requirements conformance –Functionality– Quality attribute considerations – System quality attributes-Introduction to tactics – Achieving Quality Attributes through Tactics – Tactics types –Architectural patterns and styles – Architecture and Quality Attributes – Quality attribute scenarios in practice.

**OUTCOMES:**

**Upon Completion of the course, the students should be able to:**

- Develop Software applications starting from software architecture and design.
- Learn and evaluate existing software architectures.
- Realize importance of architectural documentation and document them.
- Employ various software architecture design components.
- Design methods for improving software quality from the perspective of software architecture.

**TOTAL:45 PERIODS**

**TEXT BOOKS:**

1. Len Bass, Paul Clements, Rick Kazman, "Software Architecture in Practice", Third Edition, Addison,Wesley, 2012.
2. David Budgen, "Software Design", Second Edition, Pearson Education, 2004.

**REFERENCES:**

1. Richard N.Taylor, NenadMedvidovic and Eric M.Dashofy, "Software Architecture, Foundations,Theory and Practice", Wiley 2010.
2. Hong Zhu, "Software Design Methodology from Principles to Architectural Styles", Elsevier, 2005.

3. Mary Shaw and David Garlan, "Software Architecture –Perspectives on an emerging Discipline", Pearson Education, 2008.

<b>AD8006</b>	<b>ENGINEERING PREDICTIVE ANALYSIS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To explain terminology, technology and applications of predictive analysis
- To apply data preparation techniques and generate appropriate association rules.
- To discuss various descriptive models, their merits, demerits and application.
- To describe various predictive modelling methods.
- To introduce the text mining tools, technologies and case study which is used in day-to-day analytics cycle

**UNIT I INTRODUCTION TO PREDICTIVE ANALYTICS 9**

Overview of Predictive Analytics- Setting Up the Problem - Data Understanding- Single Variable- Data Visualization in One Dimension- Data Visualization, Two or Higher Dimensions- The Value of Statistical Significance- Pulling It All Together into a Data Audit.

**UNIT II DATA PREPARATION AND ASSOCIATION RULES 9**

Data Preparation- Variable Cleaning- Feature Creation- Item sets and Association Rules- Terminology- Parameter Settings- How the Data Is Organized- Measures of Interesting Rules- Deploying Association Rules- Problems with Association Rules- Building Classification Rules from Association Rules.

**UNIT III MODELLING 9**

Descriptive Modeling- Data Preparation Issues with Descriptive Modeling- Principal Component Analysis- Clustering Algorithms- Interpreting Descriptive Models- Standard Cluster Model Interpretation

**UNIT IV PREDICTIVE MODELLING 9**

Decision Trees- Logistic Regression -Neural Network Model – K-Nearest Neighbours – Naive Bayes – Regression Models - Linear Regression - Other Regression Algorithms.

**UNIT V TEXT MINING 9**

Motivation for Text Mining- A Predictive Modeling Approach to Text Mining- Structured vs. Unstructured Data- Why Text Mining Is Hard- Data Preparation Steps- Text Mining Features- Modeling with Text Mining Features- Regular Expressions- Case Studies:- Survey Analysis.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of this course, the students will be able to:**

- CO1: Explain terminology, technology and applications of predictive analysis  
 CO2: Apply data preparation techniques to effectively interpret big data  
 CO3: Discuss various descriptive models, their merits, demerits and application.  
 CO4: Describe principles of predictive analytics and apply them to achieve real, pragmatic

solutions.

CO5: Illustrate the features and applications of text mining.

## REFERENCES:

1. Dean Abbott, "Applied Predictive Analytics-Principles and Techniques for the Professional Data Analyst", Wiley, 2014
2. Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.
3. Conrad Carlberg, "Predictive Analytics: Microsoft Excel", 1st Edition, Que Publishing, 2012.
4. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani. An Introduction to Statistical Learning with Applications in R Springer 2013
5. Alberto Cordoba, "Understanding the Predictive Analytics Lifecycle", Wiley, 2014
6. Anasse Bari, Mohammad Chaouchi, Tommy Jung, Predictive Analytics for Dummies, 2nd Edition, 2017.

CS8603

## DISTRIBUTED SYSTEMS

L T P C  
3 0 0 3

### OBJECTIVES:

- To understand the foundations of distributed systems.
- To learn issues related to clock Synchronization and the need for global state in distributed systems.
- To learn distributed mutual exclusion and deadlock detection algorithms.
- To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems.
- To learn the characteristics of peer-to-peer and distributed shared memory systems.

### UNIT I Introduction 9

**Introduction:** Definition –Relation to computer system components –Motivation –Relation to parallel systems – Message-passing systems versus shared memory systems –Primitives for distributed communication –Synchronous versus asynchronous executions –Design issues and challenges. **A model of distributed computations:** A distributed program –A model of distributed executions –Models of communication networks –Global state – Cuts –Past and future cones of an event –Models of process communications. **Logical Time:** A framework for a system of logical clocks –Scalar time –Vector time – Physical clock synchronization: NTP.

### UNIT II MESSAGE ORDERING & SNAPSHOTS 9

**Message ordering and group communication:** Message ordering paradigms –Asynchronous execution with synchronous communication –Synchronous program order on an asynchronous system –Group communication – Causal order (CO) - Total order. **Global state and snapshot recording algorithms:** Introduction –System model and definitions –Snapshot algorithms for FIFO channels

### UNIT III DISTRIBUTED MUTEX & DEADLOCK 9

**Distributed mutual exclusion algorithms:** Introduction – Preliminaries – Lamport's algorithm –

Ricart-Agrawala algorithm – Maekawa’s algorithm – Suzuki–Kasami’s broadcast algorithm.  
**Deadlock detection in distributed systems:** Introduction – System model – Preliminaries – Models of deadlocks – Knapp’s classification – Algorithms for the single resource model, the AND model and the OR model.

#### **UNIT IV RECOVERY & CONSENSUS 9**

**Checkpointing and rollback recovery:** Introduction – Background and definitions – Issues in failure recovery – Checkpoint-based recovery – Log-based rollback recovery – Coordinated checkpointing algorithm – Algorithm for asynchronous checkpointing and recovery. **Consensus and agreement algorithms:** Problem definition – Overview of results – Agreement in a failure – free system – Agreement in synchronous systems with failures.

#### **UNIT V P2P & DISTRIBUTED SHARED MEMORY 9**

**Peer-to-peer computing and overlay graphs:** Introduction – Data indexing and overlays – Chord – Content addressable networks – Tapestry. **Distributed shared memory:** Abstraction and advantages – Memory consistency models – Shared memory Mutual Exclusion.

#### **OUTCOMES:**

**At the end of this course, the students will be able to:**

- Elucidate the foundations and issues of distributed systems
- Understand the various synchronization issues and global state for distributed systems.
- Understand the Mutual Exclusion and Deadlock detection algorithms in distributed systems
- Describe the agreement protocols and fault tolerance mechanisms in distributed systems.
- Describe the features of peer-to-peer and distributed shared memory systems

**TOTAL:45 PERIODS**

#### **TEXT BOOKS:**

1. Kshemkalyani, Ajay D., and Mukesh Singhal. Distributed computing: principles, algorithms, and systems. Cambridge University Press, 2011.
2. George Coulouris, Jean Dollimore and Tim Kindberg, “Distributed Systems Concepts and Design”, Fifth Edition, Pearson Education, 2012.

#### **REFERENCES:**

1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
2. Mukesh Singhal and Niranjana G. Shivaratri. Advanced concepts in operating systems. McGraw-Hill, Inc., 1994.
3. Tanenbaum A.S., Van Steen M., “Distributed Systems: Principles and Paradigms”, Pearson Education, 2007.
4. Liu M.L., “Distributed Computing, Principles and Applications”, Pearson Education, 2004.
5. Nancy A Lynch, “Distributed Algorithms”, Morgan Kaufman Publishers, USA, 2003.



- Develop techniques and tools for improving team collaboration and software quality.
- Perform Software process improvement as an ongoing task for development teams.
- Show how agile approaches can be scaled up to the enterprise level.

**TEXT BOOKS:**

1. David J. Anderson and Eli Schragenheim, “Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results”, Prentice Hall, 2003.
2. Hazza and Dubinsky, “Agile Software Engineering, Series: Undergraduate Topics in Computer Science”, Springer, 2009.

**REFERENCES:**

1. Craig Larman, “Agile and Iterative Development: A Manager’s Guide”, Addison-Wesley, 2004.
2. Kevin C. Desouza, “Agile Information Systems: Conceptualization, Construction, and Management”, Butterworth-Heinemann, 2007.

**CS8081**

**INTERNET OF THINGS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

**UNIT I FUNDAMENTALS OF IoT**

**9**

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

**UNIT II IoT PROTOCOLS**

**9**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

**UNIT III DESIGN AND DEVELOPMENT**

**9**

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

**UNIT IV DATA ANALYTICS AND SUPPORTING SERVICES**

**9**

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG

## UNIT V CASE STUDIES/INDUSTRIAL APPLICATIONS

9

Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

**TOTAL : 45 PERIODS**

### OUTCOMES:

**Upon completion of the course, the student should be able to:**

- Explain the concept of IoT.
- Analyze various protocols for IoT.
- Design a PoC of an IoT system using Rasperry Pi/Arduino
- Apply data analytics and use cloud offerings related to IoT.
- Analyze applications of IoT in real time scenario

### TEXTBOOK:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

### REFERENCES:

1. Arshdeep Bahga, Vijay Madiseti, "Internet of Things – A hands-on approach", Universities Press, 2015
2. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012 (for Unit 2).
3. Jan Ho" ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.
5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2<sup>nd</sup> Edition, O'Reilly\_Media, 2011.

<https://www.arduino.cc/>

[https://www.ibm.com/smarterplanet/us/en/?ca=v\\_smarterplanet](https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet)

<b>AD8007</b>	<b>SOFTWARE TESTING AND QUALITY ASSURANCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### OBJECTIVES:

- To understand the basics of testing, planning, designing and managing test cases.
- To study the various types of test in the life cycle of the software product.
- To build design concepts for system testing and execution.
- To learn the software quality assurance ,metrics, defect prevention techniques
- To learn the techniques for quality assurance and applying for applications.

**UNIT I SOFTWARE TESTING - CONCEPTS, ISSUES, AND TECHNIQUES 9**

Quality Revolution, Verification and Validation, Failure, Error, Fault, and Defect, Objectives of Testing, Testing Activities, Test Case Selection White-Box and Black, test Planning and design, Test Tools and Automation, Power of Test. Test Team Organization and Management-Test Groups, Software Quality Assurance Group, System Test Team Hierarchy, Team Building

**UNIT II SYSTEM TESTING 9**

System Testing - System Integration Techniques-Incremental, Top Down Bottom Up Sandwich and Big Bang, Software and Hardware Integration, Hardware Design Verification Tests, Hardware and Software Compatibility Matrix Test Plan for System Integration. Built- in Testing. Functional testing - Testing a Function in Context. Boundary Value Analysis, Decision Tables. acceptance testing - Selection of Acceptance Criteria, Acceptance Test Plan, Test Execution Test. software reliability - Fault and Failure, Factors Influencing Software, Reliability Models

**UNIT III SYSTEM TEST CATEGORIES 10**

System test categories Taxonomy of System Tests, Interface Tests Functionality Tests. GUI Tests, Security Tests Feature Tests, Robustness Tests, Boundary Value Tests Power Cycling Tests Interoperability Tests, Scalability Tests, Stress Tests, Load and Stability Tests, Reliability Tests, Regression Tests, Regulatory Tests. Test Generation from FSM models- State-Oriented Model. Finite-State Machine Transition Tour Method, Testing with State Verification. Test Architectures-Local, distributed, Coordinated, Remote system test design- Test Design Factors Requirement Identification, modeling a Test Design Process Test Design Preparedness, Metrics, Test Case Design Effectiveness. System test execution- Modeling Defects, Metrics for Monitoring Test Execution .Defect Reports, Defect Causal Analysis, Beta testing, measuring Test Effectiveness.

**UNIT IV SOFTWARE QUALITY 8**

Software quality - People's Quality Expectations, Frameworks and ISO-9126, McCall's Quality Factors and Criteria – Relationship. Quality Metrics. Quality Characteristics ISO 9000:2000 Software Quality Standard. Maturity models- Test Process Improvement, Testing Maturity Model.

**UNIT V SOFTWARE QUALITY ASSURANCE 9**

Quality Assurance - Root Cause Analysis, modeling, technologies, standards and methodologies for defect prevention. Fault Tolerance and Failure Containment - Safety Assurance and Damage Control, Hazard analysis using fault-trees and event-trees. Comparing Quality Assurance Techniques and Activities. QA Monitoring and Measurement, Risk Identification for Quantifiable Quality Improvement. Case Study: FSM-Based Testing of Web-Based Applications.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Perform functional and non-functional tests in the life cycle of the software product.
- Understand system testing and test execution process.
- Identify defect prevention techniques and software quality assurance metrics.
- Apply techniques of quality assurance for typical applications.

**TEXT BOOKS:**

1. Software Testing And Quality Assurance-Theory and Practice, Kshirasagar Naik, Priyadarshi Tripathy, John Wiley & Sons Inc,2008

2. Software Quality Assurance - From Theory to Implementation, Daniel Galin, Pearson Education Ltd UK, 2004

**REFERENCES:**

1. Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement, Jeff Tian, John Wiley & Sons, Inc., Hoboken, New Jersey. 2005.
2. Software Quality Assurance, Milind Limaye, TMH ,New Delhi, 2011
3. Aditya P. Mathur, “Foundations of Software Testing \_ Fundamental Algorithms and Techniques”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.

**CS8791**

**CLOUD COMPUTING**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To understand the concept of cloud computing.
- To appreciate the evolution of cloud from the existing technologies.
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.

**UNIT I INTRODUCTION 9**

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning

**UNIT II CLOUD ENABLING TECHNOLOGIES 9**

Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish-Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery.

**UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE 9**

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - IaaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

**UNIT IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD 9**

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.

**UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS 9**

Hadoop – MapReduce – Virtual Box -- Google App Engine – Programming Environment for Google App Engine — Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.

## OUTCOMES:

### On Completion of the course, the students should be able to:

- Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
- Learn the key and enabling technologies that help in the development of cloud.
- Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.
- Explain the core issues of cloud computing such as resource management and security.
- Be able to install and use current cloud technologies.
- Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

**TOTAL:45 PERIODS**

## TEXT BOOKS:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017.

## REFERENCES:

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach", Tata Mcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)", O'Reilly, 2009.

**CS8085**

**SOCIAL NETWORK ANALYTICS**

**L T P C**

**3 0 0 3**

## OBJECTIVES:

- To understand the concept of semantic web and related applications.
- To learn knowledge representation using ontology.
- To understand human behaviour in social web and related communities.
- To learn visualization of social networks.

## UNIT I INTRODUCTION

**9**

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

## UNIT II MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION

**9**

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of



**OBJECTIVES:**

1. To understand the types of web services, resources, APIs and their architectures
2. To analyze the web service / API design patterns
3. To understand the design principles and best practices
4. To develop, deploy RESTful web service APIs in JAVA
5. To understand the security concerns.

**9****INTRODUCTION****UNIT I**

Web Services - Building Blocks, Types; Service Oriented architectures - resource oriented architectures, API architectures, Micro services and architectures, HATEOAS, REST, URI, Code on Demand.

**UNIT II RESOURCES AND DESIGN PATTERNS****9**

Resources - Identification, Resource Relations, Representations, Parameters, types, methods, Requirements for APIs, Architectural Patterns. Basic and Advanced RESTful API patterns.

**UNIT III RESTFUL API DESIGN PRINCIPLES****9**

API front End Design, API back end Design, Identifier Design, Interaction Design with HTTP, Metadata Design, Representation Design, URI design, REST constraints, Best Practices.

**UNIT IV DEVELOPMENT AND DEPLOYMENT****9**

Frameworks, Standard Languages, API Description Languages, Handover points, Development and Deployment of RESTful web service applications in Java, microservice API, Best Practices.

**UNIT V PERFORMANCE AND SECURITY****9**

Performance and availability - caching - Traffic shaping - Evolution and versioning, Security concerns - Mechanisms, Authentication, Validation, Access Control, Token Based Authentication, Authorization.

**OUTCOMES:**

At the end of the course, the student should be able to:

- Use a suitable architecture for a given design problem
- Analyze the types of resources and suitable design patterns for development and deployment
- Create and Analyze front-end and Back end designs
- Deploy RESTful API web services using JAVA
- Implement security best practices for preventing security attacks

**TOTAL:45 PERIODS****TEXT BOOK:**

1. Matthias Biehl, "RESTful API Design, API University Series, 1st Edition, CreateSpace Independent Publishing Platform, 2016.
2. Mark Masse, "REST API Design Rulebook: Designing Consistent RESTful Web Service Interfaces", 1st Edition, O' Reilly, 2011.
3. Harihara Subramanian, Pethuru Raj, "Hands-On RESTful API Design Patterns and Best Practices: Design, develop, and deploy highly adaptable, scalable, and secure "RESTful web APIs", Packt Publishing, 2019.

**REFERENCES:**

1. JJ Geewax, "API Design Patterns", 1st Edition, Manning Publications, 2021.
2. Bogunuva Mohanram Balachandar, "Restful Java Web Services: A pragmatic guide to designing and building RESTful APIs using Java, 3rd Edition, Ingram Short Title, 2017.

<b>AD8009</b>	<b>OPERATIONS AND SUPPLY CHAIN MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To provide an insight on the operations, quality management and sampling tools and fundamentals of supply chain networks, tools and techniques

**UNIT I INTRODUCTION TO OPERATIONS AND SUPPLY CHAIN MANAGEMENT 9**

Scope and Importance- Evolution of Supply Chain - Decision Phases in Supply Chain - Competitive and Supply chain Strategies – Drivers of Supply Chain Performance and Obstacles - The Operations Function - The Evolution of Operations and Supply Chain Management – Globalization - Productivity and Competitiveness - Strategy and Operations-Operational Decision-Making Tools: Decision Analysis-Decision Analysis with and without Probabilities

**UNIT II QUALITY MANAGEMENT 9**

Quality and Value in Athletic Shoes -What Is Quality-Quality Management System-Quality Tools-Quality in Services-Six Sigma-Quality Costs and Productivity-Quality Awards-ISO 9000-Statistical Process Control-Operational Decision-Making Tools: Acceptance Samp

**UNIT III NETWORK DESIGN AND TRANSPORTATION 9**

Factors influencing Distribution network design – Design options for Distribution Network— factors affecting transportations decision – Design option for transportation network – Tailored transportation – Routing and scheduling in transportation

**UNIT IV SOURCING AND COORDINATION 9**

Role of sourcing supply chain - supplier selection assessment and contracts- Design collaboration - sourcing planning and analysis - supply chain co-ordination - Bull whip effect – Effect of lack of co-ordination in supply chain and obstacles – Building strategic partnerships and trust within a supply chain.

**UNIT V SUPPLY CHAIN AND INFORMATION TECHNOLOGY 9**

The role IT in supply chain- The supply chain IT frame work - Customer Relationship Management – Internal supply chain management – supplier relationship management – future of IT in supply chain – E-Business in supply chain.

**TOTAL:45 PERIODS**

**OUTCOMES:**

- To know about the operations and fundamentals of supply chain
- To understand the quality management tools and sampling process
- To understand the design factors and various design options of distribution networks in industries and the role of transportation and warehousing
- To understand the various sourcing decisions in supply chain





**UNIT II SECURITY IN OPERATING SYSTEM & NETWORKS 9**

Security in Operating Systems - Security in the Design of Operating Systems -Rootkit - Network security attack- Threats to Network Communications - Wireless Network Security - Denial of Service - Distributed Denial-of-Service.

**UNIT III DEFENCES: SECURITY COUNTER MEASURES 9**

Cryptography in Network Security - Firewalls - Intrusion Detection and Prevention Systems - Network Management - Databases - Security Requirements of Databases - Reliability and Integrity - Database Disclosure - Data Mining and Big Data.

**UNIT IV PRIVACY IN CYBERSPACE 9**

Privacy Concepts -Privacy Principles and Policies -Authentication and Privacy - Data Mining - Privacy on the Web - Email Security - Privacy Impacts of Emerging Technologies.

**UNIT V MANAGEMENT AND INCIDENTS 9**

Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster - Emerging Technologies - The Internet of Things - Economics - Electronic Voting - Cyber Warfare- Cyberspace and the Law - International Laws - Cyber crime - Cyber Warfare and Home Land Security.

**OUTCOMES:**

**After the completion of this course, students will be able to:**

- CO1: Explain the basic concepts of computer security
- CO2: Devise methods for Security in operating system & networks
- CO3: Differentiate the various security counter measures.
- CO4: Devise Privacy principles and policies
- CO5: Manage the Cyber space.

**TOTAL:45 PERIODS**

**TEXT BOOKS:**

1. Jan L.Harrington,"Network Security – A Practical Approach", Morgan Kaufmann Publishers –An Imprint of Elsevier, 2005,
2. William Stallings, "Cryptography and Network Security – Principles and Practice", Pearson Education Asia, Fourth Edition, 2005

**REFERENCES:**

1. Edward Amoroso, "Cyber Security", Silicon Press, 2006
2. Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5th Edition , Pearson Education , 2015
3. George K.Kostopoulos, Cyber Space and Cyber Security, CRC Press, 2013.
4. MarttiLehto, PekkaNeittaanmäki, Cyber Security: Analytics, Technology and Automation edited, Springer International Publishing Switzerland 2015
5. Nelson Phillips and EnfingerSteuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.

AD8012

**NONLINEAR OPTIMIZATION**

L	T	P	C
3	0	0	3

**OBJECTIVES:**

- 1.To understand the role of optimization techniques and its importance in engineering
2. To introduce the concept of nonlinear optimization methods.
3. To realize the application of non-traditional optimization algorithms
4. To choose appropriate optimization method and solve real world problems.

**UNIT I CLASSICAL OPTIMIZATION TECHNIQUES 9**

Single variable optimization, Constrained and unconstrained multi-variable optimization, Direct substitution method, Lagrange's method of multipliers, Karush-Kuhn-Tucker conditions

**UNIT II NON-LINEAR PROGRAMMING: ONE-DIMENSIONAL MINIMIZATION METHOD 9**

Unimodal function, Unrestricted search, Exhaustive search, Dichotomous search, Interval halving method, Fibonacci method, Golden section method, Direct root methods

**UNIT III NON-LINEAR PROGRAMMING: UNCONSTRAINED OPTIMIZATION TECHNIQUES 9**

Direct Search Methods: Random search methods, Grid search method, Univariate method, Hookes and Jeeves' method, Powell's method Indirect Search Methods: Steepest descent method, Fletcher-Reeves method, Newton's method

**UNIT IV NON-LINEAR PROGRAMMING: CONSTRAINED OPTIMIZATION TECHNIQUES 9**

Direct Methods: Random search method, Sequential linear programming, Indirect methods: Transformation techniques, Exterior penalty function method, Interior penalty function method

**UNITV ADVANCED NON-LINEAR OPTIMIZATION 9**

Genetic Algorithms -Working principle-Genetic operators-Numerical problem-Simulated Annealing – Numerical problem - Neural network based optimization-Optimization of fuzzy systems-fuzzy set theory-computational procedure

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of this course, the students will be able to:**

- Comprehend the need and applications of the optimization methods
- understand basic theoretical principles for formulation of optimization models and its solution.
- learn the unified and exact mathematical basis as well as the general principles of various soft computing techniques
- apply detailed theoretical and practical aspects of intelligent modelling, optimization and control of non-linear systems.

**REFERENCES:**

1. Engineering Optimization Theory and Practice, S.S.Rao, New Age International (P),5<sup>th</sup> edition,2019
2. C. B Gupta ,Optimization Techniques in Operation Research, I.K.International House

Pvt.Ltd 2007.

3. Godfrey C. Onwubolu, B. V. Babu, New Optimization Techniques in Engineering, 2004
4. Cesar Lopez, MATLAB Optimization Techniques, 2014

**AD8013**

**ETHICS OF ARTIFICIAL INTELLIGENCE**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- 1: To understand the need for ensuring ethics in AI
- 2: To understand ethical issues with the development of AI agents
- 3: To apply the ethical considerations in different AI applications
- 4: To evaluate the relation of ethics with nature
- 5: To overcome the risk for Human rights and other fundamental values.

**UNIT I INTRODUCTION TO ETHICS OF AI 9**

Role of Artificial Intelligence in Human Life, Understanding Ethics, Why Ethics in AI? Ethical Considerations of AI, Current Initiatives in AI and Ethics, Ethical Issues with our relationship with artificial Entities

**UNIT II FRAMEWORK AND MODELS 9**

AI Governance by Human-right centered design, Normative models, Role of professional norms, Teaching Machines to be Moral

**UNIT III CONCEPTS AND ISSUES 9**

Accountability in Computer Systems, Transparency, Responsibility and AI. Race and Gender, AI as a moral right-holder

**UNIT IV PERSPECTIVES AND APPROACHES 9**

Perspectives on Ethics of AI, Integrating ethical values and economic value, Automating origination, AI a Binary approach, Machine learning values, Artificial Moral Agents

**UNIT V CASES AND APPLICATION 9**

Ethics of Artificial Intelligence in Transport, Ethical AI in Military, Biomedical research, Patient Care, Public Health, Robot Teaching, Pedagogy, Policy, Smart City Ethics

**OUTCOMES:**

- CO1: Understand the ethical issues in the development of AI agents  
CO2: Learn the ethical considerations of AI with perspectives on ethical values  
CO3: Apply the ethical policies in AI based applications and Robot development  
CO4: To implement the AI concepts to societal problems by adapting the legal concepts by securing fundamental rights.  
CO5: This study will help to overcome the evil genesis in the concepts of AI.

**TOTAL:45 PERIODS**

**REFERENCES**

1. Paula Boddington, "Towards a Code of Ethics for Artificial Intelligence", Springer, 2017
2. Markus D. Dubber, Frank Pasquale, Sunit Das, "The Oxford Handbook of Ethics of AI", Oxford University Press Edited book, 2020
3. S. Matthew Liao, "Ethics of Artificial Intelligence", Oxford University Press Edited



CO5: Understand the different Production and Marketing techniques used in the industries.

**TOTAL:45 PERIODS**

**TEXT BOOKS**

1. O.P. Khanna, 'Industrial Engineering and Management', Dhanpat Rai and Sons,201
2. R. Pannerselvam, 'Engineering Economics', Prentice Hall of India Pvt. Ltd,2014

**REFERENCES**

1. S.K. Jain, "Applied Economics for Engineers and Managers", Vikas Publications House, New Delhi, 1997.
2. Mote Paul, Gupta, "Managerial Economics" Tata Mc Graw Hill, 1987.
3. Joseph L. Massie, "Essentials of Management", Prentice-Hall of India, Third edition, 1979.

<b>AD8081</b>	<b>COGNITIVE SCIENCE AND ANALYTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To explain cognitive computing and design principles.
- To distinguish between NLP and cognitive computing.
- To apply advanced analytics to cognitive computing.
- To discuss application of cognitive computing in business.
- To illustrate various applications of cognitive computing.

**UNIT I FOUNDATION & DESIGN PRINCIPLES 9**

Foundation of Cognitive Computing: cognitive computing as a new generation, the uses of cognitive systems, system cognitive, gaining insights from data, Artificial Intelligence as the foundation of cognitive computing, understanding cognition.

Design Principles for Cognitive Systems: Components of a cognitive system, building the corpus, bringing data into cognitive system, machine learning, hypotheses generation and scoring, presentation and visualization services.

**UNIT II NLP IN COGNITIVE SYSTEM 9**

Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system, semantic web, Applying Natural language technologies to Business problems.

Representing knowledge in Taxonomies and Ontologies: Representing knowledge, Defining Taxonomies and Ontologies, knowledge representation, models for knowledge representation, implementation considerations.

**UNIT III BIG DATA Vs COGNITIVE COMPUTING 9**

Relationship between Big Data and Cognitive Computing: Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data.

Applying Advanced Analytics to cognitive computing: Advanced analytics is on a path to cognitive computing, Key capabilities in advanced analytics, Using advanced analytics to create value, Impact of open source tools on advanced analytics.

**UNIT IV                      COGNITIVE COMPUTING IN BUSINESS                      9**

The Business Implications of Cognitive Computing: Preparing for change, advantages of new disruptive models, knowledge meaning to business, difference with a cognitive systems approach, meshing data together differently, using business knowledge to plan for the future, answering business questions in new ways, building business specific solutions, making cognitive computing a reality, cognitive application changing the market- IBM Watson as a cognitive systems.

**UNIT V                      APPLICATIONS                      9**

The process of building a cognitive application: Emerging cognitive platform, defining the objective, defining the domain, understanding the intended users and their attributes, questions and exploring insights, training and testing- Building a cognitive health care application- Smarter cities-Cognitive Computing in Government.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of this course, the students will be able to:**

- CO1: Explain cognitive computing and design principles.
- CO2: Distinguish between NLP and cognitive computing.
- CO3: Apply advanced analytics to cognitive computing.
- CO4: Discuss application of cognitive computing in business.
- CO5: Illustrate various applications of cognitive computing.

**REFERENCES:**

1. Judith H Hurwitz, Marcia Kaufman, Adrian Bowles, "Cognitive computing and Big Data Analytics" , Wiley, 2015.
2. Vijay Raghvan, Venu Govindaraju, C.R. Rao, Cognitive Computing: Theory and Applications", by Elsevier publications, North Holland Publication, 1<sup>st</sup> Edition, 2016.
3. Bernadette Sharp (Author), Florence Sedes (Author), Wieslaw Lubaszewski (Author), Cognitive Approach to Natural Language Processing Hardcover, First Edition May 2017.
4. Arun Kumar Sangaiah, Arunkumar Thangavelu, et al., Cognitive Computing for Big Data Systems Over IoT: Frameworks, Tools and Applications: Lecture Notes on Data Engineering and Communications Technologies 1st edition 2018
5. Min Chen and Kai Hwang, Big-Data Analytics for Cloud, IoT and Cognitive Computing Wiley Publication, 1<sup>st</sup> Edition, 2017.
6. Mallick, Pradeep Kumar, Borah, Samarjeet," Emerging Trends and Applications in Cognitive Computing", IGI Global Publishers, 2019.

**MG8591                      PRINCIPLES OF MANAGEMENT                      L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.

- UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9**  
 Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.
- UNIT II PLANNING 9**  
 Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.
- UNIT III ORGANISING 9**  
 Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management
- UNIT IV DIRECTING 9**  
 Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication –communication and IT.
- UNIT V CONTROLLING 9**  
 System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

**TEXTBOOKS:**

1. Stephen P. Robbins & Mary Coulter, “Management”, Prentice Hall (India) Pvt. Ltd., 10<sup>th</sup> Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, Pearson Education, 6th Edition, 2004.

**REFERENCES:**

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, “Fundamentals of Management” Pearson Education, 7th Edition, 2011.
2. Robert Kreitner & Mamata Mohapatra, “ Management”, Biztantra, 2008.
3. Harold Koontz & Heinz Wehrich “Essentials of management” Tata McGraw Hill, 1998.
4. Tripathy PC & Reddy PN, “Principles of Management”, Tata McGraw Hill, 1999

**OBJECTIVES:**

- To understand fundamental topics in bio-inspired optimization techniques
- To Learn the collective systems such as ACO, PSO, and BCO
- To develop skills in biologically inspired algorithm design with an emphasis on solving real world problems
- To understand the most appropriate types of algorithms for different data analysis problems and to introduce some of the most appropriate implementation strategies.
- To implement the Bio-inspired technique with other traditional algorithms.

**UNIT I INTRODUCTION 9**

Optimization Techniques: Introduction to Optimization Problems – Single and Multi- objective Optimization – Classical Techniques – Overview of various Optimization methods – Evolutionary Computing: Genetic Algorithm and Genetic Programming: Basic concept – encoding – representation – fitness function – Reproduction – differences between GA and Traditional optimization methods – Applications – Bio- inspired Computing (BIC): Motivation – Overview of BIC – usage of BIC – merits and demerits of BIC.

**UNIT II SWARM INTELLIGENCE 9**

Introduction – Biological foundations of Swarm Intelligence – Swarm Intelligence in Optimization – Ant Colonies: Ant Foraging Behavior – Towards ArtificialAnts – Ant Colony Optimization (ACO) – S-ACO – Ant Colony Optimization Metaheuristic: Combinatorial Optimization – ACO Metaheuristic – Problem solving usingACO – Other Metaheuristics – Simulated annealing – Tabu Search – Local search methods – Scope of ACO algorithms.

**UNIT III NATURAL TO ARTIFICIAL SYSTEMS 9**

Biological Nervous Systems – artificial neural networks – architecture – Learning Paradigms – unsupervised learning – supervised learning – reinforcement learning – evolution of neural networks – hybrid neural systems – Biological Inspirations in problem solving – Behavior of Social Insects: Foraging –Division of Labor – Task Allocation – Cemetery Organization and Brood Sorting – Nest Building – Cooperative transport.

**UNIT IV SWARM ROBOTICS 9**

Foraging for food – Clustering of objects – Collective Prey retrieval –Scope of Swarm Robotics – Social Adaptation of Knowledge: Particle Swarm – ParticleSwarm Optimization (PSO) – Particle Swarms for Dynamic Optimization Problems – Artificial Bee Colony (ABC) Optimization biologically inspired algorithms in engineering.

**UNIT V CASE STUDIES 9**

Other Swarm Intelligence algorithms: Fish Swarm – Bacteria foraging – Intelligent Water Drop Algorithms – Applications of biologically inspired algorithms in engineering. Case Studies: ACO and PSO for NP-hard problems – Routing problems – Assignment problems – Scheduling problems – Subset problems – Machine Learning Problems –Travelling Salesman problem.

**OUTCOMES:**

- CO1:** Familiarity with the basics of several biologically inspired optimization techniques.  
**CO2:** Familiarity with the basics of several biologically inspired computing paradigms.  
**CO3:** Ability to select an appropriate bio-inspired computing method and implement for any application and data set.

**CO4:** Theoretical understanding of the differences between the major bio-inspired computing methods.

**CO5:** Learn Other Swarm Intelligence algorithms and implement the Bio-inspired technique with other traditional algorithms.

**TOTAL PERIODS:45**

### TEXT BOOK

1. A. E. Elben and J. E. Smith, "Introduction to Evolutionary Computing", Springer, 2010.
2. Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008.
3. Leandro Nunes de Castro, " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007

### REFERENCES

1. Eric Bonabeau, Marco Dorigo, Guy Theraulaz, "Swarm Intelligence: From Natural to Artificial Systems", Oxford University press, 2000.
2. Christian Blum, Daniel Merkle (Eds.), "Swarm Intelligence: Introduction and Applications", Springer Verlag, 2008.
3. Leandro N De Castro, Fernando J Von Zuben, "Recent Developments in Biologically Inspired Computing", Idea Group Inc., 2005.
4. Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.
5. C. Ebelhart et al., "Swarm Intelligence", Morgan Kaufmann, 2001.

**AD8016**

**INFORMATION EXTRACTION AND RETRIEVAL**

**L T P C**

**3 0 0 3**

### OBJECTIVES:

- 1: To understand the different ways for extraction of multimedia data
- 2: To learn and analyze the information retrieval techniques
- 3: To apply the information retrieval algorithms for real time applications
- 4: To understand and evaluate the applications of information retrieval techniques
- 5: To understand the role of information retrieval systems in web applications

### UNIT I INTRODUCTION TO INFORMATION EXTRACTION

**9**

Introduction – Origins – Text, Audio ,Image, Video Extraction – Visual object Feature Localization - Entropy based Image Analysis – 3D shape Extraction Techniques - Semantic Multimedia Extraction using Audio & Video – Multimedia Web Documents.

### UNIT II TEXT EXTRACTION

**9**

Pre-processing Techniques – Clustering – Probabilistic Models – Browsing and Query Refinement on presentation Layer- Link Analysis – Visualization Approaches and its Operations.

### UNIT III INFORMATION RETRIEVAL SYSTEMS

**9**

Text formats –Retrieval and Ranking –Evaluation strategies – Tokens –Query processing –Static Inverted Indices – Dynamic Inverted Indices – Index compression –Categorization and Filtering Classifiers –Probabilistic, Linear ,Similarity based, Generalized Linear, Information Theoretic models- XML Retrieval.



**ANNA UNIVERSITY, CHENNAI 600 025**  
**NON-AUTONOMOUS COLLEGES AFFILIATED TO ANNA UNIVERSITY**  
**B.TECH. COMPUTER SCIENCE AND BUSINESS SYSTEMS**  
**REGULATIONS – 2017**  
**CHOICE BASED CREDIT SYSTEM**

**PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

- I. To ensure graduates will be proficient in utilizing the fundamental knowledge of basic sciences, mathematics, Computer Science and Business systems for the applications relevant to various streams of Engineering and Technology.
- II. To enrich graduates with the core competencies necessary for applying knowledge of computer science and Data analytics tools to store, retrieve, implement and analyze data in the context of business enterprise
- III. To enable graduates to gain employment in organizations and establish themselves as professionals by applying their technical skills and leadership qualities to solve real world problems and meet the diversified needs of industry, academia and research
- IV. To equip the graduates with entrepreneurial skills and qualities which help them to perceive the functioning of business, diagnose business problems, explore the entrepreneurial opportunities and prepare them to manage business efficiently.

**PROGRAM OUTCOMES (POs) ENGINEERING GRADUATES WILL BE ABLE TO:**

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

#### **PROGRAM SPECIFIC OUTCOMES (PSOs)**

PSO1: To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

PSO2: To evolve computer science domain specific methodologies for effective decision making in several critical problem domains of the real world.

PSO3: To be able to apply entrepreneurial skills and management tools for identifying, analyzing and creating business opportunities with smart business ideas.

PSO4: To manage complex IT projects with consideration of the human, financial, ethical and environmental factors and an understanding of risk management processes, and operational and policy implications

**ANNA UNIVERSITY, CHENNAI 600 025**  
**NON - AUTONOMOUS COLLEGES AFFILIATED TO ANNA UNIVERSITY**  
**B.TECH. COMPUTER SCIENCE AND BUSINESS SYSTEMS**  
**REGULATIONS – 2017**  
**CHOICE BASED CREDIT SYSTEM**  
**I - VIII SEMESTERS CURRICULUM**

**SEMESTER I**

SI. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	HS8151	Communicative English	HS	4	4	0	0	4
2.	MA8151	Engineering Mathematics – I	BS	4	4	0	0	4
3.	PH8151	Engineering Physics	BS	3	3	0	0	3
4.	CY8151	Engineering Chemistry	BS	3	3	0	0	3
5.	GE8151	Problem Solving and Python Programming	ES	3	3	0	0	3
6.	GE8152	Engineering Graphics	ES	6	2	0	4	4
<b>PRACTICALS</b>								
7.	GE8161	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
8.	BS8161	Physics and Chemistry Laboratory	BS	4	0	0	4	2
<b>TOTAL</b>				<b>31</b>	<b>19</b>	<b>0</b>	<b>12</b>	<b>25</b>

**SEMESTER II**

SI. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	HS8251	Technical English	HS	4	4	0	0	4
2.	MA8252	Linear Algebra	BS	4	4	0	0	4
3.	AD8251	Data Structures Design	PC	3	3	0	0	3
4.	GE8291	Environmental Science and Engineering	ES	3	3	0	0	3
5.	BE8255	Basic Electrical, Electronics, and Measurement Engineering	HS	3	3	0	0	3
6.	AD8252	Digital Principles and Computer Organization	PC	5	3	0	2	4
<b>PRACTICALS</b>								
7.	GE8261	Engineering Practices Laboratory	ES	4	0	0	4	2
8.	AD8261	Data Structures Design Laboratory	PC	4	0	0	4	2
<b>TOTAL</b>				<b>30</b>	<b>20</b>	<b>0</b>	<b>10</b>	<b>25</b>

### SEMESTER III

SI. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MA8351	Discrete Mathematics	BS	4	4	0	0	4
2.	CW8301	Fundamentals of Economics	BS	3	3	0	0	3
3.	CS8392	Object Oriented Programming	PC	3	3	0	0	3
4.	AD8351	Design and Analysis of Algorithms	PC	5	3	0	2	4
5.	CS8492	Database Management Systems	PC	3	3	0	0	3
<b>PRACTICALS</b>								
6.	CW8311	Business Communication and Value Science Laboratory I	PC	4	0	0	4	2
7.	CS8383	Object Oriented Programming Laboratory	PC	4	0	0	4	2
8.	CS8481	Database Management Systems Laboratory	PC	4	0	0	4	2
<b>TOTAL</b>				<b>30</b>	<b>16</b>	<b>0</b>	<b>14</b>	<b>23</b>

### SEMESTER IV

SI. No	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MA8391	Probability and Statistics	BS	4	4	0	0	4
2.	CS8493	Operating Systems	PC	3	3	0	0	3
3.	CW8401	Introduction to Business Systems	PC	3	3	0	0	3
4.	CW8402	Computational Statistics	PC	3	3	0	0	3
5.	CS8494	Software Engineering	PC	3	3	0	0	3
<b>PRACTICALS</b>								
6.	CS8461	Operating Systems Laboratory	PC	4	0	0	4	2
7.	CW8411	Computational Statistics Laboratory	PC	4	0	0	4	2
8.	CW8412	Business Communication and Value Science Laboratory II	PC	4	0	0	4	2
<b>TOTAL</b>				<b>28</b>	<b>16</b>	<b>0</b>	<b>12</b>	<b>22</b>

### SEMESTER V

Sl. No	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	CW8591	Software Architecture	PC	3	3	0	0	3
2.	CW8501	Software Design using UML	PC	5	3	0	2	4
3.	CW8502	Operations Research	BS	5	3	0	2	4
4.	CW8503	Design Thinking	PC	5	3	0	2	4
5.	CS8501	Theory of Computation	PC	3	3	0	0	3
6.		Open Elective I	OE	3	3	0	0	3
<b>PRACTICALS</b>								
7.	CW8511	Mini Project(Software / System Design/Architecture) end to end	EEC	4	0	0	4	2
8.	CW8512	Soft Skills Laboratory	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>30</b>	<b>18</b>	<b>0</b>	<b>12</b>	<b>24</b>

### SEMESTER VI

Sl. No	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	CW8691	Computer Networks	PC	5	3	0	2	4
2.	CS8691	Artificial Intelligence	PC	3	3	0	0	3
3.	CS8602	Compiler Design	PC	5	3	0	2	4
4.	CW8601	Fundamentals of Management	PC	3	3	0	0	3
5.	AD8551	Business Analytics	PC	3	3	0	0	3
6.		Professional Elective-1	PE	3	3	0	0	3
<b>PRACTICALS</b>								
7.	CW8611	Business Analytics Laboratory	PC	4	0	0	4	2
8.	CW8612	Artificial intelligence Laboratory	PC	4	0	0	4	2
<b>TOTAL</b>				<b>30</b>	<b>18</b>	<b>0</b>	<b>12</b>	<b>24</b>

### SEMESTER VII

SI. No	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	CW8701	Financial Management	PC	3	3	0	0	3
2.	IT8501	Web Technology	PC	3	3	0	0	3
3.	IT8073	Information Security	PC	3	3	0	0	3
4.		Professional Elective-II	PE	3	3	0	0	3
5.		Professional Elective-III	PE	3	3	0	0	3
6.		Open Elective II	OE	3	3	0	0	3
<b>PRACTICALS</b>								
7.	CW8711	Information Security Laboratory	PC	4	0	0	4	2
8.	IT8511	Web Technology Laboratory	PC	4	0	0	4	2
9.	CW8712	Mini Project (Based on concepts of Electives)	EEC	4	0	0	4	2
<b>TOTAL</b>				<b>30</b>	<b>18</b>	<b>0</b>	<b>12</b>	<b>24</b>

### SEMESTER VIII

SI. No	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.		Professional Elective-IV	PE	3	3	0	0	3
2.		Professional Elective-V	PE	3	3	0	0	3
<b>PRACTICALS</b>								
3.	CW8811	Project Work	EEC	20	0	0	20	10
<b>TOTAL</b>				<b>26</b>	<b>6</b>	<b>0</b>	<b>20</b>	<b>16</b>

**TOTAL NO. OF CREDITS: 183**

### PROFESSIONAL ELECTIVES (PE)

#### SEMESTER VI, ELECTIVE – I

SI. No	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	CW8001	Data Mining and Analytics	PE	3	3	0	0	3
2.	CS8601	Mobile Computing	PE	3	3	0	0	3
3.	CW8002	Cryptology	PE	3	3	0	0	3
4.	CS8791	Cloud Computing	PE	3	3	0	0	3
5.	CW8003	Modern Web Applications Development	PE	3	3	0	0	3

**SEMESTER VII, ELECTIVE – II**

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CW8004	Blockchain Technologies	PE	3	3	0	0	3
2.	AD8552	Machine Learning	PE	3	3	0	0	3
3.	AD8081	Cognitive Science and Analytics	PE	3	3	0	0	3
4.	CS8081	Internet of Things	PE	3	3	0	0	3
5.	CW8005	Social, Text and Media Analytics	PE	3	3	0	0	3

**SEMESTER VII, ELECTIVE – III**

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CW8006	Behavioral Economics	PE	3	3	0	0	3
2.	CW8007	Computational Finance and Modeling	PE	3	3	0	0	3
3.	CW8008	Marketing Research and Marketing Management	PE	3	3	0	0	3
4.	CW8009	HR Management	PE	3	3	0	0	3
5.	CW8010	Supply Chain Management	PE	3	3	0	0	3
6.	CW8011	Psychology	PE	3	3	0	0	3
7.	CW8012	Business Research Method	PE	3	3	0	0	3

**SEMESTER VIII, ELECTIVE – IV**

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CW8013	Introduction to Innovation, IP Management and Entrepreneurship	PE	3	3	0	0	3
2.	CW8014	Digital Marketing	PE	3	3	0	0	3
3.	CW8015	Risk Analytics	PE	3	3	0	0	3
4.	CW8016	Customer Relation Management and Customer Experience Management	PE	3	3	0	0	3
5.	CW8017	IT Project Management	PE	3	3	0	0	3
6.	CW8018	Enterprise Security	PE	3	3	0	0	3

**SEMESTER VIII, ELECTIVE – V**

SI. No	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	CW8019	Quantum Computation and Quantum Information	PE	3	3	0	0	3
2.	CW8020	Embedded Systems and Robotics	PE	3	3	0	0	3
3.	CW8021	Cloud, Micro services and Application	PE	3	3	0	0	3

**SUMMARY**

S. NO.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL	Percent age
		I	II	III	IV	V	VI	VII	VIII		
1.	HS	4	7							11	6.01%
2.	BS	12	4	7	4	4				31	16.94%
3.	ES	9	5							14	7.65%
4.	PC		9	16	18	14	21	13		91	49.73%
5.	PE						3	6	6	15	8.2%
6.	OE					3		3		6	3.28%
7.	EEC					3		2	10	15	8.2%
	<b>Total</b>	<b>25</b>	<b>25</b>	<b>23</b>	<b>22</b>	<b>24</b>	<b>24</b>	<b>24</b>	<b>16</b>	<b>183</b>	<b>100%</b>
8.	<b>Non Credit / Mandatory</b>										

**OBJECTIVES:**

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

**UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS 12**

**Reading-** short comprehension passages, practice in skimming-scanning and predicting- **Writing-** completing sentences- - developing hints. **Listening-** short texts- short formal and informal conversations. **Speaking-** introducing oneself - exchanging personal information- **Language development-** Wh- Questions- asking and answering-yes or no questions- parts of speech. **Vocabulary development--** prefixes- suffixes- articles.- count/ uncount nouns.

**UNIT II GENERAL READING AND FREE WRITING 12**

**Reading** - comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- **Writing** – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –**Listening-** telephonic conversations. **Speaking** – sharing information of a personal kind—greeting – taking leave- **Language development** – prepositions, conjunctions **Vocabulary development-** guessing meanings of words in context.

**UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12**

**Reading-** short texts and longer passages (close reading) **Writing-** understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences **Listening** – listening to longer texts and filling up the table- product description- narratives from different sources. **Speaking-** asking about routine actions and expressing opinions. **Language development-** degrees of comparison- pronouns- direct vs indirect questions- **Vocabulary development** – single word substitutes- adverbs.

**UNIT IV READING AND LANGUAGE DEVELOPMENT 12**

**Reading-** comprehension-reading longer texts- reading different types of texts- magazines **Writing-** letter writing, informal or personal letters-e-mails-conventions of personal email- **Listening-** listening to dialogues or conversations and completing exercises based on them. **Speaking-** speaking about oneself- speaking about one's friend- **Language development-** Tenses- simple present-simple past- present continuous and past continuous- **Vocabulary development-** synonyms-antonyms- phrasal verbs

**UNIT V EXTENDED WRITING****12**

**Reading-** longer texts- close reading –**Writing-** brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing-**Listening** – listening to talks- conversations- **Speaking** – participating in conversations- short group conversations-**Language development**-modal verbs- present/ past perfect tense - **Vocabulary development**-collocations-fixed and semi-fixed expressions.

**TOTAL: 60 PERIODS****OUTCOMES:****AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English.

**TEXT BOOKS:**

1. Board of Editors. **Using English** A Coursebook for Undergraduate Engineers and Technologists. Orient BlackSwan Limited, Hyderabad: 2015
2. Richards, C. Jack. **Interchange Students' Book-2** New Delhi: CUP, 2015.

**REFERENCES:**

1. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge,2011.
2. Means,L. Thomas and Elaine Langlois. English & Communication For Colleges. CengageLearning ,USA: 2007
3. Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student's Book & Workbook) Cambridge University Press, New Delhi: 2005
4. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011
5. Dutt P. Kiranmai and Rajeevan Geeta. Basic Communication Skills, Foundation Books: 2013.

**MA8151****ENGINEERING MATHEMATICS – I**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**OBJECTIVES:**

- The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

<b>UNIT I</b>	<b>DIFFERENTIAL CALCULUS</b>	<b>12</b>
Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.		
<b>UNIT II</b>	<b>FUNCTIONS OF SEVERAL VARIABLES</b>	<b>12</b>
Partial differentiation – Homogeneous functions and Euler’s theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor’s series for functions of two variables – Maxima and minima of functions of two variables – Lagrange’s method of undetermined multipliers.		
<b>UNIT III</b>	<b>INTEGRAL CALCULUS</b>	<b>12</b>
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.		
<b>UNIT IV</b>	<b>MULTIPLE INTEGRALS</b>	<b>12</b>
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.		
<b>UNIT V</b>	<b>DIFFERENTIAL EQUATIONS</b>	<b>12</b>
Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler’s and Legendre’s type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.		

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**After completing this course, students should demonstrate competency in the following skills:**

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.

**TEXT BOOKS :**

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 43<sup>rd</sup> Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7<sup>th</sup> Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

## REFERENCES:

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10<sup>th</sup> Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3<sup>rd</sup> Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
5. Weir, M.D and Joel Hass, "Thomas Calculus", 12<sup>th</sup> Edition, Pearson India, 2016.

PH8151

ENGINEERING PHYSICS

L	T	P	C
3	0	0	3

## OBJECTIVES:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

### UNIT I PROPERTIES OF MATTER 9

Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.

### UNIT II WAVES AND FIBER OPTICS 9

Oscillatory motion – forced and damped oscillations: differential equation and its solution – plane progressive waves – wave equation. Lasers : population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) – losses associated with optical fibers - fibre optic sensors: pressure and displacement.

### UNIT III THERMAL PHYSICS 9

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conduction in solids – thermal conductivity - Forbe's and Lee's disc method: theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.

### UNIT IV QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – tunnelling (qualitative) - scanning tunnelling microscope.

**UNIT V CRYSTAL PHYSICS****9**

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

**TOTAL :45 PERIODS****OUTCOMES:****Upon completion of this course,**

- The students will gain knowledge on the basics of properties of matter and its applications,
- The students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
- The students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
- The students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
- The students will understand the basics of crystals, their structures and different crystal growth techniques.

**TEXT BOOKS:**

1. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. "Engineering Physics". Cengage Learning India, 2012.

**REFERENCES:**

1. Halliday, D., Resnick, R. & Walker, J. "Principles of Physics". Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. "Physics for Scientists and Engineers". Cengage Learning, 2010.
3. Tipler, P.A. & Mosca, G. "Physics for Scientists and Engineers with Modern Physics". W.H.Freeman, 2007.

**CY8151****ENGINEERING CHEMISTRY****L T P C  
3 0 0 3****OBJECTIVES:**

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

**UNIT I WATER AND ITS TREATMENT 9**

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

**UNIT II SURFACE CHEMISTRY AND CATALYSIS 9**

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions – adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – kinetics of surface reactions, unimolecular reactions, Langmuir - applications of adsorption on pollution abatement. Catalysis: Catalyst – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis– Michaelis – Menten equation.

**UNIT III ALLOYS AND PHASE RULE 9**

Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

**UNIT IV FUELS AND COMBUSTION 9**

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel. Combustion of fuels: Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

**UNIT V ENERGY SOURCES AND STORAGE DEVICES 9**

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H<sub>2</sub>-O<sub>2</sub> fuel cell.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

**TEXT BOOKS:**

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015

3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

#### REFERENCES:

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

GE8151

PROBLEM SOLVING AND PYTHON PROGRAMMING

L T P C

3 0 0 3

#### OBJECTIVES:

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures — lists, tuples, dictionaries.
- To do input/output with files in Python.

#### UNIT I ALGORITHMIC PROBLEM SOLVING

9

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

#### UNIT II DATA, EXPRESSIONS, STATEMENTS

9

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

#### UNIT III CONTROL FLOW, FUNCTIONS

9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

#### UNIT IV LISTS, TUPLES, DICTIONARIES

9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

**UNIT V FILES, MODULES, PACKAGES****9**

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

**TOTAL: 45 PERIODS****OUTCOMES:**

**Upon completion of the course, students will be able to**

- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.

**TEXT BOOKS:**

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2<sup>nd</sup> edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (<http://greenteapress.com/wp/think-python/>)
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

**REFERENCES:**

1. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press , 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd.,, 2015.
4. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
5. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.

**GE8152****ENGINEERING GRAPHICS****L T P C****2 0 4 4****OBJECTIVES:**

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

**CONCEPTS AND CONVENTIONS (Not for Examination)****1**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

**UNIT I PLANE CURVES AND FREEHAND SKETCHING****7+12**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of

involutess of square and circle – Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

**UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12**

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

**UNIT III PROJECTION OF SOLIDS 5+12**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

**UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+12**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

**UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

**TOTAL: 90 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the student will be able to:**

- Familiarize with the fundamentals and standards of Engineering graphics
- Perform freehand sketching of basic geometrical constructions and multiple views of objects.
- Project orthographic projections of lines and plane surfaces.
- Draw projections and solids and development of surfaces.
- Visualize and to project isometric and perspective sections of simple solids.

**TEXT BOOKS:**

1. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.

**REFERENCES:**

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50<sup>th</sup> Edition, 2010.
2. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N. S. Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2<sup>nd</sup> Edition, 2009.

**Publication of Bureau of Indian Standards:**

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. sheets.
3. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
4. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
5. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
6. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

**Special points applicable to University Examinations on Engineering Graphics:**

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

**GE8161      PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY      L T P C**  
**0 0 4 2**

**OBJECTIVES:**

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

**LIST OF PROGRAMS:**

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame

13. Simulate bouncing ball using Pygame

**PLATFORM NEEDED**

Python 3 interpreter for Windows/Linux

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

**BS8161**

**PHYSICS AND CHEMISTRY LABORATORY**  
**(Common to all branches of B.E. / B.Tech Programmes)**

L	T	P	C
0	0	4	2

**OBJECTIVES:**

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

**LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)**

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser  
(b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

**TOTAL: 30 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to**

- Apply principles of elasticity, optics and thermal properties for engineering applications.

**CHEMISTRY LABORATORY: (Any seven experiments to be conducted)**

**OBJECTIVES:**

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by viscometry.

1. Estimation of HCl using  $\text{Na}_2\text{CO}_3$  as primary standard and Determination of alkalinity in water sample.

2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.
13. Corrosion experiment-weight loss method.
14. Determination of CMC.
15. Phase change in a solid.
16. Conductometric titration of strong acid vs strong base.

#### OUTCOMES:

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

**TOTAL: 30 PERIODS**

#### TEXTBOOK:

1. Vogel's Textbook of Quantitative Chemical Analysis (8<sup>TH</sup> edition, 2014).

HS8251

TECHNICAL ENGLISH

L	T	P	C
4	0	0	4

#### OBJECTIVES:

**The Course prepares second semester engineering and Technology students to:**

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization.

**UNIT I**

**INTRODUCTION TECHNICAL ENGLISH**

**12**

**Listening-** Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- **Speaking** –Asking for and giving directions- **Reading** – reading short technical texts from journals- newspapers- **Writing-** purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-**Vocabulary Development-** technical vocabulary **Language Development** –subject verb agreement - compound words.

**UNIT II                      READING AND STUDY SKILLS                      12**

**Listening-** Listening to longer technical talks and completing exercises based on them-**Speaking** – describing a process-**Reading** – reading longer technical texts- identifying the various transitions in a text- paragraphing- **Writing-** interpreting charts, graphs- **Vocabulary Development-** vocabulary used in formal letters/emails and reports **Language Development-** impersonal passive voice, numerical adjectives.

**UNIT III                      TECHNICAL WRITING AND GRAMMAR                      12**

**Listening-** Listening to classroom lectures/ talks on engineering/technology -**Speaking** – introduction to technical presentations- **Reading** – longer texts both general and technical, practice in speed reading; **Writing-**Describing a process, use of sequence words- **Vocabulary Development-** sequence words- Misspelled words. **Language Development-** embedded sentences

**UNIT IV                      REPORT WRITING                      12**

**Listening-** Listening to documentaries and making notes. **Speaking** – mechanics of presentations- **Reading** – reading for detailed comprehension- **Writing-** email etiquette- job application – cover letter –Résumé preparation( via email and hard copy)- analytical essays and issue based essays--**Vocabulary Development-** finding suitable synonyms-paraphrasing-. **Language Development-** clauses- if conditionals.

**UNIT V                      GROUP DISCUSSION AND JOB APPLICATIONS                      12**

**Listening-** TED/Ink talks; **Speaking** –participating in a group discussion -**Reading**– reading and understanding technical articles **Writing**– Writing reports- minutes of a meeting- accident and survey-**Vocabulary Development-** verbal analogies **Language Development-** reported speech.

**TOTAL :60 PERIODS**

**OUTCOMES:**

**At the end of the course learners will be able to:**

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

**TEXT BOOKS:**

1. Board of editors. **Fluency in English A Course book for Engineering and Technology.** Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. **English for Technical Communication.** Cambridge University Press: New Delhi, 2016.

**REFERENCES:**

1. Raman, Meenakshi and Sharma, Sangeetha- **Technical Communication Principles and Practice.**Oxford University Press: New Delhi,2014.
2. Kumar, Suresh. E. **Engineering English.** Orient Blackswan: Hyderabad,2015
3. Booth-L. Diana, **Project Work,** Oxford University Press, Oxford: 2014.
4. Grussendorf, Marion, **English for Presentations,** Oxford University Press, Oxford: 2007



## TEXT BOOKS :

1. Friedberg A.H, Insel A.J. and Spence L, Linear Algebra, Prentice Hall of India, New Delhi, 2004.
2. Faires J.D. and Burden R., Numerical Methods, Brooks/Cole (Thomson Publications), New Delhi, 2002.

## REFERENCE BOOKS

1. Kumaresan S, Linear Algebra - A geometric approach, Prentice Hall of India, New Delhi, Reprint, 2010.
2. Strang G, Linear Algebra and its applications, Thomson (Brooks / Cole) New Delhi, 2005.
3. Gerald C.F. and Wheatley P.O, Applied Numerical Analysis, Pearson Educations, New Delhi, 2002.
4. Sundarapandian V, Numerical Linear Algebra, Prentice Hall of India, New Delhi, 2008.
5. Richard Branson, Matrix Operations, Schaum's outline series, 1989.
6. Bernard Kolman, David R. Hill, Introductory Linear Algebra, Pearson Educations, New Delhi, First Reprint, 2009.

**AD8251**

**DATA STRUCTURES DESIGN**

**L T P C**  
**3 0 0 3**

### OBJECTIVES:

- To understand the concepts of ADTs
- To design linear data structures – lists, stacks, and queues
- To understand sorting, searching and hashing algorithms
- To apply Tree and Graph structures

### UNIT I ABSTRACT DATA TYPES

**9**

Abstract Data Types (ADTs) – ADTs and classes – introduction to OOP – classes in Python – inheritance – namespaces – shallow and deep copying

Introduction to analysis of algorithms – asymptotic notations – recursion – analyzing recursive algorithms

### UNIT II LINEAR STRUCTURES

**9**

List ADT – array-based implementations – linked list implementations – singly linked lists – circularly linked lists – doubly linked lists – applications of lists – Stack ADT – Queue ADT – double ended queues

### UNIT III SORTING AND SEARCHING

**9**

Bubble sort – selection sort – insertion sort – merge sort – quick sort – linear search – binary search – hashing – hash functions – collision handling – load factors, rehashing, and efficiency

### UNIT IV TREE STRUCTURES

**9**

Tree ADT – Binary Tree ADT – tree traversals – binary search trees – AVL trees – heaps – multi-way search trees

**UNIT V GRAPH STRUCTURES****9**

Graph ADT – representations of graph – graph traversals – DAG – topological ordering – shortest paths – minimum spanning trees

**TOTAL: 45 PERIODS****OUTCOMES:**

At the end of the course, the student should be able to:

- explain abstract data types
- design, implement, and analyse linear data structures, such as lists, queues, and stacks, according to the needs of different applications
- design, implement, and analyse efficient tree structures to meet requirements such as searching, indexing, and sorting
- model problems as graph problems and implement efficient graph algorithms to solve them

**TEXT BOOK:**

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, “Data Structures & Algorithms in Python”, John Wiley & Sons Inc., 2013
2. **Lee**, Kent D., **Hubbard**, Steve, “Data Structures and Algorithms with Python” Springer Edition 2015

**REFERENCES:**

1. Rance D. Necaise, “Data Structures and Algorithms Using Python”, John Wiley & Sons, 2011
2. Aho, Hopcroft, and Ullman, “Data Structures and Algorithms”, Pearson Education, 1983.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, “Introduction to Algorithms”, Second Edition, McGraw Hill, 2002.
4. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Fourth Edition, Pearson Education, 2014

**GE8291****ENVIRONMENTAL SCIENCE AND ENGINEERING****L T P C****3 0 0 3****OBJECTIVES:**

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth’s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY****14**

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological

pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

## **UNIT II ENVIRONMENTAL POLLUTION**

**8**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

## **UNIT III NATURAL RESOURCES**

**10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

## **UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT**

**7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

## **UNIT V HUMAN POPULATION AND THE ENVIRONMENT**

**6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.



construction and working principle. Batteries-NiCd, Pb Acid and Li ion–Charge and Discharge Characteristics. Protection-need for earthing, fuses and circuit breakers.Energy Tariff calculation for domestic loads.

#### **UNIT IV ELECTRONIC CIRCUITS**

**9**

PN Junction-VI Characteristics of Diode, zener diode, Transistors configurations - amplifiers. Op amps- Amplifiers, oscillator,rectifiers, differentiator, integrator, ADC, DAC. Multi vibrator using 555 Timer IC . Voltage regulator IC using LM 723,LM 317.

#### **UNIT V ELECTRICAL MEASUREMENT**

**9**

Characteristic of measurement-errors in measurement, torque in indicating instruments- moving coil and moving iron meters, Energy meter and watt meter. Transducers- classification-thermo electric, RTD, Strain gauge, LVDT, LDR and piezoelectric. Oscilloscope-CRO.

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Discuss the essentials of electric circuits and analysis.
- Discuss the basic operation of electric machines and transformers
- Introduction of renewable sources and common domestic loads.
- Introduction to measurement and metering for electric circuits.

#### **TEXT BOOKS:**

1. D.P. Kotharti and I.J Nagarath, Basic Electrical and Electronics Engineering, Mc Graw Hill, 2016,Third Edition.
2. M.S. Sukhija and T.K. Nagsarkar, Basic Electrical and Electronic Engineering, Oxford, 2016.

#### **REFERENCES:**

1. S.B. Lal Seksena and Kaustuv Dasgupta, Fundaments of Electrical Engineering, Cambridge, 2016
2. B.L Theraja, Fundamentals of Electrical Engineering and Electronics. Chand & Co, 2008.
3. S.K.Sahdev, Basic of Electrical Engineering, Pearson, 2015
4. John Bird, “Electrical and Electronic Principles and Technology”, Fourth Edition, Elsevier, 2010.
5. Mittle,Mittal, “Basic Electrical Engineering”, 2nd Edition, Tata McGraw-Hill Edition, 2016.
6. C.L.Wadhwa, “Generation, Distribution and Utilisation of Electrical Energy”, New Age international pvt.ltd.,2003.

**AD8252**

**DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION**

**L T P C**

**3 0 2 4**

#### **UNIT I DIGITAL FUNDAMENTALS**

**9**

Digital Systems – Binary Numbers – Octal – Hexadecimal Conversions – Signed Binary Numbers – Complements – Logic Gates – Boolean Algebra – K-Maps – Standard Forms – NAND – NOR Implementation.



## GROUP A (CIVIL & MECHANICAL)

### **I CIVIL ENGINEERING PRACTICE**

**13**

#### **BUILDINGS:**

- (a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

#### **PLUMBING WORKS:**

- (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- (b) Study of pipe connections requirements for pumps and turbines.
- (c) Preparation of plumbing line sketches for water supply and sewage works.
- (d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

- (e) Demonstration of plumbing requirements of high-rise buildings.

#### **CARPENTRY USING POWER TOOLS ONLY:**

- (a) Study of the joints in roofs, doors, windows and furniture.
- (b) Hands-on-exercise:  
Wood work, joints by sawing, planing and cutting.

### **II MECHANICAL ENGINEERING PRACTICE**

**18**

#### **WELDING:**

- (a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
- (b) Gas welding practice

#### **BASIC MACHINING:**

- (a) Simple Turning and Taper turning
- (b) Drilling Practice

#### **SHEET METAL WORK:**

- (a) Forming & Bending:
- (b) Model making – Trays and funnels.
- (c) Different type of joints.

#### **MACHINE ASSEMBLY PRACTICE:**

- (a) Study of centrifugal pump
- (b) Study of air conditioner

#### **DEMONSTRATION ON:**

- (a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.

- (b) Foundry operations like mould preparation for gear and step cone pulley.  
 (c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

**GROUP B (ELECTRICAL & ELECTRONICS)**

**III ELECTRICAL ENGINEERING PRACTICE**

**13**

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

**IV ELECTRONICS ENGINEERING PRACTICE**

**16**

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the student will be able to**

- Fabricate carpentry components and pipe connections including plumbing works.
- Use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

**CIVIL**

- |   |          |
|---|----------|
| 1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. | 15 Sets. |
| 2. Carpentry vice (fitted to work bench)  | 15 Nos.  |
| 3. Standard woodworking tools   | 15 Sets. |
| 4. Models of industrial trusses, door joints, furniture joints  | 5 each   |
| 5. Power Tools: (a) Rotary Hammer   | 2 Nos    |
| (b) Demolition Hammer   | 2 Nos    |
| (c) Circular Saw  | 2 Nos    |
| (d) Planer  | 2 Nos    |
| (e) Hand Drilling Machine   | 2 Nos    |

(f) Jigsaw 2 Nos

### MECHANICAL

- |   |           |
|---|-----------|
| 1. Arc welding transformer with cables and holders                            | 5 Nos.    |
| 2. Welding booth with exhaust facility  | 5 Nos.    |
| 3. Welding accessories like welding shield, chipping hammer, wire brush, etc. | 5 Sets.   |
| 4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.    | 2 Nos.    |
| 5. Centre lathe   | 2 Nos.    |
| 6. Hearth furnace, anvil and smithy tools                                     | 2 Sets.   |
| 7. Moulding table, foundry tools  | 2 Sets.   |
| 8. Power Tool: Angle Grinder  | 2 Nos     |
| 9. Study-purpose items: centrifugal pump, air-conditioner                     | One each. |

### ELECTRICAL

- |   |         |
|---|---------|
| 1. Assorted electrical components for house wiring                  | 15 Sets |
| 2. Electrical measuring instruments                                 | 10 Sets |
| 3. Study purpose items: Iron box, fan and regulator, emergency lamp | 1 each  |
| 4. Megger (250V/500V)   | 1 No.   |
| 5. Power Tools: (a) Range Finder                                    | 2 Nos   |
| (b) Digital Live-wire detector                                      | 2 Nos   |

### ELECTRONICS

- |   |         |
|---|---------|
| 1. Soldering guns   | 10 Nos. |
| 2. Assorted electronic components for making circuits                 | 50 Nos. |
| 3. Small PCBs   | 10 Nos. |
| 4. Multimeters  | 10 Nos. |
| 5. Study purpose items: Telephone, FM radio, low-voltage power supply |         |

**AD8261**

**DATA STRUCTURES DESIGN LABORATORY**

**L T P C**

**0 0 4 2**

#### OBJECTIVES:

- To implement ADTs in Python
- To design and implement linear data structures – lists, stacks, and queues
- To implement sorting, searching and hashing algorithms
- To solve problems using tree and graph structures

1. Implement simple ADTs as Python classes
2. Implement recursive algorithms in Python
3. Implement List ADT using Python arrays
4. Linked list implementations of List
5. Implementation of Stack and Queue ADTs
6. Applications of List, Stack and Queue ADTs

7. Implementation of sorting and searching algorithms
8. Implementation of Hash tables
9. Tree representation and traversal algorithms
10. Implementation of Binary Search Trees
11. Implementation of Heaps
12. Graph representation and Traversal algorithms
13. Implementation of single source shortest path algorithm
14. Implementation of minimum spanning tree algorithms

**TOTAL: 60 PERIODS**

**OUTCOMES:**

At the end of the course, the student should be able to:

- implement ADTs as Python classes
- design, implement, and analyse linear data structures, such as lists, queues, and stacks, according to the needs of different applications
- design, implement, and analyse efficient tree structures to meet requirements such as searching, indexing, and sorting
- model problems as graph problems and implement efficient graph algorithms to solve them

**TEXT BOOK:**

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, “Data Structures & Algorithms in Python”, John Wiley & Sons Inc., 2013

**REFERENCES:**

1. Rance D. Necaie, “Data Structures and Algorithms Using Python”, John Wiley & Sons, 2011
2. Aho, Hopcroft, and Ullman, “Data Structures and Algorithms”, Pearson Education, 1983.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, “Introduction to Algorithms”, Second Edition, McGraw Hill, 2002.
4. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Fourth Edition, Pearson Education, 2014

**MA8351**

**DISCRETE MATHEMATICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**OBJECTIVES:**

- To extend student’s logical and mathematical maturity and ability to deal with abstraction.
- To introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
- To understand the basic concepts of combinatorics and graph theory.
- To familiarize the applications of algebraic structures.
- To understand the concepts and significance of lattices and boolean algebra which are widely used in computer science and engineering.

**UNIT I LOGIC AND PROOFS**

**12**

Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.



- To differentiate Price ceilings , Price floors and compare income effects ,substitute effects
- To Analyze the Keynesian's process of multiplier theory in macro economics

**UNIT I INTRODUCTION TO MICRO ECONOMICS 9**

Introduction to Economics – Themes of Economics – Micro Vs Macro Economics- Demand curves and supply curves- Elasticity of Demand - Elasticity of Supply- Demand Curves of Households and firms

**UNIT II WELFARE ANALYSIS 9**

Consumers and Producers Surplus- Price Ceilings and Price Floors; Consumer Behavior - Axioms of Choice-Budget Constraints and Indifference Curves; Consumers Equilibrium Effects of a Price Change, Income and Substitution Effects Derivation of a Demand Curve

**UNIT III PRODUCTION AD COST FUNCTION 9**

Theory of Production - Production Function and Isoquants - Cost Minimization; Cost Curves - Total, Average and Marginal Costs - Long Run and Short Run Costs; Equilibrium of a Firm under Perfect Competition; Monopoly and Monopolistic Competition

**UNIT IV MACRO ECONOMICS 9**

National Income and its Components - GNP, NNP, GDP, NDP Consumption Function; Investment; Simple Keynesian Model of Income Determination and the Keynesian Multiplier; Government Sector -Taxes and Subsidies; External Sector - Exports and Imports; Money -Definitions; Demand for Money Transaction and Speculative Demand; Supply of Money - Banks Credit Creation Multiplier; Integrating Money and Commodity Markets - IS, LM Model

**UNIT V BUSINESS CYCLES AND STABILIZATION 9**

Monetary and Fiscal Policy - Central Bank and the Government; the Classical Paradigm - Price and Wage Rigidities - Voluntary and Involuntary Unemployment.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon Completion of the course, the students should be able to:**

- To analyze the supporting of price, income and substitution effects in the consumers and producers surplus.
- To compare the equilibrium of a firm under perfect competition, monopoly and monopolistic competition.
- To study the concepts of demand for money and supply of money with appropriate model in macro economic analysis.
- To examine and evaluate the problems of voluntary and involuntary unemployment

**TEXT BOOKS :**

1. Paul Anthony Samuelson, William D. Nordhaus, Economics, Nineteenth Edition, McGraw-Hill Education, 2010.
2. N. Gregory Mankiw, Principles of Macroeconomics, Seventh Edition, Cengage Learning, 2018.
3. Pindyck, Robert S and Daniel L. Rubinfeld , Micro Economics, Eighth Edition, 2013 .

## REFERENCES

1. Dornbusch, Fischer and Startz, Macroeconomics, Tenth Edition, Tata Mcgraw Hill, 2012.
2. Hal R, Varia, Intermediate Microeconomics: A Modern Approach, Eighth Edition Affiliated East-West Press, 2006

**CS8392**

**OBJECT ORIENTED PROGRAMMING**

**L T P C**

**3 0 0 3**

## OBJECTIVES:

- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the principles of packages, inheritance and interfaces
- To define exceptions and use I/O streams
- To develop a java application with threads and generics classes
- To design and build simple Graphical User Interfaces

## **UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS**

**10**

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File -Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages - JavaDoc comments.

## **UNIT II INHERITANCE AND INTERFACES**

**9**

Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning -inner classes, Array Lists - Strings

## **UNIT III EXCEPTION HANDLING AND I/O**

**9**

Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

## **UNIT IV MULTITHREADING AND GENERIC PROGRAMMING**

**8**

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

## **UNIT V EVENT DRIVEN PROGRAMMING**

**9**

Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon completion of the course, students will be able to:

- Develop Java programs using OOP principles
- Develop Java programs with the concepts inheritance and interfaces
- Build Java applications using exceptions and I/O streams
- Develop Java applications with threads and generics classes
- Develop interactive Java programs using swings

**TEXT BOOKS:**

1. Herbert Schildt, "Java The complete reference", 8<sup>th</sup> Edition, McGraw Hill Education, 2011.
2. Cay S. Horstmann, Gary Cornell, "Core Java Volume –I Fundamentals", 9<sup>th</sup> Edition, Prentice Hall, 2013.

**REFERENCES:**

1. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3<sup>rd</sup> Edition, Pearson, 2015.
2. Steven Holzner, "Java 2 Black book", Dreamtech press, 2011.
3. Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000.

**AD8351****DESIGN AND ANALYSIS OF ALGORITHMS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

**UNIT I INTRODUCTION AND ANALYSIS****9**

Introduction: Fundamentals of algorithmic Problem solving – Important problem types; Recursive algorithms, -- Fundamentals of the Analysis of Algorithm Efficiency: Analysis framework -- Asymptotic notations and basic complexity classes – recurrences – case studies

**UNIT II DIVIDE-AND-CONQUER AND GREEDY STRATEGIES****9**

Divide and Conquer strategy -- Mergesort -- Quicksort -- Multiplication of large integers and Strassen's matrix multiplication – closest pairs Greedy strategy – Huffman coding – shortest paths algorithms – minimum-cost spanning tree algorithms –disjoint sets

**UNIT III DYNAMIC PROGRAMMING AND STATE-SPACE APPROACH****9**

Dynamic Programming: Computing binomial coefficient – Knapsack problem and memory functions – ordering of matrix multiplications -- Warshall's and Floyd's algorithm State-space approach – exhaustive search: DFS, BFS, Iterative deepening

**UNIT IV BACKTRACKING , ITERATIVE IMPROVEMENT, AND BRANCH & BOUND 10**

Backtracking and permutations – N-queens problem – Hamilton circuits – best-first search -- Iterative Improvement: Stable marriage -- Maximum matching in bipartite graphs – maximum flow - -- Branch and Bound: Knapsack problem -- Traveling salesman problem

## UNIT V INTRACTABILITY

8

Introduction to intractability -- Polynomial reductions – SAT and 3-SAT – NP-complete and NP-Hard problems -- Approximation algorithms: Traveling salesman problem -- Knapsack problem – Introduction to randomized and parallel algorithms

**THEORY PERIODS: 45**

### SUGGESTIVE EXERCISES

1. Implementation of iterative and recursive algorithms for the given problem
2. Empirical analysis of algorithms
3. Implementation of divide-and-conquer sorting algorithms
4. Implementation of closest-pairs algorithm
5. Implementation of Huffman coding
6. Implementation of Dijkstra's and Prim's algorithms
7. Implementation of disjoint sets and Kruskal's algorithm
8. Implementation of dynamic programming algorithm for knapsack problem
9. Implementation of backtracking to solve n-Queens and Hamilton circuits problems
10. Implementation of iterative improvement strategy for stable marriage and maxflow problems
11. Implementation of Branch and Bound technique to solve knapsack and TSP problems
12. Implementation of approximation algorithms for knapsack and TSP problems

**PRACTICAL PERIODS: 30**

**TOTAL PERIODS: 75**

### TEXT BOOKS:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, 2012.
2. Jon Kleinberg and Eva Tardos, "Algorithm Design", Pearson Education, 2006.

### REFERENCES

1. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, PHI Learning Private Limited, 2012.
2. Steven S Skiena, "The Algorithm Design Manual", 2nd Edition, Springer, 2008.
3. S Dasgupta, C H Papadimitriou, U V Vazirani, "Algorithms", 1st Edition, McGraw Hill Education, 2017.
4. S. Sridhar, "Design and Analysis of Algorithms", Oxford University Press, 2015.
5. Sara Baase and Allen Van Gelder, Computer Algorithms, Third Edition, Pearson Education, 2000.
6. Dexter C. Kozen, The Design and Analysis of Algorithms, Springer-Verlag, 1992.

**CS8492**

**DATABASE MANAGEMENT SYSTEMS**

**L T P C  
3 0 0 3**

### OBJECTIVES

- To learn the fundamentals of data models and to represent a database system using ER diagrams.
- To study SQL and relational database design.



## REFERENCES:

1. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, "Database Management Systems", Fourth Edition, McGraw-Hill College Publications, 2015.
3. G.K.Gupta,"Database Management Systems", Tata McGraw Hill, 2011.

CW8311

**BUSINESS COMMUNICATION AND VALUE SCIENCE  
LABORATORY - I**

**L T P C  
0 0 4 2**

## OBJECTIVES

- Augment students overall communication and interpersonal skills by engaging them in group activities and thus aid in helping them to emerge as professionals.
- Focus on the development of basic fluency in English, usage of words and also introduce them to the concept and importance of interpersonal skills so as to effectively present their personalities.

## LIST OF EXPERIMENTS :

1. Different forms of words
2. Technical terminology
3. Interpersonal Skills: Dialogue & Conversation
4. Job Application
5. Letters & Reports
6. SWOT analysis
7. Socio cultural & Cross-cultural understanding
8. Women in all spheres
9. Team vs Group
10. Conflict management
11. Acquiring Leadership traits
12. Human values and Corporate culture

**TOTAL : 60 PERIODS**

## OUTCOMES:

**Upon completion of the course, the students will be able to:**

- Speak fluently in English without errors in tenses and hence present themselves as effective English communicators. They will be able to learn the 12 tenses and use them appropriately.
- Differentiate between active and passive vocabulary and be able to use the 60 words discussed in class for their daily conversation and 40 words also given as assignments
- The ability to process their ideas and thoughts (verbal communication) into written communication in an effective, coherent and logical manner within a stipulated time and specific word limit of 100-150 words for paragraph writing
- Present them in a certain manner by using the 50-55 phrases discussed in class appropriately for group discussions, personal interviews during the campus recruitment process/competitive exams.

- Enhance their communication skills by acquainting with the 2 important aspects of communication and helping them to overcome the 10 most common barriers of communication.

## REFERENCES:

1. Business Communication, Dr. Saroj Hire math
2. English vocabulary in use , Alan McCarthy and O'Dell
3. Strategic Writing by Charles Marsh
4. he Seven Basic Plots by Christopher Booker

**CS8383**

**OBJECT ORIENTED PROGRAMMING LABORATORY**

**L T P C**

**0 0 4 2**

## OBJECTIVES

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, arraylist, exception handling and file processing.
- To develop applications using generic programming and event handling.

## LIST OF EXPERIMENTS

1. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff.

If the type of the EB connection is domestic, calculate the amount to be paid as follows:

- First 100 units - Rs. 1 per unit
- 101-200 units - Rs. 2.50 per unit
- 201 -500 units - Rs. 4 per unit
- > 501 units - Rs. 6 per unit

If the type of the EB connection is commercial, calculate the amount to be paid as follows:

- First 100 units - Rs. 2 per unit
- 101-200 units - Rs. 4.50 per unit
- 201 -500 units - Rs. 6 per unit
- > 501 units - Rs. 7 per unit

2. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa) , time converter (hours to minutes, seconds and vice versa) using packages.
3. Develop a java application with Employee class with Emp\_name, Emp\_id, Address, Mail\_id, Mobile\_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
4. Design a Java interface for ADT Stack. Implement this interface using array. Provide

necessary exception handling in both the implementations.

5. Write a program to perform string operations using ArrayList. Write functions for the following
  - a. Append - add at end
  - b. Insert – add at particular index
  - c. Search
  - d. List all string starts with given letter
6. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
7. Write a Java program to implement user defined exception handling.
8. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.
9. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
10. Write a java program to find the maximum value from the given type of elements using a generic function.
11. Design a calculator using event-driven programming paradigm of Java with the following options.
  - a) Decimal manipulations
  - b) Scientific manipulations
12. Develop a mini project for any application using Java concepts.

**TOTAL : 60 PERIODS**

## **OUTCOMES**

**Upon completion of the course, the students will be able to**

- Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.
- Develop and implement Java programs with arraylist, exception handling and multithreading .
- Design applications using file processing, generic programming and event handling.

**CS8481**

**DATABASE MANAGEMENT SYSTEMS LABORATORY**

**L T P C**

**0 0 4 2**

## **AIM:**

The aim of this laboratory is to inculcate the abilities of applying the principles of the database management systems. This course aims to prepare the students for projects where a proper implementation of databases will be required.

**OBJECTIVES:**

- To understand data definitions and data manipulation commands
  - To learn the use of nested and join queries
  - To understand functions, procedures and procedural extensions of data bases
  - To be familiar with the use of a front end tool
  - To understand design and implementation of typical database applications
1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements
  2. Database Querying – Simple queries, Nested queries, Sub queries and Joins
  3. Views, Sequences, Synonyms
  4. Database Programming: Implicit and Explicit Cursors
  5. Procedures and Functions
  6. Triggers
  7. Exception Handling
  8. Database Design using ER modeling, normalization and Implementation for any application
  9. Database Connectivity with Front End Tools
  10. Case Study using real life database applications

**TOTAL: 60 PERIODS****OUTCOMES:****Upon completion of the course, the students will be able to:**

- Use typical data definitions and manipulation commands.
- Design applications to test Nested and Join Queries
- Implement simple applications that use Views
- Implement applications that require a Front-end Tool
- Critically analyze the use of Tables, Views, Functions and Procedures

**MA8391****PROBABILITY AND STATISTICS****L T P C****4 0 0 4****OBJECTIVES:**

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

**UNIT I PROBABILITY AND RANDOM VARIABLES****12**

Probability – The axioms of probability – Conditional probability – Baye’s theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

**UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 12**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

**UNIT III TESTING OF HYPOTHESIS 12**

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

**UNIT IV DESIGN OF EXPERIMENTS 12**

One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design -  $2^2$  factorial design.

**UNIT V STATISTICAL QUALITY CONTROL 12**

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

**TOTAL : 60 PERIODS**

**OUTCOMES:**

**Upon successful completion of the course, students will be able to:**

- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

**TEXT BOOKS:**

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8<sup>th</sup> Edition, 2015.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4<sup>th</sup> Edition, 2007.

**REFERENCES:**

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8<sup>th</sup> Edition, 2014.
2. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4<sup>th</sup> Edition, New Delhi, 2010.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3<sup>rd</sup> Edition, Elsevier, 2004.
4. Spiegel. M.R., Schiller. J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8<sup>th</sup> Edition, 2007.

**OBJECTIVES:**

- To understand the basic concepts and functions of operating systems.
- To understand Processes and Threads
- To analyze Scheduling algorithms.
- To understand the concept of Deadlocks.
- To analyze various memory management schemes.
- To understand I/O management and File systems.
- To be familiar with the basics of Linux system and Mobile OS like iOS and Android.

**UNIT I OPERATING SYSTEM OVERVIEW 7**

Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

**UNIT II PROCESS MANAGEMENT 11**

Processes - Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication; CPU Scheduling - Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Threads- Overview, Multithreading models, Threading issues; Process Synchronization - The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors; Deadlock - System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

**UNIT III STORAGE MANAGEMENT 9**

Main Memory – Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, 32 and 64 bit architecture Examples; Virtual Memory – Background, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

**UNIT IV FILE SYSTEMS AND I/O SYSTEMS 9**

Mass Storage system – Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space management; File-System Interface - File concept, Access methods, Directory Structure, Directory organization, File system mounting, File Sharing and Protection; File System Implementation- File System Structure, Directory implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem, Streams, Performance.

**UNIT V CASE STUDY 9**

Linux System - Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Inter-process Communication; Mobile OS - iOS and Android - Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.

**TOTAL : 45 PERIODS**

## OUTCOMES:

At the end of the course, the students should be able to:

- Analyze various scheduling algorithms.
- Understand deadlock, prevention and avoidance algorithms.
- Compare and contrast various memory management schemes.
- Understand the functionality of file systems.
- Perform administrative tasks on Linux Servers.
- Compare iOS and Android Operating Systems.

## TEXT BOOK :

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9<sup>th</sup> Edition, John Wiley and Sons Inc., 2012.

## REFERENCES :

1. Ramaz Elmasri, A. Gil Carrick, David Levine, "Operating Systems – A Spiral Approach", Tata McGraw Hill Edition, 2010.
2. Achyut S. Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.
3. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Pearson Education, 2004.
4. Gary Nutt, "Operating Systems", Third Edition, Pearson Education, 2004.
5. Harvey M. Deitel, "Operating Systems", Third Edition, Pearson Education, 2004.
6. Daniel P. Bovet and Marco Cesati, "Understanding the Linux kernel", 3rd edition, O'Reilly, 2005.
7. Neil Smyth, "iPhone iOS 4 Development Essentials – Xcode", Fourth Edition, Payload media, 2011.

**CW8401**

**INTRODUCTION TO BUSINESS SYSTEMS**

**L T P C**  
**3 0 0 3**

## OBJECTIVES:

- To develop and strengthen business quality and motivation in students
- To impart basic business skills
- To understanding to run a business efficiently and effectively.

## UNIT I OVERVIEW OF BUSINESS SYSTEM

**9**

Business environmental factors - Internal and External. System approach of management Process - Input for the business, Transformational process and output. Objectives of the business system. System model of business management. Management functions – Planning, Organising, Staffing, Directing and Controlling.

## UNIT II OUTLINE OF BUSINESS ORGANISATION

**9**

Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises, Multinational and Global companies. Managing Global environment. Management levels and types.





**OBJECTIVES:**

- To understand the phases in a software project
- To understand fundamental concepts of requirements engineering and Analysis Modeling.
- To understand the various software design methodologies
- To learn various testing and maintenance measures

**UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT 9**

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming-XP Process.

**UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION 9**

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

**UNIT III SOFTWARE DESIGN 9**

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

**UNIT IV TESTING AND MAINTENANCE 9**

Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging –Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering.

**9****UNIT V PROJECT MANAGEMENT**

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS

**TOTAL :45 PERIODS****OUTCOMES:****On Completion of the course, the students should be able to:**

- Identify the key activities in managing a software project.
- Compare different process models.
- Concepts of requirements engineering and Analysis Modeling.
- Apply systematic procedure for software design and deployment.
- Compare and contrast the various testing and maintenance.
- Manage project schedule, estimate project cost and effort required.

**TEXT BOOKS:**

1. Roger S. Pressman, “Software Engineering – A Practitioner’s Approach”, Seventh Edition, Mc

- Graw-Hill International Edition, 2010.
2. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.

## REFERENCES:

1. Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning Private Limited, 2009.
2. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.
3. Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007.
4. Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited, 2007.
5. <http://nptel.ac.in/>.

**CS8461**

**OPERATING SYSTEMS LABORATORY**

**L T P C**  
**0 0 4 2**

## OBJECTIVES

- To learn Unix commands and shell programming
- To implement various CPU Scheduling Algorithms
- To implement Process Creation and Inter Process Communication.
- To implement Deadlock Avoidance and Deadlock Detection Algorithms
- To implement Page Replacement Algorithms
- To implement File Organization and File Allocation Strategies

## LIST OF EXPERIMENTS

1. Basics of UNIX commands
2. Write programs using the following system calls of UNIX operating system  
fork, exec, getpid, exit, wait, close, stat, opendir, readdir
3. Write C programs to simulate UNIX commands like cp, ls, grep, etc.
4. Shell Programming
5. Write C programs to implement the various CPU Scheduling Algorithms
6. Implementation of Semaphores
7. Implementation of Shared memory and IPC
8. Bankers Algorithm for Deadlock Avoidance
9. Implementation of Deadlock Detection Algorithm
10. Write C program to implement Threading & Synchronization Applications
11. Implementation of the following Memory Allocation Methods for fixed partition
  - a) First Fit
  - b) Worst Fit
  - c) Best Fit
12. Implementation of Paging Technique of Memory Management
13. Implementation of the following Page Replacement Algorithms
  - a) FIFO
  - b) LRU
  - c) LFU
14. Implementation of the various File Organization Techniques
15. Implementation of the following File Allocation Strategies
  - a) Sequential
  - b) Indexed
  - c) Linked

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to**

- Compare the performance of various CPU Scheduling Algorithms
- Implement Deadlock avoidance and Detection Algorithms
- Implement Semaphores
- Create processes and implement IPC
- Analyze the performance of the various Page Replacement Algorithms
- Implement File Organization and File Allocation Strategies

**CW8411****COMPUTATIONAL STATISTICS LABORATORY****L T P C  
0 0 4 2****OBJECTIVES:**

- To expose the variables, expressions, control stations of R
- To use R Programming for Analysis of data and visualize outcome inform of graphs, charts
- To develop and understand the modern computational statistical approaches and their applications to different datasets.
- To apply principles of data science to analyze various business problems.
- To use R software to carry out statistical computations
- To analysis data using R

**LIST OF EXPERIMENTS :**

1. Install R and R Studio
2. Creation and manipulation of Vectors, Matrices, Arrays, Lists, Factors and Data Frames
3. Install of Packages and scripts for Importing and Exporting Data
4. Implement Control structures and Functions
5. Visualize Statistical Graphs using Scatter Plots, Box Plots, Whisker Plot, Histograms
6. Perform Data exploration and visualization techniques over a dataset.
7. Perform Data Query using SQL and R.
8. Create a data set and do statistical analysis on the data

**PLATFORM NEEDED**

Systems with R, R Studio (Additional libraries required)

**TOTAL : 60 PERIODS****OUTCOMES:**

Upon Completion of the course, the students should be able to:

- Use R software to carry out statistical computations
- State the capabilities of R and its data, variable
- Describe various operators, control statements and scoping rules in R
- Apply R programming for manipulation of datasets
- Produce various graphs and distribution plots using R
- Analyze dataset using Statistical Tools available in R

**OBJECTIVES:**

- The course aims to augment students overall communication and interpersonal skills by engaging them in group activities and thus aid in helping them to emerge as professionals.

**LIST OF EXPERIMENTS :**

1. Writing letters and creating mails
2. Construction of paragraphs and essays
3. Speaking skills and methods of speech
4. Leadership, Communication and Interpersonal skills
5. Being a motivator and role model
6. Corporate Etiquettes
7. Professionalism in the work place
8. Engineering ethics, rights and responsibilities
9. Managing cultural diversities and global diversities
10. Right use of social media
11. Maintaining the image and pride of the organization
12. Winning formula for a successful manager/leader

**TOTAL : 60 PERIODS**

**TEXT BOOKS:**

1. Business Communication Today by Bovee, Thill, Raina
2. APAART: Speak Well 1 (English Language and Communication)
3. APAART: Speak Well 2 (Soft Skills)

**REFERENCES:**

1. Strategic Communication by Charles Marsh
2. English vocabulary in use – Alan Mc'carthy and O'dell
3. Business Communication – Dr. Saroj Hiremath

**OUTCOMES:**

**Upon Completion of the course, the students should be able to:**

- Speak fluently in English without errors in the sentence construction and hence present themselves as effective English communicators.
- Differentiate between vocabularies used as adjectives, verbs.
- Deliver a public speech according to the need of the audience and also be aware of positive body language to be manifested during a speech.
- Deal with the deeper parameters of working in teams like team motivation, multicultural team activity and team conflict resolution.
- Set realistic goals in terms of personal and professional growth.

**OBJECTIVES:**

- Understand the fundamentals of software architecture.
- Study the various software development methodologies.
- Learn the importance of architectural documentation and evaluation.
- Learn the various software architecture design components.
- Relate software architecture and software quality.

**UNIT I INTRODUCTION 9**

Basic concepts of software architecture – Context of Software Architecture – ABC cycle – What software architecture is and what it isn't – Architectural patterns – Good Architecture- Reference models – Architectural structures and views-Introduction to styles – Decentralized Architectures.

**UNIT II DESIGN METHODOLOGIES 9**

Structured design- Design practices-Stepwise refinement – Incremental design- Structured system analysis and design –Jackson structured programming – Jackson system Development.

**UNIT III ARCHITECTURAL DESCRIPTION DOCUMENTATION AND EVALUATION 9**

Early architecture description languages-Domain and style specific ADL's- Extensible ADL's – Documenting software architecture – Uses and Audiences for Architecture Documentation – Views – Choosing Views – Combining Views –Architecture evaluation – Evaluation Factors –Architecture Tradeoff Analysis Method – Lightweight Architecture Evaluation – ATAM.

**UNIT IV ARCHITECTURE DESIGN 9**

Typical architectural design-Dataflow-Independent components-Call and return – Using styles in design – Architectural design space-Design space of architectural elements – Design space of architectural styles.

**UNIT V IMPLEMENTATION AND CONFORMANCE TO ARCHITECTURE 9**

Understanding quality attributes- Implementation of Quality attributes in Architecture – Architecture and requirements conformance –Functionality– Quality attribute considerations – System quality attributes-Introduction to tactics – Achieving Quality Attributes through Tactics –Tactics types – Architectural patterns and styles – Architecture and Quality Attributes – Quality attribute scenarios in practice.

**TOTAL : 45 PERIODS****OUTCOMES:**

**Upon Completion of the course, the students should be able to:**

- Develop Software applications starting from software architecture and design.
- Learn and evaluate existing software architectures.
- Realize importance of architectural documentation and document them.
- Employ various software architecture design components.
- Design methods for improving software quality from the perspective of software architecture.

## TEXT BOOKS:

1. Len Bass, Paul Clements, Rick Kazman, "Software Architecture in Practice", Third Edition, Addison,Wesley, 2012.
2. David Budgen, "Software Design", Second Edition, Pearson Education, 2004.

## REFERENCES:

1. Richard N.Taylor, NenadMedvidovic and Eric M.Dashofy, "Software Architecture, Foundations,Theory and Practice", Wiley 2010.
2. Hong Zhu, "Software Design Methodology from Principles to Architectural Styles", Elsevier, 2005.
3. Mary Shaw and David Garlan, "Software Architecture –Perspectives on an emerging Discipline",Pearson Education, 2008.

**CW8501**

**SOFTWARE DESIGN USING UML**

**L T P C**  
**3 0 2 4**

## OBJECTIVES:

- To understand the fundamentals of object modeling
- To understand and differentiate Unified Process from other approaches.
- To design with static UML diagrams.
- To design with the UML dynamic and implementation diagrams.
- To improve the software design with design patterns.
- To test the software against its requirements specification

### **UNIT I UNIFIED PROCESS AND USE CASE DIAGRAMS 9**

Introduction to OOAD with OO Basics - Unified Process – UML diagrams – Use Case –Case study – the Next Gen POS system, Inception -Use case Modelling – Relating Use cases – include, extend and generalization – When to use Use-cases.

### **UNIT II STATIC UML DIAGRAMS 9**

Class Diagram— Elaboration – Domain Model – Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition - Relationship between sequence diagrams and use cases – When to use Class Diagrams.

### **UNIT III DYNAMIC AND ARCHITECTURAL MODELING UML DIAGRAMS 9**

Dynamic Diagrams – UML interaction diagrams - System sequence diagram – Collaboration diagram – When to use Communication Diagrams - State machine diagram and Modelling –When to use State Diagrams - Activity diagram – When to use activity diagrams Implementation Diagrams - UML package diagram - When to use package diagrams - Component and Deployment Diagrams – When to use Component and Deployment diagrams.

### **UNIT IV DESIGN PATTERNS AND ELEMENTS 9**

DESIGN PATTERNS : GRASP-Designing objects with responsibilities –Applying GoF design patterns – Creational Patterns , Structural Patterns , Behavioral Patterns, Design Elements:

Architectural design elements - Interface design elements - Component level diagram elements - Deployment level design elements, Mapping design to code.

## **UNIT V            AGILE METHODOLOGY**

**9**

Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values

### **LIST OF EXPERIMENTS :**

Draw standard UML diagrams using an UML modeling tool for a given case study and map design to code and implement a 3 layered architecture. Test the developed code and validate whether the SRS is satisfied.

1. Identify a software system that needs to be developed.
2. Document the Software Requirements Specification (SRS) for the identified system.
3. Identify use cases and develop the Use Case model.
4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.
5. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams
6. Draw relevant State Chart and Activity Diagrams for the same system.
7. Implement the system as per the detailed design
8. Test the software system for all the scenarios identified as per the usecase diagram
9. Improve the reusability and maintainability of the software system by applying appropriate design patterns.
10. Implement the modified system and test it for various scenarios

<b>PRACTICALS</b>	<b>: 30 Periods</b>
<b>THEORY</b>	<b>: 45 Periods</b>
<b>TOTAL PERIODS</b>	<b>: 75 Periods</b>

### **OUTCOMES:**

**Upon Completion of the course, the students should be able to:**

- Express software design with UML diagrams
- Design software applications using OO concepts.
- Identify various scenarios based on software requirements
- Transform UML based software design into pattern based design using design patterns
- Understand the various testing methodologies for OO software

### **TEXT BOOKS:**

1. Craig Larman, “Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development”, Third Edition, Pearson Education, 2005.
2. Ali Bahrami - Object Oriented Systems Development - McGraw Hill International Edition – 1999.

### **REFERENCES:**

1. Erich Gamma, a n d Richard Helm, Ralph Johnson, John Vlissides, “Design patterns: Elements of Reusable Object-Oriented Software”, Addison-Wesley, 1995.

2. Martin Fowler, "UML Distilled: A Brief Guide to the Standard Object Modeling Language", Third edition, Addison Wesley, 2003.

**CW8502**

**OPERATIONS RESEARCH**

**L T P C**

**3 0 2 4**

**OBJECTIVES:**

- Solve linear programming problem and solve using graphical method.
- Solve LPP using simplex method
- Solve transportation, assignment problems
- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems

**UNIT I LINEAR MODELS**

**9**

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

**UNIT II TRANSPORTATION MODELS AND NETWORK MODELS**

**9**

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

**UNIT III INVENTORY MODELS**

**9**

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

**UNIT IV QUEUEING MODELS**

**9**

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

**UNIT V DECISION MODELS**

**9**

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

**LIST OF EXPERIMENTS :**

1. Modeling with Graphical solution of Linear Programming problems
2. Solving simplex maximization problems.
3. Solving simplex minimization problems .
4. Sensitivity Analysis and Duality
5. Solving Transportation problems
6. Solving assignment problems
7. Introduction to Network Models
8. Solving Integer Linear Programming

9. Solving Goal Programming models
10. Introduction to Nonlinear Programming

**PLATFORM NEEDED**

Systems with R, R Studio (Additional libraries required)

<b>PRACTICALS</b>	<b>30 PERIODS</b>
<b>THEORY</b>	<b>45 PERIODS</b>
<b>TOTAL</b>	<b>75 PERIODS</b>

**OUTCOMES:**

**Upon Completion of the course, the students should be able to:**

- To formulate linear programming problem and solve using graphical method.
- To solve LPP using simplex methods
- To formulate and solve transportation, assignment problems
- To solve project management problems
- To solve scheduling problems

**TEXT BOOK:**

1. Hillier and Libeberman, “Operations Research”, Holden Day, 2005
2. Taha H.A., “Operations Research”, Sixth Edition, Prentice Hall of India, 2003.

**REFERENCES:**

1. Bazara M.J., Jarvis and Sherali H., “Linear Programming and Network Flows”, John Wiley, 2009.
2. Budnick F.S., “Principles of Operations Research for Management”, Richard D Irwin, 1990.
3. Philip D.T. and Ravindran A., “Operations Research”, John Wiley, 1992.
4. Shennoy G.V. and Srivastava U.K., “Operation Research for Management”, Wiley Eastern, 1994.
5. Tulsian and Pasdey V., “Quantitative Techniques”, Pearson Asia, 2002.

**CW8503**

**DESIGN THINKING**

**L T P C**

**3 0 2 4**

**OBJECTIVES:**

- Learn design thinking concepts and principles
- Use design thinking methods in every stage of the problem
- Learn the different phases of design thinking
- Apply various methods in design thinking to different problems

**UNIT I INTRODUCTION**

**9**

Why Design? - Four Questions, Ten Tools - Principles of Design Thinking - The process of Design Thinking - How to plan a Design Thinking project.

**UNIT II UNDERSTAND, OBSERVE AND DEFINE THE PROBLEM**

**9**

Search field determination - Problem clarification - Understanding of the problem - Problem

analysis - Reformulation of the problem - Observation Phase - Empathetic design - Tips for observing - Methods for Empathetic Design - Point-of-View Phase - Characterization of the target group - Description of customer needs.

**UNIT III IDEATION AND PROTOTYPING 9**

Ideate Phase - The creative process and creative principles - Creativity techniques - Evaluation of ideas - Prototype Phase - Lean Startup Method for Prototype Development - Visualization and presentation techniques.

**UNIT IV TESTING AND IMPLEMENTATION 9**

Test Phase - Tips for interviews - Tips for surveys - Kano Model - Desirability Testing - How to conduct workshops - Requirements for the space - Material requirements - Agility for Design Thinking.

**UNIT V FUTURE 9**

Design Thinking meets the corporation – The New Social Contract – Design Activism – Designing tomorrow.

**LIST OF EXPERIMENTS :**

- (i) 2030 Schools Challenge: Concept: Design thinking is often presented without teaching content. This is very different. Learners get 30 minutes to choose a UN 2030 Goal (there are 17) that is relevant and meaningful to them, then they get into small groups. The group researches the goal quickly, by answering the questions: What does the world need to know about this goal and what can we do about it? The group then creates a short PSA (Public Service Announcement) and shares it widely with an authentic audience. It is fun, fast, and shows the power of design sprints to teach content and skills.
- (ii) THE GIFT-GIVING PROJECT VIA STANFORD D-SCHOOL Concept: The Gift-Giving Project is 90-minute (plus debrief) fast-paced project through a full design cycle. Students pair up to interview each other, come to a point-of-view of how they might design for their partner, ideate, and prototype a new solution to “redesign the giftgiving experience” for their partner.
- (iii) THE WALLET PROJECT VIA STANFORD D-SCHOOL Concept: Very similar to the Gift-Giving Project, the Wallet Project is 90-minute (plus Tentative 48 debrief) fast-paced project through a full design cycle. Students pair up, show and tell each other about their wallets, ideate, and make a new solution that is “useful and meaningful” to their partner.
- (iv) INVENT A SPORT (WITH JUST THESE ITEMS) Concept: We’ve all played sports at some point in our life. Who came up with the rules? Who created the game? Who made the constraints? And who decided the objects to play with? Now, with limited time and resources, your group will create and invent a new sport, and a set of directions for people to actually play the game.
- (v) “BOOK IN AN HOUR” ACTIVITY (VIA ALL WHO WONDER) Concept: Give a group a book (fiction or non-fiction). Then you break them up into smaller groups (or individuals) to read different parts of the book. Each group (or person) has to read and then create an overview/trailer of their part of the book to share chronologically with the rest of the class. Here

the design really starts with the creative process driving how you share the information, plot, characters etc. Perfect use for professional development when you want to introduce a topic in a fun, engaging way.

(vi) CHILDREN'S STORY DESIGN ACTIVITIES Concept: The University of Arkansas created a series of STEM Challenges that work as great design activities with groups old and young! For example after reading "The Three Billy Goat's Gruff" they set up a challenge like this: You decide to help the billy goats reach the opposite side of the creek so they can eat. You must create a model structure to help the billy goats get from one side to the other while using the design loop and only the materials provided. Your teacher will also provide you with model billy goats, with specific weights, that your bridge must be able to withstand.

(vii) New Product Development Activity: Student teams were given products ranging from toys to air fresheners. In 2 days, they had to create pitches on how to improve these products. The idea was to give them a clear sense of the scope of what they would do in a product development.

<b>PRACTICALS</b>	<b>30 PERIODS</b>
<b>THEORY</b>	<b>45 PERIODS</b>
<b>TOTAL</b>	<b>75 PERIODS</b>

**OUTCOMES:**

**Upon Completion of the course, the students should be able to:**

- Define key concepts of design thinking
- Practice design thinking in all stages of problem solving
- Apply design thinking approach to real world problems

**TEXT BOOKS :**

1. Christian Mueller-Roterberg, Handbook of Design Thinking - Tips & Tools for how to design thinking. [ Unit 1, 2, 3, 4]
2. Designing for Growth: a design thinking tool kit for managers By Jeanne Liedtka and Tim Ogilvie. [Unit 1]
3. Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation by Tim Brown. [Unit 5]

**REFERENCES:**

1. Johnny Schneider, "Understanding Design Thinking, Lean and Agile", O'Reilly Media, 2017.
2. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press , 2009.
3. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011
4. <http://ajjuliani.com/design-thinking-activities/>
5. <https://venturewell.org/class-exercises>

**OBJECTIVES:**

- To understand the language hierarchy
- To construct automata for any given pattern and find its equivalent regular expressions
- To design a context free grammar for any given language
- To understand Turing machines and their capability
- To understand undecidable problems and NP class problems

**UNIT I AUTOMATA FUNDAMENTALS 9**

Introduction to formal proof – Additional forms of Proof – Inductive Proofs – Finite Automata – Deterministic Finite Automata – Non-deterministic Finite Automata – Finite Automata with Epsilon Transitions

**UNIT II REGULAR EXPRESSIONS AND LANGUAGES 9**

Regular Expressions – FA and Regular Expressions – Proving Languages not to be regular – Closure Properties of Regular Languages – Equivalence and Minimization of Automata.

**UNIT III CONTEXT FREE GRAMMAR AND LANGUAGES 9**

CFG – Parse Trees – Ambiguity in Grammars and Languages – Definition of the Pushdown Automata – Languages of a Pushdown Automata – Equivalence of Pushdown Automata and CFG, Deterministic Pushdown Automata.

**UNIT IV PROPERTIES OF CONTEXT FREE LANGUAGES 9**

Normal Forms for CFG – Pumping Lemma for CFL – Closure Properties of CFL – Turing Machines – Programming Techniques for TM.

**UNIT V UNDECIDABILITY 9**

Non Recursive Enumerable (RE) Language – Undecidable Problem with RE – Undecidable Problems about TM – Post's Correspondence Problem, The Class P and NP.

**TOTAL: 45 PERIODS****OUTCOMES:**

**Upon completion of the course, the students should be able to :**

- Construct automata, regular expression for any pattern.
- Write Context free grammar for any construct.
- Design Turing machines for any language.
- Propose computation solutions using Turing machines.
- Derive whether a problem is decidable or not.

**TEXT BOOKS :**

1. J. E.Hopcroft, R.Motwani and J.D Ullman, "Introduction to Automata Theory, Languages and Computations", Second Edition, Pearson Education, 2003.

**REFERENCES BOOKS:**

1. H.R.Lewis and C.H.Papadimitriou, "Elements of the theory of Computation", Second Edition, PHI, 2003.
2. J.Martin, "Introduction to Languages and the Theory of Computation", Third Edition, TMH,

2003.

3. Micheal Sipser, "Introduction of the Theory and Computation", Thomson Brokecole, 1997.

**CW8512**

**SOFT SKILLS LABORATORY**

**L T P C**  
**0 0 2 1**

**OBJECTIVES:**

- To enhance the Employability and Career Skills of students
- To orient the students towards grooming as a professional
- To make them Employable Graduates
- To develop their confidence and help them attend interviews successfully
- To make effective presentations.

**LIST OF EXPERIMENTS :**

1. Soft and Hard skills
2. Being informed on current affairs and technology
3. Self Intro, G&A, Presentations
4. Group discussion
5. Interview etiquettes & mastering FAGs
6. Group vs Team
7. Net working, time management, social protocol, career plan and success

**PLATFORM NEEDED**

Systems with Rosetta stone and Globarena

**TOTAL : 30 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students should be able to :**

- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace
- Participate confidently and appropriately in conversations both formal and informal

**REFERENCES:**

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Interact English Lab Manual for Undergraduate Students,. Orient BalckSwan: Hyderabad, 2016.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

**OBJECTIVES:**

- To understand the protocol layering and physical level communication
- To analyze the performance of a network
- To understand the various components required to build different networks
- To learn the functions of network layer and the various routing protocols
- To familiarize the functions and protocols of the Transport layer

**UNIT I INTRODUCTION AND PHYSICAL LAYER 9**

Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

**UNIT II DATA-LINK LAYER & MEDIA ACCESS 9**

Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – PPP – Media Access Control – Wired LANs: Ethernet – Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices.

**UNIT III NETWORK LAYER 9**

Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets – Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.

**UNIT IV TRANSPORT LAYER 9**

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol – SCTP.

**UNIT V APPLICATION LAYER 9**

WWW and HTTP – FTP – Email – Telnet – SSH – DNS – SNMP.

**LIST OF EXPERIMENTS :**

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and trace route PDUs using a network protocol analyzer and examine.
2. Write a HTTP web client program to download a web page using TCP sockets.
3. Applications using TCP sockets like:
  - a) Echo client and echo server
  - b) Chat
  - c) File Transfer
4. Simulation of DNS using UDP sockets.
5. Write a code simulating ARP /RARP protocols.
6. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
7. Study of TCP/UDP performance using Simulation tool.
8. Simulation of Distance Vector/ Link State Routing algorithm.
9. Performance evaluation of Routing protocols using Simulation tool.
10. Simulation of an error correction code (like CRC).

**PLATFORM NEEDED :**

System with :

- C/C++/JAVA/Equivalent compiler
- Network Simulator like NS2/OPNET/Wireshark

<b>PRACTICALS</b>	<b>30 PERIODS</b>
<b>THEORY</b>	<b>45 PERIODS</b>
<b>TOTAL</b>	<b>75 PERIODS</b>

**OUTCOMES:**

Upon completion of the course, the students should be able to :

- Understand the basic layers and its functions in computer networks.
- Evaluate the performance of a network.
- Understand the basics of how data flows from one node to another.
- Analyze and design routing algorithms.
- Design protocols for various functions in the network.
- Understand the working of various application layer protocols.

**TEXT BOOK:**

1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.
2. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.

**REFERENCES:**

1. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
2. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
3. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013.
4. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011.

**CS8691****ARTIFICIAL INTELLIGENCE****L T P C****3 0 0 3****OBJECTIVES:**

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI.

**UNIT I INTRODUCTION****9**

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.



**OBJECTIVES :**

- To learn the various phases of compiler.
- To learn the various parsing techniques.
- To understand intermediate code generation and run-time environment.
- To learn to implement front-end of the compiler.
- To learn to implement code generator.

**UNIT I INTRODUCTION TO COMPILERS 9**

Structure of a compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Lex – Finite Automata – Regular Expressions to Automata – Minimizing DFA.

**UNIT II SYNTAX ANALYSIS 9**

Role of Parser – Grammars – Error Handling – Context-free grammars – Writing a grammar – Top Down Parsing - General Strategies Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0)Item Construction of SLR Parsing Table -Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC.

**UNIT III INTERMEDIATE CODE GENERATION 9**

Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking.

**UNIT IV RUN-TIME ENVIRONMENT AND CODE GENERATION 9**

Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management - Issues in Code Generation - Design of a simple Code Generator.

**UNIT V CODE OPTIMIZATION 9**

Principal Sources of Optimization – Peep-hole optimization - DAG- Optimization of Basic Blocks- Global Data Flow Analysis - Efficient Data Flow Algorithm.

**LIST OF EXPERIMENTS :**

1. Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.). Create a symbol table, while recognizing identifiers.
2. Implement a Lexical Analyzer using Lex Tool
3. Implement an Arithmetic Calculator using LEX and YACC
4. Generate three address code for a simple program using LEX and YACC.
5. Implement simple code optimization techniques (Constant folding, Strength reduction and Algebraic transformation)
6. Implement back-end of the compiler for which the three address code is given as input and the 8086 assembly language code is produced as output.

**PRACTICALS 30 PERIODS**

**THEORY 45 PERIODS**



Programmed Decisions, Steps in Problem Solving and Decision Making; Bounded Rationality and Influences on Decision Making; Group Problem Solving and Decision Making, Creativity and Innovation in Managerial Work.

**UNIT III ORGANIZATION AND HRM 9**

Principles of Organization: Organizational Design & Organizational Structures; Departmentalization, Delegation; Empowerment, Centralization, Decentralization, Recentralization; Organizational Culture; Organizational Climate and Organizational Change. Human Resource Management & Business Strategy: Talent Management, Talent Management Models and Strategic Human Resource Planning; Recruitment and Selection; Training and Development; Performance Appraisal.

**UNIT IV LEADING AND MOTIVATION 9**

Leadership, Power and Authority, Leadership Styles; Behavioral Leadership, Situational Leadership, Leadership Skills, Leader as Mentor and Coach, Leadership during adversity and Crisis; Handling Employee and Customer Complaints, Team Motivation -Types of Motivation; Relationship between Motivation, Performance and Engagement, Content Motivational Theories - Needs Hierarchy Theory, Two Factor Theory, Theory X and Theory Y.

**UNIT V EMERGING CONCEPTS AND SKILL DEVELOPMENT 9**

Creativity-Innovation-Entrepreneurship, Technology Management- Management Information Systems (MIS), Productivity Problems-TQM, Kaizen, Six Sigma, 5S Concept, Use of computers and IT in Management Control-Work Applications, Ethics and Social Responsibility.

**TOTAL 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students should be able to :**

- Understand the different elements of effective management
- Apply the concepts of planning and decision making in organizations
- Describe the concepts of organization and need for staffing process
- Adopt the concept of directing through motivation and leadership
- Demonstrate the use of control methods in changing business environment

**TEXT BOOK:**

1. Management Fundamentals, Robert N Lussier, 5e, Cengage Learning, 2013.
2. Fundamentals of Management, Stephen P. Robbins, Pearson Education, 2009.

**REFERENCES:**

1. Essentials of Management, Koontz Kleihrich, Tata McGraw Hill.
2. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012
3. Management: Principles, Processes and Practices, Anil Bhat, Arya Kumar –Oxford University Press-, 2008

**OBJECTIVES:**

1. To understand the Analytics Life Cycle.
2. To comprehend the process of acquiring Business Intelligence
3. To understand various types of analytics for Business Forecasting
4. To model the supply chain management for Analytics.
5. To apply analytics for different functions of a business

**UNIT I INTRODUCTION TO BUSINESS ANALYTICS 9**

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration

**UNIT II BUSINESS INTELLIGENCE 9**

Data Warehouses and Data Mart - Knowledge Management – Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence – OLAP –, Analytic functions

**UNIT III BUSINESS FORECASTING 9**

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modeling – Machine Learning for Predictive analytics.

**UNIT IV HR & SUPPLY CHAIN ANALYTICS 9**

Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain

**UNIT V MARKETING & SALES ANALYTICS 9**

Marketing Strategy, Marketing Mix, Customer Behavior – selling Process – Sales Planning – Analytics applications in Marketing and Sales

**TOTAL: 45 PERIODS****COURSE OUTCOMES:**

- Explain the real world business problems and model with analytical solutions.
- Identify the business processes for extracting Business Intelligence
- Apply predictive analytics for business fore-casting
- Apply analytics for supply chain and logistics management
- Use analytics for marketing and sales.

**REFERENCES:**

1. [R. Evans James](#), Business Analytics, 2017
2. [R.N Prasad](#), [Seema Acharya](#), Fundamentals of Business Analytics, 2016
3. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
4. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
5. Mahadevan B, "Operations Management -Theory and Practice",3rd Edition, Pearson Education, 2018.

**OBJECTIVES:**

- Implement various machine learning techniques for predictive analysis
- Learn the various software development methodologies
- Apply predictive analytics in marketing and sales
- Learn predictive analysis in HR, supply chain
- Learn predictive analysis in marketing and sales

**LIST OF EXPERIMENTS :**

1. Implement Machine learning techniques for Predictive analytics.
2. Predict the Customer Credit Risk for Credit card data-set using Linear Regression
3. Apply HR Analytics to make a prediction of the demand for hourly-employees for the following month or for the next few years
4. Apply analytics for forecasting and inventory planning for a large retailer.
5. Perform predictive analytics for customers' behaviour in marketing and sales

**TOTAL : 60 PERIODS****PLATFORM NEEDED**

Systems with R, R Studio (Additional libraries required)

**OUTCOMES:****Upon Completion of the course, the students should be able to:**

- Implement Machine learning techniques for Predictive analytics.
- Analyse prediction using Linear Regression
- Perform analytics for forecasting and inventory planning for a large retailer.
- Apply predictive analysis in HR, supply chain
- Apply predictive analysis in marketing and sales

**OBJECTIVES :**

- To formalize design systems capable of automated reasoning.
- To identify and implement appropriate learning strategies
- To implement and apply machine learning techniques in prediction problems.

**LIST OF EXPERIMENTS :**

1. Study of Prolog.
2. Write simple fact for the statements using PROLOG.
3. Write predicates one converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing.



**UNIT IV WORKING CAPITAL MANAGEMENT 9**

Principles of working capital: Concepts, Needs, Determinants, issues and estimation of working capital - Accounts Receivables Management and factoring - Inventory management – Cash management - Working capital finance : Trade credit, Bank finance and Commercial paper.

**UNIT V LONG TERM SOURCES OF FINANCE 9**

Indian capital and stock market, New issues market Long term finance: Shares, debentures and term loans, lease, hire purchase, venture capital financing, Private Equity.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Possess the techniques of managing finance in an organization

**TEXT BOOKS**

1. M.Y. Khan and P.K.Jain Financial management, Text, Problems and cases Tata McGraw Hill, 6th edition, 2011.
2. M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd., 10th edition, 2012.

**REFERENCES**

1. Aswat Damodaran, Corporate Finance Theory and practice, John Wiley & Sons, 2011.
2. James C. Vanhorne –Fundamentals of Financial Management– PHI Learning, 11th Edition, 2012.
3. Brigham, Ehrhardt, Financial Management Theory and Practice, 12th edition, Cengage Learning 2010.
4. Prasanna Chandra, Financial Management, 9th edition, Tata McGraw Hill, 2012.
5. Srivatsava, Mishra, Financial Management, Oxford University Press, 2011.

<b>IT8501</b>	<b>WEB TECHNOLOGY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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**OBJECTIVES:**

- To understand about client-server communication and protocols used during communication.
- To design interactive web pages using Scripting languages.
- To learn server side programming using servlets and JSP.
- To develop web pages using XML/XSLT.

**UNIT I WEB SITE BASICS AND HTML 9**

Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols –The World Wide Web-HTTP request message-response message-Web Clients Web Servers. Markup Languages: XHTML. An Introduction to HTML History-Versions-Basic XHTML Syntax and Semantics- Some Fundamental HTML Elements-Relative URLs-Lists-tables-Frames-Forms-HTML 5.0.

**UNIT II CSS AND CLIENT SIDE SCRIPTING 9**

Style Sheets: CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-Style Sheets and HTML- Style Rule Cascading and Inheritance-Text Properties-Box Model Normal Flow Box Layout-Beyond the Normal Flow-CSS3.0. Client-Side Programming: The JavaScript Language-History and Versions Introduction JavaScript in Perspective-Syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers.

**UNIT III SERVER SIDE SCRIPTING 9**

Host Objects: Browsers and the DOM-Introduction to the Document Object Model DOM History and Levels-Intrinsic Event Handling-Modifying Element Style-The Document Tree-DOM Event Handling-Accommodating Noncompliant Browsers Properties of window. Server-Side Programming: Java Servlets- Architecture -Overview-A Servlet-Generating Dynamic Content-Life Cycle- Parameter Data- Sessions-Cookies-URL Rewriting-Other Capabilities-Data Storage Servlets and Concurrency- Databases and Java Servlets.

**UNIT IV JSP AND XML 9**

Separating Programming and Presentation: JSP Technology Introduction-JSP and Servlets-Running JSP Applications Basic JSP-JavaBeans Classes and JSP-Tag Libraries and Files-Support for the Model-View-Controller Paradigm- Databases and JSP. Representing Web Data: XML-Documents and Vocabularies-Versions and Declaration-Namespaces- DOM based XML processing Event-oriented Parsing: SAX-Transforming XML Documents-Selecting XML Data: XPATH-Template based Transformations: XSLT-Displaying XML Documents in Browsers.

**UNIT V AJAX AND WEB SERVICES 9**

AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods. Web Services: JAX-RPC-Concepts-Writing a Java Web Service-Writing a Java Web Service Client-Describing Web Services: WSDL- Representing Data Types: XML Schema-Communicating Object Data: SOAP Related Technologies-Software Installation-Storing Java Objects as Files.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design simple web pages using markup languages like HTML and XHTML.
- Create dynamic web pages using DHTML and java script that is easy to navigate and use.
- Program server side web pages that have to process request from client side web pages.
- Represent web data using XML and develop web pages using JSP.
- Understand various web services and how these web services interact.

**TEXT BOOK:**

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.

**REFERENCES**

1. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007 .

2. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006.
3. Marty Hall and Larry Brown," Core Web Programming" Second Edition, Volume I and II, Pearson Education, 2001.
4. Bates, "Developing Web Applications", Wiley, 2006

<b>IT8073</b>	<b>INFORMATION SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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**OBJECTIVES:**

- To understand the basics of Information Security
- To know the legal, ethical and professional issues in Information Security
- To know the aspects of risk management
- To become aware of various standards in this area
- To know the technological aspects of Information Security

**UNIT I INTRODUCTION 9**

History, What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

**UNIT II SECURITY INVESTIGATION 9**

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues  
 - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies.

**UNIT III SECURITY ANALYSIS 9**

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk - Systems: Access Control Mechanisms, Information Flow and Confinement Problem.

**UNIT IV LOGICAL DESIGN 9**

Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity.

**UNIT V PHYSICAL DESIGN 9**

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel.

**TOTAL :45 PERIODS**

**OUTCOMES:**

**At the end of this course, the students should be able to:**

- Discuss the basics of information security
- Illustrate the legal, ethical and professional issues in information security
- Demonstrate the aspects of risk management.
- Become aware of various standards in the Information Security System
- Design and implementation of Security Techniques.

**TEXT BOOK:**

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2003

**REFERENCES:**

1. Micki Krause, Harold F. Tipton, " Handbook of Information Security Management", Vol 1-3 CRC Press LLC, 2004.
2. Stuart McClure, Joel Scrambray, George Kurtz, "Hacking Exposed", Tata McGraw- Hill, 2003
3. Matt Bishop, "Computer Security Art and Science", Pearson/PHI, 2002.

<b>CW8711</b>	<b>INFORMATION SECURITY LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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**OBJECTIVES:**

- Explain the legal issues of preparing for and performing information security analysis
- Perform hashing, password cracking .
- Explain penetration testing
- Explain Intrusion Detection Systems
- Demonstrate OS security related issues

**LIST OF EXPERIMENTS**

1. Introduction to legal issuesDisk Imaging and Cloning: Use VMWare and modify device configuration in a VMWare system - Image a drive to a file - Extract individual partitions from an image file - Mount the image as a loopback device and read only for analysis - Properly sanitize a disk for cloning - Clone a drive versus imaging the drive - Verify disk and file integrity with hashing.
2. Implement SHA-1 algorithm
3. Implement MD5 algorithm for practical applications.
4. Implementing Digital Signal Standard (DSS).
5. Crack passwords using John the Ripper.
6. Demonstrate penetration testing using any tool (Metasploit or wireshark, etc).
7. Demonstrate intrusion detection system (IDS) using Snort.
8. Demonstrate OS fingerprinting using Nmap.
9. Implementing system call filters using Seccomp BPF filter.
10. Implementing Security Access Control using Multi-factor authentication.

**TOTAL: 60 PERIODS****OUTCOMES:****Upon Completion of the course, the students will be able to:**

- Explain the legal issues of preparing for and performing information security analysis
- Perform hashing, password cracking
- Create penetration testing
- Represent Intrusion Detection Systems
- Understand OS security related issues

**PLATFORM NEEDED:**

System with :

- Linux OS
- Java
- John the Ripper
- Metasploit
- Snort
- Nmap
- Wireshark
- Kali Linux

IT8511

WEB TECHNOLOGY LABORATORY

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**OBJECTIVES:**

- To design interactive web pages using Scripting languages.
- To learn server side programming using servlets and JSP.
- To develop web pages using XML/XSLT.

**LIST OF EXPERIMENTS**

1. Create a web page with the following using HTML.
  - i) To embed an image map in a web page.
  - ii) To fix the hot spots.
  - iii) Show all the related information when the hot spots are clicked
2. Create a web page with all types of Cascading style sheets.
3. Client Side Scripts for Validating Web Form Controls using DHTML.  
78
4. Installation of Apache Tomcat web server.
5. Write programs in Java using Servlets: To invoke servlets from HTML forms.  
Session Tracking.
6. Write programs in Java to create three-tier applications using JSP and Databases
  - For conducting on-line examination.
  - For displaying student mark list. Assume that student information is available in a database which has been stored in a database server.
7. Programs using XML – Schema – XSLT/XSL.
8. Programs using DOM and SAX parsers.
9. Programs using AJAX.
10. Consider a case where we have two web Services- an airline service and a travel agent and the travel agent is searching for an airline. Implement this scenario using Web Services and Data base.

**TOTAL: 60 PERIODS****OUTCOMES:****Upon Completion of the course, the students will be able to:**

- Design simple web pages using markup languages like HTML and XHTML.
- Create dynamic web pages using DHTML and java script that is easy to navigate and use.
- Program server side web pages that have to process request from client side web pages.

- Represent web data using XML and develop web pages using JSP.
- Understand various web services and how these web services interact.

**PLATFORM NEEDED:**

System with :

Dream Weaver or Equivalent, MySQL or Equivalent, Apache Server, WAMP/XAMPP

**CW8001**

**DATA MINING AND ANALYTICS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To understand data pre-processing and data visualization techniques
- To study algorithms for finding hidden and interesting patterns in data
- To understand and apply various classification and clustering techniques using tools.
- Learn the different ways of Data Analysis
- To familiar with the visualization

**UNIT I DATA MINING – INTRODUCTION 9**

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

**UNIT II DATA MINING - FREQUENT PATTERN ANALYSIS 9**

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns

**UNIT III CLASSIFICATION AND CLUSTERING 9**

Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines — Lazy Learners – Model Evaluation and Selection- Techniques to improve Classification Accuracy. Clustering Techniques – Cluster analysis- Partitioning Methods - Hierarchical Methods – Density Based Methods - Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.

**UNIT IV DATA ANALYSIS 9**

Web data – Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting- Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and kernel methods, Analysis of time series: linear systems analysis, nonlinear dynamics - Rule induction - Neural networks: learning and generalization, competitive learning, principal component analysis and neural networks; Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods.

**UNIT V FRAMEWORKS AND VISUALIZATION 9**

MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed file systems – Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications:

**OUTCOMES:**

**Upon completion of the course, the students should be able to:**

- Apply suitable pre-processing and visualization techniques for data analysis
- Apply frequent pattern and association rule mining techniques for data analysis
- Apply appropriate classification and clustering techniques for data analysis
- Compare and contrast various soft computing frameworks
- Use Visualization techniques

**TEXT BOOKS:**

1. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.
1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012.

**REFERENCES:**

1. K.P. Soman, Shyam Diwakar and V. Ajay, "Insight into Data Mining Theory and Practice", Eastern Economy Edition, Prentice Hall of India, 2006.
2. Ian H.Witten and Eibe Frank, "Data Mining: Practical Machine Learning Tools and Techniques", Elsevier, Second Edition.
3. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analytics, John Wiley & sons, 2012.
4. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O'Reilly, 2011.
5. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.

**CS8601**

**MOBILE COMPUTING**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To understand the basic concepts of mobile computing.
- To learn the basics of mobile telecommunication system .
- To be familiar with the network layer protocols and Ad-Hoc networks.
- To know the basis of transport and application layer protocols.
- To gain knowledge about different mobile platforms and application development.

**UNIT I INTRODUCTION**

**9**

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA

**UNIT II MOBILE TELECOMMUNICATION SYSTEM**

**9**

Introduction to Cellular Systems - GSM – Services & Architecture – Protocols – Connection

Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS/UMTS – Architecture – Handover - Security

**UNIT III MOBILE NETWORK LAYER 9**

Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security.

**UNIT IV MOBILE TRANSPORT AND APPLICATION LAYER 9**

Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML

**UNIT V MOBILE PLATFORMS AND APPLICATIONS 9**

Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues

**TOTAL :45 PERIODS**

**OUTCOMES:**

**At the end of the course, the students should be able to:**

- Explain the basics of mobile telecommunication systems
- Illustrate the generations of telecommunication systems in wireless networks
- Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network
- Explain the functionality of Transport and Application layers
- Develop a mobile application using android/blackberry/ios/Windows SDK

**TEXT BOOKS:**

1. Jochen Schiller, “Mobile Communications”, PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt.Ltd, New Delhi – 2012

**REFERENCES :**

1. Dharma Prakash Agarwal, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, 2003.
3. William.C.Y.Lee,“Mobile Cellular Telecommunications-Analog and Digital Systems”, Second Edition, TataMcGraw Hill Edition ,2006.
4. C.K.Toh, “AdHoc Mobile Wireless Networks”, First Edition, Pearson Education, 2002.
5. Android Developers : <http://developer.android.com/index.html>
6. Apple Developer : <https://developer.apple.com/>
7. Windows Phone DevCenter : <http://developer.windowsphone.com>
8. BlackBerry Developer : <http://developer.blackberry.com>

**OBJECTIVES:**

- To understand Cryptography Theories, Algorithms and Systems.
- To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.
- To understand the cryptanalysis on standard algorithms meant for confidentiality, integrity and authenticity.

**UNIT I INTRODUCTION****9**

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem.

**UNIT II SYMMETRIC KEY CRYPTOGRAPHY****9**

MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures - Modular arithmetic-Euclid's algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution.

**UNIT III PUBLIC KEY CRYPTOGRAPHY****9**

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem

**UNIT IV ALGORITHMIC CRYPTANALYSIS****9**

Linear Algebra – Dense matrix multiplication - Gaussian elimination algorithms - Sieve Algorithms – Sieving for smooth composites - Brute force cryptanalysis - Brute force steps in advanced cryptanalysis - Birthday attacks through quadrisection

**UNIT V CRYPTANALYSIS APPLICATIONS****9**

Attacks on stream ciphers - Correlation attacks - Algebraic attacks - Lattice-based cryptanalysis - Direct attacks using lattice reduction - Coppersmith's small roots attacks - Elliptic curves and pairings - The Weil pairing - The elliptic curve factoring method - Index calculus algorithms - A simple finite field example

**TOTAL :45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Understand the fundamentals of networks security, security architecture, threats and vulnerabilities
- Apply the different cryptographic operations of symmetric cryptographic algorithms
- Apply the different cryptographic operations of public key cryptography

- Evaluate and choose the appropriate technologies, algorithms and approaches for security.

**TEXT BOOK:**

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006. (Units 1, 2, 3)
2. Antoine Joux, Algorithmic Cryptanalysis, (Chapman & Hall/CRC Cryptography and Network Security Series), 2009. (Units 4, 5)

**REFERENCES:**

1. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd. 2011
2. BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.
3. Lawrence C. Washington, Elliptic Curves: Number Theory and Cryptography, Second Edition, CRC Press 2008.

**CS8791**

**CLOUD COMPUTING**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To understand the concept of cloud computing.
- To appreciate the evolution of cloud from the existing technologies.
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.

**UNIT I INTRODUCTION**

**9**

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning.

**UNIT II CLOUD ENABLING TECHNOLOGIES**

**10**

Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish-Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery.

**UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE**

**8**

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - IaaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

**UNIT IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD**

**10**

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.

**UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS****8**

Hadoop – MapReduce – Virtual Box -- Google App Engine – Programming Environment for Google App Engine — Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.

**TOTAL: 45 PERIODS****OUTCOMES:****On Completion of the course, the students should be able to:**

- Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
- Learn the key and enabling technologies that help in the development of cloud.
- Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.
- Explain the core issues of cloud computing such as resource management and security.
- Be able to install and use current cloud technologies.
- Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

**TEXT BOOKS:**

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017.

**REFERENCES:**

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach", Tata Mcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)", O'Reilly, 2009.

**CW8003****MODERN WEB APPLICATIONS DEVELOPMENT****L T P C****3 0 0 3****OBJECTIVES:**

- To understand the back end data model and accessing
- To understand Django fundamentals and use its concepts to build and deploy robust web applications and apps.
- Learn about Django URL patterns and views and deploy Django applications

**UNIT I PYTHON: OBJECT ORIENTED PROGRAMMING****9**

Class Definitions – Instantiation - Sub Classing – Inner Classes – Regular Expressions – Inheriting from other classes- Class and Static Methods – Private Methods- Polymorphism - Importing python modules and libraries-Creating objects-Manipulating and working with objects.

**UNIT II DJANGO 9**

Creating the Project – Running the Development Server – Creating the Application – Designing a Model – Setting up the Database – Setting up the Application – Dynamic Web Sites – Communication – Data Storage – Presentation.

**UNIT III DJANGO ARCHITECTURE 9**

Django and Python - Django stake on MVC: Models - Views and Template – Overall Django Architecture - 3 Core Files: models.py- urls.py- views.py – URL's – Modeling HTTP: Requests ; Responses and Middleware – Views / Logic

**UNIT IV DJANGO FORMS AND APIS 9**

Templates – Forms - Validation – Authentication - Advanced Forms processing techniques - Django REST framework – Django piston.

**UNIT V APPLICATION ESSENTIALS 9**

Creation of simple interactive applications - Simple database applications - Multimedia applications - Design and development of information systems – Personal Information System – Information retrieval system – Social networking applications

**TOTAL : 45 PERIODS**

**OUTCOMES:**

After completing this course- students will have a fundamental understanding of how to Implementing Python based applications

- Safely model and store data in SQL databases
- Use MVC (Models- Views & Templates)
- Build and deploy robust Django web apps
- Integrate with RESTful web services
- Unit Testing and Debugging Django apps

**REFERENCES:**

1. Python Web Development with Django 1st Edition by Jeff Forcier ; Paul Bissex; Wesley Chun; Pearson Education; 2009
2. Think Python, 2nd Edition - How to Think Like a Computer Scientist - Allen B. Downey – 2<sup>nd</sup> Edition, Shroff / O'Reilly Publication, 2016.
3. Django for Beginners: Build websites with Python and Django Paperback, William S Vincent, Independently Published, 2018

<b>CW8004</b>	<b>BLOCKCHAIN TECHNOLOGIES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To decompose a blockchain system's fundamental components, how they fit together and examine a decentralization using blockchain.
- To explain how Cryptocurrency works, from when a transaction is created to when it is considered part of the blockchain.
- To explain the components of Ethereum and Programming Languages for Ethereum.
- To study the basics Hyperledger and Web3.

- To provide a details of alternative blockchain and blockchain projects in different perspective.

**UNIT I INTRODUCTION TO BLOCKCHAIN 9**

History of Blockchain – Types of Blockchain – Consensus – Decentralization using Blockchain – Blockchain and Full Ecosystem Decentralization – Platforms for Decentralization.

**UNIT II INTRODUCTION TO CRYPTOCURRENCY 9**

Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments – Wallets – Alternative Coins – Theoretical Limitations – Bitcoin Limitations – Name Coin – Prime Coin – Zcash – Smart Contracts – Ricardian Contracts.

**UNIT III ETHEREUM 9**

The Ethereum Network – Components of Ethereum Ecosystem – Ethereum Programming Languages: Runtime Byte Code, Blocks and Blockchain, Fee Schedule – Supporting Protocols – Solidity Language.

**UNIT IV WEB3 AND HYPERLEDGER 9**

Introduction to Web3 – Contract Deployment – POST Requests – Development frameworks – Hyperledger as a protocol – The Reference Architecture – Hyperledger Fabric – Distributed Ledger – Corda.

**UNIT V ALTERNATIVE BLOCKCHAINS AND NEXT EMERGING TRENDS 9**

Kadena – Ripple- Rootstock – Quorum – Tendermint – Scalability – Privacy – Other Challenges – Blockchain Research – Notable Projects – Miscellaneous tools.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon Completion of the course, the students should be able to:**

- Understand the technology components of Blockchain and how it works behind-the scenes.
- Aware of different approaches to developing decentralized applications.
- Understand the Bitcoin and its limitations by comparing with other alternative coins.
- Establish deep understanding of the Ethereum model, its consensus model, code execution.
- Understand the architectural components of a Hyperledger and its development framework.
- Come to know the Alternative blockchains and emerging trends in blockchain.

**TEXT BOOK:**

1. Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained”, Second Edition, Packt Publishing, 2018.

**REFERENCES:**

1. Arshdeep Bahga, Vijay Madiseti, “Blockchain Applications: A Hands-On Approach”, VPT, 2017.
2. Andreas Antonopoulos, Satoshi Nakamoto, “Mastering Bitcoin”, O’Reilly Publishing, 2014.
3. Roger Wattenhofer, “The Science of the Blockchain” CreateSpace Independent Publishing Platform, 2016.

4. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.
5. Alex Leverington, "Ethereum Programming", Packt Publishing, 2017.

**AD8552**

**MACHINE LEARNING**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To understand the basics of Machine Learning (ML)
- To understand the methods of Machine Learning
- To know about the implementation aspects of machine learning
- To understand the concepts of Data Analytics and Machine Learning
- To understand and implement usecases of ML

**UNIT I MACHINE LEARNING BASICS 8**

Introduction to Machine Learning (ML) - Essential concepts of ML – Types of learning – Machine learning methods based on Time – Dimensionality – Linearity and Non linearity – Early trends in Machine learning – Data Understanding Representation and visualization.

**UNIT II MACHINE LEARNING METHODS 11**

Linear methods – Regression -Classification –Perceptron and Neural networks – Decision trees – Support vector machines – Probabilistic models —Unsupervised learning – Featurization

**UNIT III MACHINE LEARNING IN PRACTICE 9**

Ranking – Recommendation System - Designing and Tuning model pipelines- Performance measurement – Azure Machine Learning – Open-source Machine Learning libraries – Amazon’s Machine Learning Tool Kit: Sagemaker

**UNIT IV MACHINE LEARNING AND DATA ANALYTICS 9**

Machine Learning for Predictive Data Analytics – Data to Insights to Decisions – Data Exploration – Information based Learning – Similarity based learning – Probability based learning – Error based learning – Evaluation – The art of Machine learning to Predictive Data Analytics.

**UNIT V APPLICATIONS OF MACHINE LEARNING 8**

Image Recognition – Speech Recognition – Email spam and Malware Filtering – Online fraud detection – Medical Diagnosis.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Understand the basics of ML
- Explain various Machine Learning methods
- Demonstrate various ML techniques using standard packages.
- Explore knowledge on Machine learning and Data Analytics
- Apply ML to various real time examples

**TEXT BOOKS:**

1. Ameet V Joshi, Machine Learning and Artificial Intelligence, Springer Publications, 2020
2. John D. Kelleher, Brain Mac Namee, Aoife D' Arcy, Fundamentals of Machine learning for Predictive Data Analytics, Algorithms, Worked Examples and case studies, MIT press,2015

**REFERENCES:**

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer Publications, 2011
2. Stuart Jonathan Russell, Peter Norvig, John Canny, Artificial Intelligence: A Modern Approach, Prentice Hall, 2020
3. Machine Learning Dummies, John Paul Muller, Luca Massaron, Wiley Publications, 2021

<b>AD8081</b>	<b>COGNITIVE SCIENCE AND ANALYTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To explain cognitive computing and design principles.
- To distinguish between NLP and cognitive computing.
- To apply advanced analytics to cognitive computing.
- To discuss application of cognitive computing in business.
- To illustrate various applications of cognitive computing.

**UNIT I FOUNDATION & DESIGN PRINCIPLES 9**

Foundation of Cognitive Computing: cognitive computing as a new generation, the uses of cognitive systems, system cognitive, gaining insights from data, Artificial Intelligence as the foundation of cognitive computing, understanding cognition.

Design Principles for Cognitive Systems: Components of a cognitive system, building the corpus, bringing data into cognitive system, machine learning, hypotheses generation and scoring, presentation and visualization services.

**UNIT II NLP IN COGNITIVE SYSTEM 9**

Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system, semantic web, Applying Natural language technologies to Business problems.

Representing knowledge in Taxonomies and Ontologies: Representing knowledge, Defining Taxonomies and Ontologies, knowledge representation, models for knowledge representation, implementation considerations.

**UNIT III BIG DATA Vs COGNITIVE COMPUTING 9**

Relationship between Big Data and Cognitive Computing: Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data.

Applying Advanced Analytics to cognitive computing: Advanced analytics is on a path to cognitive computing, Key capabilities in advanced analytics, Using advanced analytics to create value, Impact of open source tools on advanced analytics.

**UNIT IV                      COGNITIVE COMPUTING IN BUSINESS                      9**

The Business Implications of Cognitive Computing: Preparing for change, advantages of new disruptive models, knowledge meaning to business, difference with a cognitive systems approach, meshing data together differently, using business knowledge to plan for the future, answering business questions in new ways, building business specific solutions, making cognitive computing a reality, cognitive application changing the market- IBM Watson as a cognitive systems.

**UNIT V                      APPLICATIONS                      9**

The process of building a cognitive application: Emerging cognitive platform, defining the objective, defining the domain, understanding the intended users and their attributes, questions and exploring insights, training and testing- Building a cognitive health care application- Smarter cities-Cognitive Computing in Government.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of this course, the students will be able to:**

- CO1: Explain cognitive computing and design principles.
- CO2: Distinguish between NLP and cognitive computing.
- CO3: Apply advanced analytics to cognitive computing.
- CO4: Discuss application of cognitive computing in business.
- CO5: Illustrate various applications of cognitive computing.

**REFERENCES:**

1. Judith H Hurwitz, Marcia Kaufman, Adrian Bowles, "Cognitive computing and Big Data Analytics" , Wiley, 2015.
2. Vijay Raghvan, Venu Govindaraju, C.R. Rao, Cognitive Computing: Theory and Applications", by Elsevier publications, North Holland Publication, 1<sup>st</sup> Edition, 2016.
3. Bernadette Sharp (Author), Florence Sedes (Author), Wieslaw Lubaszewski (Author), Cognitive Approach to Natural Language Processing Hardcover, First Edition May 2017.
4. Arun Kumar Sangaiah, Arunkumar Thangavelu, et al., Cognitive Computing for Big Data Systems Over IoT: Frameworks, Tools and Applications: Lecture Notes on Data Engineering and Communications Technologies 1st edition 2018
5. Min Chen and Kai Hwang, Big-Data Analytics for Cloud, IoT and Cognitive Computing Wiley Publication, 1<sup>st</sup> Edition, 2017.
6. Mallick, Pradeep Kumar, Borah, Samarjeet," Emerging Trends and Applications in Cognitive Computing", IGI Global Publishers, 2019.

**OBJECTIVES:**

- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

**UNIT I FUNDAMENTALS OF IoT 9**

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

**UNIT II IoT PROTOCOLS 9**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

**UNIT III DESIGN AND DEVELOPMENT 9**

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

**UNIT IV DATA ANALYTICS AND SUPPORTING SERVICES 9**

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG

**UNIT V CASE STUDIES/INDUSTRIAL APPLICATIONS 9**

Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

**TOTAL : 45 PERIODS****OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Explain the concept of IoT.
- Analyze various protocols for IoT.
- Design a PoC of an IoT system using Raspberry Pi/Arduino
- Apply data analytics and use cloud offerings related to IoT.
- Analyze applications of IoT in real time scenario

**TEXTBOOK:**

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

**REFERENCES:**

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015
2. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012 (for Unit 2).
3. Jan Ho" ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.
5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2<sup>nd</sup> Edition, O'Reilly\_Media,\_2011.  
<https://www.arduino.cc/>  
[https://www.ibm.com/smarterplanet/us/en/?ca=v\\_smarterplanet](https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet)

<b>CW8005</b>	<b>SOCIAL, TEXT AND MEDIA ANALYTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the basic issues and types of social,,text and media mining
- Familiarize the learners with the concept of social, text and media analytics and understand its significance.
- Familiarize the learners with the tools of social, text and media analytics.
- Enable the learners to develop skills required for analyzing the effectiveness of social, text and media for business purposes
- To know the applications in real time systems.

**UNIT I INTRODUCTION TO SOCIAL MEDIA ANALYSIS 9**

Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas. Network fundamentals and models: The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks. Information visualization.

**UNIT II OVERVIEW OF TEXT MINING 9**

Overview of text mining- Definition- General Architecture– Algorithms– Core Operations – Preprocessing–Types of Problems- basics of document classification- information retrieval-

clustering and organizing documents- information extraction- prediction and evaluation-Textual information to numerical vectors -Collecting documents- document standardization- tokenization- lemmatization vector generation for prediction- sentence boundary determination -evaluation performance.

### **UNIT III TEXT MINING FOR INFORMATION RETRIEVAL AND INFORMATION EXTRACTION 9**

Information retrieval and text mining- keyword search- nearest-neighbor methods- similarity- web based document search- matching- inverted lists- evaluation. Information extraction- Architecture - Co-reference - Named Entity and Relation Extraction- Template filling and database construction – Applications. Inductive -Unsupervised Algorithms for Information Extraction. Text Summarization Techniques - Topic Representation - Influence of Context - Indicator Representations – Pattern Extraction - Apriori Algorithm – FP Tree algorithm.

### **UNIT IV WEB ANALYTICS TOOLS 9**

Clickstream analysis, A/B testing, online surveys, Web crawling and Indexing. Natural Language Processing Techniques for Micro-text Analysis.

### **UNIT V SOCIAL MEDIA ANALYTICS 9**

Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post- performance on FB. Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis.

#### **OUTCOMES:**

**Upon Completion of the course, the students should be able to:**

- Understand about social, text and media mining
- Understand the significance of social text and media analytics
- Learn tools of social, text and media analytics.
- Develop skills required for analyzing the effectiveness of social text and media for business purposes
- Know the applications in real time systems.

#### **TEXT BOOK:**

1. Marshall Sponder, Social Media Analytics, McGraw Hill ,2011.
2. Charu C. Aggarwal ,ChengXiang Zhai, Mining Text Data, Springer; 2012

#### **REFERENCES:**

1. Matthew Ganis, Avinash Kohirkar , Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media, Pearson, 2016.
2. Jim Sterne, Social Media Metrics: How to Measure and Optimize Your Marketing Investment, Wiley, 2010.
3. Oliver Blanchard ,Social Media ROI: Managing and Measuring Social Media Efforts in Your Organization (Que Biz-Tech), 2019.
4. Sholom Weiss, Nitin Indurkha, Tong Zhang, Fred Damerau “The Text Mining Handbook.
5. Advanced Approaches in Analyzing Unstructured Data”, Springer, paperback 2010
6. Ronen Feldman, James Sanger -“ The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data”, Springer, paperback 2010.
7. Tracy L. Tuten, Michael R. Solomon, Social Media Marketing , Sage, 2016.

**OBJECTIVES:**

- To familiarize the students to the basic concepts of management in order to aid in understanding how an organization functions
- To explain economic decision-making process and role of psychology in it
- To elaborate the deviation in reality and standard economic theoretical predictions in the framework of behavioral economics

**UNIT I INTRODUCTION TO BEHAVIORAL ECONOMICS 9**

Behavioral Economics and Consumer Behavior – Psychology and Behavioral Economics – Institution in Behavioral Economics – Introspective economics – Integrating emotions into economic theory.

**UNIT II CONTEXT AND MODELLING 9**

Introduction to Behavioral Economics, Origins of Behavioral Economics, Decision-making under Neo-classical economic framework- rationality, optimization Role of Intuition, Emotions, Beliefs in decision making Bounded Rationality Judgment under Risk & Uncertainty : Heuristics & Biases Heuristics : Representativeness, Substitution, Availability, Affect, Anchoring, framing Biases: Cognitive and emotional biases.

**UNIT III RISK AND UNCERTAINTY 9**

Choice Under Risk & Uncertainty Expected Utility Prospect Theory – Reference Points – Risk Concept and Understanding – Loss Aversion – Shape of Utility Function – Decision Weighting– Probabilistic Judgment. Mental Accounting Framing Mental Accounts Fungibility & Labels Hedonic Editing.

**UNIT IV EVIDENCE ON HUMAN CHOICE 9**

Intertemporal Choice, Temporal Choice, Construal Level Theory, Valuation of Delayed Consumption Preferences for Sequences of Outcomes, Hyperbolic Discounting, Preference Reversal

**UNIT V BEHAVIORAL GAME THEORY 9**

Behavioral Game Theory Social preferences: Fairness, trust, cooperation, reciprocity, Norms Limited Strategic Thinking Choice architecture: Nudge, Nudge vs. boost, Behavioral public policy.

**TOTAL : 45 PERIODS**

**OUTCOME:**

**Upon Completion of the course, the students should be able to:**

- Familiarize the concepts of management in order to aid in understanding how an organization functions
- Explain economic decision-making process and role of psychology in it
- Elaborate the deviation in reality and standard economic theoretical predictions in the framework of behavioral economics

**TEXT BOOK:**

1. M. Altman, Handbook of Contemporary Behavioural Economics: Foundation and Developments, Prentice Hall India, 2007
2. Sanjit Dhama, "The Foundations of Behavioral Economic Analysis", Oxford University Press, 2016.

**REFERENCES:**

1. Erik Angner, "A Course in Behavioral Economics", Palgrave Macmillan
2. E. Cartwright, Behavioural Economics (2011), Routledge
3. D. Kahneman, Thinking Fast and Slow (2011), Allen Lane, Penguin Books
4. G. Loewenstein, Exotic Preferences: Behavioural Economics and Human Motivation (2007), Oxford University Press
5. Behavioral Economics: Toward a New Economics by Integration with Traditional Economics by Ogaki, Masao, Tanaka, Saori C. Published by Springer, ISBN 978-981-10-6439-5
6. Nick Wilkinson; Matthias Klaes (2012), An Introduction to Behavioral Economics, 2<sup>nd</sup> Edition, Palgrave Macmillan.
7. World Development Report 2015: Mind, Society, and Behavior

<b>CW8007</b>	<b>COMPUTATIONAL FINANCE AND MODELING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To build financial models by including various fields of study viz financial management and derivatives.
- To design and construct useful and robust financial modelling applications
- To recognize efficient financial budgeting and forecasting techniques
- To develop various portfolio models

**UNIT I INTRODUCTION TO FINANCIAL MODELLING & BUILT IN FUNCTIONS  
USING SPREAD SHEETS**
**9**

Introduction to Financial Modelling- Need for Financial Modelling- Steps for effective financial modelling-Introduction to Time value of money & Lookup array functions :FV,PV,PMT,RATE,NPER, Vlookup, Hlookup ,if, countifetc - Time value of Money Models: EMI with Single & Two Interest rates –Loan amortisation modelling-Debenture redemption modelling

**UNIT II BOND & EQUITY SHARE VALUATION MODELLING****9**

Bond valuation – Yield to Maturity(YTM): Rate method Vs IRR method-Flexi Bond and Strip Bond YTM Modelling-Bond redemption modelling -Equity share valuation : Multiple growth rate valuation modelling with and without growth rates.

**UNIT III CORPORATE FINANCIAL MODELLING 9**

Alt Man Z score Bankruptcy Modelling-Indifference point modelling – Financial Break even modelling -Corporate valuation modelling( Two stage growth)- Business Modelling for capital budgeting evaluation: Payback period ,NPV ,IRR and MIRR.

**UNIT IV PORTFOLIO MODELLING 9**

Risk ,Beta and Annualised Return –Security Market Line Modelling –Portfolio risk calculation (Equal Proportions)-Portfolio risk optimisation (varying proportions)-Portfolio construction modelling.

**UNIT V DERIVATIVE MODELLING 9**

Option pay off modelling: Long and Short Call & Put options -Option pricing modelling (B-S Model)- Optimal Hedge Contract modelling.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon Completion of the course, the students should be able to:**

- Develop fast, efficient and accurate excel skills
- Design and construct useful and robust financial modelling applications
- Recognize efficient financial budgeting and forecasting techniques
- Familiarise the students with the valuation modelling of securities
- Develop various portfolio models

**TEXT BOOK:**

1. John C. Hull, Options, Futures, and Other Derviatives Prentice Hall, Tenth Edition
- Ruey S. Tsay, Analysis of Financial Time Series John Wiley, 2020

**REFERENCES:**

1. Wayne L Winston, " Microsoft Excel 2016-Data Analysis and Business Modelling ",PHI publications, (Microsoft Press),New Delhi,2017.
2. Chandan Sen Gupta, "Financial analysis and Modelling –Using Excel and VBA" , Wiley Publishing House ,2014'
3. Craig W Holden,"Excel Modelling in Investments" Pearson Prentice Hall, Pearson Inc,New Jersey,5th Edition 2015
4. Ruzhbeh J Bodanwala , "Financial management using excel spread sheet",Taxman Allied services Pvt Ltd, New Delhi,3rd Edition 2015.

<b>CW8008</b>	<b>MARKETING RESEARCH AND MARKETING MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the changing business environment and the fundamental premise underlying market driven strategies.
- To identify the indicators of management thoughts and practices.
- to analyze the nature of consumer buying behaviour

- To understanding the marketing research and new trends in the arena of marketing

**UNIT I INTRODUCTION 9**

Defining Marketing – Core concepts in Marketing – Evolution of Marketing – Marketing Planning Process – Scanning Business environment: Internal and External – Value chain – Core Competencies – PESTEL – SWOT Analysis – Marketing interface with other functional areas – Production, Finance, Human Relations Management, Information System – Marketing in global environment – International Marketing – Rural Marketing – Prospects and Challenges.

**UNIT II MARKETING STRATEGY 9**

Marketing strategy formulations – Key Drivers of Marketing Strategies - Strategies for Industrial Marketing – Consumer Marketing – Services marketing – Competition Analysis – Analysis of consumer and industrial markets – Influence of Economic and Behavioral Factors – Strategic Marketing Mix components.

**UNIT III MARKETING MIX DECISIONS 9**

Product planning and development – Product life cycle – New product Development and Management – Defining Market Segmentation – Targeting and Positioning – Brand Positioning and Differentiation – Channel Management – Managing Integrated Marketing Channels – Managing Retailing, Wholesaling and Logistics – Advertising and Sales Promotions – Pricing Objectives, Policies and Methods.

**UNIT IV BUYER BEHAVIOUR 9**

Understanding Industrial and Consumer Buyer Behaviour – Influencing factors – Buyer Behaviour Models – Online buyer behaviour – Building and measuring customer satisfaction – Customer relationships management – Customer acquisition, Retaining, Defection – Creating Long Term Loyalty Relationships.

**UNIT V MARKETING RESEARCH & TRENDS IN MARKETING 9**

Marketing Information System – Marketing Research Process – Concepts and applications: Product – Advertising – Promotion – Consumer Behaviour – Retail research – Customer driven organizations - Cause related marketing – Ethics in marketing – Online marketing trends - social media and digital marketing.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon Completion of the course, the students should be able to:**

- Applied knowledge of contemporary marketing theories to the demands of business and management practice
- Enhanced knowledge of marketing strategies for consumer and industrial marketing
- Deep understanding of choice of marketing mix elements and managing integrated marketing channels
- Ability to analyze the nature of consumer buying behaviour
- Understanding of the marketing research and new trends in the arena of marketing

## TEXT BOOK:

1. Philip T. Kotler and Kevin Lane Keller, Marketing Management, Prentice Hall India, 15th Edition, 2017.
2. KS Chandrasekar, "Marketing management-Text and Cases", Tata McGraw Hill Education, 2012

## REFERENCES:

1. Philip T. Kotler and Kevin Lane Keller, Marketing Management, Prentice Hall India, 15th Edition, 2017.
2. KS Chandrasekar, "Marketing management-Text and Cases", Tata McGraw Hill Education, 2012
3. Lamb, Hair, Sharma, Mc Daniel– Marketing – An Innovative approach to learning and teaching- A south Asian perspective, Cengage Learning, 2012.
4. Paul Baines, Chris Fill, Kelly Page, Marketing, Asian edition, Oxford University Press, 5th edition, 2019.
5. Ramasamy, V.S, Namakumari, S, Marketing Management: Global Perspective Indian Context, Macmillan Education, New Delhi, 6th edition, 2018.
6. NAG, Marketing successfully- A Professional Perspective, Macmillan 2008.
7. Micheal R.Czinkota, Masaaki Kotabe, Marketing Management, Vikas Thomson Learning, 2nd edition 2006.
8. Philip Kotler, Gay Armstrong, Prafulla Agnihotri, Principles of marketing, 7th edition, 2018.

**CW8009**

**HR MANAGEMENT**

L	T	P	C
3	0	0	3

## OBJECTIVES:

- To provide knowledge about management issues related to staffing, training, performance, compensation, human factors consideration and compliance with human resource requirements.
- To gain knowledge needed for success as a human resources professional.
- To develop the skills needed for a successful HR manager
- To implement the concepts learned in the workplace.

### **UNIT I PERSPECTIVES IN HUMAN RESOURCE MANAGEMENT 9**

Evolution of human resource management – The importance of the human capital – Role of human resource manager –Challenges for human resource managers - trends in Human resource policies – Computer applications in human resource management – Human resource accounting and audit.

### **UNIT II HUMAN RESOURCE PLANNING AND RECRUITMENT 9**

Importance of Human Resource Planning – Forecasting human resource requirement –matching supply and demand - Internal and External sources- Organizational Attraction-. Recruitment, Selection, Induction and Socialization- Theories, Methods and Process.

**UNIT III TRAINING AND DEVELOPMENT 9**

Types of training methods –purpose- benefits- resistance. Executive development programme – Common practices - Benefits – Self development – Knowledge management.

**UNIT IV EMPLOYEE ENGAGEMENT 9**

Compensation plan – Reward – Motivation – Application of theories of motivation – Career management – Mentoring - Development of mentor – Protégé relationships- Job Satisfaction, Employee Engagement, Organizational Citizenship Behavior: Theories, Models.

**UNIT V PERFORMANCE EVALUATION AND CONTROL 9**

Method of performance evaluation – Feedback – Industry practices. Promotion, Demotion, Transfer and Separation – Implication of job change. The control process – Importance – Methods – Requirement of effective control systems grievances – Causes – Implications – Redressal methods.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon Completion of the course, the students should be able to:**

- Gain knowledge on the various aspects of HRM
- Gain knowledge needed for success as a human resources professional.
- Develop the skills needed for a successful HR manager
- Prepared to implement the concepts learned in the workplace.
- Aware of the emerging concepts in the field of HRM

**TEXT BOOK:**

1. Human Resource Management, 8th Edition, K. Aswathappa, Tata McGraw Hill, 2017.

**REFERENCES:**

1. Dessler Human Resource Management, Pearson Education Limited, 14th Edition, 2015.
2. Decenzo and Robbins, Fundamentals of Human Resource Management, Wiley, 11th Edition, 2013.
3. Luis R.Gomez-Mejia, David B.Balkin, Robert L Cardy. Managing Human Resource. PHI Learning. 2012
4. Bernadin , Human Resource Management ,Tata Mcgraw Hill ,8th edition 2012.
5. Wayne Cascio, Managing Human Resource, McGraw Hill, 2007.
6. Ivancevich, Human Resource Management, McGraw Hill 2012.
7. Uday Kumar Haldar, Juthika Sarkar. Human Resource management. Oxford. 2012

<b>CW8010</b>	<b>SUPPLY CHAIN MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the importance of and major decisions in supply chain management for gaining competitive advantage
- To design supply chain networks to enhance supply chain performance
- To plan demand based on inventory and supply

- To understanding the role of logistics in supply chain performance

**UNIT I INTRODUCTION 9**

Supply Chain – Fundamentals, Evolution, Role in Economy, Importance, Decision Phases, Enablers & Drivers of Supply Chain Performance; Supply chain strategy; Supply Chain Performance Measures.

**UNIT II SUPPLY CHAIN NETWORK 9**

Distribution Network Design – Role in supply chain, Influencing factors, design options, online sales and distribution network, Distribution Strategies; Network Design in supply chain – Role, influencing factors, framework for network design, Impact of uncertainty on Network Design.

**UNIT III PLANNING DEMAND, INVENTORY AND SUPPLY 9**

Managing supply chain cycle inventory and safety inventory - Uncertainty in the supply chain ,Analyzing impact of supplychain redesign on the inventory, Risk Pooling, Managing inventory for short life-cycle products, multiple item -multiple location inventory management; Pricing and Revenue Management.

**UNIT IV LOGISTICS 9**

Transportation – Role, Modes and their characteristics, infrastructure and policies, transport documentation, design options, trade-offs in transportation design, intermodal transportation. Logistics outsourcing – catalysts, benefits, value proposition. 3PL, 4PL, 5PL, 6PL; International Logistics -objectives, importance in global economy, Characteristics of global supply chains, Incoterms.

**UNIT V SUPPLY CHAIN INNOVATIONS 9**

Supply Chain Integration, SC process restructuring, IT in Supply Chain; Agile Supply Chains, Legible supply chain, Green Supply Chain, Reverse Supply chain; Supply chain technology trends – AI, Advanced analytics, Internet of Things, Intelligent things, conversational systems, robotic process automation, immersive technologies, Blockchain.

**TOTAL: 45 PERIODS**

**OUTCOME:**

**Upon Completion of the course, the students should be able to:**

- Understanding of supply chain fundamentals
- Ability to design supply chain networks to enhance supply chain performance
- Ability to plan demand based on inventory and supply
- Understanding the role of logistics in supply chain performance
- Awareness of innovations for sustainable supply chains

**TEXT BOOK:**

1. Chopra, Sunil, Meindl, Peter and Kalra, D. V.; Supply Chain Management: Strategy, Planning and Operation; Pearson Education, 2015.
2. Altekar, Rahul V.; Supply Chain Management: Concepts and Cases; PHI Learning, 2005.

**REFERENCES:**

1. Sunil Chopra, Peter Meindl and DharamVirKalra, Supply Chain Management-Strategy Planning and Operation, Pearson Education, Sixth Edition, 2016.
2. Janat Shah, Supply Chain Management – Text and Cases, Pearson Education, 2009

3. Ballou Ronald H, Business Logistics and Supply Chain Management, Pearson Education, 5th Edition, 2007.
4. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, Designing and Managing the Supply Chain: Concepts, Strategies, and Cases, Tata McGraw-Hill, 2005.
5. Pierre David, International Logistics, Biztantra, 2011.

**CW8011**

**PSYCHOLOGY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To develop students' awareness – on psychology, learning behavior and usage of perception effectively.
- To learn to use the various kinds of thinking in a formal context.
- To critically evaluate content and comprehend the message on the bases of perception, personality and intelligence.

**UNIT I INTRODUCTION**

**9**

Psychology as science – Behavior and its role in human communication – socio-cultural bases of behaviour – Biological bases of behavior - Brain and its functions – Principles of Heredity – Cognition and its functions Fields of psychology – Cognitive and Perceptual – Industrial and Organizational.

**UNIT II SENSORY & PERCEPTUAL PROCESSES**

**9**

Some general properties of Senses: Visual system – the eye, colour vision – Auditory system – Hearing, listening, Sounds - Other senses - Selective attention; physiological correlates of attention; Internal influences on perception learning – set - motivation & emotion - cognitive styles; External influences on perception figure and ground separation – movement – organization – illusion; Internal- external interactions: Constancy - Depth Perception- Binocular & Monocular Perception; Perceptual defense & Perceptual vigilance; Sensory deprivation -Sensory bombardment; ESP - Social Perception.

**UNIT III COGNITION & AFFECT**

**9**

Learning and memory – philosophy of mind – concepts - words – images – semantic features – Association of words – Repetition – Retrieval – Chunking - Schemata - Emotion and motivation – nature and types of motivation – Biological & Psychosocial motivation – nature and types of emotions – physiological & cognitive bases of emotions – expressions of emotions – managing negative emotions - enhancing positive emotions.

**UNIT IV THINKING, PROBLEM-SOLVING & DECISION MAKING**

**9**

Thinking skills – Types of thinking skills – Concrete & Abstract thinking – Convergent & Divergent - Analytical & Creative thinking – Problem & Possibility thinking – Vertical & Lateral thinking – Problem solving skills – stages of problem solving skills – Decision making - intuition and reasoning skills - Thinking and language - The thinking process- concepts, problem solving, decision-making, creative thinking; language communication.

## UNIT V PERSONALITY & INTELLIGENCE

9

Psychological phenomena & Attributes of humans - cognition, motivation, and behaviour - thoughts, feelings, perceptions, and actions – personality dimensions, traits, patterns - Specialized knowledge, performance accomplishments, automaticity or ease of functioning, skilled performance under challenge - generative flexibility, and speed of learning or behaviour change.

**TOTAL: 45 PERIODS**

### OUTCOME:

**Upon Completion of the course, the students should be able to:**

- Have got awareness – on psychology, learning behaviour and usage of perception effectively.
- Learn to use the various kinds of thinking in a formal context.
- Evaluate content and comprehend the message on the bases of perception, personality and intelligence.

### TEXT BOOK:

1. Michael W. Passer, Ronald E. Smith, "Psychology: The science of mind and Behavior", Tata McGraw-Hill, 3rd Edition, 2007.

### REFERENCES :

1. Baron, R. & Misra, G. (2013). Psychology. New Delhi: Pearson.
2. Chadha, N.K. & Seth, S. (2014). The Psychological Realm: An Introduction. New Delhi: Pinnacle Learning
3. Morgan, C.T. and King, R.A "Introduction to Psychology", Tata McGraw Hill Co Ltd, New Delhi, 1994.
4. Robert A. Baron, "Psychology", 5th Edition, Prentice Hall, India, 2002.
5. Robert S. Feldman, "Understanding Psychology", Tata McGraw – Hill, 6th Edition, 2004.
6. Endler, N. S., & Summerfeldt, L. J., "Intelligence, personality, psychopathology and Adjustment".
7. D. H. Saklofske & M. Zeidner (Eds.), "International handbook of personality and intelligence", (pp. 249-284). New York: Plenum Press, 1995.
8. Ford, M. E., "A living systems approach to the integration of personality and intelligence". R. J. Sternberg & P. Ruzgis (Eds.), "Personality and intelligence", (pp. 188-217), New York: Cambridge University Press.
9. De Bono E, "Lateral Thinking", Harper Perennial, New York.

**CW8012**

**BUSINESS RESEARCH METHOD**

**L T P C**

**3 0 0 3**

### OBJECTIVES:

- To make the students of tourism understand the principles of scientific methodology in business enquiry
- To develop analytical skills of business research
- To prepare scientific business reports.

**UNIT I INTRODUCTION 9**

Business Research – Definition and Significance – the research process – Types of Research – Exploratory and causal Research – Theoretical and empirical Research – Cross –Sectional and time – series Research – Research questions / Problems – Research objectives – Research hypotheses – characteristics – Research in an evolutionary perspective – the role of theory in research.

**UNIT II RESEARCH DESIGN AND MEASUREMENT 9**

Research design – Definition – types of research design – exploratory and causal research design – Descriptive and experimental design – different types of experimental design – Validity of findings – internal and external validity – Variables in Research – Measurement and scaling – Different scales – Construction of instrument – Validity and Reliability of instrument.

**UNIT III DATA COLLECTION 9**

Types of data – Primary Vs Secondary data – Methods of primary data collection – Survey Vs Observation – Experiments – Construction of questionnaire and instrument – Types of Validity – Sampling plan – Sample size – determinants optimal sample size – sampling techniques – Sampling methods.

**UNIT IV DATA PREPARATION AND ANALYSIS 9**

Data Preparation – editing – Coding –Data entry – Validity of data – Qualitative Vs Quantitative data analyses – Applications of Bivariate and Multivariate statistical techniques, Factor analysis, Discriminant analysis, Cluster analysis, Multiple regression and Correlation, Multidimensional scaling – Conjoint Analysis – Application of statistical software for data analysis.

**UNIT V REPORT DESIGN, WRITING AND ETHICS IN BUSINESS RESEARCH 9**

Research report –Types – Contents of report – need for executive summary – chapterization – contents of chapter – report writing – the role of audience – readability – comprehension – tone – final proof – report format – title of the report – ethics in research – Ethics in research – Subjectivity and Objectivity in research.

**TOTAL : 45 PERIODS**

**OUTCOME:**

**Upon Completion of the course, the students should be able to:**

- Understand and appreciate scientific inquiry
- Know to write research proposals
- Undertake a systematic outlook towards business situations for the purpose of objective decision making
- Understand the method of conducting scientific inquiry to solve organizational problems
- Analyze data and find solutions to the problems.
- Prepare research reports

**TEXT BOOK:**

1. Kothari ,C. R, Research Methodology- Methods & Techniques, New age international publishers, 2016.
2. Gupta, S L & Gupta, H, Business Research Methods, TMHE Pvt. Ltd, 2009.

**REFERENCES :**

1. Donald R. Cooper, Pamela S. Schindler and J K Sharma, Business Research methods,

- 11th Edition, Tata Mc Graw Hill, New Delhi, 2012.
2. Alan Bryman and Emma Bell, Business Research methods, 3rd Edition, Oxford University Press, New Delhi, 2011.
  3. Uma Sekaran and Roger Bougie, Research methods for Business, 5th Edition, Wiley India, New Delhi, 2012.
  4. William G Zikmund, Barry J Babin, Jon C.Carr, AtanuAdhikari,Mitch Griffin, Business Research methods, A South Asian Perspective, 8th Edition, Cengage Learning, New Delhi, 2012.
  5. Panneerselvam. R, Research Methodology, 2nd Edition, PHI Learning, 2014.

**CW8013 INTRODUCTION TO INNOVATION, IP MANAGEMENT AND ENTREPRENEURSHIP**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To develop and strengthen innovation, IP management and entrepreneurial quality
- To motivate in and to impart basic skills
- To understanding to run a business efficiently and effectively

**UNIT I INTRODUCTION TO INNOVATION 9**

Adoption of Innovations, Exploring Innovations, Idea generation, Developing innovative culture, Executing innovations, Innovation attributes and their adoption rate, Measuring and evaluation of innovation, Exploiting and renewing innovations, Managing innovations in organizations, Innovation and intellectual property rights, Innovation portfolio

**UNIT II INTRODUCTION TO IPR 9**

Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

**UNIT III REGISTRATION OF IPRs 9**

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad, Agreements and Legislations

**UNIT IV ENTREPRENEURSHIP 9**

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur, Major Motives Influencing an Entrepreneur –Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management

**UNIT V BUSINESS AND FINANCING 9**

Small Enterprises – Characteristics, Ownership Structures – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project

Appraisal –Sources of Finance, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.

**TOTAL : 45 PERIODS**

**OUTCOME:**

**Upon Completion of the course, the students should be able to:**

- Understand the concept of innovation
- Ability to manage Intellectual Property portfolio to enhance the value of the firm.
- Gain knowledge and skills needed to run a business successfully.

**TEXT BOOKS :**

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S.V. Satarkar, Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002
3. Donald F Kuratko, “Entrepreneuership – Theory, Process and Practice”, 9 th Edition, Cengage Learning, 2014.
4. Khanka. S.S., “Entrepreneurial Development” S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.

**REFERENCES :**

1. Deborah E. Bouchoux, “Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets”, Cengage Learning, Third Edition, 2012.
2. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.
3. Prabuddha Ganguli, “Intellectual Property Rights: Unleashing the Knowledge Economy”, McGraw Hill Education, 2011.
4. EDII “Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development”, Institute of India, Ahmadabad, 1986.
5. Hisrich R D, Peters M P, “Entrepreneurship” 8 th Edition, Tata McGraw-Hill, 2013.
6. Mathew J Manimala, "Enterpreneuership theory at cross roads: paradigms and praxis" 2 nd Edition Dream tech, 2005.

**CW8014**

**DIGITAL MARKETING**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To learn the role of digital marketing in overall marketing strategy
- To understand pertinent concepts in digital marketing, like, marketing datasets, dummy display ads, virtual website optimization, SEO, and so on.
- To learn analytical concepts to measure marketing effectiveness, like, analytical software, launching of dummy display ads, creating optimization of website through Google Adwords, etc.
- To apply the above learned concepts in the creation of a holistic online marketing plan, in line with the main marketing strategy.

**UNIT I INTRODUCTION TO DIGITAL MARKETING 9**

Digital marketing - Importance of digital marketing-Difference between traditional and digital marketing- Digital marketing platforms- recent trends and current scenario of the industry - digital marketing as a tool for students, professionals and businesses-Tools.

**UNIT II WEBSITE DESIGNING AND OPTIMIZATION 9**

On Page Optimisation (OPO)- HTML and CSS basics- Meta tags usage- Using Javascript - Contextual interlinking - Microformats & schemas - Off-Page Optimization - Linking Strategies - Competitor Analysis-Sculpting-Link baiting - Social Book Marking and Promotions- Directory submissions-Search Engine Optimization (SEO)- Growth of SEO-Ecosystem of a search engine- SEO Tools.

**UNIT III SEARCH ENGINE MARKETING 9**

SEM platforms- Google Adwords – Ad creation process- Keyword grouping-Bidding techniques – Site targeting & keyword targeting -Ad approval process – Ad extensions- Site, Demographic targeting, CPC-based, CPA-based & CPM-based accounts

**UNIT IV SOCIAL MEDIA MARKETING 9**

Social Media Marketing- Email Marketing- Mobile Marketing - Adsense, Blogging and Affiliate Marketing.

**UNIT V WEB ANALYTICS 9**

Introduction to Web Analytics- GA Terminology (Dimensions & Metrics)- Introduction to Reports- Audience Reports, Traffic Sources and Content Reports- Campaign Tagging & Reporting- Dashboard- Linking and Using Data from Google Adwords- Case studies on digital marketing strategies.

**OUTCOME:**

**Upon Completion of the course, the students should be able to:**

- Explain the role and importance of digital marketing in a rapidly changing business landscape.
- Examine how marketing, operations, and human resources interact in real-time delivery.
- Applying applicable marketing ideas and structures, explain emerging developments in digital marketing and critically evaluate the usage of digital marketing tools.
- Discuss the key elements of a digital marketing strategy.
- Demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs

**TEXTBOOKS:**

1. Seema Gupta, Digital Marketing, McGraw Hill, 2nd Edition, 2020.
2. Subhankar Das, Search Engine Optimization and Marketing A Recipe for Success in Digital Marketing, CRC Press, 2021.
3. Chuck Hemann, Ken Burbary, Digital Marketing Analytics, Pearson, Second Edition, 2019.

## REFERENCES :

1. Dave Chaffey, Fiona Ellis-Chadwick, Digital Marketing: Strategy, Implementation and Practice 7th Edition, Pearson, 2019.
2. Ian Dodson, The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaign, Wiley, 2016.
3. Rob Stokes, eMarketing The Essential Guide to Marketing in a digital world, Quirk eMarketing.
4. Shivani Karwal, Digital Marketing Handbook: A Guide to Search Engine Optimization, 2015.
5. Jacobson, Howie, McDonald, Joel and McDonald, Kristie, Google AdWords For Dummies, 3rd Edition, O'Reilly, 2011.
6. <http://www.gbv.de/dms/zbw/865712123.pdf>
7. [https://www.redandyellow.co.za/content/uploads/woocommerce\\_uploads/2017/10/emarketing\\_textbook\\_download.pdf](https://www.redandyellow.co.za/content/uploads/woocommerce_uploads/2017/10/emarketing_textbook_download.pdf)

**CW8015**

**RISK ANALYTICS**

**L T P C**

**3 0 0 3**

### OBJECTIVES:

- To develop a basic understanding of risk assessment and its role within the risk management process.
- To differentiate between risk assessment and risk management.
- To develop a basic understanding of how to conduct and evaluate an uncertainty analysis for a risk assessment
- 

### **UNIT I INTRODUCTION**

**9**

Introduction, Fundamentals of Risk- Risk Planning, Assessment and Management Process and the Systems Approach-Types of Risk Assessment- Risk, Hazard, Performance and Engineering Risk Assessment

### **UNIT II RISK IDENTIFICATION**

**9**

Risk Identification- Historical data, comparative analysis, and checklist- Taxonomy based, risk breakdown structure, HHM, SWOT, root cause analysis, influence diagram- Expert/ user/ stakeholder-based elicitation (Delphi, brainstorming, interview), Scenario-based, experience based, objective-based analysis.

### **UNIT III TOOLS AND METHODS FOR RISK ASSESSMENT**

**9**

Preliminary Hazard Analysis (PHA), Hazards and Operability Analysis (HAZOP) - Job Safety Analysis (JSA) - Failure Modes and Effects Analysis (FMEA)- Fault Tree Analysis (FTA), Event Tree Analysis (ETA), Decision Trees- Cause-Consequence Analysis (CCA).

### **UNIT IV RISK PRIORITIZATION & TREATMENT**

**9**

Risk Probability and Impact Assessment, Risk Index and Risk Ranking - Risk Matrix, EV Analysis, Sensitivity and Tradeoff Analysis, Modeling and Simulation- Risk Attitude and Risk Tolerance, As Low As Reasonably Practicable (ALARP)- Avoidance, Separation, Reduction, Transfer, Acceptance- Detection, Control, Response and Recovery- Performance Monitoring.

## **UNIT V SPECIAL TOPICS AND APPLICATION**

**9**

ISO3100, Quality and Reliability- Supply Chain Risk Management- Project Risk Management- Positive Risk/ Opportunities Management- Risk and TOC.

### **OUTCOME:**

**Upon Completion of the course, the students should be able to:**

- Identify the core types of project risks.
- Use qualitative and quantitative risk assessment methods.
- Competently use risk simulation techniques and other risk analysis tools/methods and work in a group to create a risk management plan based on the ISO 31000:2009.
- Identify a range of risk management issues/challenges and the risks as complex systems cascade and be competent to initiate potential actions in response;

### **TEXTBOOKS:**

1. Marvin Rausand Stein Haugen, Risk Assessment: Theory, Methods, and Applications, John Wiley & Sons, 2020.
2. Vlasta Molak, Fundamentals of Risk Analysis and Risk Management, CRC Press.
3. Mohammad Modarres, Risk Analysis in Engineering Techniques, Tools and Trends, Taylor & Francis, CRC Press, 2016.

### **REFERENCES :**

1. Marvin Rausand Stein Haugen , Risk Assessment: Theory, Methods, and Applications, Wiley, 2020.
2. Mohammad Modarres , Risk Analysis in Engineering Techniques, Tools, and Trends, CRC Press, 2006.

## **CW8016 CUSTOMER RELATION MANAGEMENT AND CUSTOMER EXPERIENCE MANAGEMENT**

**L T P C  
3 0 0 3**

### **COURSE OBJECTIVES:**

- Learning the fundamentals of strategic, operational and analytical CRM to enhance customer experience.

## **UNIT I UNDERSTANDING CUSTOMER RELATIONSHIPS**

**9**

CRM definition and constituencies, understanding and misunderstanding CRM, the social CRM fit, commercial contexts, the third sector- not-for-profit, CRM models. Relationship quality, customer lifetime value, relationships with customers and suppliers. Managing the customer lifecycle – customer acquisition, retention and development.

## **UNIT II STRATEGIC CRM**

**9**

Customer portfolio management (CPM) - Customer portfolio, basic disciplines of CPM, CPM in B2B context, CPM models, tools for CPM, strategically significant customers, seven core customer management strategies.

## **UNIT III OPERATIONAL CRM**

**9**

Sales force automation (SFA) – SFA and its ecosystem, SFA software functionality, SFA adaptation. Marketing automation (MA) – definition of MA, benefits and software applications.

Service Automation (SA) –customer service definition, modelling service quality, software for SA, benefits of SA, customer service excellence certification.

**UNIT IV ANALYTICAL CRM 9**

Customer database management –corporate customer data, structured and unstructured data, developing a customer database, data – integration, warehousing and marts in the CRM context, knowledge management, Analytics for – CRM strategy and tactics, customer lifecycle, structured and unstructured data, Big data analytics in CRM, analytical insights.

**UNIT V MANAGING CUSTOMER EXPERIENCE AND VALUE 9**

Understanding Value and when do customers experience value, Modelling customer-perceived value, Sources of customer value, Value through the marketing mix, Customisation for customer value. Understanding customer experience and concepts, how to manage customer experience, CRM vs CEM, Use of CRM software in CEM

**TOTAL : 45 PERIODS**

**COURSE OUTCOMES**

- Understanding and applying the elements and tools of CRM to manage customer portfolios.

**TEXT BOOK(S)**

1. Buttle Francis and Maklan Stan, Customer Relationship Management – Concepts and Technologies, Special Indian edition, Fourth edition, Routledge, 2019.
2. Gerardus Blokdyk, Customer Relationship Management – A complete guide 2020 edition, 5starcooks, 2019.

**REFERENCES :**

1. Henry Assael, Consumer Behavior, Cengage Learning, 6th Edition, 2008
2. Kumar, Customer Relationship Management - A Database Approach, Wiley India, 2012.
3. V. Kumar and Werner Reinartz, Customer Relationship Management, Concept, Strategy and Tools, Springer 2018.
4. Zikmund, Customer Relationship Management, Wiley 2012.
5. G. Shainesh, J. Jagdish N Seth. Customer Relationship Management : Emerging Concepts, Tools and Application, McGraw Hill Education, 2017.

**CW8017**

**IT PROJECT MANAGEMENT**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To learn the concepts of managing IT projects.
- To learn more about planning, budgeting and scheduling
- To understand resource allocation, control, and completion
- To learn software quality management

**UNIT I INTRODUCTION TO PROJECT MANAGEMENT 9**

Project Management – Definition –Goal - Lifecycles. Project Selection Methods. Project Portfolio Process – Project Formulation. Project Manager – Roles- Responsibilities and Selection – Project

Teams, Project support activities, Types of project organizations.

**UNIT II PLANNING AND BUDGETING 9**

The Planning Process – Work Break down Structure – Role of Multidisciplinary teams, Critical path analysis.. Budget the Project – Methods. Cost Estimating and Improvement. Budget uncertainty and risk management.

**UNIT III SCHEDULING & RESOURCE ALLOCATION 9**

PERT & CPM Networks - Crashing – Project Uncertainty and Risk Management – Simulation – Gantt Charts – Expediting a project – Resource loading and leveling. Allocating scarce resources – Goldratt’s Critical Chain.

**UNIT IV CONTROL AND COMPLETION 9**

The Plan-Monitor-Control cycle – Data Collecting and reporting – Project Control – Designing the control system. Project Evaluation, Earned Value Analysis, Auditing and Termination, Risk Management, – Conflict – Origin & Consequences. Managing conflict – Team methods for resolving conflict

**UNIT V SOFTWARE QUALITY MANAGEMENT 9**

Product quality and software quality, quality management systems, principles and features, System quality specification and measurement, Process and product quality approaches, Quality assurance and quality control, project audit and quality audit, Methods of enhancing quality: the different types of testing, inspections, reviews, standards, Management and control of testing.

**TOTAL : 45 PERIODS**

**OUTCOME:**

**Upon Completion of the course, the students should be able to:**

- Apply project management principles in business situations
- Learn more about planning, budgeting and scheduling
- Optimize resource utilization and time optimization
- Understand resource allocation, control, and completion
- Learn software quality management

**TEXT BOOKS :**

1. Clifford Gray and Erik Larson, Project Management, Tata McGraw Hill Edition, 2005.
2. John M. Nicholas, Project Management for Business and Technology - Principles and Practice, Second Edition, Pearson Education, 2006.
3. Hughes B, Project Management for IT-related Projects. BCS Publications, 2012.

**REFERENCES :**

1. Gido and Clements, Successful Project Management, Second Edition, Thomson Learning, 2003.
2. Harvey Maylor, Project Management, Third Edition, Pearson Education, 2006.

**COURSE OBJECTIVE:**

- The course provides students with a framework for understanding enterprise security in today's world. Students learn how to evaluate business processes related to risk management, business continuity, auditing, and security issues in software development.

**UNIT I INTRODUCTION****9**

Developing a Secure Foundation-threat and vulnerabilities-Security Categorization Applied to Information Types & Information Systems-Minimum Security Requirements-Infrastructure Security Model Components-Systems Security Categorization-Business Impact Analysis-Risk Management.

**UNIT II PLANNING , MANAGEMENT AND MONITORING****9**

Phases of Security-Focused Configuration Management-Security Configuration Management Plan-Baseline Identification-Roles and Responsibilities-Measurements-Configuration Audits-Types of Plans-Continuous Monitoring Strategy-Continuous Monitoring Program-Monitoring and Assessment Frequencies.

**UNIT III SECURITY ARCHITECTURE****9**

The Meaning of Security - Measuring and Prioritizing Business Risk-Empowering the Customers-Protecting Relationships and Leveraging Trust-The Meaning of Architecture-Information Systems Architecture-Enterprise Security Architecture-Security Architecture Model-The SABSA Model-Contextual and Conceptual Security Architecture

**UNIT IV SECURITY POLICY , OPERATIONAL RISK AND ASSURANCE MANAGEMENT****9**

Structuring the Content of a Security Policy-Policy Hierarchy and Architecture-Policy Principles-Types of Security Policies-Complexity of Operational Risk Management-Approaches to Risk Assessment-Risk Mitigation-Risk Financing-Assurance of Operational Continuity-Security Audits-Functional & Penetration Testing.

**UNIT V SECURITY ADMINISTRATION, OPERATIONS AND VALIDATION****9**

Introduction-Managing the People-Managing Physical and Environmental Security-Managing ICT Operations and Support-Access Control Management-Compliance Management-Security-Specific Operations- Managed Security Services-Product Evaluation and Selection-Business Continuity Management-Certification and Accreditation Process-General Process Phase I & II.

**COURSE OUTCOMES:**

At the end of this course, the students will be able to:

- Design appropriate security architecture with an understanding of the technology
- Create and deploy enterprise solutions in support of organizational goals
- Plan and implement projects related to infrastructure, security, software development.
- Interpret and manage IT governance policies.

**TEXTBOOKS:**

1. James A. Scholz, Enterprise Architecture and Information Assurance Developing a Secure Foundation, CRC Press, 2013.(UNIT –I &II)

- John Sherwood, Andrew Clark, David Lynas, Enterprise Security Architecture A Business-Driven Approach, CRC Press, 2005. (UNIT-III,IV and V)

**REFERENCE BOOKS:**

- John R.Vacca, Computer and Information Security Handbook, Second Edition, Elsevier 2013.
- Michael E. Whitman, Herbert J. Mattord, Principal of Information Security, Fourth Edition, Cengage Learning, 2012.

<b>CW8019</b>	<b>QUANTUM COMPUTATION AND QUANTUM INFORMATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To learn quantum computation and quantum information
- To understand quantum entanglement, quantum algorithms
- To understand quantum channels
- To learn quantum information theory

**UNIT I INTRODUCTION 9**

Quantum states, density operators, generalized measurements, quantum operations/channels, no-cloning theorem.

**UNIT II QUANTUM CORRELATIONS 9**

Bell inequalities and entanglement, Schmidt decomposition, super-dense coding, teleportation, PPT criterion.

**UNIT III QUANTUM GATES AND ALGORITHMS 9**

Universal set of gates, quantum circuits, Solovay-Kitaev theorem, Deutsch-Jozsa algorithm, period-finding, factoring, Shor's algorithm, quantum search, Abelian quantum hidden subgroup problem.

**UNIT IV QUANTUM INFORMATION THEORY AND QUANTUM CRYPTOGRAPHY 9**

Shannon entropy, noiseless coding theorem, von Neumann entropy and properties, Schumacher compression, noisy-coding theorem. **Quantum cryptography:** quantum key distribution, entropic uncertainty relations

**UNIT V QUANTUM NOISE AND ERROR-CORRECTION 9**

Distance measures, Knill-Laflamme conditions, quantum error-correcting codes, Hamming bound.

**TOTAL : 45 PERIODS**

**OUTCOME:**

**Upon Completion of the course, the students should be able to:**

- Learn quantum computation and quantum information
- Understand quantum entanglement, quantum algorithms
- Understand quantum channels
- Learn quantum information theory

## TEXT BOOKS :

1. Quantum Computation and Quantum Information, M. A. Nielsen & I. Chuang, Cambridge University Press (2000).
2. Lecture notes by Prof. John Preskill, California Institute of Technology

## REFERENCES :

1. The mathematical language of quantum theory: from uncertainty to entanglement, T. Hienosaari & M. Ziman, Cambridge University Press (2011).
2. Quantum systems, channels, information, A.S. Holevo, de Gruyter Studies in Mathematical Physics (2012).
3. Quantum information Theory, Mark M. Wilde, Cambridge University Press (2012).
4. Quantum error correction, D. A. Lidar & T. A. Brun, Cambridge University Press (2013).

<b>CW8020</b>	<b>EMBEDDED SYSTEMS AND ROBOTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

## OBJECTIVES:

- To know about different components of Embedded System
- To understand embedded Networking Technologies & Various scheduling algorithms.
- To understand the concepts of RTOS, memory interface, communication process.
- To know more about embedded System Applications.
- To understand the parts of Robot and fields of robotics.
- To know about robotic control for some specific applications.

### **UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9**

Introduction to Embedded Systems –Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

### **UNIT II EMBEDDED NETWORKING & RTOS 9**

Introduction, I/O Device Ports & Buses– Serial Bus communication protocols-Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) –need for device drivers.Introduction to basic concepts of RTOS- Task, process & threads, interrupt routine,task scheduling & communication,inter process communication,semaphore, priority inversion & inheritance.

### **UNIT III EMBEDDED SYSTEM APPLICATION AND DEVELOPMENT 9**

Case Study of Washing Machine- Automotive Application- Smart card System Application-ATM machine –Digital camera.

### **UNIT IV INTRODUCTION TO ROBOTICS 9**

Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Robot classifications and specifications- Asimov's laws of robotics – dynamic





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**PROGRAM EDUCATIONAL OBJECTIVES (PEOs):**

1. To enable graduates to pursue higher education and research, or have a successful career in industries associated with Computer Science and Engineering, or as entrepreneurs. To ensure that graduates will have the ability and attitude to adapt to emerging technological changes.

**PROGRAM OUTCOMES POs:**

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### **PROGRAM SPECIFIC OBJECTIVES (PSOs)**

To analyze, design and develop computing solutions by applying foundational concepts of Computer Science and Engineering.

To apply software engineering principles and practices for developing quality software for scientific and business applications.

To adapt to emerging Information and Communication Technologies (ICT) to innovate ideas and solutions to existing/novel problems.

#### Mapping of POs/PSOs to PEOs

Contribution

1: Reasonable

2: Significant

3: Strong

	PEOs	
POs	1. Graduates will pursue higher education and research, or have a successful career in industries associated with Computer Science and Engineering, or as entrepreneurs.	2. Graduates will have the ability and attitude to adapt to emerging technological changes.
1. <b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	1
2. <b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	1
3. <b>Design/development of solutions:</b> Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3	2
4. <b>Conduct investigations of complex problems:</b> Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	3	2
5. <b>Modern tool usage:</b> Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	2	3
6. <b>The engineer and society:</b> Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	2	2

<p><b>7. Environment and sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.</p>	2	1
<p><b>8. Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.</p>	3	1
<p><b>9. Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.</p>	3	2
<p><b>10. Communication:</b> Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.</p>	3	2
<p><b>11. Project management and finance:</b> Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.</p>	2	2
<p><b>12. Life-long learning:</b> Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.</p>	1	3

<b>PSOs</b>		
1. Analyze, design and develop computing solutions by applying foundational concepts of computer science and engineering.	3	1
2. Apply software engineering principles and practices for developing quality software for scientific and business applications.	3	1
3. Adapt to emerging information and communication technologies (ICT) to innovate ideas and solutions to existing/novel problems.	1	3

### MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES

A broad relation between the Course Outcomes and Programme Outcomes is given in the following table

	Course Title	Programme Outcome (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
<b>SEMESTER I</b>	Communicative English								√	√	√		√
	Engineering Mathematics - I	√	√	√						√			
	Engineering Physics	√	√	√									
	Engineering Chemistry	√	√	√									
	Problem Solving and Python Programming	√	√	√									
	Engineering Graphics	√	√	√		√			√	√	√		√
	Problem Solving and Python Programming Laboratory	√	√	√		√			√	√	√		√
	Physics and Chemistry Laboratory	√	√	√					√	√	√		
<b>SEMESTER II</b>	Technical English								√	√	√		√
	Engineering Mathematics II	√	√	√						√			
	Physics for Information Science	√	√	√									
	Basic Electrical, Electronics and Measurement Engineering	√	√	√									
	Environmental Science and Engineering	√	√	√				√	√	√	√		√
	Programming in C	√	√	√					√	√	√		√
	Engineering Practices Laboratory	√	√	√	√	√	√		√	√	√		√
	C Programming Laboratory	√	√	√					√	√	√		√

		PROGRAMME OUTCOME (PO)													
YEAR II	SEMESTER III	COURSE TITLE	1	2	3	4	5	6	7	8	9	10	11	12	
		Discrete Mathematics	√	√	√							√			
		Digital Principles and Design	√	√	√										
		Data Structures	√	√	√										
		Object Oriented Programming	√	√	√										
		Communication Engineering	√	√	√										
		Data Structures Laboratory	√	√	√						√	√	√		√
		Object Oriented Programming Laboratory	√	√	√						√	√	√		√
		Digital Systems Laboratory	√	√	√				√		√	√	√		√
		Interpersonal Skills/Listening & Speaking									√	√	√		√
	SEMESTER IV	Probability and Queueing Theory	√	√	√							√	√		√
		Computer Architecture	√	√	√										
Database Management Systems		√	√	√											
Design and Analysis of Algorithms		√	√	√							√	√		√	
Operating Systems		√	√	√											
Software Engineering		√	√	√		√	√			√	√	√		√	
Database Management Systems Laboratory		√	√	√						√	√	√		√	
Operating Systems Laboratory		√	√	√						√	√	√		√	
Advanced Reading and Writing										√	√	√		√	

YEAR III	SEMESTER V	Algebra and Number Theory	√	√	√						√				
		Computer Networks	√	√	√										
		Microprocessors and Microcontrollers	√	√	√										
		Theory of Computation	√	√	√										
		Object Oriented Analysis and Design	√	√	√			√							
		Open Elective I													
		Microprocessors and Microcontrollers Laboratory	√	√	√					√	√	√			√
		Object Oriented Analysis and Design Laboratory	√	√	√		√	√		√	√	√			√
		Networks Laboratory	√	√	√					√	√	√			√
	SEMESTER VI	Internet Programming	√	√	√					√	√	√		√	
		Artificial Intelligence	√	√	√										
		Mobile Computing	√	√	√										
		Compiler Design	√	√	√					√	√	√		√	
		Distributed Systems	√	√	√										
		Professional Elective I													
		Internet Programming Laboratory	√	√	√		√			√	√	√		√	
		Mobile Application Development Laboratory	√	√	√		√	√		√	√	√		√	
		Mini Project	√	√	√	√	√	√	√	√	√	√	√	√	
		Professional Communication						√			√		√		
YEAR IV	SEMESTER VII	Principles of Management	√	√	√								√		
		Cryptography and Network Security	√	√	√										
		Cloud Computing	√	√	√										
		Open Elective II													

		Professional Elective II												
		Professional Elective III												
		Cloud Computing Laboratory	√	√	√		√			√	√	√		√
		Security Laboratory	√	√	√		√			√	√	√		√
	<b>SEMESTER VIII</b>	Professional Elective IV												
		Professional Elective V												
		Project Work	√	√	√	√	√	√	√	√	√	√	√	√

## PROFESSIONAL ELECTIVES

SEM	COURSE TITLE	PROGRAMME OUTCOME (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
VI	Data Warehousing and Data Mining	√	√	√									
	Software Testing	√	√	√		√				√	√		
	Embedded Systems	√	√	√									
	Agile Methodologies	√	√	√									
	Graph Theory and Applications-Intellectual Property Rights	√	√	√			√	√	√	√	√	√	√
	Digital Signal Processing	√	√	√									
VII	Big Data Analytics	√	√	√		√				√	√		
	Machine Learning Techniques	√	√	√		√				√	√		
	Computer Graphics and Multimedia	√	√	√									
	Software Project Management	√	√	√			√		√	√	√	√	√
	Internet of Things	√	√	√									
	Service Oriented Architecture	√	√	√									
	Total Quality Management	√	√	√									√
	Multi-core Architectures and Programming	√	√	√									
	Human Computer Interaction	√	√	√									
	C# and .Net Programming	√	√	√		√				√	√		
	Wireless Adhoc and Sensor Networks	√	√	√									
	Advanced Topics on Databases	√	√	√									
	Foundation Skills in Integrated Product Development	√	√	√									
	Human Rights	√	√	√									
Disaster Management	√	√	√				√						
VIII	Digital Image Processing	√	√	√									
	Social Network Analysis	√	√	√									
	Information Security	√	√	√					√				
	Software Defined Networks	√	√	√									
	Cyber Forensics	√	√	√					√				
	Soft Computing	√	√	√									
	Professional Ethics in Engineering						√	√	√	√	√		√
	Information Retrieval Techniques	√	√	√									
	Green Computing	√	√	√									
	GPU Architecture and Programming	√	√	√									
	Natural Language Processing	√	√	√									
	Parallel Algorithms	√	√	√									
	Speech Processing	√	√	√									
	Fundamentals of Nanoscience	√	√	√									

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**I - VIII SEMESTERS CURRICULA AND SYLLABI**

**SEMESTER I**

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	HS8151	Communicative English	HS	4	4	0	0	4
2.	MA8151	Engineering Mathematics - I	BS	4	4	0	0	4
3.	PH8151	Engineering Physics	BS	3	3	0	0	3
4.	CY8151	Engineering Chemistry	BS	3	3	0	0	3
5.	GE8151	Problem Solving and Python Programming	ES	3	3	0	0	3
6.	GE8152	Engineering Graphics	ES	6	2	0	4	4
<b>PRACTICALS</b>								
7.	GE8161	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
8.	BS8161	Physics and Chemistry Laboratory	BS	4	0	0	4	2
<b>TOTAL</b>				<b>31</b>	<b>19</b>	<b>0</b>	<b>12</b>	<b>25</b>

**SEMESTER II**

SI.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	HS8251	Technical English	HS	4	4	0	0	4
2.	MA8251	Engineering Mathematics - II	BS	4	4	0	0	4
3.	PH8252	Physics for Information Science	BS	3	3	0	0	3
4.	BE8255	Basic Electrical, Electronics and Measurement Engineering	ES	3	3	0	0	3
5.	GE8291	Environmental Science and Engineering	HS	3	3	0	0	3
6.	CS8251	Programming in C	PC	3	3	0	0	3
<b>PRACTICALS</b>								
7.	GE8261	Engineering Practices Laboratory	ES	4	0	0	4	2
8.	CS8261	C Programming Laboratory	PC	4	0	0	4	2
<b>TOTAL</b>				<b>28</b>	<b>20</b>	<b>0</b>	<b>8</b>	<b>24</b>

**SEMESTER III**

SI.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MA8351	Discrete Mathematics	BS	4	4	0	0	4
2.	CS8351	Digital Principles and System Design	ES	4	4	0	0	4
3.	CS8391	Data Structures	PC	3	3	0	0	3
4.	CS8392	Object Oriented Programming	PC	3	3	0	0	3
5.	EC8395	Communication Engineering	ES	3	3	0	0	3
<b>PRACTICALS</b>								
6.	CS8381	Data Structures Laboratory	PC	4	0	0	4	2
7.	CS8383	Object Oriented Programming Laboratory	PC	4	0	0	4	2
8.	CS8382	Digital Systems Laboratory	ES	4	0	0	4	2
9.	HS8381	Interpersonal Skills/Listening & Speaking	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>31</b>	<b>17</b>	<b>0</b>	<b>14</b>	<b>24</b>

**SEMESTER IV**

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MA8402	Probability and Queueing Theory	BS	4	4	0	0	4
2.	CS8491	Computer Architecture	PC	3	3	0	0	3
3.	CS8492	Database Management Systems	PC	3	3	0	0	3
4.	CS8451	Design and Analysis of Algorithms	PC	3	3	0	0	3
5.	CS8493	Operating Systems	PC	3	3	0	0	3
6.	CS8494	Software Engineering	PC	3	3	0	0	3
<b>PRACTICALS</b>								
7.	CS8481	Database Management Systems Laboratory	PC	4	0	0	4	2
8.	CS8461	Operating Systems Laboratory	PC	4	0	0	4	2
9.	HS8461	Advanced Reading and Writing	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>29</b>	<b>19</b>	<b>0</b>	<b>10</b>	<b>24</b>

**SEMESTER V**

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MA8551	Algebra and Number Theory	BS	4	4	0	0	4
2.	CS8591	Computer Networks	PC	3	3	0	0	3
3.	EC8691	Microprocessors and Microcontrollers	PC	3	3	0	0	3
4.	CS8501	Theory of Computation	PC	3	3	0	0	3
5.	CS8592	Object Oriented Analysis and Design	PC	3	3	0	0	3
6.		Open Elective I	OE	3	3	0	0	3
<b>PRACTICALS</b>								
7.	EC8681	Microprocessors and Microcontrollers Laboratory	PC	4	0	0	4	2
8.	CS8582	Object Oriented Analysis and Design Laboratory	PC	4	0	0	4	2
9.	CS8581	Networks Laboratory	PC	4	0	0	4	2
<b>TOTAL</b>				<b>31</b>	<b>19</b>	<b>0</b>	<b>12</b>	<b>25</b>

**SEMESTER VI**

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	CS8651	Internet Programming	PC	3	3	0	0	3
2.	CS8691	Artificial Intelligence	PC	3	3	0	0	3
3.	CS8601	Mobile Computing	PC	3	3	0	0	3
4.	CS8602	Compiler Design	PC	5	3	0	2	4
5.	CS8603	Distributed Systems	PC	3	3	0	0	3
6.		Professional Elective I	PE	3	3	0	0	3
<b>PRACTICALS</b>								
7.	CS8661	Internet Programming Laboratory	PC	4	0	0	4	2
8.	CS8662	Mobile Application Development Laboratory	PC	4	0	0	4	2
9.	CS8611	Mini Project	EEC	2	0	0	2	1
10.	HS8581	Professional Communication	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>32</b>	<b>18</b>	<b>0</b>	<b>14</b>	<b>25</b>

### SEMESTER VII

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MG8591	Principles of Management	HS	3	3	0	0	3
2.	CS8792	Cryptography and Network Security	PC	3	3	0	0	3
3.	CS8791	Cloud Computing	PC	3	3	0	0	3
4.		Open Elective II	OE	3	3	0	0	3
5.		Professional Elective II	PE	3	3	0	0	3
6.		Professional Elective III	PE	3	3	0	0	3
<b>PRACTICALS</b>								
7.	CS8711	Cloud Computing Laboratory	PC	4	0	0	4	2
8.	IT8761	Security Laboratory	PC	4	0	0	4	2
<b>TOTAL</b>				<b>26</b>	<b>18</b>	<b>0</b>	<b>8</b>	<b>22</b>

### SEMESTER VIII

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.		Professional Elective IV	PE	3	3	0	0	3
2.		Professional Elective V	PE	3	3	0	0	3
<b>PRACTICALS</b>								
3.	CS8811	Project Work	EEC	20	0	0	20	10
<b>TOTAL</b>				<b>26</b>	<b>6</b>	<b>0</b>	<b>20</b>	<b>16</b>

**TOTAL NO. OF CREDITS: 185**

### HUMANITIES AND SOCIAL SCIENCES (HS)

SI. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	HS8151	Communicative English	HS	4	4	0	0	4
2.	HS8251	Technical English	HS	4	4	0	0	4
3.	GE8291	Environmental Science and Engineering	HS	3	3	0	0	3
4.	MG8591	Principles of Management	HS	3	3	0	0	3

### BASIC SCIENCES (BS)

SI. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MA8151	Engineering Mathematics I	BS	4	4	0	0	4
2.	PH8151	Engineering Physics	BS	3	3	0	0	3
3.	CY8151	Engineering Chemistry	BS	3	3	0	0	3
4.	BS8161	Physics and Chemistry Laboratory	BS	4	0	0	4	2
5.	MA8251	Engineering Mathematics II	BS	4	4	0	0	4
6.	PH8252	Physics for Information Science	BS	3	3	0	0	3
7.	MA8351	Discrete Mathematics	BS	4	4	0	0	4
8.	MA8402	Probability and Queueing Theory	BS	4	4	0	0	4
9.	MA8551	Algebra and Number Theory	BS	4	4	0	0	4

### ENGINEERING SCIENCES (ES)

SI. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	GE8151	Problem Solving and Python Programming	ES	3	3	0	0	3
2.	GE8152	Engineering Graphics	ES	6	2	0	4	4
3.	GE8161	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
4.	BE8255	Basic Electrical, Electronics and Measurement Engineering	ES	3	3	0	0	3
5.	GE8261	Engineering Practices Laboratory	ES	4	0	0	4	2
6.	CS8351	Digital Principles and System Design	ES	4	4	0	0	4
7.	EC8395	Communication Engineering	ES	3	3	0	0	3
8.	CS8382	Digital Systems Laboratory	ES	4	0	0	4	2

**PROFESSIONAL CORE (PC)**

SI. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CS8251	Programming in C	PC	3	3	0	0	3
2.	CS8261	C Programming Laboratory	PC	4	0	0	4	2
3.	CS8391	Data Structures	PC	3	3	0	0	3
4.	CS8392	Object Oriented Programming	PC	3	3	0	0	3
5.	CS8381	Data Structures Laboratory	PC	4	0	0	4	2
6.	CS8383	Object Oriented Programming Laboratory	PC	4	0	0	4	2
7.	CS8491	Computer Architecture	PC	3	3	0	0	3
8.	CS8492	Database Management Systems	PC	3	3	0	0	3
9.	CS8451	Design and Analysis of Algorithms	PC	3	3	0	0	3
10.	CS8493	Operating Systems	PC	3	3	0	0	3
11.	CS8494	Software Engineering	PC	3	3	0	0	3
12.	CS8481	Database Management Systems Laboratory	PC	4	0	0	4	2
13.	CS8461	Operating Systems Laboratory	PC	4	0	0	4	2
14.	CS8591	Computer Networks	PC	3	3	0	0	3
15.	EC8691	Microprocessors and Microcontrollers	PC	3	3	0	0	3
16.	CS8501	Theory of Computation	PC	3	3	0	0	3
17.	CS8592	Object Oriented Analysis and Design	PC	3	3	0	0	3
18.	EC8681	Microprocessors and Microcontrollers Laboratory	PC	4	0	0	4	2
19.	CS8582	Object Oriented Analysis and Design Laboratory	PC	4	0	0	4	2
20.	CS8581	Networks Laboratory	PC	4	0	0	4	2
21.	CS8651	Internet Programming	PC	3	3	0	0	3
22.	CS8691	Artificial Intelligence	PC	3	3	0	0	3
23.	CS8601	Mobile Computing	PC	3	3	0	0	3
24.	CS8602	Compiler Design	PC	5	3	0	2	4
25.	CS8603	Distributed Systems	PC	3	3	0	0	3
26.	CS8661	Internet Programming Laboratory	PC	4	0	0	4	2
27.	CS8662	Mobile Application Development Laboratory	PC	4	0	0	4	2
28.	CS8792	Cryptography and Network Security	PC	3	3	0	0	3
29.	CS8791	Cloud Computing	PC	3	3	0	0	3
30.	CS8711	Cloud Computing Laboratory	PC	4	0	0	4	2
31.	IT8761	Security Laboratory	PC	4	0	0	4	2

**PROFESSIONAL ELECTIVES (PE)****SEMESTER VI  
ELECTIVE - I**

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CS8075	Data Warehousing and Data Mining	PE	3	3	0	0	3
2.	IT8076	Software Testing	PE	3	3	0	0	3
3.	IT8072	Embedded Systems	PE	3	3	0	0	3
4.	CS8072	Agile Methodologies	PE	3	3	0	0	3
5.	CS8077	Graph Theory and Applications-	PE	3	3	0	0	3
6.	IT8071	Digital Signal Processing	PE	3	3	0	0	3
7.	GE8075	Intellectual Property Rights	PE	3	3	0	0	3

**SEMESTER VII  
ELECTIVE - II**

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CS8091	Big Data Analytics	PE	3	3	0	0	3
2.	CS8082	Machine Learning Techniques	PE	3	3	0	0	3
3.	CS8092	Computer Graphics and Multimedia	PE	3	3	0	0	3
4.	IT8075	Software Project Management	PE	3	3	0	0	3
5.	CS8081	Internet of Things	PE	3	3	0	0	3
6.	IT8074	Service Oriented Architecture	PE	3	3	0	0	3
7.	GE8077	Total Quality Management	PE	3	3	0	0	3

**SEMESTER VII  
ELECTIVE - III**

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CS8083	Multi-core Architectures and Programming	PE	3	3	0	0	3
2.	CS8079	Human Computer Interaction	PE	3	3	0	0	3
3.	CS8073	C# and .Net Programming	PE	3	3	0	0	3
4.	CS8088	Wireless Adhoc and Sensor Networks	PE	3	3	0	0	3
5.	CS8071	Advanced Topics on Databases	PE	3	3	0	0	3
6.	GE8072	Foundation Skills in Integrated Product Development	PE	3	3	0	0	3
7.	GE8074	Human Rights	PE	3	3	0	0	3
8.	GE8071	Disaster Management	PE	3	3	0	0	3

**SEMESTER VIII  
ELECTIVE - IV**

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	EC8093	Digital Image Processing	PE	3	3	0	0	3
2.	CS8085	Social Network Analysis	PE	3	3	0	0	3
3.	IT8073	Information Security	PE	3	3	0	0	3
4.	CS8087	Software Defined Networks	PE	3	3	0	0	3
5.	CS8074	Cyber Forensics	PE	3	3	0	0	3
6.	CS8086	Soft Computing	PE	3	3	0	0	3
7.	GE8076	Professional Ethics in Engineering	PE	3	3	0	0	3

**SEMESTER VIII  
ELECTIVE - V**

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CS8080	Information Retrieval Techniques	PE	3	3	0	0	3
2.	CS8078	Green Computing	PE	3	3	0	0	3
3.	CS8076	GPU Architecture and Programming	PE	3	3	0	0	3
4.	CS8084	Natural Language Processing	PE	3	3	0	0	3
5.	CS8001	Parallel Algorithms	PE	3	3	0	0	3
6.	IT8077	Speech Processing	PE	3	3	0	0	3
7.	GE8073	Fundamentals of Nanoscience	PE	3	3	0	0	3

**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

SI. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	HS8381	Interpersonal Skills/Listening & Speaking	EEC	2	0	0	2	1
2.	HS8461	Advanced Reading and Writing	EEC	2	0	0	2	1
3.	CS8611	Mini Project	EEC	2	0	0	2	1
4.	HS8581	Professional Communication	EEC	2	0	0	2	1
5.	CS8811	Project Work	EEC	20	0	0	20	10

## SUMMARY

S.NO.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL	Percentage
		I	II	III	IV	V	VI	VII	VIII		
1.	HS	4	7					3		14	7.60%
2.	BS	12	7	4	4	4				31	16.8%
3.	ES	9	5	9						23	12.5%
4.	PC		5	10	19	18	20	10		82	44.5%
5.	PE						3	6	6	15	8.15%
6.	OE					3		3		6	3.3%
7.	EEC			1	1		2		10	14	7.65%
	<b>Total</b>	<b>25</b>	<b>24</b>	<b>24</b>	<b>24</b>	<b>25</b>	<b>25</b>	<b>22</b>	<b>16</b>	<b>185</b>	
8.	<b>Non Credit / Mandatory</b>										

**OBJECTIVES:**

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

**UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS 12**

**Reading-** short comprehension passages, practice in skimming-scanning and predicting- **Writing-** completing sentences- - developing hints. **Listening-** short texts- short formal and informal conversations. **Speaking-** introducing oneself - exchanging personal information- **Language development-** Wh- Questions- asking and answering-yes or no questions- parts of speech. **Vocabulary development--** prefixes- suffixes- articles.- count/ uncount nouns.

**UNIT II GENERAL READING AND FREE WRITING 12**

**Reading** - comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- **Writing** – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –**Listening-** telephonic conversations. **Speaking** – sharing information of a personal kind—greeting – taking leave- **Language development** – prepositions, conjunctions **Vocabulary development-** guessing meanings of words in context.

**UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12**

**Reading-** short texts and longer passages (close reading) **Writing-** understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences **Listening** – listening to longer texts and filling up the table- product description- narratives from different sources. **Speaking-** asking about routine actions and expressing opinions. **Language development-** degrees of comparison- pronouns- direct vs indirect questions- **Vocabulary development** – single word substitutes- adverbs.

**UNIT IV READING AND LANGUAGE DEVELOPMENT 12**

**Reading-** comprehension-reading longer texts- reading different types of texts- magazines **Writing-** letter writing, informal or personal letters-e-mails-conventions of personal email- **Listening-** listening to dialogues or conversations and completing exercises based on them. **Speaking-** speaking about oneself- speaking about one's friend- **Language development-** Tenses- simple present-simple past- present continuous and past continuous- **Vocabulary development-** synonyms-antonyms- phrasal verbs

**UNIT V EXTENDED WRITING****12**

**Reading**- longer texts- close reading –**Writing**- brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing-**Listening** – listening to talks- conversations- **Speaking** – participating in conversations- short group conversations-**Language development**-modal verbs- present/ past perfect tense - **Vocabulary development**-collocations-fixed and semi-fixed expressions.

**TOTAL: 60 PERIODS****OUTCOMES:****AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English.

**TEXT BOOKS:**

1. Board of Editors. **Using English** A Coursebook for Undergraduate Engineers and Technologists. Orient BlackSwan Limited, Hyderabad: 2015
2. Richards, C. Jack. **Interchange Students' Book-2** New Delhi: CUP, 2015.

**REFERENCES:**

1. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge,2011.
2. Means,L. Thomas and Elaine Langlois. English & Communication For Colleges. CengageLearning ,USA: 2007
3. Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student's Book & Workbook) Cambridge University Press, New Delhi: 2005
4. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011
5. Dutt P. Kiranmai and Rajeevan Geeta. Basic Communication Skills, Foundation Books: 2013.

**MA8151****ENGINEERING MATHEMATICS – I**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**OBJECTIVES :**

The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

**UNIT I DIFFERENTIAL CALCULUS****12**

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

**UNIT II FUNCTIONS OF SEVERAL VARIABLES****12**

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

**UNIT III INTEGRAL CALCULUS****12**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

**UNIT IV MULTIPLE INTEGRALS****12**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

**UNIT V DIFFERENTIAL EQUATIONS****12**

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

**TOTAL: 60 PERIODS****OUTCOMES:**

**After completing this course, students should demonstrate competency in the following skills:**

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.

**TEXT BOOKS :**

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43<sup>rd</sup> Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7<sup>th</sup> Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

**REFERENCES:**

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10<sup>th</sup> Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3<sup>rd</sup> Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
5. Weir, M.D and Joel Hass, "Thomas Calculus", 12<sup>th</sup> Edition, Pearson India, 2016.



**TEXT BOOKS:**

1. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. "Engineering Physics". Cengage Learning India, 2012.

**REFERENCES:**

1. Halliday, D., Resnick, R. & Walker, J. "Principles of Physics". Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. "Physics for Scientists and Engineers". Cengage Learning, 2010.
3. Tipler, P.A. & Mosca, G. "Physics for Scientists and Engineers with Modern Physics". W.H. Freeman, 2007.

**CY8151****ENGINEERING CHEMISTRY****L T P C  
3 0 0 3****OBJECTIVES:**

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

**UNIT I WATER AND ITS TREATMENT****9**

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

**UNIT II SURFACE CHEMISTRY AND CATALYSIS****9**

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions – adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – kinetics of surface reactions, unimolecular reactions, Langmuir - applications of adsorption on pollution abatement. Catalysis: Catalyst – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis– Michaelis – Menten equation.

**UNIT III ALLOYS AND PHASE RULE****9**

Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

**UNIT IV FUELS AND COMBUSTION****9**

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel. Combustion of fuels: Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

**UNIT V ENERGY SOURCES AND STORAGE DEVICES****9**

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H<sub>2</sub>-O<sub>2</sub> fuel cell.

**TOTAL: 45 PERIODS****OUTCOMES:**

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

**TEXT BOOKS:**

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

**REFERENCES:**

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

**GE8151****PROBLEM SOLVING AND PYTHON PROGRAMMING****L T P C****3 0 0 3****OBJECTIVES:**

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures -- lists, tuples, dictionaries.
- To do input/output with files in Python.

**UNIT I ALGORITHMIC PROBLEM SOLVING****9**

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

**UNIT II DATA, EXPRESSIONS, STATEMENTS****9**

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

**UNIT III CONTROL FLOW, FUNCTIONS****9**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices,



dimensioning.

**UNIT I PLANE CURVES AND FREEHAND SKETCHING 7+12**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

**UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12**

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

**UNIT III PROJECTION OF SOLIDS 5+12**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

**UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+12**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

**UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6 +12**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

**TOTAL: 90 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the student will be able to:**

- Familiarize with the fundamentals and standards of Engineering graphics
- Perform freehand sketching of basic geometrical constructions and multiple views of objects.
- Project orthographic projections of lines and plane surfaces.
- Draw projections and solids and development of surfaces.
- Visualize and to project isometric and perspective sections of simple solids.

**TEXT BOOKS:**

1. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.

**REFERENCES:**

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50<sup>th</sup> Edition, 2010.
2. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.

4. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N. S. Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2<sup>nd</sup> Edition, 2009.

**Publication of Bureau of Indian Standards:**

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

**Special points applicable to University Examinations on Engineering Graphics:**

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

**GE8161      PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY      L T P C  
0 0 4 2**

**OBJECTIVES:**

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

**LIST OF PROGRAMS:**

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

**PLATFORM NEEDED**

Python 3 interpreter for Windows/Linux

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.

- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

**BS8161**

**PHYSICS AND CHEMISTRY LABORATORY**  
(Common to all branches of B.E. / B.Tech Programmes)

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**OBJECTIVES:**

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

**LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)**

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser  
(b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

**TOTAL: 30 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to**

- Apply principles of elasticity, optics and thermal properties for engineering applications.

**CHEMISTRY LABORATORY: (Any seven experiments to be conducted)**

**OBJECTIVES:**

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by viscometry.

1. Estimation of HCl using Na<sub>2</sub>CO<sub>3</sub> as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.
13. Corrosion experiment-weight loss method.
14. Determination of CMC.
15. Phase change in a solid.

16. Conductometric titration of strong acid vs strong base.

**OUTCOMES:**

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

**TOTAL: 30 PERIODS**

**TEXTBOOK:**

1. Vogel's Textbook of Quantitative Chemical Analysis (8<sup>TH</sup> edition, 2014).

**HS8251**

**TECHNICAL ENGLISH**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**OBJECTIVES:**

**The Course prepares second semester engineering and Technology students to:**

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization.

**UNIT I INTRODUCTION TECHNICAL ENGLISH**

**12**

**Listening-** Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- **Speaking** –Asking for and giving directions- **Reading** – reading short technical texts from journals- newspapers- **Writing-** purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-**Vocabulary Development-** technical vocabulary **Language Development** –subject verb agreement - compound words.

**UNIT II READING AND STUDY SKILLS**

**12**

**Listening-** Listening to longer technical talks and completing exercises based on them-**Speaking** – describing a process-**Reading** – reading longer technical texts- identifying the various transitions in a text- paragraphing- **Writing-** interpreting charts, graphs- **Vocabulary Development-** vocabulary used in formal letters/emails and reports **Language Development-** impersonal passive voice, numerical adjectives.

**UNIT III TECHNICAL WRITING AND GRAMMAR**

**12**

**Listening-** Listening to classroom lectures/ talks on engineering/technology -**Speaking** – introduction to technical presentations- **Reading** – longer texts both general and technical, practice in speed reading; **Writing-**Describing a process, use of sequence words- **Vocabulary Development-** sequence words- Misspelled words. **Language Development-** embedded sentences

**UNIT IV REPORT WRITING**

**12**

**Listening-** Listening to documentaries and making notes. **Speaking** – mechanics of presentations- **Reading** – reading for detailed comprehension- **Writing-** email etiquette- job application – cover letter –Résumé preparation( via email and hard copy)- analytical essays and issue based essays--**Vocabulary Development-** finding suitable synonyms-paraphrasing-. **Language Development-** clauses- if conditionals.

**UNIT V GROUP DISCUSSION AND JOB APPLICATIONS****12**

**Listening-** TED/Ink talks; **Speaking** –participating in a group discussion **-Reading–** reading and understanding technical articles **Writing–** Writing reports- minutes of a meeting- accident and survey-**Vocabulary Development- verbal analogies Language Development-** reported speech.

**TOTAL :60 PERIODS****OUTCOMES:****At the end of the course learners will be able to:**

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

**TEXT BOOKS:**

1. Board of editors. **Fluency in English A Course book for Engineering and Technology.** Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. **English for Technical Communication.** Cambridge University Press: New Delhi, 2016.

**REFERENCES:**

1. Raman, Meenakshi and Sharma, Sangeetha- **Technical Communication Principles and Practice.**Oxford University Press: New Delhi,2014.
2. Kumar, Suresh. E. **Engineering English.** Orient Blackswan: Hyderabad,2015
3. Booth-L. Diana, **Project Work,** Oxford University Press, Oxford: 2014.
4. Grussendorf, Marion, **English for Presentations,** Oxford University Press, Oxford: 2007
5. Means, L. Thomas and Elaine Langlois, **English & Communication For Colleges.** Cengage Learning, USA: 2007

**Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.**

**MA8251****ENGINEERING MATHEMATICS – II**

L	T	P	C
4	0	0	4

**OBJECTIVES:**

This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

**UNIT I MATRICES****12**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

**UNIT II VECTOR CALCULUS****12**

Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

**UNIT III ANALYTIC FUNCTIONS 12**

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions  $w = z + c, cz, \frac{1}{z}, z^2$  - Bilinear transformation.

**UNIT IV COMPLEX INTEGRATION 12**

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour.

**UNIT V LAPLACE TRANSFORMS 12**

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

**TOTAL: 60 PERIODS**

**OUTCOMES :**

**After successfully completing the course, the student will have a good understanding of the following topics and their applications:**

- Eigen values and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

**TEXT BOOKS:**

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43<sup>rd</sup> Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10<sup>th</sup> Edition, New Delhi, 2016.

**REFERENCES :**

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7<sup>th</sup> Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., " Advanced Engineering Mathematics ", Narosa Publications, New Delhi , 3<sup>rd</sup> Edition, 2007.
3. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.
4. Sastry, S.S, "Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4<sup>th</sup> Edition, New Delhi, 2014.
5. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6<sup>th</sup> Edition, New Delhi, 2012.

**PH8252**

**PHYSICS FOR INFORMATION SCIENCE**  
(Common to CSE & IT)

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the essential principles of Physics of semiconductor device and Electron transport properties. Become proficient in magnetic and optical properties of materials and Nano-electronic devices.

**UNIT I ELECTRICAL PROPERTIES OF MATERIALS 9**

Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Wiedemann-Franz law – Success and failures - electrons in metals – Particle in a three dimensional box – degenerate states – Fermi- Dirac statistics – Density of energy states – Electron in periodic potential – Energy bands in solids – tight binding approximation - Electron effective mass – concept of hole.

**UNIT II SEMICONDUCTOR PHYSICS 9**

Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Variation of carrier concentration with temperature – variation of Fermi level with temperature and impurity concentration – Carrier transport in Semiconductor: random motion, drift, mobility and diffusion – Hall effect and devices – Ohmic contacts – Schottky diode.

**UNIT III MAGNETIC PROPERTIES OF MATERIALS 9**

Magnetic dipole moment – atomic magnetic moments- magnetic permeability and susceptibility - Magnetic material classification: diamagnetism – paramagnetism – ferromagnetism – antiferromagnetism – ferrimagnetism – Ferromagnetism: origin and exchange interaction-saturation magnetization and Curie temperature – Domain Theory- M versus H behaviour – Hard and soft magnetic materials – examples and uses— Magnetic principle in computer data storage – Magnetic hard disc (GMR sensor).

**UNIT IV OPTICAL PROPERTIES OF MATERIALS 9**

Classification of optical materials – carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only) - photo current in a P-N diode – solar cell - LED – Organic LED – Laser diodes – Optical data storage techniques.

**UNIT V NANO DEVICES 9**

Electron density in bulk material – Size dependence of Fermi energy – Quantum confinement – Quantum structures – Density of states in quantum well, quantum wire and quantum dot structure - Band gap of nanomaterials – Tunneling: single electron phenomena and single electron transistor – Quantum dot laser. Conductivity of metallic nanowires – Ballistic transport – Quantum resistance and conductance – Carbon nanotubes: Properties and applications .

**TOTAL :45 PERIODS**

**OUTCOMES:**

**At the end of the course, the students will able to**

- Gain knowledge on classical and quantum electron theories, and energy band structures,
- Acquire knowledge on basics of semiconductor physics and its applications in various devices,
- Get knowledge on magnetic properties of materials and their applications in data storage,
- Have the necessary understanding on the functioning of optical materials for optoelectronics,
- Understand the basics of quantum structures and their applications in carbon electronics..

**TEXT BOOKS:**

1. Jasprit Singh, “Semiconductor Devices: Basic Principles”, Wiley 2012.
2. Kasap, S.O. “Principles of Electronic Materials and Devices”, McGraw-Hill Education, 2007.
3. Kittel, C. “Introduction to Solid State Physics”. Wiley, 2005.

## REFERENCES:

1. Garcia, N. & Damask, A. "Physics for Computer Science Students". Springer-Verlag, 2012.
2. Hanson, G.W. "Fundamentals of Nanoelectronics". Pearson Education, 2009.
3. Rogers, B., Adams, J. & Pennathur, S. "Nanotechnology: Understanding Small Systems". CRC Press, 2014.

**BE8255**

**BASIC ELECTRICAL, ELECTRONICS AND MEASUREMENT  
ENGINEERING**

**L T P C  
3 0 0 3**

## OBJECTIVES:

- To understand the fundamentals of electronic circuit constructions.
- To learn the fundamental laws, theorems of electrical circuits and also to analyze them
- To study the basic principles of electrical machines and their performance
- To study the different energy sources, protective devices and their field applications
- To understand the principles and operation of measuring instruments and transducers

### **UNIT I ELECTRICAL CIRCUITS ANALYSIS**

**9**

Ohms Law, Kirchhoff's Law-Instantaneous power- series and parallel circuit analysis with resistive, capacitive and inductive network - nodal analysis, mesh analysis- network theorems - Thevenins theorem, Norton theorem, maximum power transfer theorem and superposition theorem, three phase supply-Instantaneous, Reactive and apparent power-star delta conversion.

### **UNIT II ELECTRICAL MACHINES**

**9**

DC and AC ROTATING MACHINES:Types, Construction, principle, Emf and torque equation, application Speed Control- Basics of Stepper Motor – Brushless DC motors- Transformers-Introduction- types and construction, working principle of Ideal transformer-Emf equation- All day efficiency calculation.

### **UNIT III UTILIZATION OF ELECTRICAL POWER**

**9**

Renewable energy sources-wind and solar panels. Illumination by lamps- Sodium Vapour, Mercury vapour, Fluorescent tube. Domestic refrigerator and air conditioner-Electric circuit, construction and working principle. Batteries-NiCd, Pb Acid and Li ion–Charge and Discharge Characteristics. Protection-need for earthing, fuses and circuit breakers.Energy Tariff calculation for domestic loads.

### **UNIT IV ELECTRONIC CIRCUITS**

**9**

PN Junction-VI Characteristics of Diode, zener diode, Transistors configurations - amplifiers. Op amps- Amplifiers, oscillator,rectifiers, differentiator, integrator, ADC, DAC. Multi vibrator using 555 Timer IC . Voltage regulator IC using LM 723,LM 317.

### **UNIT V ELECTRICAL MEASUREMENT**

**9**

Characteristic of measurement-errors in measurement, torque in indicating instruments- moving coil and moving iron meters, Energy meter and watt meter. Transducers- classification-thermo electric, RTD, Strain gauge, LVDT, LDR and piezoelectric. Oscilloscope-CRO.

**TOTAL: 45 PERIODS**

## OUTCOMES:

**Upon completion of the course, the students will be able to:**

- Discuss the essentials of electric circuits and analysis.
- Discuss the basic operation of electric machines and transformers
- Introduction of renewable sources and common domestic loads.
- Introduction to measurement and metering for electric circuits.

**TEXT BOOKS:**

1. D.P. Kotharti and I.J. Nagarath, Basic Electrical and Electronics Engineering, Mc Graw Hill, 2016, Third Edition.
2. M.S. Sukhija and T.K. Nagsarkar, Basic Electrical and Electronic Engineering, Oxford, 2016.

**REFERENCES:**

1. S.B. Lal Seksena and Kaustuv Dasgupta, Fundamentals of Electrical Engineering, Cambridge, 2016
2. B.L. Theraja, Fundamentals of Electrical Engineering and Electronics. Chand & Co, 2008.
3. S.K. Sahdev, Basic of Electrical Engineering, Pearson, 2015
4. John Bird, —Electrical and Electronic Principles and Technology, Fourth Edition, Elsevier, 2010.
5. Mittal, Mittal, Basic Electrical Engineering, 2nd Edition, Tata McGraw-Hill Edition, 2016.
6. C.L. Wadhwa, "Generation, Distribution and Utilisation of Electrical Energy", New Age international pvt.ltd., 2003.

**GE8291****ENVIRONMENTAL SCIENCE AND ENGINEERING****L T P C  
3 0 0 3****OBJECTIVES:**

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY****14**

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

**UNIT II ENVIRONMENTAL POLLUTION****8**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

### **UNIT III NATURAL RESOURCES**

**10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

### **UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT**

**7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

### **UNIT V HUMAN POPULATION AND THE ENVIRONMENT**

**6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

#### **TEXTBOOKS:**

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2<sup>nd</sup> edition, Pearson Education, 2004.

#### **REFERENCES :**

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hyderabad, 2015.
3. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.
4. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.



3. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996.

**GE8261**

**ENGINEERING PRACTICES LABORATORY**

**L T P C  
0 0 4 2**

**OBJECTIVES:**

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

**GROUP A (CIVIL & MECHANICAL)**

**I CIVIL ENGINEERING PRACTICE**

**13**

**BUILDINGS:**

- (a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

**PLUMBING WORKS:**

- (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- (b) Study of pipe connections requirements for pumps and turbines.
- (c) Preparation of plumbing line sketches for water supply and sewage works.
- (d) Hands-on-exercise:  
Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
- (e) Demonstration of plumbing requirements of high-rise buildings.

**CARPENTRY USING POWER TOOLS ONLY:**

- (a) Study of the joints in roofs, doors, windows and furniture.
- (b) Hands-on-exercise:  
Wood work, joints by sawing, planing and cutting.

**II MECHANICAL ENGINEERING PRACTICE**

**18**

**WELDING:**

- (a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
- (b) Gas welding practice

**BASIC MACHINING:**

- (a) Simple Turning and Taper turning
- (b) Drilling Practice

**SHEET METAL WORK:**

- (a) Forming & Bending:
- (b) Model making – Trays and funnels.
- (c) Different type of joints.

**MACHINE ASSEMBLY PRACTICE:**

- (a) Study of centrifugal pump

(b) Study of air conditioner

**DEMONSTRATION ON:**

- (a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
- (b) Foundry operations like mould preparation for gear and step cone pulley.
- (c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

**GROUP B (ELECTRICAL & ELECTRONICS)**

**III ELECTRICAL ENGINEERING PRACTICE 13**

- 1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
- 2. Fluorescent lamp wiring.
- 3. Stair case wiring
- 4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
- 5. Measurement of energy using single phase energy meter.
- 6. Measurement of resistance to earth of an electrical equipment.

**IV ELECTRONICS ENGINEERING PRACTICE 16**

- 1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
- 2. Study of logic gates AND, OR, EX-OR and NOT.
- 3. Generation of Clock Signal.
- 4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
- 5. Measurement of ripple factor of HWR and FWR.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the student will be able to**

- Fabricate carpentry components and pipe connections including plumbing works.
- Use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundry and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

**CIVIL**

- 1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
- 2. Carpentry vice (fitted to work bench) 15 Nos.
- 3. Standard woodworking tools 15 Sets.
- 4. Models of industrial trusses, door joints, furniture joints 5 each
- 5. Power Tools: (a) Rotary Hammer 2 Nos
- (b) Demolition Hammer 2 Nos
- (c) Circular Saw 2 Nos
- (d) Planer 2 Nos
- (e) Hand Drilling Machine 2 Nos
- (f) Jigsaw 2 Nos

**MECHANICAL**

- 1. Arc welding transformer with cables and holders 5 Nos.

- |   |           |
|---|-----------|
| 2. Welding booth with exhaust facility  | 5 Nos.    |
| 3. Welding accessories like welding shield, chipping hammer, wire brush, etc. | 5 Sets.   |
| 4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.    | 2 Nos.    |
| 5. Centre lathe   | 2 Nos.    |
| 6. Hearth furnace, anvil and smithy tools                                     | 2 Sets.   |
| 7. Moulding table, foundry tools  | 2 Sets.   |
| 8. Power Tool: Angle Grinder  | 2 Nos     |
| 9. Study-purpose items: centrifugal pump, air-conditioner                     | One each. |

### **ELECTRICAL**

- |  |         |
|--|---------|
| 1. Assorted electrical components for house wiring                         | 15 Sets |
| 2. Electrical measuring instruments  | 10 Sets |
| 3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each |         |
| 4. Megger (250V/500V)  | 1 No.   |
| 5. Power Tools: (a) Range Finder   | 2 Nos   |
| (b) Digital Live-wire detector   | 2 Nos   |

### **ELECTRONICS**

- |   |         |
|---|---------|
| 1. Soldering guns   | 10 Nos. |
| 2. Assorted electronic components for making circuits                 | 50 Nos. |
| 3. Small PCBs   | 10 Nos. |
| 4. Multimeters  | 10 Nos. |
| 5. Study purpose items: Telephone, FM radio, low-voltage power supply |         |

**CS8261**

**C PROGRAMMING LABORATORY**

**L T P C  
0 0 4 2**

#### **OBJECTIVES:**

- To develop programs in C using basic constructs.
- To develop applications in C using strings, pointers, functions, structures.
- To develop applications in C using file processing.

#### **LIST OF EXPERIMENTS:**

1. Programs using I/O statements and expressions.
2. Programs using decision-making constructs.
3. Write a program to find whether the given year is leap year or Not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
4. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.
5. Check whether a given number is Armstrong number or not?
6. Given a set of numbers like <10, 36, 54, 89, 12, 27>, find sum of weights based on the following conditions.
  - 5 if it is a perfect cube.
  - 4 if it is a multiple of 4 and divisible by 6.
  - 3 if it is a prime number.

Sort the numbers based on the weight in the increasing order as shown below

<10,its weight>,<36,its weight><89,its weight>

7. Populate an array with height of persons and find how many persons are above the average height.
8. Populate a two dimensional array with height and weight of persons and compute the Body Mass Index of the individuals.
9. Given a string "a\$bcd./fg" find its reverse without changing the position of special characters.  
(Example input:a@gh%;j and output:j@hg%;a)

10. Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions.
11. From a given paragraph perform the following using built-in functions:
  - a. Find the total number of words.
  - b. Capitalize the first word of each sentence.
  - c. Replace a given word with another word.
12. Solve towers of Hanoi using recursion.
13. Sort the list of numbers using pass by reference.
14. Generate salary slip of employees using structures and pointers.
15. Compute internal marks of students for five different subjects using structures and functions.
16. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.
17. Count the number of account holders whose balance is less than the minimum balance using sequential access file.

#### Mini project

18. Create a "Railway reservation system" with the following modules
  - Booking
  - Availability checking
  - Cancellation
  - Prepare chart

**TOTAL: 60 PERIODS**

#### OUTCOMES:

**Upon completion of the course, the students will be able to:**

- Develop C programs for simple applications making use of basic constructs, arrays and strings.
- Develop C programs involving functions, recursion, pointers, and structures.
- Design applications using sequential and random access file processing.

**MA8351**

**DISCRETE MATHEMATICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

#### OBJECTIVES:

- To extend student's logical and mathematical maturity and ability to deal with abstraction.
- To introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
- To understand the basic concepts of combinatorics and graph theory.
- To familiarize the applications of algebraic structures.
- To understand the concepts and significance of lattices and boolean algebra which are widely used in computer science and engineering.

#### **UNIT I      LOGIC AND PROOFS**

**12**

Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.

#### **UNIT II      COMBINATORICS**

**12**

Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications

#### **UNIT III      GRAPHS**

**12**

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

**UNIT IV ALGEBRAIC STRUCTURES****12**

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism's – Normal subgroup and cosets – Lagrange's theorem – Definitions and examples of Rings and Fields.

**UNIT V LATTICES AND BOOLEAN ALGEBRA****12**

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.

**TOTAL: 60 PERIODS****OUTCOMES:****At the end of the course, students would:**

- Have knowledge of the concepts needed to test the logic of a program.
- Have an understanding in identifying structures on many levels.
- Be aware of a class of functions which transform a finite set into another finite set which relates to input and output functions in computer science.
- Be aware of the counting principles.
- Be exposed to concepts and properties of algebraic structures such as groups, rings and fields.

**TEXTBOOKS:**

1. Rosen, K.H., "Discrete Mathematics and its Applications", 7<sup>th</sup> Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.
2. Tremblay, J.P. and Manohar.R, " Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30<sup>th</sup> Reprint, 2011.

**REFERENCES:**

1. Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 4<sup>th</sup> Edition, Pearson Education Asia, Delhi, 2007.
2. Lipschutz, S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3<sup>rd</sup> Edition, 2010.
3. Koshy, T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.

<b>CS8351</b>	<b>DIGITAL PRINCIPLES AND SYSTEM DESIGN</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**OBJECTIVES:**

- To design digital circuits using simplified Boolean functions
- To analyze and design combinational circuits
- To analyze and design synchronous and asynchronous sequential circuits
- To understand Programmable Logic Devices
- To write HDL code for combinational and sequential circuits

**UNIT I BOOLEAN ALGEBRA AND LOGIC GATES****12**

Number Systems - Arithmetic Operations - Binary Codes- Boolean Algebra and Logic Gates - Theorems and Properties of Boolean Algebra - Boolean Functions - Canonical and Standard Forms - Simplification of Boolean Functions using Karnaugh Map - Logic Gates – NAND and NOR Implementations.

**UNIT II COMBINATIONAL LOGIC****12**

Combinational Circuits – Analysis and Design Procedures - Binary Adder-Subtractor - Decimal Adder - Binary Multiplier - Magnitude Comparator - Decoders – Encoders – Multiplexers - Introduction to HDL – HDL Models of Combinational circuits.





interfaces - Object cloning -inner classes, Array Lists - Strings

**UNIT III EXCEPTION HANDLING AND I/O 9**

Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

**UNIT IV MULTITHREADING AND GENERIC PROGRAMMING 8**

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

**UNIT V EVENT DRIVEN PROGRAMMING 9**

Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Develop Java programs using OOP principles
- Develop Java programs with the concepts inheritance and interfaces
- Build Java applications using exceptions and I/O streams
- Develop Java applications with threads and generics classes
- Develop interactive Java programs using swings

**TEXT BOOKS:**

1. Herbert Schildt, “Java The complete reference”, 8<sup>th</sup> Edition, McGraw Hill Education, 2011.
2. Cay S. Horstmann, Gary cornell, “Core Java Volume –I Fundamentals”, 9<sup>th</sup> Edition, Prentice Hall, 2013.

**REFERENCES:**

1. Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, 3<sup>rd</sup> Edition, Pearson, 2015.
2. Steven Holzner, “Java 2 Black book”, Dreamtech press, 2011.
3. Timothy Budd, “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education, 2000.

**EC8395**

**COMMUNICATION ENGINEERING**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To study the various analog and digital modulation techniques
- To study the principles behind information theory and coding
- To study the various digital communication techniques

**UNIT I ANALOG MODULATION 9**

Amplitude Modulation – AM, DSBSC, SSBSC, VSB – PSD, modulators and demodulators – Angle modulation – PM and FM – PSD, modulators and demodulators – Superheterodyne receivers

<b>UNIT II</b>	<b>PULSE MODULATION</b>	<b>9</b>
Low pass sampling theorem – Quantization – PAM – Line coding – PCM, DPCM, DM, and ADPCM And ADM, Channel Vocoder - Time Division Multiplexing, Frequency Division Multiplexing		
<b>UNIT III</b>	<b>DIGITAL MODULATION AND TRANSMISSION</b>	<b>9</b>
Phase shift keying – BPSK, DPSK, QPSK – Principles of M-ary signaling M-ary PSK & QAM – Comparison, ISI – Pulse shaping – Duo binary encoding – Cosine filters – Eye pattern, equalizers		
<b>UNIT IV</b>	<b>INFORMATION THEORY AND CODING</b>	<b>9</b>
Measure of information – Entropy – Source coding theorem – Shannon–Fano coding, Huffman Coding, LZ Coding – Channel capacity – Shannon-Hartley law – Shannon's limit – Error control codes – Cyclic codes, Syndrome calculation – Convolution Coding, Sequential and Viterbi decoding		
<b>UNIT V</b>	<b>SPREAD SPECTRUM AND MULTIPLE ACCESS</b>	<b>9</b>
PN sequences – properties – m-sequence – DSSS – Processing gain, Jamming – FHSS – Synchronisation and tracking – Multiple Access – FDMA, TDMA, CDMA,		
		<b>TOTAL: 45 PERIODS</b>

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Apply analog and digital communication techniques.
- Use data and pulse communication techniques.
- Analyze Source and Error control coding.

**TEXT BOOKS:**

1. H Taub, D L Schilling, G Saha, "Principles of Communication Systems" 3/e, TMH 2007
2. S. Haykin "Digital Communications" John Wiley 2005

**REFERENCES:**

1. B.P.Lathi, "Modern Digital and Analog Communication Systems", 3<sup>rd</sup> edition, Oxford University Press, 2007
2. H P Hsu, Schaum Outline Series – "Analog and Digital Communications" TMH 2006
3. B.Sklar, Digital Communications Fundamentals and Applications" 2/e Pearson Education 2007.

**CS8381**

**DATA STRUCTURES LABORATORY**

**L T P C  
0 0 4 2**

**OBJECTIVES**

- To implement linear and non-linear data structures
  - To understand the different operations of search trees
  - To implement graph traversal algorithms
  - To get familiarized to sorting and searching algorithms
1. Array implementation of Stack and Queue ADTs
  2. Array implementation of List ADT
  3. Linked list implementation of List, Stack and Queue ADTs
  4. Applications of List, Stack and Queue ADTs
  5. Implementation of Binary Trees and operations of Binary Trees
  6. Implementation of Binary Search Trees
  7. Implementation of AVL Trees
  8. Implementation of Heaps using Priority Queues.

9. Graph representation and Traversal algorithms
10. Applications of Graphs
11. Implementation of searching and sorting algorithms
12. Hashing – any two collision techniques

**TOTAL: 60 PERIODS**

### **OUTCOMES:**

**At the end of the course, the students will be able to:**

- Write functions to implement linear and non-linear data structure operations
- Suggest appropriate linear / non-linear data structure operations for solving a given problem
- Appropriately use the linear / non-linear data structure operations for a given problem
- Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval

**CS8383**

**OBJECT ORIENTED PROGRAMMING LABORATORY**

**L T P C  
0 0 4 2**

### **OBJECTIVES**

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, arraylist, exception handling and file processing.
- To develop applications using generic programming and event handling.

### **LIST OF EXPERIMENTS**

1. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff.

If the type of the EB connection is domestic, calculate the amount to be paid as follows:

- First 100 units - Rs. 1 per unit
- 101-200 units - Rs. 2.50 per unit
- 201 -500 units - Rs. 4 per unit
- > 501 units - Rs. 6 per unit

If the type of the EB connection is commercial, calculate the amount to be paid as follows:

- First 100 units - Rs. 2 per unit
- 101-200 units - Rs. 4.50 per unit
- 201 -500 units - Rs. 6 per unit
- > 501 units - Rs. 7 per unit

2. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa) , time converter (hours to minutes, seconds and vice versa) using packages.
3. Develop a java application with Employee class with Emp\_name, Emp\_id, Address, Mail\_id, Mobile\_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
4. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.

5. Write a program to perform string operations using ArrayList. Write functions for the following
  - a. Append - add at end
  - b. Insert – add at particular index
  - c. Search
  - d. List all string starts with given letter
6. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
7. Write a Java program to implement user defined exception handling.
8. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.
9. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
10. Write a java program to find the maximum value from the given type of elements using a generic function.
11. Design a calculator using event-driven programming paradigm of Java with the following options.
  - a) Decimal manipulations
  - b) Scientific manipulations
12. Develop a mini project for any application using Java concepts.

**TOTAL : 60 PERIODS**

## **OUTCOMES**

**Upon completion of the course, the students will be able to**

- Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.
- Develop and implement Java programs with arraylist, exception handling and multithreading .
- Design applications using file processing, generic programming and event handling.

**CS8382**

**DIGITAL SYSTEMS LABORATORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

## **OBJECTIVES:**

- To understand the various basic logic gates
- To design and implement the various combinational circuits
- To design and implement combinational circuits using MSI devices.
- To design and implement sequential circuits
- To understand and code with HDL programming

## **LIST OF EXPERIMENTS**

1. Verification of Boolean Theorems using basic gates.
2. Design and implementation of combinational circuits using basic gates for arbitrary

- functions, code converters.
3. Design and implement Half/Full Adder and Subtractor.
  4. Design and implement combinational circuits using MSI devices:
    - 4 – bit binary adder / subtractor
    - Parity generator / checker
    - Magnitude Comparator
    - Application using multiplexers
  5. Design and implement shift-registers.
  6. Design and implement synchronous counters.
  7. Design and implement asynchronous counters.
  8. Coding combinational circuits using HDL.
  9. Coding sequential circuits using HDL.
  10. Design and implementation of a simple digital system (Mini Project).

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**Upon Completion of the course, the students will be able to:**

- Implement simplified combinational circuits using basic logic gates
- Implement combinational circuits using MSI devices
- Implement sequential circuits like registers and counters
- Simulate combinational and sequential circuits using HDL

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

**LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS HARDWARE:**

1. Digital trainer kits - 30
2. Digital ICs required for the experiments in sufficient numbers

**SOFTWARE:**

1. HDL simulator.

		L	T	P	C
<b>HS8381</b>	<b>INTERPERSONAL SKILLS/LISTENING&amp;SPEAKING</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**OBJECTIVES:**

**The Course will enable learners to:**

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- improve general and academic listening skills
- Make effective presentations.

**UNIT I**

Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

**UNIT II**

Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

### UNIT III

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail

### UNIT IV

Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

### UNIT V

Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

**TOTAL :30PERIODS**

### OUTCOMES:

**At the end of the course Learners will be able to:**

- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal

### TEXT BOOKS:

1. Brooks, Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.
2. Richards, C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

### REFERENCES:

1. Bhatnagar, Nitin and Mamta Bhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.
2. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
3. Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013.
4. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
5. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014

**MA8402**

**PROBABILITY AND QUEUING THEORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

### OBJECTIVES:

- To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
- To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
- To understand the basic concepts of random processes which are widely used in IT fields.
- To understand the concept of queueing models and apply in engineering.
- To understand the significance of advanced queueing models.
- To provide the required mathematical support in real life problems and develop probabilistic models which can be used in several areas of science and engineering.

<b>UNIT I</b>	<b>PROBABILITY AND RANDOM VARIABLES</b>	<b>12</b>
Probability – Axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.		
<b>UNIT II</b>	<b>TWO - DIMENSIONAL RANDOM VARIABLES</b>	<b>12</b>
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).		
<b>UNIT III</b>	<b>RANDOM PROCESSES</b>	<b>12</b>
Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions.		
<b>UNIT IV</b>	<b>QUEUEING MODELS</b>	<b>12</b>
Markovian queues – Birth and death processes – Single and multiple server queueing models – Little's formula - Queues with finite waiting rooms – Queues with impatient customers : Balking and renegeing.		
<b>UNIT V</b>	<b>ADVANCED QUEUEING MODELS</b>	<b>12</b>
Finite source models - M/G/1 queue – Pollaczek Khinchin formula - M/D/1 and M/E <sub>k</sub> /1 as special cases – Series queues – Open Jackson networks.		

**TOTAL : 60 PERIODS**

**OUTCOMES:**

**Upon successful completion of the course, students should be able to:**

- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept of random processes in engineering disciplines.
- Acquire skills in analyzing queueing models.
- Understand and characterize phenomenon which evolve with respect to time in a probabilistic manner

**TEXTBOOKS:**

1. Gross, D., Shortle, J.F, Thompson, J.M and Harris. C.M., "Fundamentals of Queueing Theory", Wiley Student 4<sup>th</sup> Edition, 2014.
2. Ibe, O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 1<sup>st</sup> Indian Reprint, 2007.

**REFERENCES :**

1. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2004.
2. Taha, H.A., "Operations Research", 9<sup>th</sup> Edition, Pearson India Education Services, Delhi, 2016.
3. Trivedi, K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2<sup>nd</sup> Edition, John Wiley and Sons, 2002.
4. Yates, R.D. and Goodman. D. J., "Probability and Stochastic Processes", 2<sup>nd</sup> Edition, Wiley India Pvt. Ltd., Bangalore, 2012.

**OBJECTIVES:**

- To learn the basic structure and operations of a computer.
- To learn the arithmetic and logic unit and implementation of fixed-point and floating point arithmetic unit.
- To learn the basics of pipelined execution.
- To understand parallelism and multi-core processors.
- To understand the memory hierarchies, cache memories and virtual memories.
- To learn the different ways of communication with I/O devices.

**UNIT I BASIC STRUCTURE OF A COMPUTER SYSTEM 9**

Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing.

**UNIT II ARITHMETIC FOR COMPUTERS 9**

Addition and Subtraction – Multiplication – Division – Floating Point Representation – Floating Point Operations – Subword Parallelism

**UNIT III PROCESSOR AND CONTROL UNIT 9**

A Basic MIPS implementation – Building a Datapath – Control Implementation Scheme – Pipelining – Pipelined datapath and control – Handling Data Hazards & Control Hazards – Exceptions.

**UNIT IV PARALLELISIM 9**

Parallel processing challenges – Flynn’s classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures - Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.

**UNIT V MEMORY & I/O SYSTEMS 9**

Memory Hierarchy - memory technologies – cache memory – measuring and improving cache performance – virtual memory, TLB’s – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure – Bus operation – Arbitration – Interface circuits - USB.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Understand the basics structure of computers, operations and instructions.
- Design arithmetic and logic unit.
- Understand pipelined execution and design control unit.
- Understand parallel processing architectures.
- Understand the various memory systems and I/O communication.

**TEXT BOOKS:**

1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012.

**REFERENCES:**

1. William Stallings, Computer Organization and Architecture – Designing for Performance, Eighth Edition, Pearson Education, 2010.
2. John P. Hayes, Computer Architecture and Organization, Third Edition, Tata

- McGraw Hill, 2012.
- John L. Hennessey and David A. Patterson, Computer Architecture – A Quantitative Approach, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.

**CS8492**

**DATABASE MANAGEMENT SYSTEMS**

**L T P C  
3 0 0 3**

**OBJECTIVES**

- To learn the fundamentals of data models and to represent a database system using ER diagrams.
- To study SQL and relational database design.
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design.
- To understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.
- To have an introductory knowledge about the Storage and Query processing Techniques

**UNIT I RELATIONAL DATABASES**

**10**

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL

**UNIT II DATABASE DESIGN**

**8**

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

**UNIT III TRANSACTIONS**

**9**

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery - Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery.

**UNIT IV IMPLEMENTATION TECHNIQUES**

**9**

RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics and Cost Estimation.

**UNIT V ADVANCED TOPICS**

**9**

Distributed Databases: Architecture, Data Storage, Transaction Processing – Object-based Databases: Object Database Concepts, Object-Relational features, ODMG Object Model, ODL, OQL - XML Databases: XML Hierarchical Model, DTD, XML Schema, XQuery – Information Retrieval: IR Concepts, Retrieval Models, Queries in IR systems.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Classify the modern and futuristic database applications based on size and complexity
- Map ER model to Relational model to perform database design effectively
- Write queries using normalization criteria and optimize queries
- Compare and contrast various indexing strategies in different database systems
- Appraise how advanced databases differ from traditional databases.

**TEXT BOOKS:**

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2011.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Sixth Edition, Pearson Education, 2011.

**REFERENCES:**

1. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, —Database Management SystemsII, Fourth Edition, McGraw-Hill College Publications, 2015.
3. G.K.Gupta, "Database Management Systems", Tata McGraw Hill, 2011.

**CS8451****DESIGN AND ANALYSIS OF ALGORITHMS****L T P C  
3 0 0 3****OBJECTIVES:**

- To understand and apply the algorithm analysis techniques.
- To critically analyze the efficiency of alternative algorithmic solutions for the same problem
- To understand different algorithm design techniques.
- To understand the limitations of Algorithmic power.

**UNIT I INTRODUCTION****9**

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties. Analysis Framework – Empirical analysis - Mathematical analysis for Recursive and Non-recursive algorithms - Visualization

**UNIT II BRUTE FORCE AND DIVIDE-AND-CONQUER****9**

Brute Force – Computing  $a^n$  – String Matching - Closest-Pair and Convex-Hull Problems - Exhaustive Search - Travelling Salesman Problem - Knapsack Problem - Assignment problem. Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort – Heap Sort - Multiplication of Large Integers – Closest-Pair and Convex - Hull Problems.

**UNIT III DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE****9**

Dynamic programming – Principle of optimality - Coin changing problem, Computing a Binomial Coefficient – Floyd's algorithm – Multi stage graph - Optimal Binary Search Trees – Knapsack Problem and Memory functions.

Greedy Technique – Container loading problem - Prim's algorithm and Kruskal's Algorithm – 0/1 Knapsack problem, Optimal Merge pattern - Huffman Trees.

**UNIT IV ITERATIVE IMPROVEMENT****9**

The Simplex Method - The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs, Stable marriage Problem.

**UNIT V COPING WITH THE LIMITATIONS OF ALGORITHM POWER****9**

Lower - Bound Arguments - P, NP NP- Complete and NP Hard Problems. Backtracking – n-Queen problem - Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – LIFO Search and FIFO search - Assignment problem – Knapsack Problem – Travelling Salesman Problem - Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem – Knapsack problem.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the students should be able to:**

- Design algorithms for various computing problems.
- Analyze the time and space complexity of algorithms.
- Critically analyze the different algorithm design techniques for a given problem.
- Modify existing algorithms to improve efficiency.

**TEXT BOOKS:**

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2007.

**REFERENCES:**

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
3. Harsh Bhasin, "Algorithms Design and Analysis", Oxford university press, 2016.
4. S. Sridhar, "Design and Analysis of Algorithms", Oxford university press, 2014.
5. <http://nptel.ac.in/>

**CS8493****OPERATING SYSTEMS****L T P C  
3 0 0 3****OBJECTIVES:**

- To understand the basic concepts and functions of operating systems.
- To understand Processes and Threads
- To analyze Scheduling algorithms.
- To understand the concept of Deadlocks.
- To analyze various memory management schemes.
- To understand I/O management and File systems.
- To be familiar with the basics of Linux system and Mobile OS like iOS and Android.

**UNIT I OPERATING SYSTEM OVERVIEW****7**

Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

**UNIT II PROCESS MANAGEMENT****11**

Processes - Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication; CPU Scheduling - Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Threads- Overview, Multithreading models, Threading issues; Process Synchronization - The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors; Deadlock - System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

**UNIT III STORAGE MANAGEMENT****9**

Main Memory – Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, 32 and 64 bit architecture Examples; Virtual Memory – Background,

Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

**UNIT IV FILE SYSTEMS AND I/O SYSTEMS 9**

Mass Storage system – Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space management; File-System Interface - File concept, Access methods, Directory Structure, Directory organization, File system mounting, File Sharing and Protection; File System Implementation- File System Structure, Directory implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem, Streams, Performance.

**UNIT V CASE STUDY 9**

Linux System - Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Inter-process Communication; Mobile OS - iOS and Android - Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the students should be able to:**

- Analyze various scheduling algorithms.
- Understand deadlock, prevention and avoidance algorithms.
- Compare and contrast various memory management schemes.
- Understand the functionality of file systems.
- Perform administrative tasks on Linux Servers.
- Compare iOS and Android Operating Systems.

**TEXT BOOK :**

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9<sup>th</sup> Edition, John Wiley and Sons Inc., 2012.

**REFERENCES :**

1. Ramaz Elmasri, A. Gil Carrick, David Levine, "Operating Systems – A Spiral Approach", Tata McGraw Hill Edition, 2010.
2. Achyut S.Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.
3. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Pearson Education, 2004.
4. Gary Nutt, "Operating Systems", Third Edition, Pearson Education, 2004.
5. Harvey M. Deitel, "Operating Systems", Third Edition, Pearson Education, 2004.
6. Daniel P Bovet and Marco Cesati, "Understanding the Linux kernel", 3rd edition, O'Reilly, 2005.
7. Neil Smyth, "iPhone iOS 4 Development Essentials – Xcode", Fourth Edition, Payload media, 2011.

**CS8494**

**SOFTWARE ENGINEERING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the phases in a software project
- To understand fundamental concepts of requirements engineering and Analysis Modeling.
- To understand the various software design methodologies
- To learn various testing and maintenance measures

**UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT 9**

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming-XP Process.

**UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION 9**

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management- Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

**UNIT III SOFTWARE DESIGN 9**

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

**UNIT IV TESTING AND MAINTENANCE 9**

Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging –Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering.

**UNIT V PROJECT MANAGEMENT 9**

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS

**TOTAL :45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Identify the key activities in managing a software project.
- Compare different process models.
- Concepts of requirements engineering and Analysis Modeling.
- Apply systematic procedure for software design and deployment.
- Compare and contrast the various testing and maintenance.
- Manage project schedule, estimate project cost and effort required.

**TEXT BOOKS:**

1. Roger S. Pressman, “Software Engineering – A Practitioner’s Approach”, Seventh Edition, Mc Graw-Hill International Edition, 2010.
2. Ian Sommerville, “Software Engineering”, 9th Edition, Pearson Education Asia, 2011.

**REFERENCES:**

1. Rajib Mall, “Fundamentals of Software Engineering”, Third Edition, PHI Learning Private Limited, 2009.
2. Pankaj Jalote, “Software Engineering, A Precise Approach”, Wiley India, 2010.
3. Kelkar S.A., “Software Engineering”, Prentice Hall of India Pvt Ltd, 2007.
4. Stephen R.Schach, “Software Engineering”, Tata McGraw-Hill Publishing Company Limited,2007.
5. <http://nptel.ac.in/>.

**CS8481 DATABASE MANAGEMENT SYSTEMS LABORATORY L T P C  
0 0 4 2**

**AIM:**

The aim of this laboratory is to inculcate the abilities of applying the principles of the database management systems. This course aims to prepare the students for projects where a proper implementation of databases will be required.

## OBJECTIVES:

- To understand data definitions and data manipulation commands
  - To learn the use of nested and join queries
  - To understand functions, procedures and procedural extensions of data bases
  - To be familiar with the use of a front end tool
  - To understand design and implementation of typical database applications
1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements
  2. Database Querying – Simple queries, Nested queries, Sub queries and Joins
  3. Views, Sequences, Synonyms
  4. Database Programming: Implicit and Explicit Cursors
  5. Procedures and Functions
  6. Triggers
  7. Exception Handling
  8. Database Design using ER modeling, normalization and Implementation for any application
  9. Database Connectivity with Front End Tools
  10. Case Study using real life database applications

**TOTAL: 60 PERIODS**

## OUTCOMES:

**Upon completion of the course, the students will be able to:**

- Use typical data definitions and manipulation commands.
- Design applications to test Nested and Join Queries
- Implement simple applications that use Views
- Implement applications that require a Front-end Tool
- Critically analyze the use of Tables, Views, Functions and Procedures

**CS8461**

**OPERATING SYSTEMS LABORATORY**

**L T P C  
0 0 4 2**

## OBJECTIVES

- To learn Unix commands and shell programming
- To implement various CPU Scheduling Algorithms
- To implement Process Creation and Inter Process Communication.
- To implement Deadlock Avoidance and Deadlock Detection Algorithms
- To implement Page Replacement Algorithms
- To implement File Organization and File Allocation Strategies

## LIST OF EXPERIMENTS

1. Basics of UNIX commands
2. Write programs using the following system calls of UNIX operating system  
fork, exec, getpid, exit, wait, close, stat, opendir, readdir
3. Write C programs to simulate UNIX commands like cp, ls, grep, etc.
4. Shell Programming
5. Write C programs to implement the various CPU Scheduling Algorithms
6. Implementation of Semaphores
7. Implementation of Shared memory and IPC
8. Bankers Algorithm for Deadlock Avoidance
9. Implementation of Deadlock Detection Algorithm
10. Write C program to implement Threading & Synchronization Applications
11. Implementation of the following Memory Allocation Methods for fixed partition
  - a) First Fit
  - b) Worst Fit
  - c) Best Fit
12. Implementation of Paging Technique of Memory Management
13. Implementation of the following Page Replacement Algorithms
  - a) FIFO
  - b) LRU
  - c) LFU





**OUTCOMES:****Upon successful completion of the course, students should be able to:**

- Apply the basic notions of groups, rings, fields which will then be used to solve related problems.
- Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
- Demonstrate accurate and efficient use of advanced algebraic techniques.
- Demonstrate their mastery by solving non - trivial problems related to the concepts, and by proving simple theorems about the, statements proven by the text.
- Apply integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject.

**TEXTBOOKS:**

1. Grimaldi, R.P and Ramana, B.V., "Discrete and Combinatorial Mathematics", Pearson Education, 5<sup>th</sup> Edition, New Delhi, 2007.
2. Koshy, T., "Elementary Number Theory with Applications", Elsevier Publications, New Delhi, 2002.

**REFERENCES:**

1. Lidl, R. and Pitz, G, "Applied Abstract Algebra", Springer Verlag, New Delhi, 2<sup>nd</sup> Edition, 2006.
2. Niven, I., Zuckerman.H.S., and Montgomery, H.L., "An Introduction to Theory of Numbers", John Wiley and Sons , Singapore, 2004.
3. San Ling and Chaoping Xing, "Coding Theory – A first Course", Cambridge Publications, Cambridge, 2004.

**CS8591****COMPUTER NETWORKS**

L	T	P	C
3	0	0	3

**OBJECTIVES:**

- To understand the protocol layering and physical level communication.
- To analyze the performance of a network.
- To understand the various components required to build different networks.
- To learn the functions of network layer and the various routing protocols.
- To familiarize the functions and protocols of the Transport layer.

**UNIT I INTRODUCTION AND PHYSICAL LAYER 9**

Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

**UNIT II DATA-LINK LAYER & MEDIA ACCESS 9**

Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – PPP - Media Access Control - Wired LANs: Ethernet - Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices.

**UNIT III NETWORK LAYER 9**

Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets - Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.

**UNIT IV TRANSPORT LAYER 9**

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol – SCTP.

**UNIT V APPLICATION LAYER 9**

WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP.

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Understand the basic layers and its functions in computer networks.
- Evaluate the performance of a network.
- Understand the basics of how data flows from one node to another.
- Analyze and design routing algorithms.
- Design protocols for various functions in the network.
- Understand the working of various application layer protocols.

**TEXT BOOK:**

1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.

**REFERENCES**

1. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.
2. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
3. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
4. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011.
5. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013.

**EC8691**

**MICROPROCESSORS AND MICROCONTROLLERS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To understand the Architecture of 8086 microprocessor.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To interface microprocessors with supporting chips.
- To study the Architecture of 8051 microcontroller.
- To design a microcontroller based system

**UNIT I THE 8086 MICROPROCESSOR**

**9**

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

**UNIT II 8086 SYSTEM BUS STRUCTURE**

**9**

8086 signals – Basic configurations – System bus timing –System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.

**UNIT III I/O INTERFACING**

**9**

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

**UNIT IV MICROCONTROLLER**

**9**

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

**UNIT V INTERFACING MICROCONTROLLER****9**

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of the course, the students should be able to:**

- Understand and execute programs based on 8086 microprocessor.
- Design Memory Interfacing circuits.
- Design and interface I/O circuits.
- Design and implement 8051 microcontroller based systems.

**TEXT BOOKS:**

1. Yu-Cheng Liu, Glenn A.Gibson, “Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design”, Second Edition, Prentice Hall of India, 2007. (UNIT I- III)
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Second Edition, Pearson education, 2011. (UNIT IV-V)

**REFERENCES:**

1. Douglas V.Hall, “Microprocessors and Interfacing, Programming and Hardware”,TMH,2012
2. A.K.Ray,K.M.Bhurchandi,”Advanced Microprocessors and Peripherals “3<sup>rd</sup> edition, Tata McGrawHill,2012

**CS8501****THEORY OF COMPUTATION****L T P C  
3 0 0 3****OBJECTIVES:**

- To understand the language hierarchy
- To construct automata for any given pattern and find its equivalent regular expressions
- To design a context free grammar for any given language
- To understand Turing machines and their capability
- To understand undecidable problems and NP class problems

**UNIT I AUTOMATA FUNDAMENTALS****9**

Introduction to formal proof – Additional forms of Proof – Inductive Proofs –Finite Automata – Deterministic Finite Automata – Non-deterministic Finite Automata – Finite Automata with Epsilon Transitions

**UNIT II REGULAR EXPRESSIONS AND LANGUAGES****9**

Regular Expressions – FA and Regular Expressions – Proving Languages not to be regular – Closure Properties of Regular Languages – Equivalence and Minimization of Automata.

**UNIT III CONTEXT FREE GRAMMAR AND LANGUAGES****9**

CFG – Parse Trees – Ambiguity in Grammars and Languages – Definition of the Pushdown Automata – Languages of a Pushdown Automata – Equivalence of Pushdown Automata and CFG, Deterministic Pushdown Automata.



**Implementation Diagrams** - UML package diagram - When to use package diagrams - Component and Deployment Diagrams – When to use Component and Deployment diagrams

**UNIT IV DESIGN PATTERNS 9**

**GRASP:** Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller

**Design Patterns – creational** – factory method – **structural** – Bridge – Adapter – **behavioural** – Strategy – observer –Applying GoF design patterns – Mapping design to code

**UNIT V TESTING 9**

Object Oriented Methodologies – Software Quality Assurance – Impact of object orientation on Testing – Develop Test Cases and Test Plans

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the students will be able to:**

- Express software design with UML diagrams
- Design software applications using OO concepts.
- Identify various scenarios based on software requirements
- Transform UML based software design into pattern based design using design patterns
- Understand the various testing methodologies for OO software

**TEXT BOOKS:**

1. Craig Larman, “Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development”, Third Edition, Pearson Education, 2005.
2. Ali Bahrami - Object Oriented Systems Development - McGraw Hill International Edition - 1999

**REFERENCES:**

1. Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, “Design patterns: Elements of Reusable Object-Oriented Software”, Addison-Wesley, 1995.
2. Martin Fowler, “UML Distilled: A Brief Guide to the Standard Object Modeling Language”, Third edition, Addison Wesley, 2003.

**EC8681 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY L T P C  
0 0 4 2**

**OBJECTIVES:**

- To Introduce ALP concepts, features and Coding methods
- Write ALP for arithmetic and logical operations in 8086 and 8051
- Differentiate Serial and Parallel Interface
- Interface different I/Os with Microprocessors
- Be familiar with MASM

**LIST OF EXPERIMENTS:**

**8086 Programs using kits and MASM**

1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. Code conversion, decimal arithmetic and Matrix operations.
4. Floating point operations, string manipulations, sorting and searching
5. Password checking, Print RAM size and system date
6. Counters and Time Delay

**Peripherals and Interfacing Experiments**

7. Traffic light controller
8. Stepper motor control

9. Digital clock
10. Key board and Display
11. Printer status
12. Serial interface and Parallel interface
13. A/D and D/A interface and Waveform Generation

### **8051 Experiments using kits and MASM**

14. Basic arithmetic and Logical operations
15. Square and Cube program, Find 2's complement of a number
16. Unpacked BCD to ASCII

**TOTAL: 60 PERIODS**

### **OUTCOMES:**

**At the end of the course, the student should be able to:**

- Write ALP Programmes for fixed and Floating Point and Arithmetic operations
- Interface different I/Os with processor
- Generate waveforms using Microprocessors
- Execute Programs in 8051
- Explain the difference between simulator and Emulator

### **LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

#### **HARDWARE:**

8086 development kits - 30 nos  
 Interfacing Units - Each 10 nos  
 Microcontroller - 30 nos

#### **SOFTWARE:**

Intel Desktop Systems with MASM - 30 nos  
 8086 Assembler  
 8051 Cross Assembler

## **CS8582 OBJECT ORIENTED ANALYSIS AND DESIGN LABORATORY**

**L T P C**  
**0 0 4 2**

### **OBJECTIVES:**

- To capture the requirements specification for an intended software system
- To draw the UML diagrams for the given specification
- To map the design properly to code
- To test the software system thoroughly for all scenarios
- To improve the design by applying appropriate design patterns.

Draw standard UML diagrams using an UML modeling tool for a given case study and map design to code and implement a 3 layered architecture. Test the developed code and validate whether the SRS is satisfied.

1. Identify a software system that needs to be developed.
2. Document the Software Requirements Specification (SRS) for the identified system.
3. Identify use cases and develop the Use Case model.
4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.
5. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams
6. Draw relevant State Chart and Activity Diagrams for the same system.
7. Implement the system as per the detailed design
8. Test the software system for all the scenarios identified as per the usecase diagram
9. Improve the reusability and maintainability of the software system by applying appropriate

design patterns.

10. Implement the modified system and test it for various scenarios

### **SUGGESTED DOMAINS FOR MINI-PROJECT:**

1. Passport automation system.
2. Book bank
3. Exam registration
4. Stock maintenance system.
5. Online course reservation system
6. Airline/Railway reservation system
7. Software personnel management system
8. Credit card processing
9. e-book management system
10. Recruitment system
11. Foreign trading system
12. Conference management system
13. BPO management system
14. Library management system
15. Student information system

**TOTAL: 60 PERIODS**

### **OUTCOMES:**

**Upon completion of this course, the students will be able to:**

- Perform OO analysis and design for a given problem specification.
- Identify and map basic software requirements in UML mapping.
- Improve the software quality using design patterns and to explain the rationale behind applying specific design patterns
- Test the compliance of the software with the SRS.

### **HARDWARE REQUIREMENTS**

Standard PC

### **SOFTWARE REQUIREMENTS**

1. Windows 7 or higher
2. ArgoUML that supports UML 1.4 and higher
3. Selenium, JUnit or Apache JMeter

**CS8581**

**NETWORKS LABORATORY**

L	T	P	C
0	0	4	2

### **OBJECTIVES:**

- To learn and use network commands.
- To learn socket programming.
- To implement and analyze various network protocols.
- To learn and use simulation tools.
- To use simulation tools to analyze the performance of various network protocols.

### **LIST OF EXPERIMENTS**

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine.
2. Write a HTTP web client program to download a web page using TCP sockets.
3. Applications using TCP sockets like:
  - Echo client and echo server
  - Chat
  - File Transfer

4. Simulation of DNS using UDP sockets.
5. Write a code simulating ARP /RARP protocols.
6. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
7. Study of TCP/UDP performance using Simulation tool.
8. Simulation of Distance Vector/ Link State Routing algorithm.
9. Performance evaluation of Routing protocols using Simulation tool.
10. Simulation of error correction code (like CRC).

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**Upon Completion of the course, the students will be able to:**

- Implement various protocols using TCP and UDP.
- Compare the performance of different transport layer protocols.
- Use simulation tools to analyze the performance of various network protocols.
- Analyze various routing algorithms.
- Implement error correction codes.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

**LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:**

**HARDWARE:**

- |                        |        |
|------------------------|--------|
| 1. Standalone desktops | 30 Nos |
|------------------------|--------|

**SOFTWARE:**

- |  |    |
|--|----|
| 1. C / C++ / Java / Python / Equivalent Compiler                         | 30 |
| 2. Network simulator like NS2/Glomosim/OPNET/ Packet Tracer / Equivalent |    |

<b>CS8651</b>	<b>INTERNET PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand different Internet Technologies.
- To learn java-specific web services architecture

**UNIT I WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0 9**

Web Essentials: Clients, Servers and Communication – The Internet – Basic Internet protocols – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Semantic elements – Drag and Drop – Audio – Video controls - CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.

**UNIT II CLIENT SIDE PROGRAMMING 9**

Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects,- Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling-DHTML with JavaScript- JSON introduction – Syntax – Function Files – Http Request – SQL.

**UNIT III SERVER SIDE PROGRAMMING 9**

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat Web Server- DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example - JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.

**UNIT IV PHP and XML 9**

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation- Regular Expressions - File handling – Cookies - Connecting to Database. XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).

**UNIT V INTRODUCTION TO AJAX and WEB SERVICES 9**

AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods; Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application –SOAP.

**TOTAL 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the students should be able to:**

- Construct a basic website using HTML and Cascading Style Sheets.
- Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.
- Develop server side programs using Servlets and JSP.
- Construct simple web pages in PHP and to represent data in XML format.
- Use AJAX and web services to develop interactive web applications

**TEXT BOOK:**

1. Deitel and Deitel and Nieto, “Internet and World Wide Web - How to Program”, Prentice Hall, 5th Edition, 2011.

**REFERENCES:**

1. Stephen Wynkoop and John Burke “Running a Perfect Website”, QUE, 2nd Edition,1999.
2. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2009.
3. Jeffrey C and Jackson, “Web Technologies A Computer Science Perspective”, Pearson Education, 2011.
4. Gopalan N.P. and Akilandeswari J., “Web Technology”, Prentice Hall of India, 2011.
5. UttamK.Roy, “Web Technologies”, Oxford University Press, 2011.

**CS8691**

**ARTIFICIAL INTELLIGENCE**

L	T	P	C
3	0	0	3

**OBJECTIVES:**

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI.

**UNIT I INTRODUCTION 9**

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.



**OBJECTIVES:**

- To understand the basic concepts of mobile computing.
- To learn the basics of mobile telecommunication system .
- To be familiar with the network layer protocols and Ad-Hoc networks.
- To know the basis of transport and application layer protocols.
- To gain knowledge about different mobile platforms and application development.

**UNIT I INTRODUCTION 9**  
Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA

**UNIT II MOBILE TELECOMMUNICATION SYSTEM 9**  
Introduction to Cellular Systems - GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS-UMTS – Architecture – Handover - Security

**UNIT III MOBILE NETWORK LAYER 9**  
Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks ( VANET) –MANET Vs VANET – Security.

**UNIT IV MOBILE TRANSPORT AND APPLICATION LAYER 9**  
Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML

**UNIT V MOBILE PLATFORMS AND APPLICATIONS 9**  
Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues

**TOTAL 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the students should be able to:**

- Explain the basics of mobile telecommunication systems
- Illustrate the generations of telecommunication systems in wireless networks
- Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network
- Explain the functionality of Transport and Application layers
- Develop a mobile application using android/blackberry/ios/Windows SDK

**TEXT BOOKS:**

1. Jochen Schiller, "Mobile Communications", PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt.Ltd, New Delhi – 2012

**REFERENCES**

1. Dharma Prakash Agarwal, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.
3. William.C.Y.Lee, "Mobile Cellular Telecommunications-Analog and Digital Systems", Second Edition, TataMcGraw Hill Edition ,2006.
4. C.K.Toth, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.

5. Android Developers : <http://developer.android.com/index.html>
6. Apple Developer : <https://developer.apple.com/>
7. Windows Phone DevCenter : <http://developer.windowsphone.com>
8. BlackBerry Developer : <http://developer.blackberry.com>

**CS8602**

**COMPILER DESIGN**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

**OBJECTIVES:**

- To learn the various phases of compiler.
- To learn the various parsing techniques.
- To understand intermediate code generation and run-time environment.
- To learn to implement front-end of the compiler.
- To learn to implement code generator.

**UNIT I INTRODUCTION TO COMPILERS 9**

Structure of a compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Lex – Finite Automata – Regular Expressions to Automata – Minimizing DFA.

**UNIT II SYNTAX ANALYSIS 12**

Role of Parser – Grammars – Error Handling – Context-free grammars – Writing a grammar – Top Down Parsing - General Strategies Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0)Item Construction of SLR Parsing Table - Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC.

**UNIT III INTERMEDIATE CODE GENERATION 8**

Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking.

**UNIT IV RUN-TIME ENVIRONMENT AND CODE GENERATION 8**

Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management - Issues in Code Generation - Design of a simple Code Generator.

**UNIT V CODE OPTIMIZATION 8**

Principal Sources of Optimization – Peep-hole optimization - DAG- Optimization of Basic Blocks- Global Data Flow Analysis - Efficient Data Flow Algorithm.

**LIST OF EXPERIMENTS:**

1. Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.). Create a symbol table, while recognizing identifiers.
2. Implement a Lexical Analyzer using Lex Tool
3. Implement an Arithmetic Calculator using LEX and YACC
4. Generate three address code for a simple program using LEX and YACC.
5. Implement simple code optimization techniques (Constant folding, Strength reduction and Algebraic transformation)
6. Implement back-end of the compiler for which the three address code is given as input and the 8086 assembly language code is produced as output.

<b>PRACTICALS</b>	<b>30</b>	<b>PERIODS</b>
<b>THEORY</b>	<b>45</b>	<b>PERIODS</b>
<b>TOTAL :</b>	<b>75</b>	<b>PERIODS</b>

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Understand the different phases of compiler.
- Design a lexical analyzer for a sample language.

- Apply different parsing algorithms to develop the parsers for a given grammar.
- Understand syntax-directed translation and run-time environment.
- Learn to implement code optimization techniques and a simple code generator.
- Design and implement a scanner and a parser using LEX and YACC tools.

#### TEXT BOOK:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools, Second Edition, Pearson Education, 2009.

#### REFERENCES

1. Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, Advanced Compiler Design and Implementation, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
3. Keith D Cooper and Linda Torczon, Engineering a Compiler, Morgan Kaufmann Publishers Elsevier Science, 2004.
4. V. Raghavan, Principles of Compiler Design, Tata McGraw Hill Education Publishers, 2010.
5. Allen I. Holub, Compiler Design in C++, Prentice-Hall Software Series, 1993.

CS8603

DISTRIBUTED SYSTEMS

L T P C  
3 0 0 3

#### OBJECTIVES:

- To understand the foundations of distributed systems.
- To learn issues related to clock Synchronization and the need for global state in distributed systems.
- To learn distributed mutual exclusion and deadlock detection algorithms.
- To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems.
- To learn the characteristics of peer-to-peer and distributed shared memory systems.

#### UNIT I INTRODUCTION

9

**Introduction:** Definition –Relation to computer system components –Motivation –Relation to parallel systems – Message-passing systems versus shared memory systems –Primitives for distributed communication –Synchronous versus asynchronous executions –Design issues and challenges. **A model of distributed computations:** A distributed program –A model of distributed executions –Models of communication networks –Global state – Cuts –Past and future cones of an event –Models of process communications. **Logical Time:** A framework for a system of logical clocks –Scalar time –Vector time – Physical clock synchronization: NTP.

#### UNIT II MESSAGE ORDERING & SNAPSHOTS

9

**Message ordering and group communication:** Message ordering paradigms –Asynchronous execution with synchronous communication –Synchronous program order on an asynchronous system –Group communication – Causal order (CO) - Total order. **Global state and snapshot recording algorithms:** Introduction –System model and definitions –Snapshot algorithms for FIFO channels

#### UNIT III DISTRIBUTED MUTEX & DEADLOCK

9

**Distributed mutual exclusion algorithms:** Introduction – Preliminaries – Lamport's algorithm – Ricart-Agrawala algorithm – Maekawa's algorithm – Suzuki-Kasami's broadcast algorithm. **Deadlock detection in distributed systems:** Introduction – System model – Preliminaries – Models of deadlocks – Knapp's classification – Algorithms for the single resource model, the AND model and the OR model.

**UNIT IV RECOVERY & CONSENSUS****9**

**Checkpointing and rollback recovery:** Introduction – Background and definitions – Issues in failure recovery – Checkpoint-based recovery – Log-based rollback recovery – Coordinated checkpointing algorithm – Algorithm for asynchronous checkpointing and recovery. **Consensus and agreement algorithms:** Problem definition – Overview of results – Agreement in a failure – free system – Agreement in synchronous systems with failures.

**UNIT V P2P & DISTRIBUTED SHARED MEMORY****9**

**Peer-to-peer computing and overlay graphs:** Introduction – Data indexing and overlays – Chord – Content addressable networks – Tapestry. **Distributed shared memory:** Abstraction and advantages – Memory consistency models – Shared memory Mutual Exclusion.

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of this course, the students will be able to:**

- Elucidate the foundations and issues of distributed systems
- Understand the various synchronization issues and global state for distributed systems.
- Understand the Mutual Exclusion and Deadlock detection algorithms in distributed systems
- Describe the agreement protocols and fault tolerance mechanisms in distributed systems.
- Describe the features of peer-to-peer and distributed shared memory systems

**TEXT BOOKS:**

1. Kshemkalyani, Ajay D., and Mukesh Singhal. Distributed computing: principles, algorithms, and systems. Cambridge University Press, 2011.
2. George Coulouris, Jean Dollimore and Tim Kindberg, “Distributed Systems Concepts and Design”, Fifth Edition, Pearson Education, 2012.

**REFERENCES:**

1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
2. Mukesh Singhal and Niranjana G. Shivaratri. Advanced concepts in operating systems. McGraw-Hill, Inc., 1994.
3. Tanenbaum A.S., Van Steen M., “Distributed Systems: Principles and Paradigms”, Pearson Education, 2007.
4. Liu M.L., “Distributed Computing, Principles and Applications”, Pearson Education, 2004.
5. Nancy A Lynch, “Distributed Algorithms”, Morgan Kaufman Publishers, USA, 2003.

**CS8661****INTERNET PROGRAMMING LABORATORY****L T P C****0 0 4 2****OBJECTIVES:**

- To be familiar with Web page design using HTML/XML and style sheets
- To be exposed to creation of user interfaces using Java frames and applets.
- To learn to create dynamic web pages using server side scripting.
- To learn to write Client Server applications.
- To be familiar with the PHP programming.
- To be exposed to creating applications with AJAX

**LIST OF EXPERIMENTS**

1. Create a web page with the following using HTML
  - a. To embed a map in a web page
  - b. To fix the hot spots in that map
  - c. Show all the related information when the hot spots are clicked.

2. Create a web page with the following.
  - a. Cascading style sheets.
  - b. Embedded style sheets.
  - c. Inline style sheets. Use our college information for the web pages.
3. Validate the Registration, user login, user profile and payment by credit card pages using JavaScript.
4. Write programs in Java using Servlets:
  - i. To invoke servlets from HTML forms
  - ii. Session tracking using hidden form fields and Session tracking for a hit count
5. Write programs in Java to create three-tier applications using servlets for conducting on-line examination for displaying student mark list. Assume that student information is available in a database which has been stored in a database server.
6. Install TOMCAT web server. Convert the static web pages of programs into dynamic web pages using servlets (or JSP) and cookies. Hint: Users information (user id, password, credit card number) would be stored in web.xml. Each user should have a separate Shopping Cart.
7. Redo the previous task using JSP by converting the static web pages into dynamic web pages. Create a database with user information and books information. The books catalogue should be dynamically loaded from the database.
8. Create and save an XML document at the server, which contains 10 users Information. Write a Program, which takes user Id as an input and returns the User details by taking the user information from the XML document
9.
  - i. Validate the form using PHP regular expression.
  - ii. PHP stores a form data into database.
10. Write a web service for finding what people think by asking 500 people's opinion for any consumer product.

**TOTAL: 60PERIODS**

**OUTCOMES:**

**Upon Completion of the course, the students will be able to:**

- Construct Web pages using HTML/XML and style sheets.
- Build dynamic web pages with validation using Java Script objects and by applying different event handling mechanisms.
- Develop dynamic web pages using server side scripting.
- Use PHP programming to develop web applications.
- Construct web applications using AJAX and web services.

**SOFTWARE REQUIRED:**

- Dream Weaver or Equivalent, MySQL or Equivalent, Apache Server, WAMP/XAMPP

<b>CS8662</b>	<b>MOBILE APPLICATION DEVELOPMENT LABORATORY</b>	<b>L T P C</b>
		<b>0 0 4 2</b>

**OBJECTIVES:**

- To understand the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
- To understand how to work with various mobile application development frameworks.
- To learn the basic and important design concepts and issues of development of mobile applications.
- To understand the capabilities and limitations of mobile devices.

## LIST OF EXPERIMENTS

1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Write an application that draws basic graphical primitives on the screen.
4. Develop an application that makes use of databases.
5. Develop an application that makes use of Notification Manager
6. Implement an application that uses Multi-threading
7. Develop a native application that uses GPS location information
8. Implement an application that writes data to the SD card.
9. Implement an application that creates an alert upon receiving a message
10. Write a mobile application that makes use of RSS feed
11. Develop a mobile application to send an email.
12. Develop a Mobile application for simple needs (Mini Project)

**TOTAL: 60 PERIODS**

## OUTCOMES:

**Upon Completion of the course, the students will be able to:**

- Develop mobile applications using GUI and Layouts.
- Develop mobile applications using Event Listener.
- Develop mobile applications using Databases.
- Develop mobile applications using RSS Feed, Internal/External Storage, SMS, Multi-threading and GPS.
- Analyze and discover own mobile app for simple needs.

## REFERENCES:

1. Build Your Own Security Lab, Michael Gregg, Wiley India

## LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Standalone desktops with Windows or Android or

iOS or Equivalent Mobile Application Development

Tools with appropriate emulators and debuggers - 30 Nos.

**HS8581**

**PROFESSIONAL COMMUNICATION**

L	T	P	C
0	0	2	1

## OBJECTIVES:

**The course aims to:**

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

## UNIT I

Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

## UNIT II

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

### UNIT III

Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -- questioning and clarifying –GD strategies- activities to improve GD skills

### UNIT IV

Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

### UNIT V

Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

**TOTAL : 30 PERIODS**

### OUTCOMES:

**At the end of the course Learners will be able to:**

- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

### Recommended Software

1. Open Source Software
2. Win English

### REFERENCES:

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Interact English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

**MG8591**

**PRINCIPLES OF MANAGEMENT**

**LT P C**

**3 0 0 3**

### OBJECTIVES:

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization .

### UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

**9**

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

### UNIT II PLANNING

**9**

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

### UNIT III ORGANISING

**9**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority –

centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management

**UNIT IV DIRECTING 9**

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication –communication and IT.

**UNIT V CONTROLLING 9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

**TEXTBOOKS:**

1. Stephen P. Robbins & Mary Coulter, “Management”, Prentice Hall (India) Pvt. Ltd., 10<sup>th</sup> Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, Pearson Education, 6th Edition, 2004.

**REFERENCES:**

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, “Fundamentals of Management” Pearson Education, 7th Edition, 2011.
2. Robert Kreitner & Mamata Mohapatra, “ Management”, Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich “Essentials of management” Tata McGraw Hill,1998.
4. Tripathy PC & Reddy PN, “Principles of Management”, Tata McGraw Hill, 1999

<b>CS8792</b>	<b>CRYPTOGRAPHY AND NETWORK SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand Cryptography Theories, Algorithms and Systems.
- To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

**UNIT I INTRODUCTION 9**

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.

**UNIT II SYMMETRIC KEY CRYPTOGRAPHY 9**

MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures - Modular arithmetic-Euclid’s algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 –

Key distribution.

**UNIT III PUBLIC KEY CRYPTOGRAPHY 9**

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

**UNIT IV MESSAGE AUTHENTICATION AND INTEGRITY 9**

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509

**UNIT V SECURITY PRACTICE AND SYSTEM SECURITY 9**

Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.

**TOTAL 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Understand the fundamentals of networks security, security architecture, threats and vulnerabilities
- Apply the different cryptographic operations of symmetric cryptographic algorithms
- Apply the different cryptographic operations of public key cryptography
- Apply the various Authentication schemes to simulate different applications.
- Understand various Security practices and System security standards

**TEXT BOOK:**

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006.

**REFERENCES:**

1. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd
2. BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.
3. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2

**CS8791**

**CLOUD COMPUTING**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To understand the concept of cloud computing.
- To appreciate the evolution of cloud from the existing technologies.
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.

**UNIT I INTRODUCTION 9**

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning.

**UNIT II CLOUD ENABLING TECHNOLOGIES 10**

Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish-Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices – Virtualization Support and Disaster Recovery.

**UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE 8**

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - IaaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

**UNIT IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD 10**

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.

**UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS 8**

Hadoop – MapReduce – Virtual Box -- Google App Engine – Programming Environment for Google App Engine — Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
- Learn the key and enabling technologies that help in the development of cloud.
- Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.
- Explain the core issues of cloud computing such as resource management and security.
- Be able to install and use current cloud technologies.
- Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

**TEXT BOOKS:**

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017.

**REFERENCES:**

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach", Tata Mcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)", O'Reilly, 2009.

**OBJECTIVES:**

- To develop web applications in cloud
  - To learn the design and development process involved in creating a cloud based application
  - To learn to implement and use parallel programming using Hadoop
1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
  2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
  3. Install Google App Engine. Create *hello world* app and other simple web applications using python/java.
  4. Use GAE launcher to launch the web applications.
  5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
  6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
  7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
  8. Install Hadoop single node cluster and run simple applications like wordcount.

**TOTAL : 60 PERIODS****OUTCOMES:****On completion of this course, the students will be able to:**

- Configure various virtualization tools such as Virtual Box, VMware workstation.
- Design and deploy a web application in a PaaS environment.
- Learn how to simulate a cloud environment to implement new schedulers.
- Install and use a generic cloud environment that can be used as a private cloud.
- Manipulate large data sets in a parallel environment.

**OBJECTIVES:**

- To learn different cipher techniques
- To implement the algorithms DES, RSA, MD5, SHA-1
- To use network security tools and vulnerability assessment tools

**LIST OF EXPERIMENTS**

1. Perform encryption, decryption using the following substitution techniques  
(i) Ceaser cipher, (ii) playfair cipher iii) Hill Cipher iv) Vigenere cipher
2. Perform encryption and decryption using following transposition techniques  
i) Rail fence ii) row & Column Transformation
3. Apply DES algorithm for practical applications.
4. Apply AES algorithm for practical applications.
5. Implement RSA Algorithm using HTML and JavaScript
6. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
7. Calculate the message digest of a text using the SHA-1 algorithm.
8. Implement the SIGNATURE SCHEME - Digital Signature Standard.
9. Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.

- 10. Automated Attack and Penetration Tools  
Exploring N-Stalker, a Vulnerability Assessment Tool
- 11. Defeating Malware  
i) Building Trojans ii) Rootkit Hunter

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**Upon Completion of the course, the students will be able to:**

- Develop code for classical Encryption Techniques to solve the problems.
- Build cryptosystems by applying symmetric and public key encryption algorithms.
- Construct code for authentication algorithms.
- Develop a signature scheme using Digital signature standard.
- Demonstrate the network security system using open source tools

**REFERENCES:**

1. Build Your Own Security Lab, Michael Gregg, Wiley India

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS: SOFTWARE:** C / C++ / Java or equivalent compiler GnuPG, Snort, N-Stalker or Equivalent **HARDWARE:** Standalone desktops - 30 Nos. (or) Server supporting 30 terminals or more.

**CS8811**

**PROJECT WORK**

**L T P C**  
**0 0 20 10**

**OBJECTIVES:**

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL: 300 PERIODS**

**OUTCOME:**

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

**CS8075**

**DATA WAREHOUSING AND DATA MINING**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To understand data warehouse concepts, architecture, business analysis and tools
- To understand data pre-processing and data visualization techniques
- To study algorithms for finding hidden and interesting patterns in data
- To understand and apply various classification and clustering techniques using tools.

- UNIT I DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING (OLAP) 9**  
 Basic Concepts - Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors - Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.
- UNIT II DATA MINING – INTRODUCTION 9**  
 Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.
- UNIT III DATA MINING - FREQUENT PATTERN ANALYSIS 9**  
 Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns
- UNIT IV CLASSIFICATION AND CLUSTERING 9**  
 Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines — Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy.
- Clustering Techniques – Cluster analysis-Partitioning Methods - Hierarchical Methods – Density Based Methods - Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.
- UNIT V WEKA TOOL 9**  
 Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database - Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students should be able to:**

- Design a Data warehouse system and perform business analysis with OLAP tools.
- Apply suitable pre-processing and visualization techniques for data analysis
- Apply frequent pattern and association rule mining techniques for data analysis
- Apply appropriate classification and clustering techniques for data analysis

**TEXT BOOK:**

1. Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2012.

**REFERENCES:**

1. Alex Berson and Stephen J.Smith, “Data Warehousing, Data Mining & OLAP”, Tata McGraw – Hill Edition, 35<sup>th</sup> Reprint 2016.
2. K.P. Soman, Shyam Diwakar and V. Ajay, “Insight into Data Mining Theory and Practice”, Eastern Economy Edition, Prentice Hall of India, 2006.
3. Ian H.Witten and Eibe Frank, “Data Mining: Practical Machine Learning Tools and Techniques”, Elsevier, Second Edition.

**OBJECTIVES:**

- To learn the criteria for test cases.
- To learn the design of test cases.
- To understand test management and test automation techniques.
- To apply test metrics and measurements.

**UNIT I INTRODUCTION****9**

Testing as an Engineering Activity – Testing as a Process – Testing Maturity Model- Testing axioms – Basic definitions – Software Testing Principles – The Tester’s Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design –Defect Examples- Developer/Tester Support of Developing a Defect Repository.

**UNIT II TEST CASE DESIGN STRATEGIES****9**

Test case Design Strategies – Using Black Box Approach to Test Case Design – Boundary Value Analysis – Equivalence Class Partitioning – State based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing - Random Testing – Requirements based testing – Using White Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing – Additional White box testing approaches- Evaluating Test Adequacy Criteria.

**UNIT III LEVELS OF TESTING****9**

The need for Levels of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility testing – Configuration testing –Compatibility testing – Testing the documentation – Website testing.

**UNIT IV TEST MANAGEMENT****9**

People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group- The Structure of Testing Group- .The Technical Training Program.

**UNIT V TEST AUTOMATION****9**

Software test automation – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of the course the students will be able to:**

- Design test cases suitable for a software development for different domains.
- Identify suitable tests to be carried out.
- Prepare test planning based on the document.
- Document test plans and test cases designed.
- Use automatic testing tools.
- Develop and validate a test plan.

**TEXT BOOKS:**

1. Srinivasan Desikan and Gopaldaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education, 2006.
2. Ron Patton, "Software Testing", Second Edition, Sams Publishing, Pearson Education, 2007.  
AU Library.com

**REFERENCES:**

1. Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2003.
2. Edward Kit, "Software Testing in the Real World – Improving the Process", Pearson Education, 1995.
3. Boris Beizer, "Software Testing Techniques" – 2nd Edition, Van Nostrand Reinhold, New York, 1990.
4. Aditya P. Mathur, "Foundations of Software Testing \_ Fundamental Algorithms and Techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.

**IT8072****EMBEDDED SYSTEMS****L T P C  
3 0 0 3****OBJECTIVES:**

- To learn the architecture and programming of ARM processor.
- To become familiar with the embedded computing platform design and analysis.
- To get thorough knowledge in interfacing concepts
- To design an embedded system and to develop programs

**UNIT I INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS 9**

Complex systems and micro processors– Embedded system design process –Design example: Model train controller- Instruction sets preliminaries - ARM Processor – CPU: programming input and output- supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance- CPU power consumption.

**UNIT II EMBEDDED COMPUTING PLATFORM DESIGN 9**

The CPU Bus-Memory devices and systems–Designing with computing platforms – consumer electronics architecture – platform-level performance analysis - Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.

**UNIT III SENSOR INTERFACING WITH ARDUINO 9**

Basics of hardware design and functions of basic passive components-sensors and actuators- Arduino code - library file for sensor interfacing-construction of basic applications

**UNIT IV EMBEDDED FIRMWARE 9**

Reset Circuit, Brown-out Protection Circuit-Oscillator Unit - Real Time Clock-Watchdog Timer - Embedded Firmware Design Approaches and Development Languages.

**UNIT V EMBEDDED C PROGRAMMING 9**

Introduction-Creating 'hardware delays' using Timer 0 and Timer 1-Reading switches-Adding Structure to the code-Generating a minimum and maximum delay-Example: Creating a portable hardware delay- Timeout mechanisms-Creating loop timeouts-Testing loop timeouts- hardware timeouts-Testing a hardware timeout

**TOTAL : 45 PERIODS**

## OUTCOMES:

Upon completion of the course, students will be able to:

- Describe the architecture and programming of ARM processor.
- Explain the concepts of embedded systems
- Understand the Concepts of peripherals and interfacing of sensors.
- Capable of using the system design techniques to develop firmware
- Illustrate the code for constructing a system

## TEXT BOOKS:

1. Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", Third Edition "Morgan Kaufmann Publisher (An imprint from Elsevier), 2012. (unit I & II)
- 2 <https://www.coursera.org/learn/interface-with-arduino#syllabus> (Unit III)
- 3 .Michael J. Pont, "Embedded C", 2 nd Edition, Pearson Education, 2008.(Unit IV & V)

## REFERENCES:

1. Shibu K.V, "Introduction to Embedded Systems", McGraw Hill.2014
2. Jonathan W. Valvano, "Embedded Microcomputer Systems Real Time Interfacing", Third Edition Cengage Learning, 2012
- 3 Raj Kamal, "Embedded Systems-Architecture, programming and design", 3 edition, TMH.2015
4. Lyla, "Embedded Systems", Pearson , 2013
6. David E. Simon, "An Embedded Software Primer", Pearson Education, 2000.

**CS8072**

**AGILE METHODOLOGIES**

**L T P C**  
**3 0 0 3**

## OBJECTIVES:

- To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software.
- To provide a good understanding of software design and a set of software technologies and APIs.
- To do a detailed examination and demonstration of Agile development and testing techniques.
- To understand the benefits and pitfalls of working in an Agile team.
- To understand Agile development and testing.

## UNIT I AGILE METHODOLOGY

**9**

Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values

## UNIT II AGILE PROCESSES

**9**

Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.

## UNIT III AGILITY AND KNOWLEDGE MANAGEMENT

**9**

Agile Information Systems – Agile Decision Making - Earl'S Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment , Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).

**UNIT IV      AGILITY AND REQUIREMENTS ENGINEERING      9**

Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.

**UNIT V      AGILITY AND QUALITY ASSURANCE      9**

Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance - Test Driven Development – Agile Approach in Global Software Development.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Realize the importance of interacting with business stakeholders in determining the requirements for a software system
- Perform iterative software development processes: how to plan them, how to execute them.
- Point out the impact of social aspects on software development success.
- Develop techniques and tools for improving team collaboration and software quality.
- Perform Software process improvement as an ongoing task for development teams.
- Show how agile approaches can be scaled up to the enterprise level.

**TEXT BOOKS:**

1. David J. Anderson and Eli Schragenheim, “Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results”, Prentice Hall, 2003.
2. Hazza and Dubinsky, “Agile Software Engineering, Series: Undergraduate Topics in Computer Science”, Springer, 2009.

**REFERENCES:**

1. Craig Larman, “Agile and Iterative Development: A Manager’s Guide”, Addison-Wesley, 2004.
2. Kevin C. Desouza, “Agile Information Systems: Conceptualization, Construction, and Management”, Butterworth-Heinemann, 2007.

<b>CS8077</b>	<b>GRAPH THEORY AND APPLICATIONS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand fundamentals of graph theory.
- To study proof techniques related to various concepts in graphs.
- To explore modern applications of graph theory.

**UNIT I      9**

Introduction - Graph Terminologies - Types of Graphs - Sub Graph- Multi Graph - Regular Graph - Isomorphism - Isomorphic Graphs - Sub-graph - Euler graph - Hamiltonian Graph - Related Theorems.

**UNIT II      9**

Trees -Properties- Distance and Centres - Types - Rooted Tree-- Tree Enumeration- Labeled Tree - Unlabeled Tree - Spanning Tree - Fundamental Circuits- Cut Sets - Properties - Fundamental Circuit and Cut-set- Connectivity- Separability -Related Theorems.

**UNIT III** **9**  
 Network Flows - Planar Graph - Representation - Detection - Dual Graph - Geometric and Combinatorial Dual - Related Theorems - Digraph - Properties - Euler Digraph.

**UNIT IV** **9**  
 Matrix Representation - Adjacency matrix- Incidence matrix- Circuit matrix - Cut-set matrix - Path Matrix- Properties - Related Theorems - Correlations. Graph Coloring - Chromatic Polynomial - Chromatic Partitioning - Matching - Covering - Related Theorems.

**UNIT V** **9**  
 Graph Algorithms- Connectedness and Components- Spanning Tree- Fundamental Circuits- Cut Vertices- Directed Circuits- Shortest Path - Applications overview.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon completion of this course, the students should be able to**

- Understand the basic concepts of graphs, and different types of graphs
- Understand the properties, theorems and be able to prove theorems.
- Apply suitable graph model and algorithm for solving applications.

**TEXT BOOKS:**

1. Narsingh Deo, "Graph Theory with Application to Engineering and Computer Science", Prentice-Hall of India Pvt.Ltd, 2003.
2. L.R.Foulds , "Graph Theory Applications", Springer ,2016.

**REFERENCES:**

1. Bondy, J. A. and Murty, U.S.R., "Graph Theory with Applications", North Holland Publication,2008.
2. West, D. B., "Introduction to Graph Theory", Pearson Education, 2011.
3. John Clark, Derek Allan Holton, "A First Look at Graph Theory", World Scientific Publishing Company, 1991.
4. Diestel, R, "Graph Theory", Springer,3rd Edition,2006.
5. Kenneth H.Rosen, "Discrete Mathematics and Its Applications", Mc Graw Hill , 2007.

<b>IT8071</b>	<b>DIGITAL SIGNAL PROCESSING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the basics of discrete time signals, systems and their classifications.
- To analyze the discrete time signals in both time and frequency domain.
- To design lowpass digital IIR filters according to predefined specifications based on analog filter theory and analog-to-digital filter transformation.
- To design Linear phase digital FIR filters using fourier method, window technique
- To realize the concept and usage of DSP in various engineering fields.

**UNIT I DISCRETE TIME SIGNALS AND SYSTEMS** **9**  
 Introduction to DSP – Basic elements of DSP– Sampling of Continuous time signals–Representation, Operation and Classification of Discrete Time Signal–Classification of Discrete Time Systems– Discrete Convolution: Linear and Circular–Correlation.

**UNIT II ANALYSIS OF LTI DISCRETE TIME SIGNALS AND SYSTEMS** **9**  
 Analysis of LTI Discrete Time Systems using DFT–Properties of DFT–Inverse DFT– Analysis of LTI Discrete Time Systems using FFT Algorithms– Inverse DFT using FFT Algorithm.

**UNIT III INFINITE IMPULSE RESPONSE FILTERS 9**

Frequency response of Analog and Digital IIR filters–Realization of IIR filter–Design of analog low pass filter–Analog to Digital filter Transformation using Bilinear Transformation and Impulse Invariant method–Design of digital IIR filters (LPF, HPF, BPF, and BRF) using various transformation techniques.

**UNIT IV FINITE IMPULSE RESPONSE FILTERS 9**

Linear Phase FIR filter–Phase delay–Group delay–Realization of FIR filter–Design of Causal and Non-causal FIR filters (LPF, HPF, BPF and BRF) using Window method (Rectangular, Hamming window, Hanning window) –Frequency Sampling Technique.

**UNIT V APPLICATIONS OF DSP 9**

Multirate Signal Processing: Decimation, Interpolation, Spectrum of the sampled signal –Processing of Audio and Radar signal.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the students should be able to:**

- Perform mathematical operations on signals.
- Understand the sampling theorem and perform sampling on continuous-time signals to get discrete time signal by applying advanced knowledge of the sampling theory.
- Transform the time domain signal into frequency domain signal and vice-versa.
- Apply the relevant theoretical knowledge to design the digital IIR/FIR filters for the given analog specifications.

**TEXT BOOK:**

1. John G. Proakis & Dimitris G. Manolakis, “Digital Signal Processing – Principles, Algorithms & Applications”, Fourth Edition, Pearson Education / Prentice Hall, 2007.

**REFERENCES**

1. Richard G. Lyons, “*Understanding Digital Signal Processing*”. Second Edition, Pearson Education.
2. A.V. Oppenheim, R.W. Schafer and J.R. Buck, “*Discrete-Time Signal Processing*”, 8th Indian Reprint, Pearson, 2004.
3. Emmanuel C. Ifeachor, & Barrie.W. Jervis, “*Digital Signal Processing*”, Second Edition, Pearson Education / Prentice Hall, 2002.
4. William D. Stanley, “Digital Signal Processing”, Second Edition, Reston Publications.

**GE8075**

**INTELLECTUAL PROPERTY RIGHTS**

**L T P C  
3 0 0 3**

**OBJECTIVE:**

- To give an idea about IPR, registration and its enforcement.

**UNIT I INTRODUCTION 9**

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

**UNIT II REGISTRATION OF IPRs 10**

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

**UNIT III AGREEMENTS AND LEGISLATIONS 10**  
 International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

**UNIT IV DIGITAL PRODUCTS AND LAW 9**  
 Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

**UNIT V ENFORCEMENT OF IPRs 7**  
 Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

**TOTAL : 45 PERIODS**

**OUTCOME:**

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

**TEXT BOOKS:**

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S. V. Satakar, "Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002

**REFERENCES:**

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

**CS8091 BIG DATA ANALYTICS L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To know the fundamental concepts of big data and analytics.
- To explore tools and practices for working with big data
- To learn about stream computing.
- To know about the research that requires the integration of large amounts of data.

**UNIT I INTRODUCTION TO BIG DATA 9**  
 Evolution of Big data - Best Practices for Big data Analytics - Big data characteristics - Validating - The Promotion of the Value of Big Data - Big Data Use Cases- Characteristics of Big Data Applications - Perception and Quantification of Value -Understanding Big Data Storage - A General Overview of High-Performance Architecture - HDFS - MapReduce and YARN - Map Reduce Programming Model

**UNIT II CLUSTERING AND CLASSIFICATION 9**  
 Advanced Analytical Theory and Methods: Overview of Clustering - K-means - Use Cases - Overview of the Method - Determining the Number of Clusters - Diagnostics - Reasons to Choose and Cautions .- Classification: Decision Trees - Overview of a Decision Tree - The General Algorithm - Decision Tree Algorithms - Evaluating a Decision Tree - Decision Trees in R - Naïve Bayes - Bayes' Theorem - Naïve Bayes Classifier.

**UNIT III ASSOCIATION AND RECOMMENDATION SYSTEM 9**

Advanced Analytical Theory and Methods: Association Rules - Overview - Apriori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Finding Association & finding similarity - Recommendation System: Collaborative Recommendation- Content Based Recommendation - Knowledge Based Recommendation- Hybrid Recommendation Approaches.

**UNIT IV STREAM MEMORY 9**

Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing, Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating moments – Counting oneness in a Window – Decaying Window – Real time Analytics Platform(RTAP) applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics

**UNIT V NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION 9**

NoSQL Databases : Schema-less Models”: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores - Tabular Stores - Object Data Stores - Graph Databases Hive - Sharding -- Hbase – Analyzing big data with twitter - Big data for E-Commerce Big data for blogs - Review of Basic Data Analytic Methods using R.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Work with big data tools and its analysis techniques
- Analyze data by utilizing clustering and classification algorithms
- Learn and apply different mining algorithms and recommendation systems for large volumes of data
- Perform analytics on data streams
- Learn NoSQL databases and management.

**TEXT BOOKS:**

1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013.

**REFERENCES:**

1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
2. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
3. Dietmar Jannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010.
4. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015.
5. Jimmy Lin and Chris Dyer, "Data-Intensive Text Processing with MapReduce", Synthesis Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1-177, Morgan Claypool publishers, 2010.

**OBJECTIVES:**

- To understand the need for machine learning for various problem solving
- To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
- To understand the latest trends in machine learning
- To design appropriate machine learning algorithms for problem solving

**UNIT I INTRODUCTION 9**

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

**UNIT II NEURAL NETWORKS AND GENETIC ALGORITHMS 9**

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

**UNIT III BAYESIAN AND COMPUTATIONAL LEARNING 9**

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

**UNIT IV INSTANT BASED LEARNING 9**

K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning.

**UNIT V ADVANCED LEARNING 9**

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

**TOTAL :45 PERIODS****OUTCOMES:****At the end of the course, the students will be able to**

- Differentiate between supervised, unsupervised, semi-supervised machine learning approaches
- Discuss the decision tree algorithm and identify and overcome the problem of overfitting
- Discuss and apply the back propagation algorithm and genetic algorithms to various problems
- Apply the Bayesian concepts to machine learning
- Analyse and suggest appropriate machine learning approaches for various types of problems

**TEXT BOOK:**

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (India) Private Limited, 2013.

**REFERENCES:**

1. Ethem Alpaydin, "Introduction to Machine Learning (Adaptive Computation and Machine Learning)", The MIT Press 2004.
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", CRC Press, 2009.

**OBJECTIVES:**

- To develop an understanding and awareness how issues such as content, information architecture, motion, sound, design, and technology merge to form effective and compelling interactive experiences for a wide range of audiences and end users.
- To become familiar with various software programs used in the creation and implementation of multi- media
- To appreciate the importance of technical ability and creativity within design practice.
- To gain knowledge about graphics hardware devices and software used.
- To understand the two-dimensional graphics and their transformations.
- To understand the three-dimensional graphics and their transformations.
- To appreciate illumination and color models
- To become familiar with understand clipping techniques
- To become familiar with Blender Graphics

**UNIT I ILLUMINATION AND COLOR MODELS 9**

Light sources - basic illumination models – halftone patterns and dithering techniques; Properties of light - Standard primaries and chromaticity diagram; Intuitive colour concepts - RGB colour model - YIQ colour model - CMY colour model - HSV colour model - HLS colour model; Colour selection. Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.

**UNIT II TWO-DIMENSIONAL GRAPHICS 9**

Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; window-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.

**UNIT III THREE-DIMENSIONAL GRAPHICS 9**

Three dimensional concepts; Three dimensional object representations – Polygon surfaces- Polygon tables- Plane equations - Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces -B-Spline curves and surfaces. TRANSFORMATION AND VIEWING: Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.

**UNIT IV MULTIMEDIA SYSTEM DESIGN & MULTIMEDIA FILE HANDLING 9**

Multimedia basics – Multimedia applications – Multimedia system architecture – Evolving technologies for multimedia – Defining objects for multimedia systems – Multimedia data interface standards – Multimedia databases. Compression and decompression – Data and file format standards – Multimedia I/O technologies – Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval technologies.

**UNIT V HYPERMEDIA 9**

Multimedia authoring and user interface - Hypermedia messaging -Mobile messaging – Hypermedia message component – Creating hypermedia message – Integrated multimedia message standards – Integrated document management – Distributed multimedia systems.**CASE STUDY: BLENDER GRAPHICS** Blender Fundamentals – Drawing Basic Shapes – Modelling – Shading & Textures

**TOTAL: 45 PERIODS**

## OUTCOMES:

At the end of the course, the students should be able to:

- Design two dimensional graphics.
- Apply two dimensional transformations.
- Design three dimensional graphics.
- Apply three dimensional transformations.
- Apply Illumination and color models.
- Apply clipping techniques to graphics.
- Understood Different types of Multimedia File Format
- Design Basic 3d Scenes using Blender

## TEXT BOOKS:

1. Donald Hearn and Pauline Baker M, "Computer Graphics", Prentice Hall, New Delhi, 2007 [ UNIT I – III ]
2. Andleigh, P. K and Kiran Thakrar, "Multimedia Systems and Design", PHI, 2003. [ UNIT IV,V ]

## REFERENCES:

1. Judith Jeffcoate, "Multimedia in practice: Technology and Applications", PHI, 1998.
2. Foley, Vandam, Feiner and Hughes, "Computer Graphics: Principles and Practice", 2<sup>nd</sup> Edition, Pearson Education, 2003.
3. Jeffrey McConnell, "Computer Graphics: Theory into Practice", Jones and Bartlett Publishers,2006.
4. Hill F S Jr., "Computer Graphics", Maxwell Macmillan , 1990.
5. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, "Fundamentals of Computer Graphics", CRC Press, 2010.
6. William M. Newman and Robert F.Sproull, "Principles of Interactive Computer Graphics", Mc Graw Hill 1978.  
<https://www.blender.org/support/tutorials/>

IT8075

SOFTWARE PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

## OBJECTIVES:

- To understand the Software Project Planning and Evaluation techniques.
- To plan and manage projects at each stage of the software development life cycle (SDLC).
- To learn about the activity planning and risk management principles.
- To manage software projects and control software deliverables.
- To develop skills to manage the various phases involved in project management and people management.
- To deliver successful software projects that support organization's strategic goals.

## UNIT I

### PROJECT EVALUATION AND PROJECT PLANNING

9

Importance of Software Project Management – Activities - Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

**UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9**

Software process and Process Models – Choice of Process models - Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II - a Parametric Productivity Model.

**UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 9**

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

**UNIT IV PROJECT MANAGEMENT AND CONTROL 9**

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

**UNIT V STAFFING IN SOFTWARE PROJECTS 9**

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

**TOTAL 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the students should be able to:**

- Understand Project Management principles while developing software.
- Gain extensive knowledge about the basic project management concepts, framework and the process models.
- Obtain adequate knowledge about software process models and software effort estimation techniques.
- Estimate the risks involved in various project activities.
- Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.
- Learn staff selection process and the issues related to people management

**TEXT BOOK:**

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

**REFERENCES:**

1. Robert K. Wysocki “Effective Software Project Management” – Wiley Publication, 2011.
2. Walker Royce: “Software Project Management”- Addison-Wesley, 1998.
3. Gopaldaswamy Ramesh, “Managing Global Software Projects” – McGraw Hill Education (India), Fourteenth Reprint 2013.

**OBJECTIVES:**

- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

**UNIT I FUNDAMENTALS OF IoT****9**

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

**UNIT II IoT PROTOCOLS****9**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

**UNIT III DESIGN AND DEVELOPMENT****9**

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

**UNIT IV DATA ANALYTICS AND SUPPORTING SERVICES****9**

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG

**UNIT V CASE STUDIES/INDUSTRIAL APPLICATIONS****9**

Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

**TOTAL : 45 PERIODS****OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Explain the concept of IoT.
- Analyze various protocols for IoT.
- Design a PoC of an IoT system using Raspberry Pi/Arduino
- Apply data analytics and use cloud offerings related to IoT.
- Analyze applications of IoT in real time scenario

**TEXTBOOK:**

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

## REFERENCES:

1. Arshdeep Bahga, Vijay Madiseti, "Internet of Things – A hands-on approach", Universities Press, 2015
2. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012 (for Unit 2).
3. Jan Ho" Iler, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.
5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2<sup>nd</sup> Edition, O'Reilly\_Media, 2011.  
<https://www.arduino.cc/>  
[https://www.ibm.com/smarterplanet/us/en/?ca=v\\_smarterplanet](https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet)

**IT8074**

**SERVICE ORIENTED ARCHITECTURE**

**L T P C**

**3 0 0 3**

## OBJECTIVES:

- To learn fundamentals of XML
- To provide an overview of Service Oriented Architecture and Web services and their importance
- To learn web services standards and technologies
- To learn service oriented analysis and design for developing SOA based applications

### **UNIT I XML**

**9**

XML document structure – Well-formed and valid documents – DTD – XML Schema – Parsing XML using DOM, SAX – XPath - XML Transformation and XSL – Xquery

### **UNIT II SERVICE ORIENTED ARCHITECTURE (SOA) BASICS**

**9**

Characteristics of SOA, Benefits of SOA , Comparing SOA with Client-Server and Distributed architectures --- Principles of Service Orientation – Service layers

### **UNIT III WEB SERVICES (WS) AND STANDARDS**

**8**

Web Services Platform – Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Service-Level Interaction Patterns – Orchestration and Choreography

### **UNIT IV WEB SERVICES EXTENSIONS**

**8**

WS-Addressing - WS-ReliableMessaging - WS-Policy – WS-Coordination – WS -Transactions - WS-Security - Examples

### **UNIT V SERVICE ORIENTED ANALYSIS AND DESIGN**

**11**

SOA delivery strategies – Service oriented analysis – Service Modelling – Service oriented design – Standards and composition guidelines -- Service design – Business process design – Case Study

**TOTAL : 45 PERIODS**

## OUTCOMES:

**Upon successful completion of this course, the students will be able to:**

- Understand XML technologies
- Understand service orientation, benefits of SOA
- Understand web services and WS standards
- Use web services extensions to develop solutions
- Understand and apply service modeling, service oriented analysis and design for application development

**TEXTBOOKS:**

1. Thomas Erl, "Service Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2005
2. Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services: An Architect's Guide", Prentice Hall, 2004

**REFERENCES:**

1. James McGovern, Sameer Tyagi, Michael E Stevens, Sunil Mathew, "Java Web Services Architecture", Elsevier, 2003.
2. Ron Schmelzer et al. "XML and Web Services", Pearson Education, 2002.
3. Frank P.Coyle, "XML, Web Services and the Data Revolution", Pearson Education, 2002

**GE8077**

**TOTAL QUALITY MANAGEMENT**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

- To facilitate the understanding of Quality Management principles and process.

**UNIT I INTRODUCTION**

**9**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

**UNIT II TQM PRINCIPLES**

**9**

Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

**UNIT III TQM TOOLS AND TECHNIQUES I**

**9**

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

**UNIT IV TQM TOOLS AND TECHNIQUES II**

**9**

Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

**UNIT V QUALITY MANAGEMENT SYSTEM**

**9**

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration- **ENVIRONMENTAL MANAGEMENT SYSTEM:** Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

**TEXT BOOK:**

1. Dale H. Besterfield, Carol B. Michna, Glen H. Besterfield, Mary B. Sacre, Hemant Urdhware she and Rashmi Urdhware she, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

**REFERENCES:**

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8<sup>th</sup> Edition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. ISO9001-2015 standards

**CS8083****MULTI-CORE ARCHITECTURES AND PROGRAMMING****L T P C  
3 0 0 3****OBJECTIVES:**

- To understand the need for multi-core processors, and their architecture.
- To understand the challenges in parallel and multi-threaded programming.
- To learn about the various parallel programming paradigms,
- To develop multicore programs and design parallel solutions.

**UNIT I MULTI-CORE PROCESSORS****9**

Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks - Symmetric and Distributed Shared Memory Architectures – Cache coherence - Performance Issues – Parallel program design.

**UNIT II PARALLEL PROGRAM CHALLENGES****9**

Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).

**UNIT III SHARED MEMORY PROGRAMMING WITH OpenMP****9**

OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs - Library functions – Handling Data and Functional Parallelism – Handling Loops - Performance Considerations.

**UNIT IV DISTRIBUTED MEMORY PROGRAMMING WITH MPI****9**

MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation

**UNIT V PARALLEL PROGRAM DEVELOPMENT****9**

Case studies - n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.

**TOTAL: 45 PERIODS****OUTCOMES:**

**At the end of the course, the students should be able to:**

- Describe multicore architectures and identify their characteristics and challenges.
- Identify the issues in programming Parallel Processors.
- Write programs using OpenMP and MPI.
- Design parallel programming solutions to common problems.
- Compare and contrast programming for serial processors and programming for parallel processors.

**TEXT BOOKS:**

1. Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan-Kaufman/Elsevier, 2011.
2. Darryl Gove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris", Pearson, 2011 (unit 2)

**REFERENCES:**

1. Michael J Quinn, "Parallel programming in C with MPI and OpenMP", Tata McGraw Hill, 2003.
2. Victor Alessandrini, Shared Memory Application Programming, 1st Edition, Concepts and Strategies in Multicore Application Programming, Morgan Kaufmann, 2015.
3. Yan Solihin, Fundamentals of Parallel Multicore Architecture, CRC Press, 2015.

**CS8079****HUMAN COMPUTER INTERACTION****L T P C  
3 0 0 3****OBJECTIVES:**

- To learn the foundations of Human Computer Interaction.
- To become familiar with the design technologies for individuals and persons with disabilities.
- To be aware of mobile HCI.
- To learn the guidelines for user interface.

**UNIT I FOUNDATIONS OF HCI****9**

**The Human:** I/O channels – Memory – Reasoning and problem solving; **The Computer:** Devices – Memory – processing and networks; **Interaction:** Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - **Case Studies**

**UNIT II DESIGN & SOFTWARE PROCESS****9**

**Interactive Design:** Basics – process – scenarios – navigation – screen design – Iteration and prototyping. **HCI in software process:** Software life cycle – usability engineering – Prototyping in practice – design rationale. **Design rules:** principles, standards, guidelines, rules. **Evaluation Techniques – Universal Design**

**UNIT III MODELS AND THEORIES****9**

**HCI Models:** Cognitive models: Socio-Organizational issues and stakeholder requirements – Communication and collaboration models-**Hypertext, Multimedia and WWW.**

**UNIT IV MOBILE HCI****9**

**Mobile Ecosystem:** Platforms, Application frameworks- **Types of Mobile Applications:** Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, **Mobile Design:** Elements of Mobile Design, Tools. - **Case Studies**

**UNIT V WEB INTERFACE DESIGN****9**

**Designing Web Interfaces** – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - **Case Studies**

**TOTAL :45 PERIODS****OUTCOMES:**

**Upon completion of the course, the students should be able to:**

- Design effective dialog for HCI
- Design effective HCI for individuals and persons with disabilities.
- Assess the importance of user feedback.
- Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
- Develop meaningful user interface.

**TEXT BOOKS:**

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004 (UNIT I, II & III)
2. Brian Fling, "Mobile Design and Development", First Edition, O'Reilly Media Inc., 2009 (UNIT – IV)
3. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O'Reilly, 2009. (UNIT-V)

<b>CS8073</b>	<b>C# AND .NET PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To learn basic programming in C# and the object oriented programming concepts.
- To update and enhance skills in writing Windows applications, ADO.NET and ASP .NET.
- To study the advanced concepts in data connectivity, WPF, WCF and WWF with C# and .NET 4.5.
- To implement mobile applications using .Net compact framework
- To understand the working of base class libraries, their operations and manipulation of data using XML.

**UNIT I C# LANGUAGE BASICS 9**

.Net Architecture - Core C# - Variables - Data Types - Flow control - Objects and Types- Classes and Structs - Inheritance- Generics – Arrays and Tuples - Operators and Casts - Indexers

**UNIT II C# ADVANCED FEATURES 9**

Delegates - Lambdas - Lambda Expressions - Events - Event Publisher - Event Listener - Strings and Regular Expressions - Generics - Collections - Memory Management and Pointers - Errors and Exceptions - Reflection

**UNIT III BASE CLASS LIBRARIES AND DATA MANIPULATION 9**

Diagnostics -Tasks, Threads and Synchronization - .Net Security - Localization - Manipulating XML- SAX and DOM - Manipulating files and the Registry- Transactions - ADO.NET- Peer-to-Peer Networking - PNRP - Building P2P Applications - Windows Presentation Foundation (WPF).

**UNIT IV WINDOW BASED APPLICATIONS, WCF AND WWF 9**

Window based applications - Core ASP.NET- ASP.NET Web forms -Windows Communication Foundation (WCF)- Introduction to Web Services - .Net Remoting - Windows Service - Windows Workflow Foundation (WWF) - Activities – Workflows

**UNIT V .NET FRAMEWORK AND COMPACT FRAMEWORK 9**

Assemblies - Shared assemblies - Custom Hosting with CLR Objects - Appdomains - Core XAML - Bubbling and Tunneling Events- Reading and Writing XAML - .Net Compact Framework - Compact Edition Data Stores – Errors, Testing and Debugging – Optimizing performance – Packaging and Deployment – Networking and Mobile Devices

**TOTAL :45 PERIODS**



**UNIT V SECURITY IN AD HOC AND SENSOR NETWORKS****9**

Security Attacks – Key Distribution and Management – Intrusion Detection – Software based Anti-tamper techniques – Water marking techniques – Defense against routing attacks - Secure Ad hoc routing protocols – Broadcast authentication WSN protocols – TESLA – Biba – Sensor Network Security Protocols – SPINS

**TOTAL :45 PERIODS****OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Identify different issues in wireless ad hoc and sensor networks .
- To analyze protocols developed for ad hoc and sensor networks .
- To identify and understand security issues in ad hoc and sensor networks.

**TEXT BOOKS:**

1. C.Siva Ram Murthy and B.S.Manoj, “Ad Hoc Wireless Networks – Architectures and 2 Protocols”, Pearson Education, 2006.
2. Holger Karl, Andreas Willing, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley & Sons, Inc., 2005.

**REFERENCES**

1. Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, “Ad Hoc Mobile Wireless Networks”, Auerbach Publications, 2008.
2. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, “Ad Hoc and Sensor Networks: Theory and Applications (2<sup>nd</sup> Edition)”, World Scientific Publishing, 2011.
3. Walteneus Dargie, Christian Poellabauer, “Fundamentals of Wireless Sensor Networks Theory and Practice”, John Wiley and Sons, 2010
4. Xiang-Yang Li , “Wireless Ad Hoc and Sensor Networks: Theory and Applications”, 1227 th edition, Cambridge university Press,2008.

**CS8071****ADVANCED TOPICS ON DATABASES****L T P C  
3 0 0 3****OBJECTIVES:**

- To learn the modeling and design of databases.
- To acquire knowledge on parallel and distributed databases and their applications.
- To study the usage and applications of Object Oriented and Intelligent databases.
- To understand the usage of advanced data models.
- To learn emerging databases such as XML, Cloud and Big Data.
- To acquire inquisitive attitude towards research topics in databases.

**UNIT I PARALLEL AND DISTRIBUTED DATABASES****9**

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Design of Parallel Systems- Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Case Studies

**UNIT II OBJECT AND OBJECT RELATIONAL DATABASES****9**

Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL –

OQL – Object Relational and Extended – Relational Systems: Object Relational features in SQL/Oracle – Case Studies.

**UNIT III INTELLIGENT DATABASES 9**

Active Databases: Syntax and Semantics (Starburst, Oracle, DB2)- Taxonomy- Applications- Design Principles for Active Rules- Temporal Databases: Overview of Temporal Databases- TSQL2- Deductive Databases: Logic of Query Languages – Datalog- Recursive Rules-Syntax and Semantics of Datalog Languages- Implementation of Rules and Recursion- Recursive Queries in SQL- Spatial Databases- Spatial Data Types- Spatial Relationships- Spatial Data Structures- Spatial Access Methods- Spatial DB Implementation.

**UNIT IV ADVANCED DATA MODELS 9**

Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models -Concurrency Control - Transaction Commit Protocols- Multimedia Databases- Information Retrieval- Data Warehousing- Data Mining- Text Mining.

**UNIT V EMERGING TECHNOLOGIES 9**

XML Databases: XML-Related Technologies-XML Schema- XML Query Languages- Storing XML in Databases-XML and SQL- Native XML Databases- Web Databases- Geographic Information Systems- Biological Data Management- Cloud Based Databases: Data Storage Systems on the Cloud- Cloud Storage Architectures-Cloud Data Models- Query Languages- Introduction to Big Data-Storage-Analysis.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon Completion of the course, the students will be able,**

- To develop in-depth understanding of relational databases and skills to optimize database performance in practice.
- To understand and critique on each type of databases.
- To design faster algorithms in solving practical database problems.
- To implement intelligent databases and various data models.

**TEXT BOOKS:**

1. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Sixth Edition , Pearson, 2011.
2. Thomas Cannolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Fourth Edition, Pearson Education, 2008.

**REFERENCES:**

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Sixth Edition, McGraw Hill, 2011.
2. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.
3. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T.Snodgrass, V.S.Subrahmanian, Roberto Zicari, “Advanced Database Systems”, Morgan Kaufmann publishers,2006.

<b>GE8072</b>	<b>FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the global trends and development methodologies of various types of



- Manage a project from start to finish

#### TEXTBOOKS:

1. Book specially prepared by NASSCOM as per the MoU.
2. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2011.
3. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, 2005.

#### REFERENCES:

1. Hiriappa B, "Corporate Strategy – Managing the Business", Author House, 2013.
2. Peter F Drucker, "People and Performance", Butterworth – Heinemann [Elsevier], Oxford, 2004.
3. Vinod Kumar Garg and Venkita Krishnan N K, "Enterprise Resource Planning – Concepts", Second Edition, Prentice Hall, 2003.
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2013

**GE8074**

**HUMAN RIGHTS**

**L T P C**

**3 0 0 3**

#### OBJECTIVE :

- To sensitize the Engineering students to various aspects of Human Rights.

#### UNIT I

**9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

#### UNIT II

**9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

#### UNIT III

**9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

#### UNIT IV

**9**

Human Rights in India – Constitutional Provisions / Guarantees.

#### UNIT V

**9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

**TOTAL: 45 PERIODS**

#### OUTCOME:

- Engineering students will acquire the basic knowledge of human rights.

#### REFERENCES:

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

**OBJECTIVES:**

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

**UNIT I INTRODUCTION TO DISASTERS 9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

**UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Process and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

**UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

**UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

**UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

**TOTAL: 45 PERIODS****OUTCOMES:****The students will be able to**

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management.

**TEXTBOOKS:**

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

**REFERENCES**

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

**EC8093****DIGITAL IMAGE PROCESSING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

**UNIT I                    DIGITAL IMAGE FUNDAMENTALS                    9**

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

**UNIT II                    IMAGE ENHANCEMENT                    9**

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

**UNIT III                    IMAGE RESTORATION                    9**

Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering

**UNIT IV                    IMAGE SEGMENTATION                    9**

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

**UNIT V                    IMAGE COMPRESSION AND RECOGNITION                    9**

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

**TOTAL    45    PERIODS**

## **OUTCOMES:**

**At the end of the course, the students should be able to:**

- Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
- Operate on images using the techniques of smoothing, sharpening and enhancement.
- Understand the restoration concepts and filtering techniques.
- Learn the basics of segmentation, features extraction, compression and recognition methods for color models.

## **TEXT BOOKS:**

1. Rafael C. Gonzalez, Richard E. Woods, 'Digital Image Processing', Pearson, Third Edition, 2010.
2. Anil K. Jain, 'Fundamentals of Digital Image Processing', Pearson, 2002.

## **REFERENCES:**

1. Kenneth R. Castleman, 'Digital Image Processing', Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, 'Digital Image Processing using MATLAB', Pearson Education, Inc., 2011.
3. D,E. Dudgeon and RM. Mersereau, 'Multidimensional Digital Signal Processing', Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, 'Digital Image Processing', John Wiley, New York, 2002
5. Milan Sonka et al 'Image processing, analysis and machine vision', Brookes/Cole, Vikas Publishing House, 2nd edition, 1999

**CS8085**

**SOCIAL NETWORK ANALYSIS**

**L T P C  
3 0 0 3**

## **OBJECTIVES:**

- To understand the concept of semantic web and related applications.
- To learn knowledge representation using ontology.
- To understand human behaviour in social web and related communities.
- To learn visualization of social networks.

## **UNIT I INTRODUCTION**

**9**

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

## **UNIT II MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION**

**9**

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.

## **UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS**

**9**

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting

communities social network infrastructures and communities - Decentralized online social networks - Multi-Relational characterization of dynamic social network communities.

**UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES 9**

Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

**UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS 9**

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students should be able to:**

- Develop semantic web related applications.
- Represent knowledge using ontology.
- Predict human behaviour in social web and related communities.
- Visualize social networks.

**TEXT BOOKS:**

1. Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer 2007.
2. Borko Furht, "Handbook of Social Network Technologies and Applications", 1<sup>st</sup> Edition, Springer, 2010.

**REFERENCES:**

1. Guandong Xu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.

**IT8073**

**INFORMATION SECURITY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the basics of Information Security
- To know the legal, ethical and professional issues in Information Security
- To know the aspects of risk management
- To become aware of various standards in this area
- To know the technological aspects of Information Security

**UNIT I INTRODUCTION 9**

History, What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

<b>UNIT II</b>	<b>SECURITY INVESTIGATION</b>	<b>9</b>
Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies		
<b>UNIT III</b>	<b>SECURITY ANALYSIS</b>	<b>9</b>
Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk - Systems: Access Control Mechanisms, Information Flow and Confinement Problem		
<b>UNIT IV</b>	<b>LOGICAL DESIGN</b>	<b>9</b>
Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity		
<b>UNIT V</b>	<b>PHYSICAL DESIGN</b>	<b>9</b>
Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel		
<b>TOTAL</b>		<b>45 PERIODS</b>

**OUTCOMES:**

**At the end of this course, the students should be able to:**

- Discuss the basics of information security
- Illustrate the legal, ethical and professional issues in information security
- Demonstrate the aspects of risk management.
- Become aware of various standards in the Information Security System
- Design and implementation of Security Techniques.

**TEXT BOOK:**

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2003

**REFERENCES**

1. Micki Krause, Harold F. Tipton, " Handbook of Information Security Management", Vol 1-3 CRCPress LLC, 2004.
2. Stuart McClure, Joel Scrambray, George Kurtz, "Hacking Exposed", Tata McGraw-Hill, 2003
3. Matt Bishop, " Computer Security Art and Science", Pearson/PHI, 2002.

<b>CS8087</b>	<b>SOFTWARE DEFINED NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To learn the fundamentals of software defined networks.
- To understand the separation of the data plane and the control plane.
- To study about the SDN Programming.
- To study about the various applications of SDN

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Why SDN – Evolution of SDN – How SDN Works – Centralized and Distributed Control and Date Planes		
<b>UNIT II</b>	<b>OPEN FLOW &amp; SDN CONTROLLERS</b>	<b>9</b>
Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor-		

Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts

**UNIT III DATA CENTERS 9**  
Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE

**UNIT IV SDN PROGRAMMING 9**  
Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications

**UNIT V SDN 9**  
Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration

**TOTAL :45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Analyze the evolution of software defined networks
- Express the various components of SDN and their uses
- Explain the use of SDN in the current networking scenario
- Design and develop various applications of SDN

**TEXT BOOKS:**

1. Paul Goransson and Chuck Black, —Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.
2. Thomas D. Nadeau, Ken Gray, —SDN: Software Defined Networks, O'Reilly Media, 2013.

**REFERENCES:**

1. Siamak Azodolmolky, —Software Defined Networking with Open Flow, Packet Publishing, 2013.
2. Vivek Tiwari, —SDN and Open Flow for BeginnersII, Amazon Digital Services, Inc., 2013.
3. Fei Hu, Editor, —Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

**CS8074 CYBER FORENSICS L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To learn computer forensics
- To become familiar with forensics tools
- To learn to analyze and validate forensics data

**UNIT I INTRODUCTION TO COMPUTER FORENSICS 9**  
Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

**UNIT II EVIDENCE COLLECTION AND FORENSICS TOOLS 9**  
Processing Crime and Incident Scenes – Working with Windows and DOS Systems.  
**Current Computer Forensics Tools:** Software/ Hardware Tools.

**UNIT III ANALYSIS AND VALIDATION 9**  
 Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics

**UNIT IV ETHICAL HACKING 9**  
 Introduction to Ethical Hacking - Footprinting and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats - Sniffing

**UNIT V ETHICAL HACKING IN WEB 9**  
 Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.

**TOTAL 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Understand the basics of computer forensics
- Apply a number of different computer forensic tools to a given scenario
- Analyze and validate forensics data
- Identify the vulnerabilities in a given network infrastructure
- Implement real-world hacking techniques to test system security

**TEXT BOOKS:**

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, “Computer Forensics and Investigations”, Cengage Learning, India Edition, 2016.
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015.

**REFERENCES**

1. John R.Vacca, “Computer Forensics”, Cengage Learning, 2005
2. MarjieT.Britz, “Computer Forensics and Cyber Crime”: An Introduction”, 3<sup>rd</sup> Edition, Prentice Hall, 2013.
3. AnkitFadia “ Ethical Hacking” Second Edition, Macmillan India Ltd, 2006
4. Kenneth C.Brancik “Insider Computer Fraud” Auerbach Publications Taylor & Francis Group–2008.

<b>CS8086</b>	<b>SOFT COMPUTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To learn the basic concepts of Soft Computing
- To become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems.
- To apply soft computing techniques to solve problems.

**UNIT I INTRODUCTION TO SOFT COMPUTING 9**  
 Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.

**UNIT II ARTIFICIAL NEURAL NETWORKS 9**  
 Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network- Bi-directional

Associative Memory -Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models.

**UNIT III FUZZY SYSTEMS 9**

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.

**UNIT IV GENETIC ALGORITHMS 9**

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion -Mutation Operator - Bit-wise Operators -Convergence of Genetic Algorithm.

**UNIT V HYBRID SYSTEMS 9**

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP - Fuzzy ArtMap: A Brief Introduction - Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon completion of this course, the students should be able to**

- Apply suitable soft computing techniques for various applications.
- Integrate various soft computing techniques for complex problems.

**TEXT BOOKS:**

1. N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.
2. S.N.Sivanandam , S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd., 2nd Edition, 2011.
3. S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt. Ltd., 2017.

**REFERENCES:**

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2002.
2. Kwang H.Lee, "First course on Fuzzy Theory and Applications", Springer, 2005.
3. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 1996.
4. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Addison Wesley, 2003.

**GE8076**

**PROFESSIONAL ETHICS IN ENGINEERING**

**LT P C  
3 0 0 3**

**OBJECTIVES:**

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

**UNIT I HUMAN VALUES 10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

**UNIT II      ENGINEERING ETHICS      9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

**UNIT III      ENGINEERING AS SOCIAL EXPERIMENTATION      9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

**UNIT IV      SAFETY, RESPONSIBILITIES AND RIGHTS      9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

**UNIT V      GLOBAL ISSUES      8**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

**TEXT BOOKS:**

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

**REFERENCES:**

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd., New Delhi, 2013.
6. World Community Service Centre, ' Value Education', Vethathiri publications, Erode, 2011.

**Web sources:**

1. [www.onlineethics.org](http://www.onlineethics.org)
2. [www.nspe.org](http://www.nspe.org)
3. [www.globalethics.org](http://www.globalethics.org)
4. [www.ethics.org](http://www.ethics.org)

**OBJECTIVES:**

- To understand the basics of Information Retrieval.
- To understand machine learning techniques for text classification and clustering.
- To understand various search engine system operations.
- To learn different techniques of recommender system.

**UNIT I INTRODUCTION****9**

Information Retrieval – Early Developments – The IR Problem – The User’s Task – Information versus Data Retrieval - The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes - The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

**UNIT II MODELING AND RETRIEVAL EVALUATION****9**

Basic IR Models - Boolean Model - TF-IDF (Term Frequency/Inverse Document Frequency) Weighting - Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.

**UNIT III TEXT CLASSIFICATION AND CLUSTERING****9**

A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing.

**UNIT IV WEB RETRIEVAL AND WEB CRAWLING****9**

The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations -- Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

**UNIT V RECOMMENDER SYSTEM****9**

Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models.

**TOTAL: 45 PERIODS****OUTCOMES:****Upon completion of the course, the students will be able to:**

- Use an open source search engine framework and explore its capabilities
- Apply appropriate method of classification or clustering.
- Design and implement innovative features in a search engine.
- Design and implement a recommender system.

**TEXT BOOKS:**

1. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, —Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.
2. Ricci, F, Rokach, L. Shapira, B.Kantor, “Recommender Systems Handbook”, First Edition, 2011.

**REFERENCES:**

1. C. Manning, P. Raghavan, and H. Schütze, —Introduction to Information Retrieval, Cambridge University Press, 2008.
2. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, —Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

**CS8078**

**GREEN COMPUTING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To learn the fundamentals of Green Computing.
- To analyze the Green computing Grid Framework.
- To understand the issues related with Green compliance.
- To study and develop various case studies.

**UNIT I FUNDAMENTALS**

**9**

Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.

**UNIT II GREEN ASSETS AND MODELING**

**9**

Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models.

**UNIT III GRID FRAMEWORK**

**9**

Virtualization of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.

**UNIT IV GREEN COMPLIANCE**

**9**

Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.

**UNIT V CASE STUDIES**

**9**

The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
- Enhance the skill in energy saving practices in their use of hardware.
- Evaluate technology tools that can reduce paper waste and carbon footprint by the stakeholders.
- Understand the ways to minimize equipment disposal requirements .

**TEXT BOOKS:**

1. Bhuvan Unhelkar, "Green IT Strategies and Applications-Using Environmental Intelligence", CRC Press, June 2014.
2. Woody Leonhard, Katherine Murray, "Green Home computing for dummies", August 2012.

**REFERENCES:**

1. Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: steps for the Journey", Shroff/IBM rebook, 2011.
2. John Lamb, "The Greening of IT", Pearson Education, 2009.
3. Jason Harris, "Green Computing and Green IT- Best Practices on regulations & industry", Lulu.com, 2008
4. Carl speshocky, "Empowering Green Initiatives with IT", John Wiley & Sons, 2010.
5. Wu Chun Feng (editor), "Green computing: Large Scale energy efficiency", CRC Press

**CS8076****GPU ARCHITECTURE AND PROGRAMMING****L T P C  
3 0 0 3****OBJECTIVES:**

- To understand the basics of GPU architectures
- To write programs for massively parallel processors
- To understand the issues in mapping algorithms for GPUs
- To introduce different GPU programming models

**UNIT I GPU ARCHITECTURE****12**

Evolution of GPU architectures - Understanding Parallelism with GPU –Typical GPU Architecture - CUDA Hardware Overview - Threads, Blocks, Grids, Warps, Scheduling - Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory.

**UNIT II CUDA PROGRAMMING****8**

Using CUDA - Multi GPU - Multi GPU Solutions - Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions.

**UNIT III PROGRAMMING ISSUES****8**

Common Problems: CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithmic Issues, Finding and Avoiding Errors.

**UNIT IV OPENCL BASICS****8**

OpenCL Standard – Kernels – Host Device Interaction – Execution Environment – Memory Model – Basic OpenCL Examples.

**UNIT V ALGORITHMS ON GPU****9**

Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix - Matrix Multiplication - Programming Heterogeneous Cluster.

**TOTAL: 45 PERIODS****OUTCOMES:****Upon completion of the course, the students will be able to**

- Describe GPU Architecture
- Write programs using CUDA, identify issues and debug them
- Implement efficient algorithms in GPUs for common application kernels, such as matrix multiplication
- Write simple programs using OpenCL
- Identify efficient parallel programming patterns to solve problems

**TEXT BOOKS:**

1. Shane Cook, CUDA Programming: —A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing), First Edition, Morgan Kaufmann, 2012.
2. David R. Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, "Heterogeneous computing with OpenCL", 3<sup>rd</sup> Edition, Morgan Kauffman, 2015.

**REFERENCES:**

1. Nicholas Wilt, —CUDA Handbook: A Comprehensive Guide to GPU Programming, Addison - Wesley, 2013.
2. Jason Sanders, Edward Kandrot, —CUDA by Example: An Introduction to General Purpose GPU ProgrammingII, Addison - Wesley, 2010.
3. David B. Kirk, Wen-meï W. Hwu, Programming Massively Parallel Processors - A Hands-on Approach, Third Edition, Morgan Kaufmann, 2016.
4. [http://www.nvidia.com/object/cuda\\_home\\_new.html](http://www.nvidia.com/object/cuda_home_new.html)
5. <http://www.openCL.org>

**CS8084****NATURAL LANGUAGE PROCESSING****L T P C  
3 0 0 3****OBJECTIVES:**

- To learn the fundamentals of natural language processing
- To understand the use of CFG and PCFG in NLP
- To understand the role of semantics of sentences and pragmatics
- To apply the NLP techniques to IR applications

**UNIT I INTRODUCTION****9**

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

**UNIT II WORD LEVEL ANALYSIS****9**

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

**UNIT III SYNTACTIC ANALYSIS****9**

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

**UNIT IV SEMANTICS AND PRAGMATICS****10**

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

**UNIT V DISCOURSE ANALYSIS AND LEXICAL RESOURCES****8**

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

**TOTAL :45 PERIODS**

**OUTCOMES:****Upon completion of the course, the students will be able to:**

- To tag a given text with basic Language features
- To design an innovative application using NLP components
- To implement a rule based system to tackle morphology/syntax of a language
- To design a tag set to be used for statistical processing for real-time applications
- To compare and contrast the use of different statistical approaches for different types of NLP applications.

**TEXT BOOKS:**

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with PythonII, First Edition, O’Reilly Media, 2009.

**REFERENCES:**

1. Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, —Natural Language Processing with Javall, O’Reilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.

**CS8001****PARALLEL ALGORITHMS**

L	T	P	C
3	0	0	3

**OBJECTIVES:**

To understand different parallel architectures and models of computation.

To introduce the various classes of parallel algorithms.

To study parallel algorithms for basic problems.

**UNIT I INTRODUCTION****9**

Need for Parallel Processing - Data and Temporal Parallelism - Models of Computation - RAM and PRAM Model – Shared Memory and Message Passing Models- Processor Organisations - PRAM Algorithm – Analysis of PRAM Algorithms- Parallel Programming Languages.

**UNIT II PRAM ALGORITHMS****9**

Parallel Algorithms for Reduction – Prefix Sum – List Ranking –Preorder Tree Traversal – Searching -Sorting - Merging Two Sorted Lists – Matrix Multiplication - Graph Coloring - Graph Searching.

**UNIT III SIMD ALGORITHMS -I****9**

2D Mesh SIMD Model - Parallel Algorithms for Reduction - Prefix Computation - Selection - Odd-Even Merge Sorting - Matrix Multiplication

**UNIT IV SIMD ALGORITHMS -II 9**  
 Hypercube SIMD Model - Parallel Algorithms for Selection- Odd-Even Merge Sort- Bitonic Sort- Matrix Multiplication Shuffle Exchange SIMD Model - Parallel Algorithms for Reduction -Bitonic Merge Sort - Matrix Multiplication - Minimum Cost Spanning Tree

**UNIT V MIMD ALGORITHMS 9**  
 UMA Multiprocessor Model -Parallel Summing on Multiprocessor- Matrix Multiplication on Multiprocessors and Multicomputer - Parallel Quick Sort - Mapping Data to Processors.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon completion of this course, the students should be able to**

- Develop parallel algorithms for standard problems and applications.
- Analyse efficiency of different parallel algorithms.

**TEXT BOOKS:**

1. Michael J. Quinn, "Parallel Computing : Theory & Practice", Tata McGraw Hill Edition, Second edition, 2017.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", University press, Second edition , 2011.
3. V Rajaraman, C Siva Ram Murthy, " Parallel computers- Architecture and Programming ", PHI learning, 2016.

**REFERENCES:**

1. Ananth Grame, George Karpis, Vipin Kumar and Anshul Gupta, "Introduction to Parallel Computing", 2nd Edition, Addison Wesley, 2003.
2. M Sasikumar, Dinesh Shikhare and P Ravi Prakash , " Introduction to Parallel Processing", PHI learning , 2013.
3. S.G.Akl, "The Design and Analysis of Parallel Algorithms", PHI, 1989.

**IT8077**

**SPEECH PROCESSING**

L	T	P	C
3	0	0	3

**OBJECTIVES:**

- To understand the fundamentals of the speech processing
- Explore the various speech models
- Gather knowledge about the phonetics and pronunciation processing
- Perform wavelet analysis of speech
- To understand the concepts of speech recognition

**UNIT I INTRODUCTION 9**

Introduction - knowledge in speech and language processing - ambiguity - models and algorithms - language - thought - understanding - regular expression and automata - words & transducers – N grams

**UNIT II SPEECH MODELLING 9**

Word classes and part of speech tagging – hidden markov model – computing likelihood: the forward algorithm – training hidden markov model – maximum entropy model – transformation-based tagging – evaluation and error analysis – issues in part of speech tagging – noisy channel model for spelling

**UNIT III SPEECH PRONUNCIATION AND SIGNAL PROCESSING 9**

Phonetics - speech sounds and phonetic transcription - articulatory phonetics - phonological categories and pronunciation variation - acoustic phonetics and signals - phonetic resources - articulatory and gestural phonology

**UNIT IV SPEECH IDENTIFICATION 9**  
Speech synthesis - text normalization - phonetic analysis - prosodic analysis – diphone waveform synthesis - unit selection waveform synthesis - evaluation

**UNIT V SPEECH RECOGNITION 9**  
Automatic speech recognition - architecture - applying hidden markov model - feature extraction: mfcc vectors - computing acoustic likelihoods - search and decoding - embedded training - multipass decoding: n-best lists and lattices- a\* ("stack") decoding - context-dependent acoustic models: triphones - discriminative training - speech recognition by humans

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**On Successful completion of the course ,Students will be able to**

- Create new algorithms with speech processing
- Derive new speech models
- Perform various language phonetic analysis
- Create a new speech identification system
- Generate a new speech recognition system

**TEXT BOOK:**

1. Daniel Jurafsky and James H. Martin, " Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Person education,2013.

**REFERENCES**

1. Kai-Fu Lee, "Automatic Speech Recognition", The Springer International Series in Engineering and Computer Science, 1999.
2. Himanshu Chaurasiya, "Soft Computing Implementation of Automatic Speech Recognition", LAP Lambert Academic Publishing, 2010.
3. Claudio Becchetti, Klucio Prina Ricotti, "Speech Recognition: Theory and C++ implementation",Wiley publications 2008.
4. Ikrami Eldirawy , Wesam Ashour, "Visual Speech Recognition", Wiley publications , 2011

**GE8073 FUNDAMENTALS OF NANOSCIENCE LT P C  
3 0 0 3**

**OBJECTIVES:**

To learn about basis of nanomaterial science, preparation method, types and application

**UNIT I INTRODUCTION 8**  
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires- ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

**UNIT II GENERAL METHODS OF PREPARATION 9**  
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

**UNIT III NANOMATERIALS****12**

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO<sub>2</sub>,MgO, ZrO<sub>2</sub>, NiO, nanoalumina, CaO, AgTiO<sub>2</sub>, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

**UNIT IV CHARACTERIZATION TECHNIQUES****9**

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques-AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

**UNIT V APPLICATIONS****7**

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

**TEXT BOOKS :**

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale Charecterisation of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

**REFERENCES:**

1. G Timp, "Nanotechnology", AIP press/Springer, 1999.
2. Akhlesh Lakhtakia,"The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

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**PROGRAMME EDUCATIONAL OBJECTIVES:**

PEO1: To enable graduates to pursue research, or have a successful career in academia or industries associated with Electronics and Communication Engineering, or as entrepreneurs.

PEO2: To provide students with strong foundational concepts and also advanced techniques and tools in order to enable them to build solutions or systems of varying complexity.

PEO3: To prepare students to critically analyze existing literature in an area of specialization and ethically develop innovative and research oriented methodologies to solve the problems identified.

**PROGRAMME OUTCOMES:**

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

#### **PROGRAM SPECIFIC OBJECTIVES (PSOs)**

1. To analyze, design and develop solutions by applying foundational concepts of electronics and communication engineering.
2. To apply design principles and best practices for developing quality products for scientific and business applications.
3. To adapt to emerging information and communication technologies (ICT) to innovate ideas and solutions to existing/novel problems.

**Contribution**            **1: Reasonable**            **2: Significant**            **3: Strong**

## MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme objective and the outcomes is given in the following table

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES											
	A	B	C	D	E	F	G	H	I	J	K	L
1	3	3	2	3	2	1	1	2	1	1	3	1
2	3	3	3	3	3	1	1	1	1	1	1	2
3	3	3	3	3	3	2	2	3	1	2	2	2

## MAPPING OF PROGRAM SPECIFIC OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the Program Specific Objectives and the outcomes is given in the following table

PROGRAM SPECIFIC OBJECTIVES	PROGRAMME OUTCOMES											
	A	B	C	D	E	F	G	H	I	J	K	L
1	3	3	2	3	2	1	1	1	1	1	1	2
2	3	3	3	3	3	2	2	3	1	3	3	3
3	3	3	3	3	3	3	3	2	1	1	1	3

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**MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES:**

A broad relation between the Course Outcomes and Programme Outcomes is given in the following table

COURSE OUTCOMES		PROGRAMME OUTCOMES												
Sem	Course Name	a	b	c	d	e	f	g	h	i	j	k	l	
I	Communicative English						√	√	√	√	√	√		
	Engineering Mathematics – I	√	√	√	√							√	√	
	Engineering Physics	√	√	√	√							√	√	
	Engineering Chemistry	√	√	√	√							√	√	
	Problem Solving and Python Programming	√	√	√	√	√						√	√	
	Engineering Graphics	√										√	√	√
	Problem Solving and Python Programming Laboratory	√	√	√	√	√							√	√
	Physics and Chemistry Laboratory	√	√	√	√								√	√
II	Technical English					√	√	√	√	√	√	√	√	
	Engineering Mathematics – II	√	√	√	√							√	√	
	Physics for Electronics Engineering	√	√	√	√							√	√	
	Basic Electrical and Instrumentation Engineering	√	√	√	√	√	√					√	√	
	Circuit Analysis	√	√	√	√	√	√					√	√	
	Electronic Devices	√	√	√	√	√	√					√	√	
	Circuits and Devices Laboratory	√	√	√	√	√						√	√	
	Engineering Practices Laboratory	√	√	√	√	√						√	√	
III	Linear Algebra and Partial Differential Equations	√	√	√	√	√						√	√	
	Fundamentals of Data Structures In C	√	√	√	√	√	√					√	√	
	Electronic Circuits- I	√	√	√	√	√	√					√	√	
	Signals and Systems	√	√	√	√	√	√					√	√	
	Digital Electronics	√	√	√	√	√	√					√	√	
	Control System Engineering	√	√	√	√	√	√					√	√	
	Fundamentals of Data Structures in C Laboratory	√	√	√	√	√	√					√	√	
	Analog and Digital Circuits Laboratory	√	√	√	√	√	√					√	√	
	Interpersonal Skills/Listening & Speaking						√		√	√	√	√	√	
IV	Probability and Random Processes	√	√	√	√	√						√	√	
	Electronic Circuits II	√	√	√	√	√	√					√	√	
	Communication Theory	√	√	√	√	√	√					√	√	
	Electromagnetic Fields	√	√	√	√	√	√					√	√	
	Linear Integrated Circuits	√	√	√	√	√	√					√	√	
	Environmental Science and Engineering	√	√		√		√	√	√			√	√	

COURSE OUTCOMES		PROGRAMME OUTCOMES											
Sem	Course Name	a	b	c	d	e	f	g	h	i	j	k	l
	Circuits Design and Simulation Laboratory	√	√	√	√	√	√					√	√
	Linear Integrated Circuits Laboratory	√	√	√	√	√	√					√	√
V	Digital Communication	√	√	√	√	√	√					√	√
	Discrete-Time Signal Processing	√	√	√	√	√	√					√	√
	Computer Architecture and Organization	√	√	√	√		√					√	√
	Communication Networks	√	√	√	√	√	√					√	√
	Professional Elective I												
	Open Elective I												
	Digital Signal Processing Laboratory	√	√	√	√	√	√					√	√
	Communication Systems Laboratory	√	√	√	√	√	√					√	√
	Networks Laboratory	√	√	√	√	√	√					√	√
VI	Microprocessors and Microcontrollers	√	√	√	√	√	√					√	√
	VLSI Design	√	√	√	√	√	√					√	√
	Wireless Communication	√	√	√	√	√	√					√	√
	Principles of Management						√	√	√		√	√	√
	Transmission Lines and RF Systems	√	√	√	√	√	√					√	√
	Professional Elective -II												
	Microprocessors and Microcontrollers Laboratory	√	√	√	√	√	√					√	√
	VLSI Design Laboratory	√	√	√	√	√	√					√	√
	Technical Seminar		√		√	√	√		√	√	√	√	√
	Professional Communication						√				√		√
VII	Antennas and Microwave Engineering	√	√	√	√	√	√					√	√
	Optical Communication	√	√	√	√		√					√	√
	Embedded and Real Time Systems	√	√	√	√	√	√					√	√
	Ad hoc and Wireless Sensor Networks	√	√	√	√	√	√					√	√
	Professional Elective -III												
	Open Elective - II												
	Embedded Laboratory	√	√	√	√	√	√					√	√
	Advanced Communication Laboratory	√	√	√	√	√	√					√	√
VIII	Professional Elective - IV												
	Professional Elective - V												
	Project Work	√	√	√	√	√	√		√	√	√	√	√

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**I - VIII SEMESTERS CURRICULA AND SYLLABI**

**SEMESTER I**

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	HS8151	Communicative English	HS	4	4	0	0	4
2.	MA8151	Engineering Mathematics - I	BS	4	4	0	0	4
3.	PH8151	Engineering Physics	BS	3	3	0	0	3
4.	CY8151	Engineering Chemistry	BS	3	3	0	0	3
5.	GE8151	Problem Solving and Python Programming	ES	3	3	0	0	3
6.	GE8152	Engineering Graphics	ES	6	2	0	4	4
<b>PRACTICALS</b>								
7.	GE8161	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
8.	BS8161	Physics and Chemistry Laboratory	BS	4	0	0	4	2
<b>TOTAL</b>				<b>31</b>	<b>19</b>	<b>0</b>	<b>12</b>	<b>25</b>

**SEMESTER II**

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	HS8251	Technical English	HS	4	4	0	0	4
2.	MA8251	Engineering Mathematics - II	BS	4	4	0	0	4
3.	PH8253	Physics for Electronics Engineering	BS	3	3	0	0	3
4.	BE8254	Basic Electrical and Instrumentation Engineering	ES	3	3	0	0	3
5.	EC8251	Circuit Analysis	PC	4	4	0	0	4
6.	EC8252	Electronic Devices	PC	3	3	0	0	3
<b>PRACTICALS</b>								
7.	EC8261	Circuits and Devices Laboratory	PC	4	0	0	4	2
8.	GE8261	Engineering Practices Laboratory	ES	4	0	0	4	2
<b>TOTAL</b>				<b>29</b>	<b>21</b>	<b>0</b>	<b>8</b>	<b>25</b>

### SEMESTER III

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MA8352	Linear Algebra and Partial Differential Equations	BS	4	4	0	0	4
2.	EC8393	Fundamentals of Data Structures In C	ES	3	3	0	0	3
3.	EC8351	Electronic Circuits- I	PC	3	3	0	0	3
4.	EC8352	Signals and Systems	PC	4	4	0	0	4
5.	EC8392	Digital Electronics	PC	3	3	0	0	3
6.	EC8391	Control Systems Engineering	PC	3	3	0	0	3
<b>PRACTICALS</b>								
7.	EC8381	Fundamentals of Data Structures in C Laboratory	ES	4	0	0	4	2
8.	EC8361	Analog and Digital Circuits Laboratory	PC	4	0	0	4	2
9.	HS8381	Interpersonal Skills/Listening &Speaking	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>30</b>	<b>20</b>	<b>0</b>	<b>10</b>	<b>25</b>

### SEMESTER IV

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MA8451	Probability and Random Processes	BS	4	4	0	0	4
2.	EC8452	Electronic Circuits II	PC	3	3	0	0	3
3.	EC8491	Communication Theory	PC	3	3	0	0	3
4.	EC8451	Electromagnetic Fields	PC	4	4	0	0	4
5.	EC8453	Linear Integrated Circuits	PC	3	3	0	0	3
6.	GE8291	Environmental Science and Engineering	HS	3	3	0	0	3
<b>PRACTICALS</b>								
7.	EC8461	Circuits Design and Simulation Laboratory	PC	4	0	0	4	2
8.	EC8462	Linear Integrated Circuits Laboratory	PC	4	0	0	4	2
<b>TOTAL</b>				<b>28</b>	<b>20</b>	<b>0</b>	<b>8</b>	<b>24</b>

### SEMESTER V

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	EC8501	Digital Communication	PC	3	3	0	0	3
2.	EC8553	Discrete-Time Signal Processing	PC	4	4	0	0	4
3.	EC8552	Computer Architecture and Organization	PC	3	3	0	0	3
4.	EC8551	Communication Networks	PC	3	3	0	0	3
5.		Professional Elective I	PE	3	3	0	0	3
6.		Open Elective I	OE	3	3	0	0	3
<b>PRACTICALS</b>								
7.	EC8562	Digital Signal Processing Laboratory	PC	4	0	0	4	2
8.	EC8561	Communication Systems Laboratory	PC	4	0	0	4	2
9.	EC8563	Communication Networks Laboratory	PC	4	0	0	4	2
<b>TOTAL</b>				<b>31</b>	<b>19</b>	<b>0</b>	<b>12</b>	<b>25</b>

### SEMESTER VI

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	EC8691	Microprocessors and Microcontrollers	PC	3	3	0	0	3
2.	EC8095	VLSI Design	PC	3	3	0	0	3
3.	EC8652	Wireless Communication	PC	3	3	0	0	3
4.	MG8591	Principles of Management	HS	3	3	0	0	3
5.	EC8651	Transmission Lines and RF Systems	PC	3	3	0	0	3
6.		Professional Elective -II	PE	3	3	0	0	3
<b>PRACTICALS</b>								
7.	EC8681	Microprocessors and Microcontrollers Laboratory	PC	4	0	0	4	2
8.	EC8661	VLSI Design Laboratory	PC	4	0	0	4	2
9.	EC8611	Technical Seminar	EEC	2	0	0	2	1
10.	HS8581	Professional Communication	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>30</b>	<b>18</b>	<b>0</b>	<b>12</b>	<b>24</b>

### SEMESTER VII

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	EC8701	Antennas and Microwave Engineering	PC	3	3	0	0	3
2.	EC8751	Optical Communication	PC	3	3	0	0	3
3.	EC8791	Embedded and Real Time Systems	PC	3	3	0	0	3
4.	EC8702	Ad hoc and Wireless Sensor Networks	PC	3	3	0	0	3
5.		Professional Elective -III	PE	3	3	0	0	3
6.		Open Elective - II	OE	3	3	0	0	3
<b>PRACTICALS</b>								
7.	EC8711	Embedded Laboratory	PC	4	0	0	4	2
8.	EC8761	Advanced Communication Laboratory	PC	4	0	0	4	2
<b>TOTAL</b>				<b>26</b>	<b>18</b>	<b>0</b>	<b>8</b>	<b>22</b>

### SEMESTER VIII

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.		Professional Elective IV	PE	3	3	0	0	3
2.		Professional Elective V	PE	3	3	0	0	3
<b>PRACTICALS</b>								
3.	EC8811	Project Work	EEC	20	0	0	20	10
<b>TOTAL</b>				<b>26</b>	<b>6</b>	<b>0</b>	<b>20</b>	<b>16</b>

**TOTAL NO. OF CREDITS: 186**

### HUMANITIES AND SOCIALSCIENCES (HS)

SI.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	HS8151	Communicative English	HS	4	4	0	0	4
2.	HS8251	Technical English	HS	4	4	0	0	4
3.	GE8291	Environmental Science and Engineering	HS	3	3	0	0	3
4.	MG8591	Principles of Management	HS	3	3	0	0	3

### BASIC SCIENCES (BS)

SI.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MA8151	Engineering Mathematics I	BS	4	4	0	0	4
2.	PH8151	Engineering Physics	BS	3	3	0	0	3
3.	CY8151	Engineering Chemistry	BS	3	3	0	0	3
4.	BS8161	Physics and Chemistry Laboratory	BS	4	0	0	4	2
5.	MA8251	Engineering Mathematics II	BS	4	4	0	0	4
6.	PH8253	Physics for Electronics Engineering	BS	3	3	0	0	3
7.	MA8352	Linear Algebra and Partial Differential Equations	BS	4	4	0	0	4
8.	MA8451	Probability and Random Processes	BS	4	4	0	0	4

### ENGINEERING SCIENCES (ES)

SI. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	GE8151	Problem Solving and Python Programming	ES	3	3	0	0	3
2.	GE8152	Engineering Graphics	ES	6	2	0	4	4
3.	GE8161	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
4.	BE8254	Basic Electrical and Instrumentation Engineering	ES	3	3	0	0	3
5.	GE8261	Engineering Practices Laboratory	ES	4	0	0	4	2
6.	EC8393	Fundamentals of Data Structures In C	ES	3	3	0	0	3
7.	EC8381	Fundamentals of Data Structures in C Laboratory	ES	4	0	0	4	2

**PROFESSIONAL CORE (PC)**

SI.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	EC8251	Circuit Analysis	PC	4	4	0	0	4
2.	EC8252	Electronic Devices	PC	3	3	0	0	3
3.	EC8261	Circuits and Devices Lab	PC	4	0	0	4	2
4.	EC8351	Electronic Circuits- I	PC	3	3	0	0	3
5.	EC8352	Signals and Systems	PC	4	4	0	0	4
6.	EC8392	Digital Electronics	PC	3	3	0	0	3
7.	EC8391	Control System Engineering	PC	3	3	0	0	3
8.	EC8361	Analog and Digital Circuits Laboratory	PC	4	0	0	4	2
9.	EC8452	Electronic Circuits II	PC	3	3	0	0	3
10.	EC8491	Communication Theory	PC	3	3	0	0	3
11.	EC8451	Electromagnetic Fields	PC	4	4	0	0	4
12.	EC8453	Linear Integrated Circuits	PC	3	3	0	0	3
13.	EC8461	Circuits Design and Simulation Laboratory	PC	4	0	0	4	2
14.	EC8462	Linear Integrated Circuits Laboratory	PC	4	0	0	4	2
15.	EC8501	Digital Communication	PC	3	3	0	0	3
16.	EC8553	Discrete-Time Signal Processing	PC	4	4	0	0	4
17.	EC8651	Transmission Lines and RF Systems	PC	3	3	0	0	3
18.	EC8552	Computer Architecture and Organization	PC	3	3	0	0	3
19.	EC8551	Communication Networks	PC	3	3	0	0	3
20.	EC8562	Digital Signal Processing Laboratory	PC	4	0	0	4	2
21.	EC8561	Communication Systems Laboratory	PC	4	0	0	4	2
22.	EC8563	Communication Networks Laboratory	PC	4	0	0	4	2
23.	EC8691	Microprocessors and Microcontrollers	PC	3	3	0	0	3
24.	EC8095	VLSI Design	PC	3	3	0	0	3
25.	EC8652	Wireless Communication	PC	3	3	0	0	3
26.	EC8661	VLSI Design Laboratory	PC	4	0	0	4	2

27.	EC8681	Microprocessors and Microcontrollers Laboratory	PC	4	0	0	4	2
28.	EC8701	Antennas and Microwave Engineering	PC	3	3	0	0	3
29.	EC8751	Optical Communication	PC	3	3	0	0	3
30.	EC8791	Embedded and Real Time Systems	PC	3	3	0	0	3
31.	EC8702	Ad hoc and Wireless Sensor Networks	PC	3	3	0	0	3
32.	EC8711	Embedded Laboratory	PC	4	0	0	4	2
33.	EC8761	Advanced Communication Laboratory	PC	4	0	0	4	2

**PROFESSIONAL ELECTIVES (PE)\*  
SEMESTER V  
ELECTIVE I**

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CS8392	Object Oriented Programming	PE	3	3	0	0	3
2.	EC8073	Medical Electronics	PE	3	3	0	0	3
3.	CS8493	Operating Systems	PE	3	3	0	0	3
4.	EC8074	Robotics and Automation	PE	3	3	0	0	3
5.	EC8075	Nano Technology and Applications	PE	3	3	0	0	3
6.	GE8074	Human Rights	PE	3	3	0	0	3
7.	GE8077	Total Quality Management	PE	3	3	0	0	3

**SEMESTER VI  
ELECTIVE II**

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CS8792	Cryptography and Network Security	PE	3	3	0	0	3
2.	EC8091	Advanced Digital Signal Processing	PE	3	3	0	0	3
3.	EC8001	MEMS and NEMS	PE	3	3	0	0	3
4.	EC8002	Multimedia Compression and Communication	PE	3	3	0	0	3
5.	EC8003	CMOS Analog IC Design	PE	3	3	0	0	3
6.	EC8004	Wireless Networks	PE	3	3	0	0	3
7.	GE8075	Intellectual Property Rights	PE	3	3	0	0	3

**SEMESTER VII  
ELECTIVE III**

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	EC8092	Advanced Wireless Communication	PE	3	3	0	0	3
2.	EC8071	Cognitive Radio	PE	3	3	0	0	3
3.	GE8072	Foundation Skills in Integrated Product Development	PE	3	3	0	0	3
4.	CS8082	Machine Learning Techniques	PE	3	3	0	0	3
5.	EC8005	Electronics Packaging and Testing	PE	3	3	0	0	3
6.	EC8006	Mixed Signal IC Design	PE	3	3	0	0	3
7.	GE8071	Disaster Management	PE	3	3	0	0	3

**SEMESTER VIII  
ELECTIVE IV**

SI.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	EC8072	Electro Magnetic Interference and Compatibility	PE	3	3	0	0	3
2.	EC8007	Low power SoC Design	PE	3	3	0	0	3
3.	EC8008	Photonic Networks	PE	3	3	0	0	3
4.	EC8009	Compressive Sensing	PE	3	3	0	0	3
5.	EC8093	Digital Image Processing	PE	3	3	0	0	3
6.	GE8076	Professional Ethics in Engineering	PE	3	3	0	0	3

**SEMESTER VIII  
ELECTIVE V**

SI.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	EC8010	Video Analytics	PE	3	3	0	0	3
2.	EC8011	DSP Architecture and Programming	PE	3	3	0	0	3
3.	EC8094	Satellite Communication	PE	3	3	0	0	3
4.	CS8086	Soft Computing	PE	3	3	0	0	3
5.	IT8006	Principles of Speech Processing	PE	3	3	0	0	3
6.	GE8073	Fundamentals of Nanoscience	PE	3	3	0	0	3

**\*Professional Electives are grouped according to elective number as was done previously.**

**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	HS8381	Interpersonal Skills/Listening & Speaking	EEC	2	0	0	2	1
2.	EC8611	Technical Seminar	EEC	2	0	0	2	1
3.	HS8581	Professional Communication	EEC	2	0	0	2	1
4.	EC8811	Project Work	EEC	20	0	0	20	10

### SUMMARY

S.NO.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL	Percentage
		I	II	III	IV	V	VI	VII	VIII		
1.	HS	4	4		3		3			14	7.56%
2.	BS	12	7	4	4					27	14.6%
3.	ES	9	5	5						19	10.27%
4.	PC		9	15	17	19	16	16		92	50%
5.	PE					3	3	3	6	15	8.10%
6.	OE					3		3		6	3.24%
7.	EEC			1			2		10	13	6.48%
	<b>Total</b>	<b>25</b>	<b>25</b>	<b>25</b>	<b>24</b>	<b>25</b>	<b>24</b>	<b>22</b>	<b>16</b>	<b>186</b>	
8.	<b>Non Credit / Mandatory</b>										

**OBJECTIVES:**

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

**UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS 12**

**Reading-** short comprehension passages, practice in skimming-scanning and predicting- **Writing-** completing sentences- - developing hints. **Listening-** short texts- short formal and informal conversations. **Speaking-** introducing oneself - exchanging personal information- **Language development-** Wh- Questions- asking and answering-yes or no questions- parts of speech. **Vocabulary development--** prefixes- suffixes- articles.- count/ uncount nouns.

**UNIT II GENERAL READING AND FREE WRITING 12**

**Reading** - comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- **Writing** – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –**Listening-** telephonic conversations. **Speaking** – sharing information of a personal kind—greeting – taking leave- **Language development** – prepositions, conjunctions **Vocabulary development-** guessing meanings of words in context.

**UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12**

**Reading-** short texts and longer passages (close reading) **Writing-** understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences **Listening** – listening to longer texts and filling up the table- product description- narratives from different sources. **Speaking-** asking about routine actions and expressing opinions. **Language development-** degrees of comparison- pronouns- direct vs indirect questions- **Vocabulary development** – single word substitutes- adverbs.

**UNIT IV READING AND LANGUAGE DEVELOPMENT 12**

**Reading-** comprehension-reading longer texts- reading different types of texts- magazines **Writing-** letter writing, informal or personal letters-e-mails-conventions of personal email- **Listening-** listening to dialogues or conversations and completing exercises based on them. **Speaking-** speaking about oneself- speaking about one's friend- **Language development-** Tenses- simple present-simple past- present continuous and past continuous- **Vocabulary development-** synonyms-antonyms- phrasal verbs

## UNIT V EXTENDED WRITING

12

**Reading**- longer texts- close reading –**Writing**- brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing-**Listening** – listening to talks- conversations- **Speaking** – participating in conversations- short group conversations-**Language development**-modal verbs- present/ past perfect tense - **Vocabulary development**-collocations- fixed and semi-fixed expressions.

**TOTAL: 60 PERIODS**

### OUTCOMES:

**At the end of the course, learners will be able to:**

- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English.

### TEXT BOOKS:

1. Board of Editors. **Using English** A Coursebook for Undergraduate Engineers and Technologists. Orient BlackSwan Limited, Hyderabad: 2015
2. Richards, C. Jack. **Interchange Students' Book-2** New Delhi: CUP, 2015.

### REFERENCES:

1. Bailey, Stephen. **Academic Writing: A practical guide for students**. New York: Rutledge,2011.
2. Means,L. Thomas and Elaine Langlois. **English & Communication For Colleges**. CengageLearning ,USA: 2007
3. Redston, Chris & Gillies Cunningham **Face2Face** (Pre-intermediate Student's Book & Workbook) Cambridge University Press, New Delhi: 2005
4. Comfort, Jeremy, et al. **Speaking Effectively: Developing Speaking Skills for Business English**. Cambridge University Press, Cambridge: Reprint 2011
5. Dutt P. Kiranmai and Rajeevan Geeta. **Basic Communication Skills**, Foundation Books: 2013.

**OBJECTIVES :**

The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

**UNIT I DIFFERENTIAL CALCULUS****12**

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

**UNIT II FUNCTIONS OF SEVERAL VARIABLES****12**

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

**UNIT III INTEGRAL CALCULUS****12**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

**UNIT IV MULTIPLE INTEGRALS****12**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

**UNIT V DIFFERENTIAL EQUATIONS****12**

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

**TOTAL : 60 PERIODS****OUTCOMES:**

**After completing this course, students should demonstrate competency in the following skills:**

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.



**UNIT V CRYSTAL PHYSICS****9**

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

**TOTAL : 45 PERIODS****OUTCOMES:****Upon completion of this course,**

- the students will gain knowledge on the basics of properties of matter and its applications,
- the students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
- the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
- the students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
- the students will understand the basics of crystals, their structures and different crystal growth techniques.

**TEXT BOOKS:**

1. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. "Engineering Physics". Cengage Learning India, 2012.

**REFERENCES:**

1. Halliday, D., Resnick, R. & Walker, J. "Principles of Physics". Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. "Physics for Scientists and Engineers". Cengage Learning, 2010.
3. Tipler, P.A. & Mosca, G. "Physics for Scientists and Engineers with Modern Physics". W.H.Freeman, 2007.

**CY8151****ENGINEERING CHEMISTRY****L T P C  
3 0 0 3****OBJECTIVES:**

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

**UNIT I WATER AND ITS TREATMENT 9**

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

**UNIT II SURFACE CHEMISTRY AND CATALYSIS 9**

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions – adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – kinetics of surface reactions, unimolecular reactions, Langmuir - applications of adsorption on pollution abatement. Catalysis: Catalyst – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis– Michaelis – Menten equation.

**UNIT III ALLOYS AND PHASE RULE 9**

Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

**UNIT IV FUELS AND COMBUSTION 9**

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel. Combustion of fuels: Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

**UNIT V ENERGY SOURCES AND STORAGE DEVICES 9**

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H<sub>2</sub>-O<sub>2</sub> fuel cell.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

**TEXT BOOKS:**

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.



**OUTCOMES:**

**Upon completion of the course, students will be able to**

- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.

**TEXT BOOKS:**

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2<sup>nd</sup> edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (<http://greenteapress.com/wp/think-python/>)
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

**REFERENCES:**

1. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press , 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd.,, 2015.
4. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
5. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.

**GE8152****ENGINEERING GRAPHICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>2</b>	<b>0</b>	<b>4</b>	<b>4</b>

**OBJECTIVES:**

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

**CONCEPTS AND CONVENTIONS (Not for Examination)****1**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

**UNIT I PLANE CURVES AND FREEHAND SKETCHING****7+12**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

**UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12**

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

**UNIT III PROJECTION OF SOLIDS 5+12**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

**UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+12**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

**UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

**TOTAL: 90 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the student will be able to:**

- Familiarize with the fundamentals and standards of Engineering graphics
- Perform freehand sketching of basic geometrical constructions and multiple views of objects.
- Project orthographic projections of lines and plane surfaces.
- Draw projections and solids and development of surfaces.
- Visualize and to project isometric and perspective sections of simple solids.

**TEXT BOOKS:**

1. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.

**REFERENCES:**

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50<sup>th</sup> Edition, 2010.
2. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N S Parthasarathy And Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2<sup>nd</sup> Edition, 2009.

**Publication of Bureau of Indian Standards:**

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.

3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

**Special points applicable to University Examinations on Engineering Graphics:**

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The
4. students will be permitted to use appropriate scale to fit solution within A3 size.
5. The examination will be conducted in appropriate sessions on the same day

**GE8161      PROBLEM SOLVING ANDPYTHON PROGRAMMING LABORATORY**

**L T P C  
0 0 4 2**

**OBJECTIVES**

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

**LIST OF PROGRAMS**

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

**PLATFORM NEEDED**

Python 3 interpreter for Windows/Linux

**OUTCOMES**

**Upon completion of the course, students will be able to:**

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

**TOTAL: 60 PERIODS**

BS8161

**PHYSICS AND CHEMISTRY LABORATORY**  
(Common to all branches of B.E. / B.Tech Programmes)

L T P C  
0 0 4 2

**OBJECTIVES:**

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

**LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)**

- Determination of rigidity modulus – Torsion pendulum
- Determination of Young's modulus by non-uniform bending method
- (a) Determination of wavelength, and particle size using Laser  
(b) Determination of acceptance angle in an optical fiber.
- Determination of thermal conductivity of a bad conductor – Lee's Disc method.
- Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
- Determination of wavelength of mercury spectrum – spectrometer grating
- Determination of band gap of a semiconductor
- Determination of thickness of a thin wire – Air wedge method

**TOTAL: 30 PERIODS**

**OUTCOMES:**

Upon completion of the course, the students will be able to

- apply principles of elasticity, optics and thermal properties for engineering applications.

**CHEMISTRY LABORATORY: (Any seven experiments to be conducted)**

**OBJECTIVES:**

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
  - To acquaint the students with the determination of molecular weight of a polymer by viscometry.
- Estimation of HCl using  $\text{Na}_2\text{CO}_3$  as primary standard and Determination of alkalinity in water sample.
  - Determination of total, temporary & permanent hardness of water by EDTA method.
  - Determination of DO content of water sample by Winkler's method.
  - Determination of chloride content of water sample by argentometric method.
  - Estimation of copper content of the given solution by Iodometry.
  - Determination of strength of given hydrochloric acid using pH meter.
  - Determination of strength of acids in a mixture of acids using conductivity meter.
  - Estimation of iron content of the given solution using potentiometer.
  - Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
  - Estimation of sodium and potassium present in water using flame photometer.
  - Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
  - Pseudo first order kinetics-ester hydrolysis.
  - Corrosion experiment-weight loss method.
  - Determination of CMC.
  - Phase change in a solid.
  - Conductometric titration of strong acid vs strong base.

**OUTCOMES:**

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

**TOTAL: 30 PERIODS**

**TEXTBOOKS:**

- Vogel's Textbook of Quantitative Chemical Analysis (8<sup>TH</sup> edition, 2014)

HS8251

TECHNICAL ENGLISH

L	T	P	C
4	0	0	4

**OBJECTIVES:**

**The Course prepares second semester engineering and Technology students to:**

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization.

**UNIT I INTRODUCTION TECHNICAL ENGLISH 12**

**Listening-** Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- **Speaking** –Asking for and giving directions- **Reading** – reading short technical texts from journals- newspapers- **Writing-** purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-**Vocabulary Development-** technical vocabulary **Language Development** –subject verb agreement - compound words.

**UNIT II READING AND STUDY SKILLS 12**

**Listening-** Listening to longer technical talks and completing exercises based on them-**Speaking** – describing a process-**Reading** – reading longer technical texts- identifying the various transitions in a text- paragraphing- **Writing-** interpreting charts, graphs- **Vocabulary Development-** vocabulary used in formal letters/emails and reports **Language Development-** impersonal passive voice, numerical adjectives.

**UNIT III TECHNICAL WRITING AND GRAMMAR 12**

**Listening-** Listening to classroom lectures/ talks on engineering/technology -**Speaking** – introduction to technical presentations- **Reading** – longer texts both general and technical, practice in speed reading; **Writing-**Describing a process, use of sequence words- **Vocabulary Development-** sequence words- Misspelled words. **Language Development-** embedded sentences

**UNIT IV REPORT WRITING 12**

**Listening-** Listening to documentaries and making notes. **Speaking** – mechanics of presentations- **Reading** – reading for detailed comprehension- **Writing-** email etiquette- job application – cover letter –Résumé preparation( via email and hard copy)- analytical essays and issue based essays--**Vocabulary Development-** finding suitable synonyms-paraphrasing-. **Language Development-** clauses- if conditionals.

**UNIT V GROUP DISCUSSION AND JOB APPLICATIONS 12**

**Listening-** TED/Ink talks; **Speaking** –participating in a group discussion -**Reading**– reading and understanding technical articles **Writing**– Writing reports- minutes of a meeting- accident and survey-**Vocabulary Development-** verbal analogies **Language Development-** reported speech

**TOTAL :60 PERIODS**

**OUTCOMES:**

**At the end of the course learners will be able to:**

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

**TEXT BOOKS:**

1. Board of editors. **Fluency in English A Course book for Engineering and Technology.** Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. **English for Technical Communication.** Cambridge University Press: New Delhi, 2016.

**REFERENCES:**

1. Raman, Meenakshi and Sharma, Sangeetha- **Technical Communication Principles and Practice.**Oxford University Press: New Delhi,2014.
2. Kumar, Suresh. E. **Engineering English.** Orient Blackswan: Hyderabad,2015
3. Booth-L. Diana, **Project Work,** Oxford University Press, Oxford: 2014.
4. Grussendorf, Marion, **English for Presentations,** Oxford University Press, Oxford: 2007
5. Means, L. Thomas and Elaine Langlois, **English & Communication For Colleges.** Cengage Learning, USA: 2007  
**Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.**

**MA8251****ENGINEERING MATHEMATICS – II**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**OBJECTIVES :**

This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

**UNIT I            MATRICES****12**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

**UNIT II            VECTOR CALCULUS****12**

Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

**UNIT III            ANALYTIC FUNCTIONS****12**

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions  $w = z + c, cz, \frac{1}{z}, z^2$  - Bilinear transformation.

**UNIT IV            COMPLEX INTEGRATION****12**

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour.

**UNIT V LAPLACE TRANSFORMS****12**

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

**TOTAL: 60 PERIODS****OUTCOMES:**

**After successfully completing the course, the student will have a good understanding of the following topics and their applications:**

- Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

**TEXT BOOKS :**

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43<sup>rd</sup> Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10<sup>th</sup> Edition, New Delhi, 2016.

**REFERENCES :**

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7<sup>th</sup> Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., " Advanced Engineering Mathematics ", Narosa Publications, New Delhi , 3<sup>rd</sup> Edition, 2007.
3. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.
4. Sastry, S.S, "Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4<sup>th</sup> Edition, New Delhi, 2014.
5. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6<sup>th</sup> Edition, New Delhi, 2012.

**PH8253****PHYSICS FOR ELECTRONICS ENGINEERING**

(Common to BME, ME, CC, ECE, EEE, E&amp;I, ICE)

**L T P C****3 0 0 3****OBJECTIVES:**

- To understand the essential principles of Physics of semiconductor device and Electron transport properties. Become proficient in magnetic, dielectric and optical properties of materials and nano devices.

**UNIT I ELECTRICAL PROPERTIES OF MATERIALS****9**

Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Wiedemann-Franz law – Success and failures - electrons in metals – Particle in a three dimensional box – degenerate states – Fermi- Dirac statistics – Density of energy states – Electron in periodic potential: Bloch theorem – metals and insulators - Energy bands in solids– tight binding approximation - Electron effective mass – concept of hole.

**UNIT II SEMICONDUCTOR PHYSICS 9**

Intrinsic Semiconductors – Energy band diagram – direct and indirect semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Carrier transport: Velocity-electric field relations – drift and diffusion transport - Einstein's relation – Hall effect and devices – Zener and avalanche breakdown in p-n junctions - Ohmic contacts – tunnel diode - Schottky diode – MOS capacitor - power transistor.

**UNIT III MAGNETIC AND DIELECTRIC PROPERTIES OF MATERIALS 9**

Magnetism in materials – magnetic field and induction – magnetization - magnetic permeability and susceptibility–types of magnetic materials – microscopic classification of magnetic materials - Ferromagnetism: origin and exchange interaction- saturation magnetization and Curie temperature – Domain Theory. Dielectric materials: Polarization processes – dielectric loss – internal field – Clausius-Mosotti relation- dielectric breakdown – high-k dielectrics.

**UNIT IV OPTICAL PROPERTIES OF MATERIALS 9**

Classification of optical materials – carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and Semiconductors (concepts only) - photo current in a P- N diode – solar cell –photo detectors - LED – Organic LED – Laser diodes – excitons - quantum confined Stark effect – quantum dot laser.

**UNIT V NANO-ELECTRONIC DEVICES 9**

Introduction - electron density in bulk material – Size dependence of Fermi energy– quantum confinement – quantum structures - Density of states in quantum well, quantum wire and quantum dot structures –Zener-Bloch oscillations – resonant tunneling – quantum interference effects – mesoscopic structures: conductance fluctuations and coherent transport – Coulomb blockade effects - Single electron phenomena and Single electron Transistor – magnetic semiconductors– spintronics - Carbon nanotubes: Properties and applications.

**TOTAL :45 PERIODS**

**OUTCOMES:**

**At the end of the course, the students will able to**

- Gain knowledge on classical and quantum electron theories, and energy band structures,
- Acquire knowledge on basics of semiconductor physics and its applications in various devices,
- Get knowledge on magnetic and dielectric properties of materials,
- Have the necessary understanding on the functioning of optical materials for optoelectronics,
- Understand the basics of quantum structures and their applications in spintronics and carbon electronics..

**TEXT BOOKS:**

1. Kasap, S.O. "Principles of Electronic Materials and Devices", McGraw-Hill Education, 2007.
2. Umesh K Mishra & Jasprit Singh, "Semiconductor Device Physics and Design", Springer, 2008.
3. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials". Narosa Publishing House, 2009.

**REFERENCES:**

1. Garcia, N. & Damask, A. "Physics for Computer Science Students". Springer-Verlag, 2012.
2. Hanson, G.W. "Fundamentals of Nanoelectronics". Pearson Education, 2009
3. Rogers, B., Adams, J. & Pennathur, S. "Nanotechnology: Understanding Small Systems". CRC Press, 2014

**OBJECTIVES:**

To impart knowledge on

- Operation of Three phase electrical circuits and power measurement
- Working principles of Electrical Machines
- Working principle of Various measuring instruments

**UNIT I AC CIRCUITS AND POWER SYSTEMS****9**

Three phase power supply – Star connection – Delta connection – Balanced and Unbalanced Loads- Power equation – Star Delta Conversion – Three Phase Power Measurement - Transmission & Distribution of electrical energy – Over head Vs Underground system – Protection of power system – types of tariff – power factor improvement

**UNIT II TRANSFORMER****9**

Introduction - Ideal Transformer – Accounting For Finite Permeability And Core Loss – Circuit Model Of Transformer – Per Unit System – Determination Of Parameters Of Circuit Model Of Transformer – Voltage Regulation – Name Plate Rating – Efficiency – Three Phase Transformers - Auto Transformers

**UNIT III DC MACHINES****9**

Introduction – Constructional Features– Motoring and generation principle - Emf And Torque equation – Circuit Model – Methods of Excitation and magnetisation characteristics – Starting and Speed Control – Universal Motor

**UNIT IV AC MACHINES****9**

Principle of operation of three-phase induction motors – Construction –Types – Equivalent circuit, Single phase Induction motors -Construction– Types–starting and speed control methods. Alternator- working principle–Equation of induced EMF – Voltage regulation, Synchronous motors-working principle-starting methods -- Torque equation – Stepper Motors – Brushless DC Motors

**UNIT V MEASUREMENT AND INSTRUMENTATION****9**

Type of Electrical and electronic instruments – Classification- Types of indicating Instruments – Principles of Electrical Instruments –Multimeters, Oscilloscopes- Static and Dynamic Characteristics of Measurement – Errors in Measurement – Transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect and Mechanical

**TOTAL: 45 PERIODS****OUTCOMES:**

**At the end of the course the students will be able to**

- Understand the concept of three phase power circuits and measurement.
- Comprehend the concepts in electrical generators, motors and transformers
- Choose appropriate measuring instruments for given application

**TEXT BOOKS:**

1. D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering", McGraw Hill Education(India) Private Limited, Third Reprint ,2016
2. Giorgio Rizzoni, "Principles and Applications of Electrical Engineering", McGraw Hill Education(India) Private Limited, 2010
3. S.K.Bhattacharya "Basic Electrical and Electronics Engineering", Pearson India, 2011

**REFERENCES:**

1. Del Toro , "Electrical Engineering Fundamentals", Pearson Education, New Delhi, 2015.
2. Leonard S Bobrow, " Foundations of Electrical Engineering", Oxford University Press, 2013
3. Rajendra Prasad , "Fundamentals of Electrical engineering", Prentice Hall of India, 2006.
4. Mittle N., "Basic Electrical Engineering", Tata McGraw Hill Edition, 24<sup>th</sup> reprint 2016
5. A.E.Fitzgerald, David E Higginbotham and Arvin Grabel, "Basic Electrical Engineering", McGraw Hill Education(India) Private Limited, 2009

**OBJECTIVES:**

- To introduce the basic concepts of DC and AC circuits behavior
- To study the transient and steady state response of the circuits subjected to step and sinusoidal excitations.
- To introduce different methods of circuit analysis using Network theorems, duality and topology.

**UNIT I BASIC CIRCUITS ANALYSIS AND NETWORK TOPOLOGY 12**

Ohm's Law – Kirchhoff's laws – Mesh current and node voltage method of analysis for D.C and A.C. circuits - Network terminology - Graph of a network - Incidence and reduced incidence matrices – Trees –Cutsets - Fundamental cutsets - Cutset matrix – Tie sets - Link currents and Tie set schedules -Twig voltages and Cutset schedules, Duality and dual networks.

**UNIT II NETWORK THEOREMS FOR DC AND AC CIRCUITS 12**

Network theorems -Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Millman's theorem, and Maximum power transfer theorem ,application of Network theorems- Network reduction: voltage and current division, source transformation – star delta conversion.

**UNIT III RESONANCE AND COUPLED CIRCUITS 12**

Resonance - Series resonance - Parallel resonance - Variation of impedance with frequency - Variation in current through and voltage across L and C with frequency – Bandwidth - Q factor - Selectivity. Self inductance - Mutual inductance - Dot rule - Coefficient of coupling - Analysis of multiwinding coupled circuits - Series, Parallel connection of coupled inductors - Single tuned and double tuned coupled circuits.

**UNITIV TRANSIENT ANALYSIS 12**

Natural response-Forced response - Transient response of RC, RL and RLC circuits to excitation by Step Signal, Impulse Signal and exponential sources - Complete response of RC, RL and RLC Circuits to sinusoidal excitation.

**UNIT V TWO PORT NETWORKS 12**

Two port networks, Z parameters, Y parameters, Transmission (ABCD) parameters, Hybrid(H) Parameters, Interconnection of two port networks, Symmetrical properties of T and  $\pi$  networks.

**TOTAL : 60 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Develop the capacity to analyze electrical circuits, apply the circuit theorems in real time
- Design and understand and evaluate the AC and DC circuits.

**TEXT BOOKS:**

1. William H. Hayt, Jr. Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis", McGraw Hill Science Engineering, Eighth Edition, 11<sup>th</sup> Reprint 2016.
2. Joseph Edminister and Mahmood Nahvi, "Electric Circuits", Schaum's Outline Series, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint 2016.

**REFERENCES:**

1. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Fifth Edition, McGraw Hill, 9<sup>th</sup> Reprint 2015.
2. A.Bruce Carlson, "Cicuits: Engineering Concepts and Analysis of Linear Electric Circuits", Cengage Learning, India Edition 2<sup>nd</sup> Indian Reprint 2009.
3. Allan H.Robbins, Wilhelm C.Miller, "Circuit Analysis Theory and Practice", Cengage Learning, Fifth Edition, 1<sup>st</sup> Indian Reprint 2013.

**OBJECTIVES:**

- To acquaint the students with the construction, theory and operation of the basic electronic devices such as PN junction diode, Bipolar and Field effect Transistors, Power control devices, LED, LCD and other Opto-electronic devices

**UNIT I SEMICONDUCTOR DIODE****9**

PN junction diode, Current equations, Energy Band diagram, Diffusion and drift current densities, forward and reverse bias characteristics, Transition and Diffusion Capacitances, Switching Characteristics, Breakdown in PN Junction Diodes.

**UNIT II BIPOLAR JUNCTION TRANSISTORS****9**

NPN -PNP -Operations-Early effect-Current equations – Input and Output characteristics of CE, CB, CC - Hybrid - $\pi$  model - h-parameter model, Ebers Moll Model- Gummel Poon-model, Multi Emitter Transistor.

**UNIT III FIELD EFFECT TRANSISTORS****9**

JFETs – Drain and Transfer characteristics,-Current equations-Pinch off voltage and its significance- MOSFET- Characteristics- Threshold voltage -Channel length modulation, D-MOSFET, E-MOSFET- Characteristics – Comparison of MOSFET with JFET.

**UNIT IV SPECIAL SEMICONDUCTOR DEVICES****9**

Metal-Semiconductor Junction- MESFET, FINFET, PINFET, CNTFET, DUAL GATE MOSFET, Schottky barrier diode-Zener diode-Varactor diode –Tunnel diode- Gallium Arsenide device, LASER diode, LDR.

**UNIT V POWER DEVICES AND DISPLAY DEVICES****9**

UJT, SCR, Diac, Triac, Power BJT- Power MOSFET- DMOS-VMOS. LED, LCD, Photo transistor, Opto Coupler, Solar cell, CCD.

**TOTAL : 45 PERIODS****OUTCOMES:**

**At the end of the course the students will be able to:**

- Explain the V-I characteristic of diode, UJT and SCR
- Describe the equivalence circuits of transistors
- Operate the basic electronic devices such as PN junction diode, Bipolar and Field effect Transistors, Power control devices, LED, LCD and other Opto-electronic devices

**TEXT BOOKS:**

- Donald A Neaman, "Semiconductor Physics and Devices", Fourth Edition, Tata Mc GrawHill Inc. 2012.
- Salivahanan. S, Suresh Kumar. N, Vallavaraj.A, "Electronic Devices and circuits", Third Edition, Tata McGraw- Hill, 2008.

**REFERENCES:**

- Robert Boylestad and Louis Nashelsky, "Electron Devices and Circuit Theory" Pearson Prentice Hall, 10th edition, July 2008.
- R.S.Sedha, " A Text Book of Applied Electronics" S.Chand Publications, 2006.
- Yang, "Fundamentals of Semiconductor devices", McGraw Hill International Edition, 1978.

EC8261

**CIRCUITS AND DEVICES LABORATORY**

**L T P C**  
**0 0 4 2**

**OBJECTIVES:**

- To learn the characteristics of basic electronic devices such as Diode, BJT, FET, SCR
- To understand the working of RL, RC and RLC circuits
- To gain hand on experience in Thevenin & Norton theorem, KVL & KCL, and Super Position Theorems

1. Characteristics of PN Junction Diode
2. Zener diode Characteristics & Regulator using Zener diode
3. Common Emitter input-output Characteristics
4. Common Base input-output Characteristics
5. FET Characteristics
6. SCR Characteristics
7. Clipper and Clamper & FWR
8. Verifications Of Thevenin & Norton theorem
9. Verifications Of KVL & KCL
10. Verifications Of Super Position Theorem
11. verifications of maximum power transfer & reciprocity theorem
12. Determination Of Resonance Frequency of Series & Parallel RLC Circuits
13. Transient analysis of RL and RC circuits

**LABORATORY REQUIREMENTS**

BC 107, BC 148, 2N2646, BFW10	- 25 each
1N4007, Zener diodes	- 25 each
Resistors, Capacitors, Inductors	- sufficient quantities
Bread Boards	- 15 Nos
CRO (30MHz)	- 15 Nos.
Function Generators (3MHz)	- 10 Nos.
Dual Regulated Power Supplies ( 0 – 30V)	- 10 Nos.

**TOTAL : 60 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Analyze the characteristics of basic electronic devices
- Design RL and RC circuits
- Verify Thevenin & Norton theorem KVL & KCL, and Super Position Theorems

GE8261

**ENGINEERING PRACTICES LABORATORY**

**L T P C**  
**0 0 4 2**

**OBJECTIVES:**

To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

**GROUP A (CIVIL & MECHANICAL)**

**I CIVIL ENGINEERING PRACTICE**

**13**

**Buildings:**

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

**Plumbing Works:**

- (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- (b) Study of pipe connections requirements for pumps and turbines.
- (c) Preparation of plumbing line sketches for water supply and sewage works.
- (d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

- (e) Demonstration of plumbing requirements of high-rise buildings.

**Carpentry using Power Tools only:**

- (a) Study of the joints in roofs, doors, windows and furniture.
- (b) Hands-on-exercise:  
Wood work, joints by sawing, planing and cutting.

**II MECHANICAL ENGINEERING PRACTICE****18****Welding:**

- (a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
- (b) Gas welding practice

**Basic Machining:**

- (a) Simple Turning and Taper turning
- (b) Drilling Practice

**Sheet Metal Work:**

- (a) Forming & Bending:
- (b) Model making – Trays and funnels.
- (c) Different type of joints.

**Machine assembly practice:**

- (a) Study of centrifugal pump
- (b) Study of air conditioner

**Demonstration on:**

- (a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
- (b) Foundry operations like mould preparation for gear and step cone pulley.
- (c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

**GROUP B (ELECTRICAL & ELECTRONICS)****III ELECTRICAL ENGINEERING PRACTICE****13**

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

**IV ELECTRONICS ENGINEERING PRACTICE****16**

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.

2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the student will be able to**

- Fabricate carpentry components and pipe connections including plumbing works.
- Use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundry and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

**CIVIL**

- |   |          |
|---|----------|
| 1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. | 15 Sets. |
| 2. Carpentry vice (fitted to work bench)  | 15 Nos.  |
| 3. Standard woodworking tools   | 15 Sets. |
| 4. Models of industrial trusses, door joints, furniture joints  | 5 each   |
| 5. Power Tools: (a) Rotary Hammer   | 2 Nos    |
| (b) Demolition Hammer   | 2 Nos    |
| (c) Circular Saw  | 2 Nos    |
| (d) Planer  | 2 Nos    |
| (e) Hand Drilling Machine   | 2 Nos    |
| (f) Jigsaw  | 2 Nos    |

**MECHANICAL**

- |   |           |
|---|-----------|
| 1. Arc welding transformer with cables and holders                            | 5 Nos.    |
| 2. Welding booth with exhaust facility  | 5 Nos.    |
| 3. Welding accessories like welding shield, chipping hammer, wire brush, etc. | 5 Sets.   |
| 4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.    | 2 Nos.    |
| 5. Centre lathe   | 2 Nos.    |
| 6. Hearth furnace, anvil and smithy tools                                     | 2 Sets.   |
| 7. Moulding table, foundry tools  | 2 Sets.   |
| 8. Power Tool: Angle Grinder  | 2 Nos     |
| 9. Study-purpose items: centrifugal pump, air-conditioner                     | One each. |

**ELECTRICAL**

- |   |         |
|---|---------|
| 1. Assorted electrical components for house wiring                  | 15 Sets |
| 2. Electrical measuring instruments                                 | 10 Sets |
| 3. Study purpose items: Iron box, fan and regulator, emergency lamp | 1 each  |
| 4. Megger (250V/500V)   | 1 No.   |
| 5. Power Tools: (a) Range Finder                                    | 2 Nos   |
| (b) Digital Live-wire detector                                      | 2 Nos   |

## ELECTRONICS

1. Soldering guns	10 Nos.
2. Assorted electronic components for making circuits	50 Nos.
3. Small PCBs	10 Nos.
4. Multimeters	10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply	

<b>MA8352</b>	<b>LINEAR ALGEBRA AND PARTIAL DIFFERENTIAL EQUATIONS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

### OBJECTIVES:

- To introduce the basic notions of groups, rings, fields which will then be used to solve related problems.
- To understand the concepts of vector space, linear transformations and diagonalization.
- To apply the concept of inner product spaces in orthogonalization.
- To understand the procedure to solve partial differential equations.
- To give an integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject.

### **UNIT I VECTOR SPACES 12**

Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

### **UNIT II LINEAR TRANSFORMATION AND DIAGONALIZATION 12**

Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a linear transformations - Eigenvalues and eigenvectors - Diagonalizability.

### **UNIT III INNER PRODUCT SPACES 12**

Inner product, norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Least square approximation.

### **UNIT IV PARTIAL DIFFERENTIAL EQUATIONS 12**

Formation – Solutions of first order equations – Standard types and equations reducible to standard types – Singular solutions – Lagrange's linear equation – Integral surface passing through a given curve – Classification of partial differential equations - Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

### **UNIT V FOURIER SERIES SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12**

Dirichlet's conditions – General Fourier series – Half range sine and cosine series - Method of separation of variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

**TOTAL: 60 PERIODS**

### OUTCOMES:

**Upon successful completion of the course, students should be able to:**

- Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
- Demonstrate accurate and efficient use of advanced algebraic techniques.
- Demonstrate their mastery by solving non - trivial problems related to the concepts and by proving simple theorems about the statements proven by the text.
- Able to solve various types of partial differential equations.  
Able to solve engineering problems using Fourier series.

**TEXTBOOKS:**

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43<sup>rd</sup> Edition, 2014.
2. Friedberg, A.H., Insel, A.J. and Spence, L., "Linear Algebra", Prentice Hall of India, New Delhi, 2004.

**REFERENCES:**

1. Burden, R.L. and Faires, J.D, "Numerical Analysis", 9<sup>th</sup> Edition, Cengage Learning, 2016.
2. James, G. "Advanced Modern Engineering Mathematics", Pearson Education, 2007.
3. Kolman, B. Hill, D.R., "Introductory Linear Algebra", Pearson Education, New Delhi, First Reprint, 2009.
4. Kumaresan, S., "Linear Algebra – A Geometric Approach", Prentice – Hall of India, New Delhi, Reprint, 2010.
5. Lay, D.C., "Linear Algebra and its Applications", 5<sup>th</sup> Edition, Pearson Education, 2015.
6. O'Neil, P.V., "Advanced Engineering Mathematics", Cengage Learning, 2007.
7. Strang, G., "Linear Algebra and its applications", Thomson (Brooks/Cole), New Delhi, 2005.
8. Sundarapandian, V. "Numerical Linear Algebra", Prentice Hall of India, New Delhi, 2008.

**EC8393****FUNDAMENTALS OF DATA STRUCTURES IN C****L T P C****3 0 0 3****OBJECTIVES:**

- To learn the features of C
- To learn the linear and non-linear data structures
- To explore the applications of linear and non-linear data structures
- To learn to represent data using graph data structure
- To learn the basic sorting and searching algorithms

**UNIT I C PROGRAMMING BASICS****9**

Structure of a C program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in C – Managing Input and Output operations – Decision Making and Branching – Looping statements. Arrays – Initialization – Declaration – One dimensional and Two-dimensional arrays. Strings- String operations – String Arrays. Simple programs- sorting-searching – matrix operations.

**UNIT II FUNCTIONS, POINTERS, STRUCTURES AND UNIONS****9**

Functions – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic. Structures and unions - definition – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

**UNIT III LINEAR DATA STRUCTURES****9**

Arrays and its representations – Stacks and Queues – Linked lists – Linked list-based implementation of Stacks and Queues – Evaluation of Expressions – Linked list based polynomial addition.

**UNIT IV NON-LINEAR DATA STRUCTURES****9**

Trees – Binary Trees – Binary tree representation and traversals – Binary Search Trees – Applications of trees. Set representations - Union-Find operations. Graph and its representations – Graph Traversals.

**UNIT V SEARCHING AND SORTING ALGORITHMS****9**

Linear Search – Binary Search. Bubble Sort, Insertion sort – Merge sort – Quick sort - Hash tables – Overflow handling.

**TOTAL: 45 PERIODS**

**OUTCOMES:****Upon completion of the course, students will be able to:**

- Implement linear and non-linear data structure operations using C
- Suggest appropriate linear / non-linear data structure for any given data set.
- Apply hashing concepts for a given problem
- Modify or suggest new data structure for an application
- Appropriately choose the sorting algorithm for an application

**TEXTBOOKS:**

1. Pradip Dey and Manas Ghosh, —Programming in C, Second Edition, Oxford University Press, 2011.
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, —Fundamentals of Data Structures in C, Second Edition, University Press, 2008.

**REFERENCES:**

1. Mark Allen Weiss, —Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 1996
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, —Data Structures and Algorithms, Pearson Education, 1983.
3. Robert Kruse, C.L.Tondo, Bruce Leung, Shashi Mogalla , — Data Structures and Program Design in C, Second Edition, Pearson Education, 2007
4. Jean-Paul Tremblay and Paul G. Sorenson, —An Introduction to Data Structures with Applications, Second Edition, Tata McGraw-Hill, 1991.

**EC8351****ELECTRONIC CIRCUITS I**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the methods of biasing transistors
- To design and analyze single stage and multistage amplifier circuits
- To analyze the frequency response of small signal amplifiers
- To design and analyze the regulated DC power supplies.
- To troubleshoot and fault analysis of power supplies.

**UNIT I BIASING OF DISCRETE BJT, JFET AND MOSFET****9**

BJT– Need for biasing - DC Load Line and Bias Point – DC analysis of Transistor circuits - Various biasing methods of BJT – Bias Circuit Design - Thermal stability - Stability factors - Bias compensation techniques using Diode, thermistor and sensistor – Biasing BJT Switching Circuits- JFET - DC Load Line and Bias Point - Various biasing methods of JFET - JFET Bias Circuit Design - MOSFET Biasing - Biasing FET Switching Circuits.

**UNIT II BJT AMPLIFIERS****9**

Small Signal Hybrid  $\pi$  equivalent circuit of BJT – Early effect - Analysis of CE, CC and CB amplifiers using Hybrid  $\pi$  equivalent circuits - AC Load Line Analysis- Darlington Amplifier - Bootstrap technique - Cascade, Cascode configurations - Differential amplifier, Basic BJT differential pair – Small signal analysis and CMRR.

**UNIT III SINGLE STAGE FET, MOSFET AMPLIFIERS****9**

Small Signal Hybrid  $\pi$  equivalent circuit of FET and MOSFET - Analysis of CS, CD and CG amplifiers using Hybrid  $\pi$  equivalent circuits - Basic FET differential pair- BiCMOS circuits.

**UNIT IV FREQUENCY RESPONSE OF AMPLIFIERS****9**

Amplifier frequency response – Frequency response of transistor amplifiers with circuit capacitors – BJT frequency response – short circuit current gain - cut off frequency –  $\alpha$ ,  $\beta$  and unity gain bandwidth – Miller effect - frequency response of FET - High frequency analysis of CE and MOSFET CS amplifier - Transistor Switching Times.

**UNIT V POWER SUPPLIES AND ELECTRONIC DEVICE TESTING****9**

Linear mode power supply - Rectifiers - Filters - Half-Wave Rectifier Power Supply - Full-Wave Rectifier Power Supply - Voltage regulators: Voltage regulation - Linear series, shunt and switching Voltage Regulators - Over voltage protection - BJT and MOSFET – Switched mode power supply (SMPS) - Power Supply Performance and Testing - Troubleshooting and Fault Analysis, Design of Regulated DC Power Supply.

**TOTAL: 45 PERIODS****OUTCOMES:****After studying this course, the student should be able to:**

- Acquire knowledge of
  - Working principles, characteristics and applications of BJT and FET
  - Frequency response characteristics of BJT and FET amplifiers
- Analyze the performance of small signal BJT and FET amplifiers - single stage and multi stage amplifiers
- Apply the knowledge gained in the design of Electronic circuits

**TEXT BOOKS:**

1. Donald. A. Neamen, Electronic Circuits Analysis and Design, 3<sup>rd</sup> Edition, Mc Graw Hill Education (India) Private Ltd., 2010. (Unit I-IV)
2. Robert L. Boylestad and Louis Nasheresky, “Electronic Devices and Circuit Theory”, 11<sup>th</sup> Edition, Pearson Education, 2013. (Unit V)

**REFERENCES**

1. Millman J, Halkias.C.and Sathyabrada Jit, Electronic Devices and Circuits, 4<sup>th</sup> Edition, Mc Graw Hill Education (India) Private Ltd., 2015.
2. Salivahanan and N. Suresh Kumar, Electronic Devices and Circuits, 4<sup>th</sup> Edition, , Mc Graw Hill Education (India) Private Ltd., 2017.
3. Floyd, Electronic Devices, Ninth Edition, Pearson Education, 2012.
4. David A. Bell, Electronic Devices & Circuits, 5<sup>th</sup> Edition, Oxford University Press, 2008.
5. Anwar A. Khan and Kanchan K. Dey, A First Course on Electronics, PHI, 2006.
6. Rashid M, Microelectronics Circuits, Thomson Learning, 2007.

**EC8352****SIGNALS AND SYSTEMS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**OBJECTIVES:**

- To understand the basic properties of signal & systems
- To know the methods of characterization of LTI systems in time domain
- To analyze continuous time signals and system in the Fourier and Laplace domain
- To analyze discrete time signals and system in the Fourier and Z transform domain

**UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS****12**

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids\_ Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals - Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

**UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS 12**  
 Fourier series for periodic signals - Fourier Transform – properties- Laplace Transforms and properties

**UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS 12**  
 Impulse response - convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

**UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 12**  
 Baseband signal Sampling – Fourier Transform of discrete time signals (DTFT) – Properties of DTFT - Z Transform & Properties

**UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS 12**  
 Impulse response – Difference equations-Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- To be able to determine if a given system is linear/causal/stable
- Capable of determining the frequency components present in a deterministic signal
- Capable of characterizing LTI systems in the time domain and frequency domain
- To be able to compute the output of an LTI system in the time and frequency domains

**TEXT BOOK:**

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, “Signals and Systems”, Pearson, 2015.(Unit 1-V)

**REFERENCES**

1. B. P. Lathi, “Principles of Linear Systems and Signals”, Second Edition, Oxford, 2009.
2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, “Signals & Systems - Continuous and Discrete”, Pearson, 2007.
3. John Alan Stuller, “An Introduction to Signals and Systems”, Thomson, 2007.

**EC8392**

**DIGITAL ELECTRONICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To present the Digital fundamentals, Boolean algebra and its applications in digital systems
- To familiarize with the design of various combinational digital circuits using logic gates
- To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits
- To explain the various semiconductor memories and related technology
- To introduce the electronic circuits involved in the making of logic gates



**OBJECTIVES:**

- To introduce the components and their representation of control systems
- To learn various methods for analyzing the time response, frequency response and stability of the systems.
- To learn the various approach for the state variable analysis.

**UNIT I        SYSTEMS COMPONENTS AND THEIR REPRESENTATION        9**

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory-Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchronous -Multivariable control system

**UNIT II        TIME RESPONSE ANALYSIS        9**

Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control-Analytical design for PD, PI,PID control systems

**UNIT III        FREQUENCY RESPONSE AND SYSTEM ANALYSIS        9**

Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation

**UNIT IV        CONCEPTS OF STABILITY ANALYSIS        9**

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.

**UNIT V        CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS        9**

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback.

**TOTAL:45 PERIODS****OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Identify the various control system components and their representations.
- Analyze the various time domain parameters.
- Analysis the various frequency response plots and its system.
- Apply the concepts of various system stability criterions.
- Design various transfer functions of digital control system using state variable models.

**TEXT BOOK:**

1. M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2012.

**REFERENCES:**

1. J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5<sup>th</sup> Edition, 2007.
2. K. Ogata, 'Modern Control Engineering', 5th edition, PHI, 2012.
3. S.K.Bhattacharya, Control System Engineering, 3rd Edition, Pearson, 2013.
4. Benjamin.C.Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition,1995.

**OBJECTIVES:**

- To understand and implement basic data structures using C
- To apply linear and non-linear data structures in problem solving.
- To learn to implement functions and recursive functions by means of data structures
- To implement searching and sorting algorithms

**LIST OF EXERCISES**

1. Basic C Programs – looping, data manipulations, arrays
2. Programs using strings – string function implementation
3. Programs using structures and pointers
4. Programs involving dynamic memory allocations
5. Array implementation of stacks and queues
6. Linked list implementation of stacks and queues
7. Application of Stacks and Queues
8. Implementation of Trees, Tree Traversals
9. Implementation of Binary Search trees
10. Implementation of Linear search and binary search
11. Implementation Insertion sort, Bubble sort, Quick sort and Merge Sort
12. Implementation Hash functions, collision resolution technique

**TOTAL:60 PERIODS****OUTCOMES:****Upon completion of the course, the students will be able to:**

- Write basic and advanced programs in C
- Implement functions and recursive functions in C
- Implement data structures using C
- Choose appropriate sorting algorithm for an application and implement it in a modularized way

**OBJECTIVES:****The student should be made to:**

- Study the Frequency response of CE, CB and CC Amplifier
- Learn the frequency response of CS Amplifiers
- Study the Transfer characteristics of differential amplifier
- Perform experiment to obtain the bandwidth of single stage and multistage amplifiers
- Perform SPICE simulation of Electronic Circuits
- Design and implement the Combinational and sequential logic circuits

**LIST OF ANALOG EXPERIMENTS:**

1. Design of Regulated Power supplies
2. Frequency Response of CE, CB, CC and CS amplifiers
3. Darlington Amplifier
4. Differential Amplifiers - Transfer characteristics, CMRR Measurement
5. Cascode and Cascade amplifiers
6. Determination of bandwidth of single stage and multistage amplifiers
7. Analysis of BJT with Fixed bias and Voltage divider bias using Spice
8. Analysis of FET, MOSFET with fixed bias, self-bias and voltage divider bias using simulation software like Spice

9. Analysis of Cascode and Cascade amplifiers using Spice
10. Analysis of Frequency Response of BJT and FET using Spice

### LIST OF DIGITAL EXPERIMENTS

1. Design and implementation of code converters using logic gates(i) BCD to excess-3 code and vice versa (ii) Binary to gray and vice-versa
2. Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder using IC 7483
3. Design and implementation of Multiplexer and De-multiplexer using logic gates
4. Design and implementation of encoder and decoder using logic gates
5. Construction and verification of 4 bit ripple counter and Mod-10 / Mod-12 Ripple counters
6. Design and implementation of 3-bit synchronous up/down counter

**TOTAL : 60 PERIODS**

### OUTCOMES:

**On completion of this laboratory course, the student should be able to:**

- Design and Test rectifiers, filters and regulated power supplies.
- Design and Test BJT/JFET amplifiers.
- Differentiate cascode and cascade amplifiers.
- Analyze the limitation in bandwidth of single stage and multi stage amplifier
- Measure CMRR in differential amplifier
- Simulate and analyze amplifier circuits using PSpice.
- Design and Test the digital logic circuits.

### LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS, 2 STUDENTS / EXPERIMENT:

#### S.NO EQUIPMENTS FOR ANALOG LAB

- 1 CRO/DSO (30MHz) – 15 Nos.
- 2 Signal Generator /Function Generators (3 MHz) – 15 Nos
- 3 Dual Regulated Power Supplies ( 0 – 30V) – 15 Nos.
- 4 Standalone desktop PCs with SPICE software – 15 Nos.
- 5 Transistor/FET (BJT-NPN-PNP and NMOS/PMOS) – 50 Nos
- 6 Components and Accessories: Resistors, Capacitors, Inductors, diodes, Zener Diodes, Bread Boards, Transformers.
- 7 SPICE Circuit Simulation Software: (any public domain or commercial software)

#### S.NO EQUIPMENTS FOR DIGITAL LAB

- 1 Dual power supply/ single mode power supply - 15 Nos
- 2 IC Trainer Kit - 15 Nos
- 3 Bread Boards - 15 Nos
- 4 Seven segment display -15 Nos
- 5 Multimeter - 15 Nos
- 6 ICs each 50 Nos  
7400/ 7402 / 7404 / 7486 / 7408 / 7432 / 7483 / 74150 /  
74151 / 74147 / 7445 / 7476/7491/ 555 / 7494 / 7447 / 74180 /  
7485 / 7473 / 74138 / 7411 / 7474

HS8381

**INTERPERSONAL SKILLS/LISTENING&SPEAKING**

L	T	P	C
0	0	2	1

**OBJECTIVES:**

**The Course will enable learners to:**

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- improve general and academic listening skills
- Make effective presentations.

**UNIT I**

Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

**UNIT II**

Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

**UNIT III**

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail

**UNIT IV**

Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

**UNIT V**

Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

**TOTAL :30PERIODS**

**OUTCOMES:**

**At the end of the course Learners will be able to:**

- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal

**TEXT BOOKS:**

1. Brooks, Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.
2. Richards, C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

**REFERENCES**

1. Bhatnagar, Nitin and Mamta Bhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.
2. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
3. Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013.
4. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
5. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014

**MA8451****PROBABILITY AND RANDOM PROCESSES**

L	T	P	C
4	0	0	4

**OBJECTIVES :**

- To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
- To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
- To understand the basic concepts of random processes which are widely used in IT fields.
- To understand the concept of correlation and spectral densities.
- To understand the significance of linear systems with random inputs.

**UNIT I      PROBABILITY AND RANDOM VARIABLES****12**

Probability – Axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

**UNIT II      TWO - DIMENSIONAL    RANDOM VARIABLES****12**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

**UNIT III      RANDOM PROCESSES****12**

Classification – Stationary process – Markov process - Markov chain - Poisson process – Random telegraph process.

**UNIT IV      CORRELATION AND SPECTRAL DENSITIES****12**

Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties.

**UNIT V      LINEAR SYSTEMS WITH RANDOM INPUTS****12**

Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output.

**TOTAL : 60 PERIODS**

**OUTCOMES:**

**Upon successful completion of the course, students should be able to:**

- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept random processes in engineering disciplines.
- Understand and apply the concept of correlation and spectral densities.
- The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable. Able to analyze the response of random inputs to linear time invariant systems.

**TEXT BOOKS:**

1. Ibe, O.C., "Fundamentals of Applied Probability and Random Processes ", 1<sup>st</sup> Indian Reprint, Elsevier, 2007.
2. Peebles, P.Z., "Probability, Random Variables and Random Signal Principles ", Tata McGraw Hill, 4<sup>th</sup> Edition, New Delhi, 2002.

**REFERENCES:**

1. Cooper. G.R., McGillem. C.D., "Probabilistic Methods of Signal and System Analysis", Oxford University Press, New Delhi, 3<sup>rd</sup> Indian Edition, 2012.
2. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes ", Tata McGraw Hill Edition, New Delhi, 2004.
3. Miller. S.L. and Childers. D.G., "Probability and Random Processes with Applications to Signal Processing and Communications ", Academic Press, 2004.
4. Stark. H. and Woods. J.W., "Probability and Random Processes with Applications to Signal Processing ", Pearson Education, Asia, 3<sup>rd</sup> Edition, 2002.
5. Yates. R.D. and Goodman. D.J., "Probability and Stochastic Processes", Wiley India Pvt. Ltd., Bangalore, 2<sup>nd</sup> Edition, 2012.

**EC8452****ELECTRONIC CIRCUITS II**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To give a comprehensive exposure to all types of amplifiers and oscillators constructed with discrete components. This helps to develop a strong basis for building linear and digital integrated circuits
- To study about feedback amplifiers and oscillators principles
- To design oscillators.
- To study about turned amplifier.
- To understand the analysis and design of LC and RC oscillators, amplifiers, multi vibrators, power amplifiers and DC convertors.

**UNIT I            FEEDBACK AMPLIFIERS AND STABILITY****9**

Feedback Concepts – gain with feedback – effect of feedback on gain stability, distortion, bandwidth, input and output impedances; topologies of feedback amplifiers – analysis of series-series, shunt-shunt and shunt-series feedback amplifiers-stability problem-Gain and Phase-margins-Frequency compensation.

**UNIT II OSCILLATORS 9**

Barkhausen criterion for oscillation – phase shift, Wien bridge - Hartley & Colpitt's oscillators – Clapp oscillator-Ring oscillators and crystal oscillators – oscillator amplitude stabilization.

**UNIT III TUNED AMPLIFIERS 9**

Coil losses, unloaded and loaded Q of tank circuits, small signal tuned amplifiers – Analysis of capacitor coupled single tuned amplifier – double tuned amplifier - effect of cascading single tuned and double tuned amplifiers on bandwidth – Stagger tuned amplifiers - Stability of tuned amplifiers – Neutralization - Hazeltine neutralization method.

**UNIT IV WAVE SHAPING AND MULTIVIBRATOR CIRCUITS 9**

Pulse circuits – attenuators – RC integrator and differentiator circuits – diode clampers and clippers –Multivibrators - Schmitt Trigger- UJT Oscillator.

**UNIT V POWER AMPLIFIERS AND DC CONVERTERS 9**

Power amplifiers- class A-Class B-Class AB-Class C-Power MOSFET-Temperature Effect- Class AB Power amplifier using MOSFET –DC/DC convertors – Buck, Boost, Buck-Boost analysis and design

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Analyze different types of amplifier, oscillator and multivibrator circuits
- Design BJT amplifier and oscillator circuits
- Analyze transistorized amplifier and oscillator circuits
- Design and analyze feedback amplifiers
- Design LC and RC oscillators, tuned amplifiers, wave shaping circuits, multivibrators, power amplifier and DC convertors.

**TEXT BOOKS:**

1. Sedra and Smith, "Micro Electronic Circuits"; Sixth Edition, Oxford University Press, 2011. (UNIT I, III,IV,V)
2. Jacob Millman, 'Microelectronics', McGraw Hill, 2nd Edition, Reprinted, 2009. (UNIT I,II,IV,V)

**REFERENCES:**

1. Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", 10th Edition, Pearson Education / PHI, 2008
2. David A. Bell, "Electronic Devices and Circuits", Fifth Edition, Oxford University Press, 2008.
3. Millman J. and Taub H., "Pulse Digital and Switching Waveforms", TMH, 2000.
4. Millman and Halkias. C., Integrated Electronics, TMH, 2007.

**OBJECTIVES:**

- To introduce the concepts of various analog modulations and their spectral characteristics
- To understand the properties of random process
- To know the effect of noise on communication systems
- To know the principles of sampling & quantization

**UNIT I AMPLITUDE MODULATION****9**

Amplitude Modulation- DSBSC, DSBFC, SSB, VSB - Modulation index, Spectra, Power relations and Bandwidth – AM Generation – Square law and Switching modulator, DSBSC Generation – Balanced and Ring Modulator, SSB Generation – Filter, Phase Shift and Third Methods, VSB Generation – Filter Method, Hilbert Transform, Pre-envelope & complex envelope –comparison of different AM techniques, Superheterodyne Receiver

**UNIT II ANGLE MODULATION****9**

Phase and frequency modulation, Narrow Band and Wide band FM – Modulation index, Spectra, Power relations and Transmission Bandwidth - FM modulation –Direct and Indirect methods, FM Demodulation – FM to AM conversion, FM Discriminator - PLL as FM Demodulator.

**UNIT III RANDOM PROCESS****9**

Random variables, Random Process, Stationary Processes, Mean, Correlation & Covariance functions, Power Spectral Density, Ergodic Processes, Gaussian Process, Transmission of a Random Process Through a LTI filter.

**UNIT IV NOISE CHARACTERIZATION****9**

Noise sources – Noise figure, noise temperature and noise bandwidth – Noise in cascaded systems. Representation of Narrow band noise –In-phase and quadrature, Envelope and Phase – Noise performance analysis in AM & FM systems – Threshold effect, Pre-emphasis and de-emphasis for FM.

**UNIT V SAMPLING & QUANTIZATION****9**

Low pass sampling – Aliasing- Signal Reconstruction-Quantization - Uniform & non-uniform quantization - quantization noise - Logarithmic Companding –PAM, PPM, PWM, PCM – TDM, FDM.

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Design AM communication systems
- Design Angle modulated communication systems
- Apply the concepts of Random Process to the design of Communication systems
- Analyze the noise performance of AM and FM systems
- Gain knowledge in sampling and quantization

**TEXT BOOKS:**

1. J.G.Proakis, M.Salehi, "Fundamentals of Communication Systems", Pearson Education 2014. (UNIT I-IV)
2. Simon Haykin, "Communication Systems", 4th Edition, Wiley, 2014.(UNIT I-V)

**REFERENCES:**

1. B.P.Lathi, "Modern Digital and Analog Communication Systems", 3rd Edition, Oxford University Press, 2007.
2. D.Roody, J.Coolen, —Electronic Communications, 4th edition PHI 2006
3. A.Papoulis, "Probability, Random variables and Stochastic Processes", McGraw Hill, 3<sup>rd</sup> edition, 1991.
4. B.Sklar, "Digital Communications Fundamentals and Applications", 2nd Edition Pearson Education 2007
5. H P Hsu, Schaum Outline Series - "Analog and Digital Communications" TMH 2006
6. Couch.L., "Modern Communication Systems", Pearson, 2001.

**EC8451****ELECTROMAGNETIC FIELDS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**OBJECTIVES:**

- To gain conceptual and basic mathematical understanding of electric and magnetic fields in free space and in materials
- To understand the coupling between electric and magnetic fields through Faraday's law, displacement current and Maxwell's equations
- To understand wave propagation in lossless and in lossy media
- To be able to solve problems based on the above concepts

**UNIT I INTRODUCTION****12**

Electromagnetic model, Units and constants, Review of vector algebra, Rectangular, cylindrical and spherical coordinate systems, Line, surface and volume integrals, Gradient of a scalar field, Divergence of a vector field, Divergence theorem, Curl of a vector field, Stoke's theorem, Null identities, Helmholtz's theorem

**UNIT II ELECTROSTATICS****12**

Electric field, Coulomb's law, Gauss's law and applications, Electric potential, Conductors in static electric field, Dielectrics in static electric field, Electric flux density and dielectric constant, Boundary conditions, Capacitance, Parallel, cylindrical and spherical capacitors, Electrostatic energy, Poisson's and Laplace's equations, Uniqueness of electrostatic solutions, Current density and Ohm's law, Electromotive force and Kirchhoff's voltage law, Equation of continuity and Kirchhoff's current law

**UNIT III MAGNETOSTATICS****12**

Lorentz force equation, Law of no magnetic monopoles, Ampere's law, Vector magnetic potential, Biot-Savart law and applications, Magnetic field intensity and idea of relative permeability, Magnetic circuits, Behaviour of magnetic materials, Boundary conditions, Inductance and inductors, Magnetic energy, Magnetic forces and torques

**UNIT IV TIME-VARYING FIELDS AND MAXWELL'S EQUATIONS****12**

Faraday's law, Displacement current and Maxwell-Ampere law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Time-harmonic fields

**UNIT V PLANE ELECTROMAGNETIC WAVES****12**

Plane waves in lossless media, Plane waves in lossy media (low-loss dielectrics and good conductors), Group velocity, Electromagnetic power flow and Poynting vector, Normal incidence at a plane conducting boundary, Normal incidence at a plane dielectric boundary

**TOTAL:60 PERIODS**

## OUTCOMES:

By the end of this course, the student should be able to:

- Display an understanding of fundamental electromagnetic laws and concepts
- Write Maxwell's equations in integral, differential and phasor forms and explain their physical meaning
- Explain electromagnetic wave propagation in lossy and in lossless media
- Solve simple problems requiring estimation of electric and magnetic field quantities based on these concepts and laws

## TEXT BOOKS:

1. D.K. Cheng, Field and wave electromagnetics, 2nd ed., Pearson (India), 1989 (UNIT I, II,III IV,V)
2. W.H. Hayt and J.A. Buck, Engineering electromagnetics, 7th ed., McGraw-Hill (India), 2006 (UNIT I-V)

## REFERENCES

1. D.J. Griffiths, Introduction to electrodynamics, 4th ed., Pearson (India), 2013
2. B.M. Notaros, Electromagnetics, Pearson: New Jersey, 2011
3. M.N.O. Sadiku and S.V. Kulkarni, Principles of electromagnetics, 6th ed., Oxford (Asian Edition), 2015

<b>EC8453</b>	<b>LINEAR INTEGRATED CIRCUITS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

## OBJECTIVES:

- To introduce the basic building blocks of linear integrated circuits
- To learn the linear and non-linear applications of operational amplifiers
- To introduce the theory and applications of analog multipliers and PLL
- To learn the theory of ADC and DAC
- To introduce the concepts of waveform generation and introduce some special function ICs

### **UNIT I                      BASICS OF OPERATIONAL AMPLIFIERS                      9**

Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, Basic information about op-amps – Ideal Operational Amplifier - General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations – JFET Operational Amplifiers – LF155 and TL082.

### **UNIT II                      APPLICATIONS OF OPERATIONAL AMPLIFIERS                      9**

Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.

### **UNIT III                      ANALOG MULTIPLIER AND PLL                      9**

Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing and clock synchronisation.

#### **UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS**

**9**

Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode R - 2R Ladder types - switches for D/A converters, high speed sample-and-hold circuits, A/D Converters – specifications - Flash type - Successive Approximation type - Single Slope type – Dual Slope type - A/D Converter using Voltage-to-Time Conversion - Over-sampling A/D Converters, Sigma – Delta converters.

#### **UNIT V WAVEFORM GENERATORS AND SPECIAL FUNCTION ICS**

**9**

Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555, IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Monolithic switching regulator, Low Drop – Out(LDO) Regulators - Switched capacitor filter IC MF10, Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers and fibre optic IC.

**TOTAL:45 PERIODS**

#### **OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Design linear and non linear applications of OP – AMPS
- Design applications using analog multiplier and PLL
- Design ADC and DAC using OP – AMPS
- Generate waveforms using OP – AMP Circuits
- Analyze special function ICs

#### **TEXT BOOKS:**

1. D.Roy Choudhry, Shail Jain, “Linear Integrated Circuits”, New Age International Pvt. Ltd., 2018, Fifth Edition. (Unit I – V)
2. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, 4th Edition, Tata Mc Graw-Hill, 2016 (Unit I – V)

#### **REFERENCES:**

1. Ramakant A. Gayakwad, “OP-AMP and Linear ICs”, 4th Edition, Prentice Hall / Pearson Education, 2015.
2. Robert F.Coughlin, Frederick F.Driscoll, “Operational Amplifiers and Linear Integrated Circuits”, Sixth Edition, PHI, 2001.
3. B.S.Sonde, “System design using Integrated Circuits” , 2nd Edition, New Age Pub, 2001.
4. Gray and Meyer, “Analysis and Design of Analog Integrated Circuits”, Wiley International,5<sup>th</sup> Edition, 2009.
5. William D.Stanley, “Operational Amplifiers with Linear Integrated Circuits”, Pearson Education,4<sup>th</sup> Edition,2001.
6. S.Salivahanan & V.S. Kanchana Bhaskaran, “Linear Integrated Circuits”, TMH,2<sup>nd</sup> Edition, 4<sup>th</sup> Reprint, 2016.

**OBJECTIVES:**

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY****14**

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

**UNIT II ENVIRONMENTAL POLLUTION****8**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

**UNIT III NATURAL RESOURCES****10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

**UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

**UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

**TEXTBOOKS:**

1. Benny Joseph, ‘Environmental Science and Engineering’, Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, ‘Introduction to Environmental Engineering and Science’, 2<sup>nd</sup> edition, Pearson Education, 2004.

**REFERENCES :**

1. Dharmendra S. Sengar, ‘Environmental law’, Prentice hall of India PVT LTD, New Delhi, 2007.
2. Erach Bharucha, “Textbook of Environmental Studies”, Universities Press(I) PVT, LTD, Hyderabad, 2015.
3. Rajagopalan, R, ‘Environmental Studies-From Crisis to Cure’, Oxford University Press, 2005.
4. G. Tyler Miller and Scott E. Spoolman, “Environmental Science”, Cengage Learning India PVT, LTD, Delhi, 2014.

<b>EC8461</b>	<b>CIRCUITS DESIGN AND SIMULATION LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**OBJECTIVES:**

- To gain hands on experience in designing electronic circuits
- To learn simulation software used in circuit design
- To learn the fundamental principles of amplifier circuits
- To differentiate feedback amplifiers and oscillators.
- To differentiate the operation of various multivibrators

## DESIGN AND ANALYSIS OF THE FOLLOWING CIRCUITS

1. Series and Shunt feedback amplifiers-Frequency response, Input and output impedance
2. RC Phase shift oscillator and Wien Bridge Oscillator
3. Hartley Oscillator and Colpitts Oscillator
4. Single Tuned Amplifier
5. RC Integrator and Differentiator circuits
6. Astable and Monostable multivibrators
7. Clippers and Clampers

### SIMULATION USING SPICE (Using Transistor):

1. Tuned Collector Oscillator
2. Twin -T Oscillator / Wein Bridge Oscillator
3. Double and Stagger tuned Amplifiers
4. Bistable Multivibrator
5. Schmitt Trigger circuit with Predictable hysteresis
6. Analysis of power amplifier

**TOTAL: 60 PERIODS**

### OUTCOMES:

**On completion of this laboratory course, the student should be able to:**

- Analyze various types of feedback amplifiers
- Design oscillators, tuned amplifiers, wave-shaping circuits and multivibrators
- Design and simulate feedback amplifiers, oscillators, tuned amplifiers, wave-shaping circuits and multivibrators using SPICE Tool.

### LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER EXPERIMENT:

S.NO	EQUIPMENTS	
1	CRO (Min 30MHz)	- 15 Nos
2	Signal Generator /Function Generators (2 MHz)	- 15 Nos
3	Dual Regulated Power Supplies (0 – 30V)	- 15 Nos
4	Digital Multimeter	- 15 Nos
5	Digital LCR Meter	- 2 Nos
6	Standalone desktops PC	- 15 Nos
7	Transistor/FET (BJT-NPN-PNP and NMOS/PMOS)	- 50 Nos

### Components and Accessories:

Transistors, Resistors, Capacitors, Inductors, diodes, Zener Diodes, Bread Boards, Transformers.  
SPICE Circuit Simulation Software: (any public domain or commercial software)

**OBJECTIVES:**

- To understand the basics of linear integrated circuits and available ICs
- To understand the characteristics of the operational amplifier.
- To apply operational amplifiers in linear and nonlinear applications.
- To acquire the basic knowledge of special function IC.
- To use SPICE software for circuit design

**DESIGN AND TESTING OF THE FOLLOWING CIRCUITS**

1. Inverting, Non inverting and differential amplifiers.
2. Integrator and Differentiator.
3. Instrumentation amplifier
4. Active low-pass, High-pass and band-pass filters.
5. Astable & Monostable multivibrators using Op-amp
6. Schmitt Trigger using op-amp.
7. Phase shift and Wien bridge oscillators using Op-amp.
8. Astable and Monostable multivibrators using NE555 Timer.
9. PLL characteristics and its use as Frequency Multiplier, Clock synchronization
10. R-2R Ladder Type D- A Converter using Op-amp.
11. DC power supply using LM317 and LM723.
12. Study of SMPS

**SIMULATION USING SPICE:**

1. Active low-pass, High-pass and band-pass filters using Op-amp
2. Astable and Monostable multivibrators using NE555 Timer.
3. A/ D converter
4. Analog multiplier

**TOTAL: 60 PERIODS****OUTCOMES:****On completion of this laboratory course, the student should be able to:**

- Design amplifiers, oscillators, D-A converters using operational amplifiers.
- Design filters using op-amp and performs an experiment on frequency response.
- Analyze the working of PLL and describe its application as a frequency multiplier.
- Design DC power supply using ICs.
- Analyze the performance of filters, multivibrators, A/D converter and analog multiplier using SPICE.

**LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER EXPERIMENT:**

S.NO	EQUIPMENTS	
1	CRO/DSO (Min 30MHz)	-- 15 Nos
2	Signal Generator /Function Generators (2 MHz)	- 15 Nos
3	Dual Regulated Power Supplies (0 – 30V)	-- 15 Nos
4	Digital Multimeter	-- 15 Nos
5	IC Tester	-- 5 Nos
6	Standalone desktops PC	-- 15 Nos
7	Components and Accessories	- 50 Nos

**Components and Accessories:**

Transistors, Resistors, Capacitors, diodes, Zener diodes, Bread Boards, Transformers, wires, Power transistors, Potentiometer, A/D and D/A convertors, LEDs .

**Note:** Op-Amps uA741, LM 301, LM311, LM 324, LM317, LM723, 7805, 7812, 2N3524, 2N3525, 2N3391, AD 633, LM 555, LM 565 may be used.

<b>EC8501</b>	<b>DIGITAL COMMUNICATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To study the limits set by Information Theory
- To study the various waveform coding schemes
- To learn the various baseband transmission schemes
- To understand the various band pass signaling schemes
- To know the fundamentals of channel coding

**UNIT I INFORMATION THEORY 9**

Discrete Memoryless source, Information, Entropy, Mutual Information - Discrete Memoryless channels – Binary Symmetric Channel, Channel Capacity - Hartley - Shannon law - Source coding theorem - Shannon - Fano & Huffman codes.

**UNIT II WAVEFORM CODING & REPRESENTATION 9**

Prediction filtering and DPCM - Delta Modulation - ADPCM & ADM principles-Linear Predictive Coding- Properties of Line codes- Power Spectral Density of Unipolar / Polar RZ & NRZ – Bipolar NRZ - Manchester

**UNIT III BASEBAND TRANSMISSION & RECEPTION 9**

ISI – Nyquist criterion for distortion less transmission – Pulse shaping – Correlative coding - Eye pattern – Receiving Filters- Matched Filter, Correlation receiver, Adaptive Equalization

**UNIT IV DIGITAL MODULATION SCHEME 9**

Geometric Representation of signals - Generation, detection, PSD & BER of Coherent BPSK, BFSK & QPSK - QAM - Carrier Synchronization - Structure of Non-coherent Receivers - Principle of DPSK.

**UNIT V ERROR CONTROL CODING 9**

Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes - Convolutional codes - Viterbi Decoder.

**TOTAL:45 PERIODS****OUTCOMES:**

**Upon completion of the course, the student should be able to**

- Design PCM systems
- Design and implement base band transmission schemes
- Design and implement band pass signaling schemes
- Analyze the spectral characteristics of band pass signaling schemes and their noise performance
- Design error control coding schemes

**TEXT BOOK:**

1. S. Haykin, "Digital Communications", John Wiley, 2005 (Unit I –V)

**REFERENCES**

1. B. Sklar, "Digital Communication Fundamentals and Applications", 2nd Edition, Pearson Education, 2009
2. B.P.Lathi, "Modern Digital and Analog Communication Systems" 3rd Edition, Oxford University Press 2007.
3. H P Hsu, Schaum Outline Series - "Analog and Digital Communications", TMH 2006
4. J.G Proakis, "Digital Communication", 4th Edition, Tata Mc Graw Hill Company, 2001.

<b>EC8553</b>	<b>DISCRETE-TIME SIGNAL PROCESSING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**OBJECTIVES:**

- To learn discrete fourier transform, properties of DFT and its application to linear filtering
- To understand the characteristics of digital filters, design digital IIR and FIR filters and apply these filters to filter undesirable signals in various frequency bands
- To understand the effects of finite precision representation on digital filters
- To understand the fundamental concepts of multi rate signal processing and its applications
- To introduce the concepts of adaptive filters and its application to communication engineering

**UNIT I DISCRETE FOURIER TRANSFORM 12**

Review of signals and systems, concept of frequency in discrete-time signals, summary of analysis & synthesis equations for FT & DTFT, frequency domain sampling, Discrete Fourier transform (DFT) - deriving DFT from DTFT, properties of DFT - periodicity, symmetry, circular convolution. Linear filtering using DFT. Filtering long data sequences - overlap save and overlap add method. Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF) Fast Fourier transform (FFT). Linear filtering using FFT.

**UNIT II INFINITE IMPULSE RESPONSE FILTERS 12**

Characteristics of practical frequency selective filters. characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.

**UNIT III FINITE IMPULSE RESPONSE FILTERS 12**

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations

**UNIT IV FINITE WORD LENGTH EFFECTS 12**

Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

**UNIT V INTRODUCTION TO DIGITAL SIGNAL PROCESSORS****12**

DSP functionalities - circular buffering – DSP architecture – Fixed and Floating point architecture principles – Programming – Application examples.

**TOTAL:60PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to**

- Apply DFT for the analysis of digital signals and systems
- Design IIR and FIR filters
- Characterize the effects of finite precision representation on digital filters
- Design multirate filters
- Apply adaptive filters appropriately in communication systems

**TEXT BOOK:**

1. John G. Proakis & Dimitris G. Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Fourth Edition, Pearson Education / Prentice Hall, 2007. (UNIT I – V)

**REFERENCES:**

1. Emmanuel C. Ifeakor & Barrie. W. Jervis, "Digital Signal Processing", Second Edition, Pearson Education / Prentice Hall, 2002.
2. A. V. Oppenheim, R.W. Schafer and J.R. Buck, "Discrete-Time Signal Processing", 8th Indian Reprint, Pearson, 2004.
3. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Tata Mc Graw Hill, 2007.
4. Andreas Antoniou, "Digital Signal Processing", Tata Mc Graw Hill, 2006.

**EC8552****COMPUTER ARCHITECTURE AND ORGANIZATION****L T P C  
3 0 0 3****OBJECTIVES:**

- To make students understand the basic structure and operation of digital computer
- To familiarize with implementation of fixed point and floating-point arithmetic operations
- To study the design of data path unit and control unit for processor
- To understand the concept of various memories and interfacing
- To introduce the parallel processing technique

**UNIT I COMPUTER ORGANIZATION & INSTRUCTIONS****9**

Basics of a computer system: Evolution, Ideas, Technology, Performance, Power wall, Uniprocessors to Multiprocessors. Addressing and addressing modes. Instructions: Operations and Operands, Representing instructions, Logical operations, control operations.

**UNIT II ARITHMETIC****9**

Fixed point Addition, Subtraction, Multiplication and Division. Floating Point arithmetic, High performance arithmetic, Subword parallelism

**UNIT III THE PROCESSOR****9**

Introduction, Logic Design Conventions, Building a Datapath - A Simple Implementation scheme - An Overview of Pipelining - Pipelined Datapath and Control. Data Hazards: Forwarding versus Stalling, Control Hazards, Exceptions, Parallelism via Instructions.

**UNIT IV MEMORY AND I/O ORGANIZATION 9**

Memory hierarchy, Memory Chip Organization, Cache memory, Virtual memory. Parallel Bus Architectures, Internal Communication Methodologies, Serial Bus Architectures, Mass storage, Input and Output Devices.

**UNIT V ADVANCED COMPUTER ARCHITECTURE 9**

Parallel processing architectures and challenges, Hardware multithreading, Multicore and shared memory multiprocessors, Introduction to Graphics Processing Units, Clusters and Warehouse scale computers - Introduction to Multiprocessor network topologies.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to**

- Describe data representation, instruction formats and the operation of a digital computer
- Illustrate the fixed point and floating-point arithmetic for ALU operation
- Discuss about implementation schemes of control unit and pipeline performance
- Explain the concept of various memories, interfacing and organization of multiple processors
- Discuss parallel processing technique and unconventional architectures

**TEXT BOOKS:**

1. David A. Patterson and John L. Hennessey, "Computer Organization and Design", Fifth edition, Morgan Kauffman / Elsevier, 2014. (UNIT I-V)
2. Miles J. Murdocca and Vincent P. Heuring, "Computer Architecture and Organization: An Integrated approach", Second edition, Wiley India Pvt Ltd, 2015 (UNIT IV,V)

**REFERENCES**

1. V. Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organization", Fifth edition, Mc Graw-Hill Education India Pvt Ltd, 2014.
2. William Stallings "Computer Organization and Architecture", Seventh Edition, Pearson Education, 2006.
3. Govindarajalu, "Computer Architecture and Organization, Design Principles and Applications", Second edition, McGraw-Hill Education India Pvt Ltd, 2014.

<b>EC8551</b>	<b>COMMUNICATION NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

**The student should be made to:**

- Understand the division of network functionalities into layers.
- Be familiar with the components required to build different types of networks
- Be exposed to the required functionality at each layer
- Learn the flow control and congestion control algorithms

**UNIT I FUNDAMENTALS & LINK LAYER 9**

Overview of Data Communications- Networks – Building Network and its types– Overview of Internet - Protocol Layering - OSI Mode – Physical Layer – Overview of Data and Signals - introduction to Data Link Layer - Link layer Addressing- Error Detection and Correction

**UNIT II MEDIA ACCESS & INTERNETWORKING 9**

Overview of Data link Control and Media access control - Ethernet (802.3) - Wireless LANs – Available Protocols – Bluetooth – Bluetooth Low Energy – WiFi – 6LowPAN–Zigbee - Network layer services – Packet Switching – IPV4 Address – Network layer protocols ( IP, ICMP, Mobile IP)

**UNIT III ROUTING 9**

Routing - Unicast Routing – Algorithms – Protocols – Multicast Routing and its basics – Overview of Intradomain and interdomain protocols – Overview of IPv6 Addressing – Transition from IPv4 to IPv6

**UNIT IV TRANSPORT LAYER 9**

Introduction to Transport layer –Protocols- User Datagram Protocols (UDP) and Transmission Control Protocols (TCP) –Services – Features – TCP Connection – State Transition Diagram – Flow, Error and Congestion Control - Congestion avoidance (DECbit, RED) – QoS – Application requirements

**UNIT V APPLICATION LAYER 9**

Application Layer Paradigms – Client Server Programming – World Wide Web and HTTP - DNS- - Electronic Mail (SMTP, POP3, IMAP, MIME) – Introduction to Peer to Peer Networks – Need for Cryptography and Network Security – Firewalls.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Identify the components required to build different types of networks
- Choose the required functionality at each layer for given application
- Identify solution for each functionality at each layer
- Trace the flow of information from one node to another node in the network

**TEXT BOOK:**

1. Behrouz A. Forouzan, “Data communication and Networking”, Fifth Edition, Tata McGraw – Hill, 2013 (UNIT I –V)

**REFERENCES**

1. James F. Kurose, Keith W. Ross, “Computer Networking - A Top-Down Approach Featuring the Internet”, Seventh Edition, Pearson Education, 2016.
2. Nader. F. Mir,“ Computer and Communication Networks”, Pearson Prentice Hall Publishers, 2<sup>nd</sup> Edition, 2014.
3. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, “Computer Networks: An Open Source Approach”, Mc Graw Hill Publisher, 2011.
4. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers, 2011.

**EC8562                      DIGITAL SIGNAL PROCESSING LABORATORY                      L   T   P   C**  
**0   0   4   2**

**OBJECTIVES:**

**The student should be made:**

- To perform basic signal processing operations such as Linear Convolution, Circular Convolution, Auto Correlation, Cross Correlation and Frequency analysis in MATLAB
- To implement FIR and IIR filters in MATLAB and DSP Processor
- To study the architecture of DSP processor
- To design a DSP system to demonstrate the Multi-rate and Adaptive signal processing concepts.

**LIST OF EXPERIMENTS: MATLAB / EQUIVALENT SOFTWARE PACKAGE**

1. Generation of elementary Discrete-Time sequences
2. Linear and Circular convolutions
3. Auto correlation and Cross Correlation
4. Frequency Analysis using DFT
5. Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filtering operation
6. Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF) and demonstrate the filtering operations

**DSP PROCESSOR BASED IMPLEMENTATION**

1. Study of architecture of Digital Signal Processor
2. Perform MAC operation using various addressing modes
3. Generation of various signals and random noise
4. Design and demonstration of FIR Filter for Low pass, High pass, Band pass and Band stop filtering
5. Design and demonstration of Butter worth and Chebyshev IIR Filters for Low pass, High pass, Band pass and Band stop filtering
6. Implement an Up-sampling and Down-sampling operation in DSP Processor

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Carryout basic signal processing operations
- Demonstrate their abilities towards MATLAB based implementation of various DSP systems
- Analyze the architecture of a DSP Processor
- Design and Implement the FIR and IIR Filters in DSP Processor for performing filtering operation over real-time signals
- Design a DSP system for various applications of DSP

**EC8561                      COMMUNICATION SYSTEMS LABORATORY                      L   T   P   C**  
**0   0   4   2**

**OBJECTIVES:**

**The student should be made:**

- To visualize the effects of sampling and TDM
- To Implement AM & FM modulation and demodulation
- To implement PCM & DM
- To simulate Digital Modulation schemes
- To simulate Error control coding schemes

## LIST OF EXPERIMENTS:

1. Signal Sampling and reconstruction
2. Time Division Multiplexing
3. AM Modulator and Demodulator
4. FM Modulator and Demodulator
5. Pulse Code Modulation and Demodulation
6. Delta Modulation and Demodulation
7. Line coding schemes
8. Simulation of ASK, FSK, and BPSK generation schemes
9. Simulation of DPSK, QPSK and QAM generation schemes
10. Simulation of signal constellations of BPSK, QPSK and QAM
11. Simulation of ASK, FSK and BPSK detection schemes
12. Simulation of Linear Block and Cyclic error control coding schemes
13. Simulation of Convolutional coding scheme
14. Communication link simulation

**TOTAL: 60 PERIODS**

## OUTCOMES:

**At the end of the course, the student should be able to:**

- Simulate & validate the various functional modules of a communication system
- Demonstrate their knowledge in base band signaling schemes through implementation of digital modulation schemes
- Apply various channel coding schemes & demonstrate their capabilities towards the improvement of the noise performance of communication system
- Simulate end-to-end communication Link

## LAB Requirements for a Batch of 30 students (3 students per experiment):

- i) Kits for Signal Sampling, TDM, AM, FM, PCM, DM and Line Coding Schemes
- ii) CROs/DSOs – 15 Nos, Function Generators – 15 Nos.
- iii) MATLAB or equivalent software package for simulation experiments
- iv) PCs - 15 Nos

**EC8563**

**COMMUNICATION NETWORKS LABORATORY**

L	T	P	C
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## OBJECTIVES:

**The student should be made to:**

- Learn to communicate between two desktop computers
- Learn to implement the different protocols
- Be familiar with IP Configuration
- Be familiar with the various routing algorithms
- Be familiar with simulation tools

## LIST OF EXPERIMENTS:

1. Implementation of Error Detection / Error Correction Techniques
2. Implementation of Stop and Wait Protocol and sliding window
3. Implementation and study of Goback-N and selective repeat protocols
4. Implementation of High Level Data Link Control
5. Implementation of IP Commands such as ping, Traceroute, nslookup.
6. Implementation of IP address configuration.
7. To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
8. Network Topology - Star, Bus, Ring

9. Implementation of distance vector routing algorithm
10. Implementation of Link state routing algorithm
11. Study of Network simulator (NS) and simulation of Congestion Control Algorithms using NS
12. Implementation of Encryption and Decryption Algorithms using any programming language

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Communicate between two desktop computers
- Implement the different protocols
- Program using sockets.
- Implement and compare the various routing algorithms
- Use the simulation tool.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

**SOFTWARE**

- C / Python / Java / Equivalent Compiler
- MATLAB SOFTWARE (Few experiments can be practiced with MATLAB)
- Standard LAN Trainer Kits 4 Nos
- Network simulator like NS2/ NS3 / Glomosim/OPNET/ 30 Equivalent

**HARDWARE**

Standalone Desktops 30 Nos

**EC8691**

**MICROPROCESSORS AND MICROCONTROLLERS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To understand the Architecture of 8086 microprocessor.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To interface microprocessors with supporting chips.
- To study the Architecture of 8051 microcontroller.
- To design a microcontroller based system

**UNIT I THE 8086 MICROPROCESSOR**

**9**

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

**UNIT II 8086 SYSTEM BUS STRUCTURE**

**9**

8086 signals – Basic configurations – System bus timing –System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.

**UNIT III I/O INTERFACING**

**9**

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

**UNIT IV MICROCONTROLLER****9**

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

**UNIT V INTERFACING MICROCONTROLLER****9**

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors

**TOTAL: 45 PERIODS****OUTCOMES:**

**At the end of the course, the students should be able to:**

- Understand and execute programs based on 8086 microprocessor.
- Design Memory Interfacing circuits.
- Design and interface I/O circuits.
- Design and implement 8051 microcontroller based systems.

**TEXT BOOKS:**

1. Yu-Cheng Liu, Glenn A.Gibson, “Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design”, Second Edition, Prentice Hall of India, 2007. (UNIT I-III)
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Second Edition, Pearson education, 2011. (UNIT IV-V)

**REFERENCES:**

1. Doughlas V.Hall, “Microprocessors and Interfacing, Programming and Hardware”,TMH,2012
2. A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3<sup>rd</sup> edition, Tata McGrawHill, 2012

**EC8095****VLSI DESIGN**

L	T	P	C
3	0	0	3

**OBJECTIVES:**

- Study the fundamentals of CMOS circuits and its characteristics.
- Learn the design and realization of combinational & sequential digital circuits.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed
- Learn the different FPGA architectures and testability of VLSI circuits.

**UNIT I INTRODUCTION TO MOS TRANSISTOR****9**

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V Charters tics, C-V Charters tics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

**UNIT II COMBINATIONAL MOS LOGIC CIRCUITS****9**

**Circuit Families:** Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls.

**Power:** Dynamic Power, Static Power, Low Power Architecture.

**UNIT III SEQUENTIAL CIRCUIT DESIGN 9**

Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.

**Timing Issues :** Timing Classification Of Digital System, Synchronous Design.

**UNIT IV DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM 9**

**Arithmetic Building Blocks:** Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.

**Designing Memory and Array structures:** Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.

**UNIT V IMPLEMENTATION STRATEGIES AND TESTING 9**

FPGA Building Block Architectures, FPGA Interconnect Routing Procedures. Design for Testability: *Ad Hoc* Testing, Scan Design, BIST, IDDQ Testing, Design for Manufacturability, Boundary Scan.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**UPON COMPLETION OF THE COURSE, STUDENTS SHOULD be ABLE TO**

- Realize the concepts of digital building blocks using MOS transistor.
- Design combinational MOS circuits and power strategies.
- Design and construct Sequential Circuits and Timing systems.
- Design arithmetic building blocks and memory subsystems.
- Apply and implement FPGA design flow and testing.

**TEXT BOOKS:**

1. Neil H.E. Weste, David Money Harris "CMOS VLSI Design: A Circuits and Systems Perspective", 4<sup>th</sup> Edition, Pearson , 2017 (UNIT I,II,V)
2. Jan M. Rabaey ,Anantha Chandrakasan, Borivoje. Nikolic, "Digital Integrated Circuits:A Design perspective", Second Edition , Pearson , 2016.(UNIT III,IV)

**REFERENCES**

1. M.J. Smith, "Application Specific Integrated Circuits", Addison Wesley, 1997
2. Sung-Mo kang, Yusuf leblebici, Chulwoo Kim "CMOS Digital Integrated Circuits:Analysis & Design",4<sup>th</sup> edition McGraw Hill Education,2013
3. Wayne Wolf, "Modern VLSI Design: System On Chip", Pearson Education, 2007
4. R.Jacob Baker, Harry W.LI., David E.Boyee, "CMOS Circuit Design, Layout and Simulation", Prentice Hall of India 2005.

**EC8652**

**WIRELESS COMMUNICATION**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To study the characteristic of wireless channel
- To understand the design of a cellular system
- To study the various digital signaling techniques and multipath mitigation techniques
- To understand the concepts of multiple antenna techniques

**UNIT I WIRELESS CHANNELS 9**

Large scale path loss – Path loss models: Free Space and Two-Ray models -Link Budget design – Small scale fading- Parameters of mobile multipath channels – Time dispersion parameters-Coherence bandwidth – Doppler spread & Coherence time, fading due to Multipath time delay spread – flat fading – frequency selective fading – Fading due to Doppler spread – fast fading – slow fading.

**UNIT II CELLULAR ARCHITECTURE 9**

Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations–Cellular concept- Frequency reuse - channel assignment- hand off- interference & system capacity-trunking & grade of service – Coverage and capacity improvement.

**UNIT III DIGITAL SIGNALING FOR FADING CHANNELS 9**

Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR.

**UNIT IV MULTIPATH MITIGATION TECHNIQUES 9**

Equalisation – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity – Micro and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver.

**UNIT V MULTIPLE ANTENNA TECHNIQUES 9**

MIMO systems – spatial multiplexing -System model -Pre-coding - Beam forming - transmitter diversity, receiver diversity- Channel state information-capacity in fading and non-fading channels.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**The student should be able to:**

- Characterize a wireless channel and evolve the system design specifications
- Design a cellular system based on resource availability and traffic demands
- Identify suitable signaling and multipath mitigation techniques for the wireless channel and system under consideration.

**TEXT BOOKS:**

1. Rappaport,T.S., —Wireless communicationsII, Pearson Education, Second Edition, 2010.(UNIT I, II, IV)
2. Andreas.F. Molisch, —Wireless CommunicationsII, John Wiley – India, 2006. (UNIT III,V)

**REFERENCES:**

1. Wireless Communication –Andrea Goldsmith, Cambridge University Press, 2011
2. Van Nee, R. and Ramji Prasad, —OFDM for wireless multimedia communications, Artech House, 2000
3. David Tse and Pramod Viswanath, —Fundamentals of Wireless Communication, Cambridge University Press, 2005.
4. Upena Dalal, —Wireless CommunicationII, Oxford University Press, 2009.

**OBJECTIVE:**

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization .

**UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9**

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations, system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

**UNIT II PLANNING 9**

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

**UNIT III ORGANISING 9**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management

**UNIT IV DIRECTING 9**

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication –communication and IT.

**UNIT V CONTROLLING 9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

**TOTAL: 45 PERIODS****OUTCOME:**

- Upon completion of the course, students will be able to have clear understanding
- Managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

**TEXTBOOKS:**

- Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall (India) Pvt. Ltd., 10<sup>th</sup> Edition, 2009.
- JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", Pearson Education, 6th Edition, 2004.

**REFERENCES:**

- Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" Pearson Education, 7th Edition, 2011.
- Robert Kreitner & Mamata Mohapatra, " Management", Biztantra, 2008.
- Harold Koontz & Heinz Wehrich "Essentials of management" Tata McGraw Hill,1998.
- Tripathy PC & Reddy PN, "Principles of Management", Tata McGraw Hill, 1999

**OBJECTIVES:**

- To introduce the various types of transmission lines and its characteristics
- To give thorough understanding about high frequency line, power and impedance measurements
- To impart technical knowledge in impedance matching using smith chart
- To introduce passive filters and basic knowledge of active RF components
- To get acquaintance with RF system transceiver design

**UNIT I TRANSMISSION LINE THEORY 9**

General theory of Transmission lines - the transmission line - general solution - The infinite line - Wavelength, velocity of propagation - Waveform distortion - the distortion-less line - Loading and different methods of loading - Line not terminated in  $Z_0$  - Reflection coefficient - calculation of current, voltage, power delivered and efficiency of transmission - Input and transfer impedance - Open and short circuited lines - reflection factor and reflection loss.

**UNIT II HIGH FREQUENCY TRANSMISSION LINES 9**

Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on the dissipation-less line, Standing Waves, Nodes, Standing Wave Ratio - Input impedance of the dissipation-less line - Open and short circuited lines - Power and impedance measurement on lines - Reflection losses - Measurement of VSWR and wavelength.

**UNIT III IMPEDANCE MATCHING IN HIGH FREQUENCY LINES 9**

Impedance matching: Quarter wave transformer - Impedance matching by stubs - Single stub and double stub matching - Smith chart - Solutions of problems using Smith chart - Single and double stub matching using Smith chart.

**UNIT IV WAVEGUIDES 9**

General Wave behavior along uniform guiding structures – Transverse Electromagnetic Waves, Transverse Magnetic Waves, Transverse Electric Waves – TM and TE Waves between parallel plates. Field Equations in rectangular waveguides, TM and TE waves in rectangular waveguides, Bessel Functions, TM and TE waves in Circular waveguides.

**UNIT V RF SYSTEM DESIGN CONCEPTS 9**

Active RF components: Semiconductor basics in RF, bipolar junction transistors, RF field effect transistors, High electron mobility transistors Basic concepts of RF design, Mixers, Low noise amplifiers, voltage control oscillators, Power amplifiers, transducer power gain and stability considerations.

**TOTAL:45 PERIODS****OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Explain the characteristics of transmission lines and its losses
- Write about the standing wave ratio and input impedance in high frequency transmission lines
- Analyze impedance matching by stubs using smith charts
- Analyze the characteristics of TE and TM waves
- Design a RF transceiver system for wireless communication

**TEXT BOOKS:**

1. John D Ryder, "Networks, lines and fields", 2nd Edition, Prentice Hall India, 2015. (UNIT I-IV)
2. Mathew M. Radmanesh, "Radio Frequency & Microwave Electronics", Pearson Education Asia, Second Edition, 2002. (UNIT V)

**REFERENCES:**

1. Reinhold Ludwig and Powel Bretchko, "RF Circuit Design – Theory and Applications", Pearson Education Asia, First Edition, 2001.
2. D. K. Misra, "Radio Frequency and Microwave Communication Circuits- Analysis and Design", John Wiley & Sons, 2004.
3. E.C.Jordan and K.G. Balmain, —Electromagnetic Waves and Radiating Systems Prentice Hall of India, 2006.
4. G.S.N Raju, "Electromagnetic Field Theory and Transmission Lines Pearson Education, First edition 2005.

**EC8681****MICROPROCESSORS AND MICROCONTROLLERS LABORATORY****L T P C****0 0 4 2****OBJECTIVES:**

- To Introduce ALP concepts, features and Coding methods
- Write ALP for arithmetic and logical operations in 8086 and 8051
- Differentiate Serial and Parallel Interface
- Interface different I/Os with Microprocessors
- Be familiar with MASM

**LIST OF EXPERIMENTS:****8086 Programs using kits and MASM**

1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. Code conversion, decimal arithmetic and Matrix operations.
4. Floating point operations, string manipulations, sorting and searching
5. Password checking, Print RAM size and system date
6. Counters and Time Delay

**Peripherals and Interfacing Experiments**

7. Traffic light controller
8. Stepper motor control
9. Digital clock
10. Key board and Display
11. Printer status
12. Serial interface and Parallel interface
13. A/D and D/A interface and Waveform Generation

**8051 Experiments using kits and MASM**

14. Basic arithmetic and Logical operations
15. Square and Cube program, Find 2's complement of a number
16. Unpacked BCD to ASCII

**TOTAL: 60 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Write ALP Programmes for fixed and Floating Point and Arithmetic operations
- Interface different I/Os with processor
- Generate waveforms using Microprocessors
- Execute Programs in 8051
- Explain the difference between simulator and Emulator

## LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:

### HARDWARE:

8086 development kits - 30 nos  
Interfacing Units - Each 10 nos  
Microcontroller - 30 nos

### SOFTWARE:

Intel Desktop Systems with MASM - 30 nos  
8086 Assembler  
8051 Cross Assembler

EC8661

VLSI DESIGN LABORATORY

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### OBJECTIVES:

#### The student should be made:

- To learn Hardware Descriptive Language(Verilog/VHDL)
- To learn the fundamental principles of VLSI circuit design in digital and analog domain
- To familiarize fusing of logical modules on FPGAs
- To provide hands on design experience with professional design (EDA) platforms

### LIST OF EXPERIMENTS:

#### Part I: Digital System Design using HDL & FPGA (24 Periods)

1. Design an Adder (Min 8 Bit) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
2. Design a Multiplier (4 Bit Min) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
3. Design an ALU using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
4. Design a Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
5. Design Finite State Machine (Moore/Mealy) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
6. Design Memories using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA

Compare pre synthesis and post synthesis simulation for experiments 1 to 6.

Requirements: Xilinx ISE/Altera Quartus/ equivalent EDA Tools along with Xilinx/Altera/equivalent FPGA Boards

#### Part-II Digital Circuit Design (24 Periods)

7. Design and simulate a CMOS inverter using digital flow
8. Design and simulate a CMOS Basic Gates & Flip-Flops
9. Design and simulate a 4-bit synchronous counter using a Flip-Flops  
Manual/Automatic Layout Generation and Post Layout Extraction for experiments 7 to 9  
Analyze the power, area and timing for experiments 7 to 9 by performing Pre Layout and Post Layout Simulations.

### Part-III Analog Circuit Design (12 Periods)

10. Design and Simulate a CMOS Inverting Amplifier.
11. Design and Simulate basic Common Source, Common Gate and Common Drain Amplifiers.  
Analyze the input impedance, output impedance, gain and bandwidth for experiments 10 and 11 by performing Schematic Simulations.  
Design and simulate simple 5 transistor differential amplifier. Analyze Gain,
12. Bandwidth and CMRR by performing Schematic Simulations.

Requirements: Cadence/Synopsis/ Mentor Graphics/Tanner/equivalent EDA Tools

**TOTAL :60 PERIODS**

#### OUTCOMES:

**At the end of the course, the student should be able to:**

- Write HDL code for basic as well as advanced digital integrated circuit
- Import the logic modules into FPGA Boards
- Synthesize Place and Route the digital IPs
- Design, Simulate and Extract the layouts of Digital & Analog IC Blocks using EDA tools

#### LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.NO	EQUIPMENT	REQUIRED
1	Xilinx ISE/Altera Quartus/ equivalent EDA Tools	10 User License
2	Xilinx/Altera/equivalent FPGA Boards	10 no
3	Cadence/Synopsis/ Mentor Graphics/Tanner/equivalent EDA Tools	10 User License
4	Personal Computer	30 no

**OBJECTIVES:****The course aims to:**

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

**UNIT I**

Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

**UNIT II**

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

**UNIT III**

Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -- questioning and clarifying –GD strategies- activities to improve GD skills

**UNIT IV**

Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

**UNIT V**

Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

**TOTAL : 30 PERIODS**

**OUTCOMES:****At the end of the course Learners will be able to:**

- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

**Recommended Software**

1. Open Source Software
2. Win English

**REFERENCES:**

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Interact English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

**OBJECTIVES:**

- To enable the student to understand the basic principles in antenna and microwave system design
- To enhance the student knowledge in the area of various antenna designs.
- To enhance the student knowledge in the area of microwave components and antenna for practical applications.

**UNIT I INTRODUCTION TO MICROWAVE SYSTEMS AND ANTENNAS 9**

Microwave frequency bands, Physical concept of radiation, Near- and far-field regions, Fields and Power Radiated by an Antenna, Antenna Pattern Characteristics, Antenna Gain and Efficiency, Aperture Efficiency and Effective Area, Antenna Noise Temperature and G/T, Impedance matching, Friis transmission equation, Link budget and link margin, Noise Characterization of a microwave receiver.

**UNIT II RADIATION MECHANISMS AND DESIGN ASPECTS 9**

Radiation Mechanisms of Linear Wire and Loop antennas, Aperture antennas, Reflector antennas, Microstrip antennas and Frequency independent antennas, Design considerations and applications.

**UNIT III ANTENNA ARRAYS AND APPLICATIONS 9**

Two-element array, Array factor, Pattern multiplication, Uniformly spaced arrays with uniform and non-uniform excitation amplitudes, Smart antennas.

**UNIT IV PASSIVE AND ACTIVE MICROWAVE DEVICES 9**

Microwave Passive components: Directional Coupler, Power Divider, Magic Tee, attenuator, resonator, Principles of Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes, Microwave tubes: Klystron, TWT, Magnetron.

**UNIT V MICROWAVE DESIGN PRINCIPLES 9**

Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design

**TOTAL: 45 PERIODS****OUTCOMES:****The student should be able to:**

- Apply the basic principles and evaluate antenna parameters and link power budgets
- Design and assess the performance of various antennas
- Design a microwave system given the application specifications

**TEXTBOOKS:**

1. John D Krauss, Ronald J Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation: Fourth Edition, Tata McGraw-Hill, 2006. (UNIT I, II, III)
2. David M. Pozar, "Microwave Engineering", Fourth Edition, Wiley India, 2012.(UNIT I,IV,V)

**REFERENCES:**

1. Constantine A.Balanis, "Antenna Theory Analysis and Design", Third edition, John Wiley India Pvt Ltd., 2005.
2. R.E.Collin, "Foundations for Microwave Engineering", Second edition, IEEE Press, 2001

## OPTICAL COMMUNICATION

L T P C  
3 0 0 3

EC8751

### OBJECTIVES:

- To study about the various optical fiber modes, configuration and transmission characteristics of optical fibers
- To learn about the various optical sources, detectors and transmission techniques
- To explore various idea about optical fiber measurements and various coupling techniques
- To enrich the knowledge about optical communication systems and networks

### UNIT I INTRODUCTION TO OPTICAL FIBERS 9

Introduction-general optical fiber communication system- basic optical laws and definitions-optical modes and configurations -mode analysis for optical propagation through fibers-modes in planar wave guide-modes in cylindrical optical fiber-transverse electric and transverse magnetic modes- fiber materials-fiber fabrication techniques-fiber optic cables-classification of optical fiber-single mode fiber-graded index fiber.

### UNIT II TRANSMISSION CHARACTERISTIC OF OPTICAL FIBER 9

Attenuation-absorption --scattering losses-bending losses-core and cladding losses-signal dispersion –inter symbol interference and bandwidth-intra modal dispersion-material dispersion- waveguide dispersion-polarization mode dispersion-intermodal dispersion-dispersion optimization of single mode fiber-characteristics of single mode fiber-R-I Profile-cutoff wave length-dispersion calculation-mode field diameter.

### UNIT III OPTICAL SOURCES AND DETECTORS 9

**Sources:** Intrinsic and extrinsic material-direct and indirect band gaps-LED-LED structures-surface emitting LED-Edge emitting LED-quantum efficiency and LED power-light source materials-modulation of LED-LASER diodes-modes and threshold conditions-Rate equations-external quantum efficiency-resonant frequencies-structures and radiation patterns-single mode laser-external modulation-temperature effort.

**Detectors:** PIN photo detector-Avalanche photo diodes-Photo detector noise-noise sources-SNR-detector response time-Avalanche multiplication noise-temperature effects-comparisons of photo detectors.

### UNIT IV OPTICAL RECEIVER, MEASUREMENTS AND COUPLING 9

Fundamental receiver operation-preamplifiers-digital signal transmission-error sources-Front end amplifiers-digital receiver performance-probability of error-receiver sensitivity-quantum limit.

Optical power measurement-attenuation measurement-dispersion measurement- Fiber Numerical Aperture Measurements- Fiber cut- off Wave length Measurements- Fiber diameter measurements-Source to Fiber Power Launching-Lensing Schemes for Coupling Management-Fiber to Fiber Joints-LED Coupling to Single Mode Fibers-Fiber Splicing-Optical Fiber connectors.

### UNIT V OPTICAL COMMUNICATION SYSTEMS AND NETWORKS 9

System design consideration Point – to –Point link design –Link power budget –rise time budget, WDM –Passive DWDM Components-Elements of optical networks-SONET/SDH-Optical Interfaces-SONET/SDH Rings and Networks-High speed light wave Links-OADM configuration-Optical ETHERNET-Soliton.

**TOTAL:45 PERIODS**

## OUTCOMES:

At the end of the course, the student should be able to:

- Realize basic elements in optical fibers, different modes and configurations.
- Analyze the transmission characteristics associated with dispersion and polarization techniques.
- Design optical sources and detectors with their use in optical communication system.
- Construct fiber optic receiver systems, measurements and coupling techniques.
- Design optical communication systems and its networks.

## TEXT BOOKS:

1. P Chakrabarti, "Optical Fiber Communication", McGraw Hill Education (India) Private Limited, 2016 (UNIT I, II, III)
2. Gred Keiser, "Optical Fiber Communication", McGraw Hill Education (India) Private Limited. Fifth Edition, Reprint 2013. (UNIT I, IV, V)

## REFERENCES:

1. John M.Senior, "Optical fiber communication", Pearson Education, second edition.2007.
2. Rajiv Ramaswami, "Optical Networks " , Second Edition, Elsevier , 2004.
3. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.
4. Govind P. Agrawal, "Fiber-optic communication systems", third edition, John Wiley & sons, 2004.

EC8791

EMBEDDED AND REAL TIME SYSTEMS

L T P C  
3 0 0 3

## OBJECTIVES:

The student should be made to:

- Understand the concepts of embedded system design and analysis
- Learn the architecture and programming of ARM processor
- Be exposed to the basic concepts of embedded programming
- Learn the real time operating systems

## UNIT I INTRODUCTION TO EMBEDDED SYSTEM DESIGN 9

Complex systems and micro processors– Embedded system design process –Design example: Model train controller- Design methodologies- Design flows - Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques - Designing with computing platforms – consumer electronics architecture – platform-level performance analysis.

## UNIT II ARM PROCESSOR AND PERIPHERALS 9

ARM Architecture Versions – ARM Architecture – Instruction Set – Stacks and Subroutines – Features of the LPC 214X Family – Peripherals – The Timer Unit – Pulse Width Modulation Unit – UART – Block Diagram of ARM9 and ARM Cortex M3 MCU.

## UNIT III EMBEDDED PROGRAMMING 9

Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.

**UNIT IV REAL TIME SYSTEMS****9**

Structure of a Real Time System — Estimating program run times – Task Assignment and Scheduling – Fault Tolerance Techniques – Reliability, Evaluation – Clock Synchronisation.

**UNIT V PROCESSES AND OPERATING SYSTEMS****9**

Introduction – Multiple tasks and multiple processes – Multirate systems- Preemptive real-time operating systems- Priority based scheduling- Interprocess communication mechanisms – Evaluating operating system performance- power optimization strategies for processes – Example Real time operating systems-POSIX-Windows CE. - Distributed embedded systems – MPSoCs and shared memory multiprocessors. – Design Example - Audio player, Engine control unit – Video accelerator.

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Describe the architecture and programming of ARM processor
- Outline the concepts of embedded systems
- Explain the basic concepts of real time operating system design
- Model real-time applications using embedded-system concepts

**TEXT BOOKS:**

1. Marilyn Wolf, “Computers as Components - Principles of Embedded Computing System Design”, Third Edition “Morgan Kaufmann Publisher (An imprint from Elsevier), 2012. (UNIT I, II, III, V)
2. Jane W.S.Liu,” Real Time Systems”, Pearson Education, Third Indian Reprint, 2003.(UNIT IV)

**REFERENCES:**

1. Lyla B.Das, “Embedded Systems : An Integrated Approach” Pearson Education, 2013.
2. Jonathan W.Valvano, “Embedded Microcomputer Systems Real Time Interfacing”, Third Edition Cengage Learning, 2012.
3. David. E. Simon, “An Embedded Software Primer”, 1st Edition, Fifth Impression, Addison-Wesley Professional, 2007.
4. Raymond J.A. Buhr, Donald L.Bailey, “An Introduction to Real-Time Systems- From Design to Networking with C/C++”, Prentice Hall, 1999.
5. C.M. Krishna, Kang G. Shin, “Real-Time Systems”, International Editions, Mc Graw Hill 1997
6. K.V.K.K.Prasad, “Embedded Real-Time Systems: Concepts, Design & Programming”, Dream Tech Press, 2005.
7. Sriram V Iyer, Pankaj Gupta, “Embedded Real Time Systems Programming”, Tata Mc Graw Hill, 2004.

**OBJECTIVES:**

The student should be made to:

- Learn Ad hoc network and Sensor Network fundamentals
- Understand the different routing protocols
- Have an in-depth knowledge on sensor network architecture and design issues
- Understand the transport layer and security issues possible in Ad hoc and Sensor networks
- Have an exposure to mote programming platforms and tools

**UNIT I AD HOC NETWORKS – INTRODUCTION AND ROUTING PROTOCOLS 9**

Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Example commercial applications of Ad hoc networking, Ad hoc wireless Internet, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols - Destination Sequenced Distance Vector (DSDV), On-Demand Routing protocols –Ad hoc On-Demand Distance Vector Routing (AODV).

**UNIT II SENSOR NETWORKS – INTRODUCTION & ARCHITECTURES 9**

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture - Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.

**UNIT III WSN NETWORKING CONCEPTS AND PROTOCOLS 9**

MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, The Mediation Device Protocol, Contention based protocols - PAMAS, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols- Energy Efficient Routing, Challenges and Issues in Transport layer protocol.

**UNIT IV SENSOR NETWORK SECURITY 9**

Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering, black hole attack, flooding attack. Key Distribution and Management, Secure Routing – SPINS, reliability requirements in sensor networks.

**UNIT V SENSOR NETWORK PLATFORMS AND TOOLS 9**

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms – TinyOS, nesC, CONTIKIOS, Node-level Simulators – NS2 and its extension to sensor networks, COOJA, TOSSIM, Programming beyond individual nodes – State centric programming.

**TOTAL:45 PERIODS**

**OUTCOMES:**

At the end of the course, the student would be able to:

- Know the basics of Ad hoc networks and Wireless Sensor Networks
- Apply this knowledge to identify the suitable routing algorithm based on the network and user requirement
- Apply the knowledge to identify appropriate physical and MAC layer protocols
- Understand the transport layer and security issues possible in Ad hoc and sensor networks.
- Be familiar with the OS used in Wireless Sensor Networks and build basic modules

**TEXT BOOKS:**

1. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks Architectures and Protocols", Prentice Hall, PTR, 2004. (UNIT I)
2. Holger Karl , Andreas willig, "Protocol and Architecture for Wireless Sensor Networks", John wiley publication, Jan 2006.(UNIT II-V)

**REFERENCES:**

1. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks: an information processing approach", Elsevier publication, 2004.
2. Charles E. Perkins, "Ad Hoc Networking", Addison Wesley, 2000.
3. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, "Wireless sensor networks: a survey", computer networks, Elsevier, 2002, 394 - 422.

**EC8711****EMBEDDED LABORATORY**

L	T	P	C
0	0	4	2

**OBJECTIVES:****The student should be made to:**

- Learn the working of ARM processor
- Understand the Building Blocks of Embedded Systems
- Learn the concept of memory map and memory interface
- Write programs to interface memory, I/Os with processor
- Study the interrupt performance

**LIST OF EXPERIMENTS:**

1. Study of ARM evaluation system
2. Interfacing ADC and DAC.
3. Interfacing LED and PWM.
4. Interfacing real time clock and serial port.
5. Interfacing keyboard and LCD.
6. Interfacing EPROM and interrupt.
7. Mailbox.
8. Interrupt performance characteristics of ARM and FPGA.
9. Flashing of LEDS.
10. Interfacing stepper motor and temperature sensor.
11. Implementing zigbee protocol with ARM.

**TOTAL: 60 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Write programs in ARM for a specific Application
- Interface memory, A/D and D/A convertors with ARM system
- Analyze the performance of interrupt
- Write program for interfacing keyboard, display, motor and sensor.
- Formulate a mini project using embedded system

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS (3 students per batch)**

Embedded trainer kits with ARM board 10 Nos

Embedded trainer kits suitable for wireless communication 10 Nos

Adequate quantities of Hardware, software and consumables

**OBJECTIVES:****The student should be made to:**

- Understand the working principle of optical sources, detector, fibers
- Develop understanding of simple optical communication link
- Understand the measurement of BER, Pulse broadening
- Understand and capture an experimental approach to digital wireless communication
- Understand actual communication waveforms that will be sent and received across wireless channel

**LIST OF OPTICAL EXPERIMENTS**

1. Measurement of connector, bending and fiber attenuation losses.
2. Numerical Aperture and Mode Characteristics of Fibers.
3. DC Characteristics of LED and PIN Photo diode.
4. Fiber optic Analog and Digital Link Characterization - frequency response(analog), eye diagram and BER (digital)

**LIST OF WIRELESS COMMUNICATION EXPERIMENTS**

1. Wireless Channel Simulation including fading and Doppler effects
2. Simulation of Channel Estimation, Synchronization & Equalization techniques
3. Analysing Impact of Pulse Shaping and Matched Filtering using Software Defined Radios
4. OFDM Signal Transmission and Reception using Software Defined Radios

**LIST OF MICROWAVE EXPERIMENTS**

1. VSWR and Impedance Measurement and Impedance Matching
2. Characterization of Directional Couplers, Isolators, Circulators
3. Gunn Diode Characteristics
4. Microwave IC – Filter Characteristics

**TOTAL: 60 PERIODS****OUTCOMES:****On completion of this lab course, the student would be able to**

- Analyze the performance of simple optical link by measurement of losses and Analyzing the mode characteristics of fiber
- Analyze the Eye Pattern, Pulse broadening of optical fiber and the impact on BER
- Estimate the Wireless Channel Characteristics and Analyze the performance of Wireless Communication System
- Understand the intricacies in Microwave System design

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS 3 STUDENTS PER EXPERIMENT:**

<b>S.NO</b>	<b>NAME OF THE EQUIPMENT</b>	<b>REQUIRED</b>
1	Trainer kit for carrying out LED and PIN diode characteristics, Digital multi meter, optical power meter	2 Nos
2	Trainer kit for determining the mode characteristics, losses in optical fiber	2 Nos
3	Trainer kit for analyzing Analog and Digital link performance, 2 Mbps PRBS Data source, 10 MHz signal generator, 20 MHz Digital storage Oscilloscope	2 Nos
4	Kit for measuring Numerical aperture and Attenuation of fiber	2 Nos
5	Advanced Optical fiber trainer kit for PC to PC communication, BER Measurement, Pulse broadening.	2 Nos
6	MM/SM Glass and plastic fiber patch chords with ST/SC/E2000 connectors	2 sets
7	LEDs with ST / SC / E2000 receptacles – 650 / 850 nm	2 sets
8	PIN PDs with ST / SC / E2000 receptacles – 650 / 850 nm	2 sets
9	Digital Communications Teaching Bundle (LabVIEW/MATLAB/Equivalent software tools)	10 Users
10	Software Define Radio Transceiver Platform with antennas and accessories	2 Nos

**EC8811**

**PROJECT WORK**

**L T P C**

**0 0 20 10**

**OBJECTIVES:**

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL: 300 PERIODS**

**OUTCOME:**

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

**CS8392****OBJECT ORIENTED PROGRAMMING****L T P C****3 0 0 3****OBJECTIVES:**

- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the principles of packages, inheritance and interfaces
- To define exceptions and use I/O streams
- To develop a java application with threads and generics classes
- To design and build simple Graphical User Interfaces

**UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 10**

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File -Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages - JavaDoc comments.

**UNIT II INHERITANCE AND INTERFACES 9**

Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning -inner classes, Array Lists - Strings

**UNIT III EXCEPTION HANDLING AND I/O 9**

Exceptions - exception hierarchy - throwing and catching exceptions - built in exceptions, creating own exception, Stack Trace Elements.

Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

**UNIT IV MULTITHREADING AND GENERIC PROGRAMMING 8**

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter thread communication, daemon threads, thread groups.

Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

**UNIT V EVENT DRIVEN PROGRAMMING 9**

Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.

**TOTAL: 45 PERIODS****OUTCOMES:****Upon completion of the course, students will be able to:**

- Develop Java programs using OOP principles
- Develop Java programs with the concepts inheritance and interfaces
- Build Java applications using exceptions and I/O streams
- Develop Java applications with threads and generics classes
- Develop interactive Java programs using swings

**TEXT BOOKS:**

1. Herbert Schildt, "Java The complete reference", 8<sup>th</sup> Edition, McGraw Hill Education, 2011.
2. Cay S. Horstmann, Gary Cornell, "Core Java Volume –I Fundamentals", 9<sup>th</sup> Edition, Prentice Hall, 2013.

**REFERENCES:**

1. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3<sup>rd</sup> Edition, Pearson, 2015.
2. Steven Holzner, "Java 2 Black book", Dreamtech press, 2011.
3. Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000.

**EC8073****MEDICAL ELECTRONICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:****The student should be made:**

- To gain knowledge about the various physiological parameters both electrical and non electrical and the methods of recording and also the method of transmitting these parameters
- To study about the various assist devices used in the hospitals
- To gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.

**UNIT I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING 9**

Sources of bio medical signals, Bio-potentials, Biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics

**UNIT II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT 9**

pH, PO<sub>2</sub>, PCO<sub>2</sub>, Colorimeter, Blood flow meter, Cardiac output, respiratory, blood pressure, temperature and pulse measurement, Blood Cell Counters.

**UNIT III ASSIST DEVICES 9**

Cardiac pacemakers, DC Defibrillator, Dialyser, Ventilators, Magnetic Resonance Imaging Systems, Ultrasonic Imaging Systems.

**UNIT IV PHYSICAL MEDICINE AND BIOTELEMETRY 9**

Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry.

**UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION 9**

Telemedicine, Insulin Pumps, Radio pill, Endomicroscopy, Brain machine interface, Lab on a chip.

**TOTAL:45 PERIODS****OUTCOMES:****On successful completion of this course, the student should be able to:**

- Know the human body electro- physiological parameters and recording of bio-potentials
- Comprehend the non-electrical physiological parameters and their measurement – body temperature, blood pressure, pulse, blood cell count, blood flow meter etc.
- Interpret the various assist devices used in the hospitals viz. pacemakers, defibrillators, dialyzers and ventilators
- Comprehend physical medicine methods eg. ultrasonic, shortwave, microwave surgical diathermies, and bio-telemetry principles and methods
- Know about recent trends in medical instrumentation

**TEXT BOOK:**

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007. (UNIT I – V)

**REFERENCES:**

1. Khandpur, R.S., "Handbook of Biomedical Instrumentation", TATA Mc Graw-Hill, New Delhi, 2003.
2. John G.Webster, "Medical Instrumentation Application and Design", 3rd Edition, Wiley India Edition, 2007
3. Joseph J.Carr and John M.Brown, "Introduction to Biomedical Equipment Technology", John Wiley and Sons, New York, 2004.

**CS8493****OPERATING SYSTEMS****L T P C  
3 0 0 3****OBJECTIVES:**

- To understand the basic concepts and functions of operating systems.
- To understand Processes and Threads
- To analyze Scheduling algorithms.
- To understand the concept of Deadlocks.
- To analyze various memory management schemes.
- To understand I/O management and File systems.
- To be familiar with the basics of Linux system and Mobile OS like iOS and Android.

**UNIT I OPERATING SYSTEM OVERVIEW****7**

Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

**UNIT II PROCESS MANAGEMENT****11**

Processes - Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication; CPU Scheduling - Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Threads- Overview, Multithreading models, Threading issues; Process Synchronization - The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors; Deadlock - System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

**UNIT III STORAGE MANAGEMENT****9**

Main Memory – Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, 32 and 64 bit architecture Examples; Virtual Memory – Background, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

**UNIT IV FILE SYSTEMS AND I/O SYSTEMS****9**

Mass Storage system – Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space management; File-System Interface - File concept, Access methods, Directory Structure, Directory organization, File system mounting, File Sharing and Protection; File System Implementation- File System Structure, Directory implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem, Streams, Performance.

**UNIT V CASE STUDY****9**

Linux System - Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Interprocess Communication; Mobile OS - iOS and Android - Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.

**TOTAL: 45 PERIODS****OUTCOMES:****At the end of the course, the students should be able to:**

- Analyze various scheduling algorithms.
- Understand deadlock, prevention and avoidance algorithms.
- Compare and contrast various memory management schemes.
- Understand the functionality of file systems.
- Perform administrative tasks on Linux Servers and compare iOS and Android Operating Systems.

**TEXT BOOK :**

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2012.

**REFERENCES :**

1. Ramaz Elmasri, A. Gil Carrick, David Levine, "Operating Systems – A Spiral Approach", Tata McGraw Hill Edition, 2010.
2. Achyut S.Godbole, Atul Kahate, " Operating Systems", McGraw Hill Education, 2016.
3. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Pearson Education, 2004.
4. Gary Nutt, "Operating Systems", Third Edition, Pearson Education, 2004.
5. Harvey M. Deital, "Operating Systems", Third Edition, Pearson Education, 2004.
6. Daniel P Bovet and Marco Cesati, "Understanding the Linux kernel", 3rd edition, O'Reilly, 2005.
7. Neil Smyth, "iPhone iOS 4 Development Essentials – Xcode", Fourth Edition, Payload media, 2011.

**EC8074****ROBOTICS AND AUTOMATION**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:****The student should be made:**

- To understand the basic concepts associated with the design, functioning, applications and social aspects of robots
- To study about the electrical drive systems and sensors used in robotics for various applications
- To learn about analyzing robot kinematics, dynamics through different methodologies and study various design aspects of robot arm manipulator and end-effector
- To learn about various motion planning techniques and the associated control architecture
- To understand the implications of AI and other trending concepts of robotics

**UNIT I FOUNDATION FOR BEGINNERS****9**

Introduction -- brief history, definition, anatomy, types, classification, specification and need based applications; role and need of robots for the immediate problems of the society, future of mankind and automation-ethical issues; industrial scenario local and global, case studies on mobile robot research platform and industrial serial arm manipulator

**UNIT II BUILDING BLOCKS OF A ROBOT 9**

Types of electric motors - DC, Servo, Stepper; specification, drives for motors - speed & direction control and circuitry, Selection criterion for actuators, direct drives, non-traditional actuators; Sensors for localization, navigation, obstacle avoidance and path planning in known and unknown environments – optical, inertial, thermal, chemical, biosensor, other common sensors; Case study on choice of sensors and actuators for maze solving robot and self driving cars

**UNIT III KINEMATICS, DYNAMICS AND DESIGN OF ROBOTS & END-EFFECTORS 9**

Robot kinematics - Geometric approach for 2R, 3R manipulators, homogenous transformation using D-H representation, kinematics of WMR, Lagrangian formulation for 2R robot dynamics; Mechanical design aspects of a 2R manipulator, WMR; End-effector - common types and design case study.

**UNIT IV NAVIGATION, PATH PLANNING AND CONTROL ARCHITECTURE 9**

Mapping & Navigation – SLAM, Path planning for serial manipulators; types of control architectures - Cartesian control, Force control and hybrid position/force control, Behaviour based control, application of Neural network, fuzzy logic, optimization algorithms for navigation problems, programming methodologies of a robot

**UNIT V AI AND OTHER RESEARCH TRENDS IN ROBOTICS 9**

Application of Machine learning - AI, Expert systems; Tele-robotics and Virtual Reality, Micro & Nanorobots, Unmanned vehicles, Cognitive robotics, Evolutionary robotics, Humanoids

**TOTAL:45 PERIODS**

**OUTCOMES:**

**The student should be able to:**

- Explain the concepts of industrial robots in terms of classification, specifications and coordinate systems, along with the need and application of robots & automation
- Examine different sensors and actuators for applications like maze solving and self driving cars.
- Design a 2R robot & an end-effector and solve the kinematics and dynamics of motion for robots.
- Explain navigation and path planning techniques along with the control architectures adopted for robot motion planning.
- Describe the impact and progress in AI and other research trends in the field of robotics

**TEXT BOOKS:**

1. Saeed. B. Niku, Introduction to Robotics, Analysis, system, Applications, Pearson educations, 2002
2. Roland Siegwart, Illah Reza Nourbakhsh, Introduction to Autonomous Mobile Robots, MIT Press, 2011

**REFERENCES:**

1. Richard David Klafter, Thomas A. Chmielewski, Michael Negin, Robotic engineering: an integrated approach, Prentice Hall, 1989
2. Craig, J. J., Introduction to Robotics: Mechanics and Control, 2nd Edition, Addison-Wesley, 1989.
3. K.S. Fu, R.C. Gonzalez and C.S.G. Lee, Robotics: Control, Sensing, Vision and Intelligence, McGraw-Hill, 1987.
4. Wesley E Snyder R, Industrial Robots, Computer Interfacing and Control, Prentice Hall International Edition, 1988.
5. Robin Murphy, Introduction to AI Robotics, MIT Press, 2000
6. Ronald C. Arkin, Behavior-based Robotics, MIT Press, 1998
7. N. P. Padhy, Artificial Intelligence and Intelligent Systems, Oxford University Press, 2005
8. Stefano Nolfi, Dario Floreano, Evolutionary Robotics – The Biology, Intelligence and



**REFERENCES:**

1. Nanomaterials, Nanotechnologies and Design: an Introduction to Engineers and Architects, D. Michael Ashby, Paulo Ferreira, Daniel L. Schodek, Butterworth-Heinemann, 2009.
2. Handbook of Nanophase and Nanostructured Materials (in four volumes), Eds: Z.L. Wang, Y. Liu, Z. Zhang, Kluwer Academic/Plenum Publishers, 2003.
3. Handbook of Nanoceramics and their Based Nanodevices (Vol. 2) Edited by Tseung-Yuen Tseng and Hari Singh Nalwa, American Scientific Publishers.

**GE8074****HUMAN RIGHTS****L T P C****3 0 0 3****OBJECTIVE:**

- To sensitize the Engineering students to various aspects of Human Rights.

**UNIT I****9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

**UNIT II****9**

Evolution of the concept of Human Rights Magna carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

**UNIT III****9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

**UNIT IV****9**

Human Rights in India – Constitutional Provisions / Guarantees.

**UNIT V****9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

**TOTAL : 45 PERIODS****OUTCOME :**

- Engineering students will acquire the basic knowledge of human rights.

**REFERENCES:**

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

**GE8077****TOTAL QUALITY MANAGEMENT****L T P C****3 0 0 3****OBJECTIVE:**

- To facilitate the understanding of Quality Management principles and process.

**UNIT I INTRODUCTION****9**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product

and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

**UNIT II TQM PRINCIPLES 9**

Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

**UNIT III TQM TOOLS AND TECHNIQUES I 9**

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

**UNIT IV TQM TOOLS AND TECHNIQUES II 9**

Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

**UNIT V QUALITY MANAGEMENT SYSTEM 9**

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration- **ENVIRONMENTAL MANAGEMENT SYSTEM:** Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

**TEXT BOOK:**

1. Dale H.Besterfield, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

**REFERENCES:**

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8<sup>th</sup> Edition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. ISO9001-2015 standards

<b>CS8792</b>	<b>CRYPTOGRAPHY AND NETWORK SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand Cryptography Theories, Algorithms and Systems.
- To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

**UNIT I INTRODUCTION 9**

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography).- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.

**UNIT II SYMMETRIC CRYPTOGRAPHY 9**

MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures - Modular arithmetic-Euclid’s algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: DES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution.

**UNIT III PUBLIC KEY CRYPTOGRAPHY 9**

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler’s totient function, Fermat’s and Euler’s Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

**UNIT IV MESSAGE AUTHENTICATION AND INTEGRITY 9**

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509

**UNIT V SECURITY PRACTICE AND SYSTEM SECURITY 9**

Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.

**TOTAL 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Understand the fundamentals of networks security, security architecture, threats and vulnerabilities
- Apply the different cryptographic operations of symmetric cryptographic algorithms
- Apply the different cryptographic operations of public key cryptography
- Apply the various Authentication schemes to simulate different applications.
- Understand various Security practices and System security standards

**TEXT BOOK:**

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006.

**REFERENCES**

1. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd
2. BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.
3. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2

**OBJECTIVES:**

- To learn and understand the concepts of stationary and non-stationary random signals and analysis & characterization of discrete-time random processes
- To enunciate the significance of estimation of power spectral density of random processes
- To introduce the principles of optimum filters such as Wiener and Kalman filters
- To introduce the principles of adaptive filters and their applications to communication engineering
- To introduce the concepts of multi-resolution analysis

**UNIT I DISCRETE-TIME RANDOM PROCESSES 9**

Random variables - ensemble averages a review, random processes - ensemble averages, autocorrelation and autocovariance matrices, ergodic random process, white noise, filtering random processes, spectral factorization, special types of random processes - AR, MA, ARMA

**UNIT II SPECTRUM ESTIMATION 10**

Bias and consistency, Non-parametric methods - Periodogram, modified-Periodogram - performance analysis. Bartlett's method, Welch's method, Blackman-Tukey method. Performance comparison. Parametric methods - autoregressive (AR) spectrum estimation - autocorrelation method, Prony's method, solution using Levinson Durbin recursion.

**UNIT III OPTIMUM FILTERS 9**

Wiener filters - FIR Wiener filter - discrete Wiener Hopf equation, Applications - filtering, linear prediction. IIR Wiener filter - causal and non-causal filters. Recursive estimators - discrete Kalman filter.

**UNIT IV ADAPTIVE FILTERS 9**

Principles and properties of adaptive filters - FIR adaptive filters. Adaptive algorithms - steepest descent algorithm, the LMS algorithm - convergence. Applications of adaptive filtering - noise cancellation, channel equalization.

**UNIT V MULTIREOLUTION ANALYSIS 8**

Short-time Fourier transform - Heisenberg uncertainty principle. Principles of multi-resolution analysis - sub-band coding, the continuous and discrete wavelet transform - properties. Applications of wavelet transform - noise reduction, image compression.

**TOTAL:45 PERIODS****OUTCOMES:****At the end of the course, the student should be able to:**

- Articulate and apply the concepts of special random processes in practical applications
- Choose appropriate spectrum estimation techniques for a given random process
- Apply optimum filters appropriately for a given communication application
- Apply appropriate adaptive algorithm for processing non-stationary signals
- Apply and analyse wavelet transforms for signal and image processing based applications

**TEXT BOOKS**

1. Monson H. Hayes, "Statistical digital signal processing and modeling", John Wiley and Sons Inc. New York, Indian reprint 2008. (UNIT I-IV)
2. P. P. Vaidyanathan, "Multirate systems and filter banks", Prentice Hall Inc. 1993 (UNIT V)

**REFERENCES:**

1. John G. Proakis & Dimitris G. Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Fourth Edition, Pearson Education / Prentice Hall, 2007.
2. Sophoncles J. Orfanidis, "Optimum signal processing", McGraw Hill, 2000

<b>EC8001</b>	<b>MEMS AND NEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To introduce the concepts of micro and nano electromechanical devices
- To know the fabrication process of Microsystems
- To know the design concepts of micro sensors and micro actuators
- To introduce the concepts of quantum mechanics and nano systems

**UNIT I INTRODUCTION TO MEMS AND NEMS 9**

Introduction to Design of MEMS and NEMS, Overview of Nano and Microelectromechanical Systems, Applications of Micro and Nanoelectromechanical systems, Materials for MEMS and NEMS: Silicon, silicon compounds, polymers, metals.

**UNIT II MEMS FABRICATION TECHNOLOGIES 9**

Photolithography, Ion Implantation, Diffusion, Oxidation, CVD, Sputtering Etching techniques, Micromachining: Bulk Micromachining, Surface Micromachining, LIGA.

**UNIT III MICRO SENSORS 9**

MEMS Sensors: Design of Acoustic wave sensors, Vibratory gyroscope, Capacitive Pressure sensors, Case study: Piezoelectric energy harvester

**UNIT IV MICRO ACTUATORS 9**

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces, Case Study: RF Switch.

**UNIT V NANO DEVICES 9**

Atomic Structures and Quantum Mechanics, Shrodinger Equation, ZnO nanorods based NEMS device: Gas sensor.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the student should be able to:**

- Interpret the basics of micro/nano electromechanical systems including their applications and advantages
- Recognize the use of materials in micro fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA.
- Analyze the key performance aspects of electromechanical transducers including sensors and actuators
- Comprehend the theoretical foundations of quantum mechanics and Nano systems

## REFERENCES:

1. Marc Madou, "Fundamentals of Microfabrication", CRC press 1997.
2. Stephen D. Senturia, "Micro system Design", Kluwer Academic Publishers, 2001
3. Tai Ran Hsu, "MEMS and Microsystems Design and Manufacture", Tata Mcraw Hill, 2002.
4. Chang Liu, "Foundations of MEMS", Pearson education India limited, 2006,
5. Sergey Edward Lyshevski, "MEMS and NEMS: Systems, Devices, and Structures" CRC Press, 2002

<b>EC8002</b>	<b>MULTIMEDIA COMPRESSION AND COMMUNICATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

## OBJECTIVES:

The student should be made:

- To understand the compression schemes for text, voice, image and video
- To understand the QoS issues in multimedia network
- To know the communication protocols for multimedia networking

### **UNIT I AUDIO COMPRESSION 9**

Sampling and Quantization of Speech (PCM) - Adaptive differential PCM - Delta Modulation - Vector Quantization- Linear predictive coding (LPC) - Code excited Linear predictive Coding (CELP)

### **UNIT II IMAGE AND VIDEO COMPRESSION 9**

Graphics Interchange format- Tagged image file format-Digitized documents- Digitized pictures- JPEG-Video Encoding-Motion estimation –Overview of H.263 and MPEG-2

### **UNIT III TEXT COMPRESSION 7**

Static and Dynamic Huffman coding – Arithmetic coding –Lempel-Ziv coding – LZW coding

### **UNIT IV GUARANTEED SERVICE MODEL 10**

Best Effort service model – Scheduling and Dropping policies – Network Performance Parameters – Quality of Service and metrics – WFQ and its variants – Random Early Detection – QoS aware Routing – Admission Control – Resource Reservation – RSVP - Traffic Shaping Algorithms – Caching – Laissez Faire Approach - Possible Architectures – An Overview of QoS Architectures

### **UNIT V MULTIMEDIA COMMUNICATION 10**

Stream characteristics for Continuous media – Temporal Relationship – Object Stream Interactions, Media Levity, Media Synchronization – Models for Temporal Specifications – Streaming of Audio and Video – Jitter – Fixed playout and Adaptive playout – Recovering from packet loss – RTSP — Multimedia Communication Standards – RTP/RTCP – SIP and H.263

**TOTAL:45 PERIODS**

## OUTCOMES:

At the end of the course, the student should be able to:

- Design audio compression techniques
- Configure Text, image and video compression techniques
- Select suitable service model for specific application
- Configure multimedia communication network

**TEXT BOOK:**

1. Fred Halsall, —Multimedia communication- Applications, Networks, Protocols and Standards, Pearson education, 2007.

**REFERENCES**

1. Tay Vaughan, —Multimedia Making it work , McGraw-Hill Osborne Media, 2006.
2. Kurose and W. Ross, —Computer Networking —A Top Down Approach, Pearson education, 3rd ed, 2005.
3. KR. Rao,Z S Bojkovic, D A Milovanovic, —Multimedia Communication Systems: Techniques, Standards, and Networks, Pearson Education 2007
4. R. Steimnetz, K. Nahrstedt, —Multimedia Computing, Communications and Applications, Pearson Education, First ed, 1995.
5. Nalin K Sharda, 'Multimedia Information Networking', Prentice Hall of India, 1999
6. Aura Ganz, Zvi Ganz and Kitti Wongthawaravat, 'Multimedia Wireless Networks: Technologies, Standards and QoS', Prentice Hall, 2003.
7. Ellen Kayata Wesel, 'Wireless Multimedia Communications: Networking Video, Voice and Data', Addison Wesley, 1998

**EC8003****CMOS ANALOG IC DESIGN**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To study the fundamentals of analog circuits and MOS device models
- To gain knowledge on various configurations of MOS transistors and feedback concepts
- To study the characteristics of noise and frequency response of the amplifier
- To learn the concepts of Op-Amp frequency compensation, capacitor switches and PLLs

**UNIT I INTRODUCTION TO ANALOG IC DESIGN AND CURRENT MIRRORS 9**

Concepts of Analog Design - General consideration of MOS devices – MOS I/V Characteristics – Second order effects – MOS device models. Basic current mirrors- Cascode current mirrors- Active current mirrors- Large and Small signal analysis- Common mode properties.

**UNIT II AMPLIFIERS AND FEEDBACK 9**

Basic Concepts – Common source stage- Source follower- Common gate stage- Cascode stage. Single ended and differential operation- Basic Differential pair- Common mode response- Differential pair with MOS loads- Gilbert Cell. Feedback- General Consideration of feedback circuits- Feedback topologies- Effect of loading- Effect of feedback on Noise.

**UNIT III FREQUENCY RESPONSE OF AMPLIFIERS AND NOISE 9**

General considerations- Miller Effect and Association of Poles with Nodes, Common source stage- Source followers- Common gate stage- Cascode stage- Differential pair. Noise- Statistical characteristics of noise- Types of noise- Representation of noise in circuits- Noise in single stage amplifiers- Noise in differential pairs- Noise Bandwidth.

**UNIT IV OPERATIONAL AMPLIFIER STABILITY AND FREQUENCY COMPENSATION 9**

General Considerations- One and Two Stage Op Amps- Gain Boosting- Comparison- Common mode feedback- Input range limitations- Slew rate- Power Supply Rejection- Noise in Op Amps- General consideration of stability and frequency compensation- Multipole system- Phase margin- Frequency compensation- Compensation of two stage op Amps- Other compensation techniques.

**UNIT V SWITCHED CAPACITOR CIRCUITS AND PLLS****9**

General Considerations- Sampling switches- Switched Capacitor Amplifiers- Switched Capacitor Integrator- Switched Capacitor Common mode feedback. Phase Locked Loops-Simple PLL- Charge pump PLLs - Non ideal Effects in PLLs- Delay locked loops- its Applications.

**TOTAL:45 PERIODS****OUTCOMES:****Upon completion of the course, student should be able to:**

- Realize the concepts of Analog MOS devices and current mirror circuits.
- Design different configuration of Amplifiers and feedback circuits.
- Analyze the characteristics of frequency response of the amplifier and its noise.
- Analyze the performance of the stability and frequency compensation techniques of Op-Amp Circuits.
- Construct switched capacitor circuits and PLLs

**TEXT BOOK:**

1. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", Tata McGraw Hill, 2001, 33<sup>rd</sup> re-print, 2016.

**REFERENCES:**

1. Phillip Allen and Douglas Holmberg "CMOS Analog Circuit Design" Second Edition, Oxford University Press, 2004.
2. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, Analysis and Design of Analog Integrated Circuits, 5th Edition, Wiley, 2009
3. Grebene, "Bipolar and MOS Analog Integrated circuit design", John Wiley & sons, Inc., 2003

**EC8004****WIRELESS NETWORKS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:****The student should be made:**

- To understand the concept about Wireless networks, protocol stack and standards
- To understand and analyse the network layer solutions for Wireless networks
- To study about fundamentals of 3G Services, its protocols and applications
- To have in depth knowledge on internetworking of WLAN and WWAN
- To learn about evolution of 4G Networks, its architecture and applications

**UNIT I WIRELESS LAN****9**

Introduction-WLAN technologies: - IEEE802.11: System architecture, protocol architecture, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, WPAN – IEEE 802.15.4, Wireless USB, Zigbee, 6LoWPAN, WirelessHART

**UNIT II MOBILE NETWORK LAYER****9**

Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol - mobile ad-hoc network: Routing: Destination Sequence distance vector, IoT: CoAP

**UNIT III 3G OVERVIEW****9**

Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3GPP Architecture, User equipment, CDMA2000 overview- Radio and Network components, Network structure, Radio Network, TD-CDMA, TD – SCDMA.

**UNIT IV INTERNETWORKING BETWEEN WLANS AND WWANS 9**

Internetworking objectives and requirements, Schemes to connect WLANS and 3G Networks, Session Mobility, Internetworking Architecture for WLAN and GPRS, System Description, Local Multipoint Distribution Service, Multichannel Multipoint Distribution System.

**UNIT V 4G & Beyond 9**

Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, IMS Architecture, LTE, Advanced Broadband Wireless Access and Services, MVNO.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the student would be able to:**

- Conversant with the latest 3G/4G networks and its architecture
- Design and implement wireless network environment for any application using latest wireless protocols and standards
- Ability to select the suitable network depending on the availability and requirement
- Implement different type of applications for smart phones and mobile devices with latest network strategies

**TEXT BOOKS:**

1. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education 2012.(Unit I,II,III)
2. Vijay Garg, "Wireless Communications and networking", First Edition, Elsevier 2007.(Unit IV,V)

**REFERENCES:**

1. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband", Second Edition, Academic Press, 2008.
2. Anurag Kumar, D.Manjunath, Joy kuri, "Wireless Networking", First Edition, Elsevier 2011.
3. Simon Haykin , Michael Moher, David Koilpillai, "Modern Wireless Communications", First Edition, Pearson Education 2013

**GE8075**

**INTELLECTUAL PROPERTY RIGHTS**

**L T P C  
3 0 0 3**

**OBJECTIVE:**

- To give an idea about IPR, registration and its enforcement.

**UNIT I INTRODUCTION 9**

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

**UNIT II REGISTRATION OF IPRs 10**

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

**UNIT III AGREEMENTS AND LEGISLATIONS 10**

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

**UNIT IV DIGITAL PRODUCTS AND LAW 9**  
 Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

**UNIT V ENFORCEMENT OF IPRs 7**  
 Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

**TOTAL : 45 PERIODS**

**OUTCOME:**

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

**TEXT BOOKS:**

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S. V. Satakar, "Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002.

**REFERENCES:**

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli, "Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

<b>EC8092</b>	<b>ADVANCED WIRELESS COMMUNICATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To expose the students to the importance of improving capacity of wireless channel using MIMO
- To enable understanding of channel impairment mitigation using space-time block and Trellis codes
- To teach advanced MIMO system like layered space time codes, MU-MIMO System and MIMO-OFDM systems

**UNIT I CAPACITY OF WIRELESS CHANNELS 9**  
 The crowded spectrum, need for high data rate, MIMO systems – Array Gain, Diversity Gain, Data Pipes, Spatial MUX, MIMO System Model. MIMO System Capacity – channel known at the TX, Channel unknown to the TX – capacity of deterministic channels, Random channels and frequency selective channels.

**UNIT II RADIO WAVE PROPAGATION 9**  
 Radio wave propagation – Macroscopic fading- free space and out door, small scale fading Fading measurements – Direct pulse measurements, spread spectrum correlation channel sounding frequency domain channel sounding, Antenna Diversity – Diversity combining methods.

**UNIT III SPACE TIME BLOCK CODES 9**  
 Delay Diversity scheme, Alamoti space time code – Maximum likelihood decoding maximum ratio combining. Transmit diversity space time block codes for real signal constellation and complex signal constellation - decoding of STBC.

**UNIT IV SPACE TIME TRELLIS CODES 9**

Space time coded systems, space time code word design criteria, design of space time T C on slow fading channels, design of STTC on Fast Fading channels, performance analysis in slow and fast fading channels, effect of imperfect channel estimation and Antenna correlation on performance, comparison of STBC & STTC.

**UNIT V LAYERED SPACE TIME CODES 9**

LST transmitter – Horizontal and Vertical LST receiver – ML Rx, Zero forcing Rx; MMSE Rx, SIC Rx, ZF V-blast Rx- MMSE V-blast Rx, Iterative Rx - capacity of MIMO – OFDM systems – capacity of MIMO multi user systems.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**The student should be able to:**

- Comprehend and appreciate the significance and role of this course in the present contemporary world
- Apply the knowledge about the importance of MIMO in today's communication
- Appreciate the various methods for improving the data rate of wireless communication system

**REFERENCES:**

1. Mohinder Jankiraman, Space-time codes and MIMO systems, Artech House, Boston, London . www.artech house.com, ISBN 1-58053-865-7-2004
2. Paulraj Rohit Nabar, Dhananjay Gore, Introduction of space time wireless communication systems, Cambridge University Press, 2003.
3. David Tse and Pramod Viswanath, —Fundamentals of Wireless CommunicationII, Cambridge University Press, 2005.
4. Sergio Verdu “ Multi User Detection” Cambridge University Press, 1998

<b>EC8071</b>	<b>COGNITIVE RADIO</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

**The student should be made:**

- To understand the evolving software defined radio and cognitive radio techniques and their essential functionalities
- To study the basic architecture and standard for cognitive radio
- To understand the physical, MAC and Network layer design of cognitive radio
- To expose the student to evolving applications and advanced features of cognitive radio

**UNIT I INTRODUCTION TO SOFTWARE-DEFINED RADIO AND COGNITIVE RADIO 9**

Evolution of Software Defined Radio and Cognitive radio: goals, benefits, definitions, architectures, relations with other radios, issues, enabling technologies, radio frequency spectrum and regulations.

**UNIT II COGNITIVE RADIO ARCHITECTURE 9**

Cognition cycle – orient, plan, decide and act phases, Organization, SDR as a platform for Cognitive Radio – Hardware and Software Architectures, Overview of IEEE 802.22 standard for broadband wireless access in TV bands.

**UNIT III SPECTRUM SENSING AND DYNAMIC SPECTRUM ACCESS 9**

Introduction – Primary user detection techniques – energy detection, feature detection, matched filtering, cooperative detection and other approaches, Fundamental Tradeoffs in spectrum sensing, Spectrum Sharing Models of Dynamic Spectrum Access - Unlicensed and Licensed Spectrum Sharing, Fundamental Limits of Cognitive Radio.

**UNIT IV MAC AND NETWORK LAYER DESIGN FOR COGNITIVE RADIO 9**

MAC for cognitive radios – Polling, ALOHA, slotted ALOHA, CSMA, CSMA / CA, Network layer design – routing in cognitive radios, flow control and error control techniques.

**UNIT V ADVANCED TOPICS IN COGNITIVE RADIO 9**

Overview of security issues in cognitive radios, auction based spectrum markets in cognitive radio networks, public safety and cognitive radio, cognitive radio for Internet of Things.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Gain knowledge on the design principles on software defined radio and cognitive radio
- Develop the ability to design and implement algorithms for cognitive radio spectrum sensing and dynamic spectrum access
- Build experiments and projects with real time wireless applications
- Apply the knowledge of advanced features of cognitive radio for real world applications

**TEXT BOOKS:**

1. Alexander M. Wyglinski, Maziar Nekovee, Thomas Hou, “Cognitive Radio Communications and Networks”, Academic Press, Elsevier, 2010. (Unit I to IV)
2. Huseyin Arslan (Ed.), “Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems, Springer, 2007. (Unit V)

**REFERENCES:**

1. Bruce Fette, “Cognitive Radio Technology”, Newnes, 2006.
2. Kwang-Cheng Chen, Ramjee Prasad, “ Cognitive Radio Networks”, John Wiley and Sons, 2009.
3. Ezio Biglieri, Professor Andrea J. Goldsmith, Dr Larry J. Greenstein, Narayan B. Mandayam, H. Vincent Poor, “Principles of Cognitive Radio” , Cambridge University Press, 2012.

<b>GE8072</b>	<b>FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer



## REFERENCES:

1. Hiriappa B, "Corporate Strategy – Managing the Business", Author House, 2013.
2. Peter F Drucker, "People and Performance", Butterworth – Heinemann [Elsevier], Oxford, 2004.
3. Vinod Kumar Garg and Venkita Krishnan N K, "Enterprise Resource Planning – Concepts", Second Edition, Prentice Hall, 2003.
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2013

**CS8082**

**MACHINE LEARNING TECHNIQUES**

**L T P C**  
**3 0 0 3**

## OBJECTIVES:

- To understand the need for machine learning for various problem solving
- To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
- To learn the new approaches in machine learning
- To design appropriate machine learning algorithms for problem solving

## UNIT I INTRODUCTION

**9**

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

## UNIT II NEURAL NETWORKS AND GENETIC ALGORITHMS

**9**

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

## UNIT III BAYESIAN AND COMPUTATIONAL LEARNING

**9**

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

## UNIT IV INSTANT BASED LEARNING

**9**

K- Nearest Neighbour Learning – Locally weighted Regression – Radial Bases Functions – Case Based Learning.

## UNIT V ADVANCED LEARNING

**9**

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

**TOTAL : 45 PERIODS**

## OUTCOMES:

**At the end of the course, the students will be able to**

- Differentiate between supervised, unsupervised, semi-supervised machine learning approaches
- Apply specific supervised or unsupervised machine learning algorithm for a particular problem
- Analyse and suggest the appropriate machine learning approach for the various types of problem
- Design and make modifications to existing machine learning algorithms to suit an

- individual application
- Provide useful case studies on the advanced machine learning algorithms

**TEXT BOOK:**

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (India) Private Limited, 2013.

**REFERENCES:**

1. Ethem Alpaydin, “Introduction to Machine Learning (Adaptive Computation and Machine Learning)”, The MIT Press 2004.
2. Stephen Marsland, “Machine Learning: An Algorithmic Perspective”, CRC Press, 2009.

<b>EC8005</b>	<b>ELECTRONIC PACKAGING AND TESTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVE:**

- To introduce and discuss various issues related to the system packaging

**UNIT I OVERVIEW OF ELECTRONIC SYSTEMS PACKAGING 9**

Functions of an Electronic Package, Packaging Hierarchy, IC packaging: MEMS packaging, consumer electronics packaging, medical electronics packaging, Trends, Challenges, Driving Forces on Packaging Technology, Materials for Microelectronic packaging, Packaging Material Properties, Ceramics, Polymers, and Metals in Packaging, Material for high density interconnect substrates

**UNIT II ELECTRICAL ISSUES IN PACKAGING 9**

Electrical Issues of Systems Packaging, Signal Distribution, Power Distribution, Electromagnetic Interference, Transmission Lines, Clock Distribution, Noise Sources, Digital and RF Issues. Design Process Electrical Design: Interconnect Capacitance, Resistance and Inductance fundamentals; Packaging roadmaps - Hybrid circuits - Resistive, Capacitive and Inductive parasitics

**UNIT III CHIP PACKAGES 9**

IC Assembly - Purpose, Requirements, Technologies, Wire bonding, Tape Automated Bonding, Flip Chip, Wafer Level Packaging, reliability, wafer level burn – in and test. Single chip packaging: functions, types, materials processes, properties, characteristics, trends. Multi chip packaging: types, design, comparison, trends. System – in - package (SIP); Passives: discrete, integrated, and embedded

**UNIT IV PCB, SURFACE MOUNT TECHNOLOGY AND THERMAL CONSIDERATIONS 9**

Printed Circuit Board: Anatomy, CAD tools for PCB design, Standard fabrication, Micro via Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges. Thermal Management, Heat transfer fundamentals, Thermal conductivity and resistance, Conduction, convection and radiation – Cooling requirements

**UNIT V TESTING 9**

Reliability, Basic concepts, Environmental interactions. Thermal mismatch and fatigue – failures – thermo mechanically induced – electrically induced – chemically induced. Electrical Testing: System level electrical testing, Interconnection tests, Active Circuit Testing, Design for Testability

**TOTAL:45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Give a comprehensive introduction to the various packaging types used along with the

associated thermal, speed, signal and integrity power issues

- Enable design of packages which can withstand higher temperature, vibrations and shock
- Design of PCBs which minimize the EMI and operate at higher frequency
- Analyze the concepts of Testing and testing methods

**TEXT BOOK:**

1. Tummala, Rao R., Fundamentals of Microsystems Packaging, McGraw Hill, 2001

**REFERENCES:**

1. Blackwell (Ed), The electronic packaging handbook, CRC Press, 2000.
2. Tummala, Rao R, Microelectronics packaging handbook, McGraw Hill, 2008.
3. Bosshart, Printed Circuit Boards Design and Technology, TataMcGraw Hill, 1988.
4. R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011
5. R.S.Khandpur, Printed Circuit Board, Tata McGraw Hill, 2005
6. Recent literature in Electronic Packaging
7. Michael L. Bushnell & Vishwani D. Agrawal, "Essentials of Electronic Testing for Digital, memory & Mixed signal VLSI Circuits", Kluwer Academic Publishers.2000.
8. M. Abramovici, M. A. Breuer, and A.D. Friedman, "Digital System Testing and Testable Design", Computer Science Press,1990

<b>EC8006</b>	<b>MIXED SIGNAL IC DESIGN</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

**The student should be made to:**

- Study the mixed signal of submicron CMOS circuits
- Understand the various integrated based filters and topologies
- Learn the data converters architecture, modeling and signal to noise ratio
- Study the integrated circuit of oscillators and PLLs

**UNIT I SUBMICRON CMOS CIRCUIT DESIGN 9**

Submicron CMOS: Overview and Models, CMOS process flow, Capacitors and Resistors. Digital circuit design: The MOSFET Switch, Delay Elements, An Adder. Analog Circuit Design: Biasing, Op-Amp Design, Circuit Noise.

**UNIT II INTEGRATOR BASED CMOS FILTERS 9**

Integrator Building Blocks- low pass filter, Active RC integrators, MOSFET-C Integrators,  $g_m$ -C integrators, Discrete time integrators. Filtering Topologies: The Bilinear transfer function, The Biquadratic transfer function, Filters using Noise shaping.

**UNIT III DATA CONVERTER ARCHITECTURES 9**

DAC Architectures- Resistor string, R-2R ladder Networks, Current Steering, Charge Scaling DACs, Cyclic DAC, and Pipeline DAC. ADC Architectures- Flash, Two-step flash ADC, Pipeline ADC, Integrating ADC's, Successive Approximation ADC.

**UNIT IV DATA CONVERTER MODELING AND SNR 9**

Sampling and Aliasing: A modeling approach, Impulse sampling, The sample and Hold, Quantization noise. Data converter SNR: An overview, Clock Jitter, Improving SNR using Averaging, Decimating filter for ADCs, Interpolating filter for DACs, Band pass and High pass sinc filters - Using feedback to improve SNR.

**UNIT V OSCILLATORS AND PLL 9**

LC oscillators, Voltage Controlled Oscillators. Simple PLL, Charge pumps PLLs, Non ideal effects in PLLs, Delay Locked Loops.

**OUTCOMES:**

**Upon completion of the course, student should be able to**

- Apply the concepts for mixed signal MOS circuit.
- Analyze the characteristics of IC based CMOS filters.
- Design of various data converter architecture circuits.
- Analyze the signal to noise ratio and modeling of mixed signals.
- Design of oscillators and phase lock loop circuit.

**REFERENCES:**

1. CMOS Mixed Signal Circuit Design by R.Jacob Baker, Wiley India, IEEE Press, reprint 2008.
2. CMOS Circuit Design, Layout and Simulation by R.Jacob Baker, Wiley India, IEEE Press, Second Edition, reprint 2009.
3. Design of Analog CMOS Integrated Circuits by Behzad Razavi, McGraw Hill, 33<sup>rd</sup> Reprint, 2016.

**GE8071**

**DISASTER MANAGEMENT**

**LT P C  
3 0 0 3**

**OBJECTIVES:**

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

**UNIT I INTRODUCTION TO DISASTERS**

**9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

**UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)**

**9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

**UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT**

**9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

**UNIT IV DISASTER RISK MANAGEMENT IN INDIA**

**9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes



**UNIT IV EMC DESIGN FOR CIRCUITS AND PCBs 9**

Noise from Relays and Switches; Nonlinearities in Circuits; Cross talk in transmission line and cross talk control; Component selection and mounting; PCB trace impedance; Routing; Power distribution decoupling; Zoning; Grounding; VIAs; Terminations.

**UNIT V EMI MEASUREMENTS AND STANDARDS 9**

Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic chamber; Line impedance stabilization networks; EMI Rx and spectrum analyzer; Civilian standards - CISPR, FCC, IEC, EN; Military standards-MIL461E/462.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Identify the various types and mechanisms of Electromagnetic Interference
- Propose a suitable EMI mitigation technique
- Describe the various EMC Standards and methods to measure them

**TEXT BOOKS:**

1. V.P.Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press, Newyork, 1996.(Unit I – V)
2. Henry W.Ott., "Noise Reduction Techniques in Electronic Systems", A Wiley Inter Science Publications, John Wiley and Sons, Newyork, 1988. (Unit – IV)

**REFERENCES:**

1. C.R.Paul,"Introduction to Electromagnetic Compatibility" , John Wiley and Sons, Inc, 1992.
2. Bemhard Keiser, "Principles of Electromagnetic Compatibility", 3rd Ed, Artech house, Norwood, 1986.
3. Don R. J.White Consultant Incorporate, "Handbook of EMI/EMC", Vol I-V, 1988.

<b>EC8007</b>	<b>LOW POWER SoC DESIGN</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

**The student should be made to:**

- Identify sources of power in an IC.
- Understand basic principle of System on Chip design
- Learn optimization of power in combinational and sequential logic machines for SoC Design
- Identify suitable techniques to reduce the power dissipation and design circuits with low power dissipation.

**UNIT I POWER CONSUMPTION IN CMOS 9**

Physics of power dissipation in CMOS FET devices – Hierarchy of limits of power – Sources of power consumption – Static Power Dissipation, Active Power Dissipation - Designing for Low Power, Circuit Techniques for Leakage Power Reduction - Basic principle of low power design, Logic level power optimization – Circuit level low power design.

**UNIT II SYSTEM-ON-CHIP DESIGN 9**

System-on-Chip Concept, Design Principles in SoC Architecture, SoC Design Flow, Platform-based and IP based SoC Designs, Basic Concepts of Bus-Based Communication Architectures. High performance algorithms for ASICs/ SoCs as case studies – Canonic Signed Digit Arithmetic, KCM, Distributed Arithmetic, High performance digital filters for sigma-delta ADC

**UNIT III POWER OPTIMIZATION OF COMBINATIONAL AND SEQUENTIAL LOGIC MACHINES FOR SOC 9**

Introduction to Standard Cell-Based Layout – Simulation - Combinational Network Delay - Logic and interconnect Design - Power Optimization - Switch Logic Networks. Introduction - Latches and Flip-Flops - Sequential Systems and Clocking Disciplines - Sequential System Design - Power Optimization - Design Validation - Sequential Testing.

**UNIT IV DESIGN OF LOW POWER CIRCUITS FOR SUB SYSTEM ON A SOC 9**

Subsystem Design Principles - Combinational Shifters – Adders – ALUs – Multipliers – High Density Memory – Field Programmable Gate Arrays - Programmable Logic Arrays - Computer arithmetic techniques for low power system – low voltage low power static Random access and dynamic Random access memories, low power clock, Inter connect and layout design

**UNIT V FLOOR PLANNING 9**

Floor-planning Methods – Block Placement & Channel Definition - Global Routing - switchbox Routing - Power Distribution - Clock Distributions - Floor-planning Tips - Design Validation - Off-Chip Connections – Packages, The I/O Architecture - PAD Design

**TOTAL:45 PERIODS**

**OUTCOME:**

**At the end of the course, the student should be able to:**

- Analyze and design low-power VLSI circuits using different circuit technologies for system on chip design

**TEXT BOOKS:**

- J.Rabaey, “Low Power Design Essentials (Integrated Circuits and Systems)”, Springer, 2009
- Wayne Wolf, “Modern VLSI Design – System – on – Chip Design”, Prentice Hall, 3rd Edition, 2008.

**REFERENCES:**

- J.B.Kuo & J.H.Lou, “Low-voltage CMOS VLSI Circuits”, Wiley, 1999.
- A.Bellaowar & M.I.Elmasry, “Low power Digital VLSI Design, Circuits and Systems”, Kluwer, 1996.
- Wayne Wolf, “Modern VLSI Design – IP based Design”, Prentice Hall, 4th Edition, 2008.
- M.J.S. Smith : Application Specific Integrated Circuits, Pearson, 2003
- Sudeep Pasricha and NikilDutt, On-Chip Communication Architectures System on Chip Interconnect, Elsevier, 2008
- Recent literature in Low Power VLSI Circuits.
- Recent literature in Design of ASICs

**EC8008**

**PHOTONIC NETWORKS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To enable the student to understand the importance of the backbone infrastructure for our present and future communication needs and familiarize them with the architectures and the protocol stack in use
- To enable the student to understand the differences in the design of data plane and the control plane and the routing, switching and the resource allocation methods and the network management and protection methods in vogue
- To expose the student to the advances in networking and switching domains and the future trends

**UNIT I OPTICAL SYSTEM COMPONENTS 9**

Light Propagation in optical fibers – Loss & bandwidth, System limitations, Nonlinear effects; Solitons; Optical Network Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters.

**UNIT II OPTICAL NETWORK ARCHITECTURES 9**

Introduction to Optical Networks; SONET / SDH, Metropolitan-Area Networks, Layered Architecture; Broadcast and Select Networks – Topologies for Broadcast Networks, Media-Access Control Protocols, Wavelength Routing Architecture.

**UNIT III WAVELENGTH ROUTING NETWORKS 9**

The optical layer, Optical Network Nodes, Routing and wavelength assignment, Traffic Grooming in Optical Networks, Architectural variations- Linear Light wave networks, Logically Routed Networks.

**UNIT IV PACKET SWITCHING AND ACCESS NETWORKS 9**

Photonic Packet Switching – OTDM, Multiplexing and Demultiplexing, Synchronization, Broadcast OTDM networks, Switch-based networks, Contention Resolution Access Networks – Network Architecture overview, Optical Access Network Architectures and OTDM networks.

**UNIT V NETWORK DESIGN AND MANAGEMENT 9**

Transmission System Engineering – System model, Power penalty - transmitter, receiver, Optical amplifiers, crosstalk, dispersion, Wavelength stabilization, Overall design considerations, Control and Management – Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student would be able to:**

- Use the backbone infrastructure for our present and future communication needs
- Analyze the architectures and the protocol stack
- Compare the differences in the design of data plane, control plane, routing, switching, resource allocation methods, network management and protection methods in vogue

**REFERENCES:**

1. Rajiv Ramaswami and Kumar N. Sivarajan, “Optical Networks: A Practical Perspective”, Harcourt Asia Pte Ltd., Second Edition 2004.
2. C. Siva Ram Moorthy and Mohan Gurusamy, “WDM Optical Networks: Concept, Design and Algorithms”, Prentice Hall of India, 1st Edition, 2002.
3. P.E. Green, Jr., “Fiber Optic Networks”, Prentice Hall, NJ, 1993.
4. Biswanath Mukherjee, “Optical WDM Networks”, Springer Series, 2006.

<b>EC8009</b>	<b>COMPRESSIVE SENSING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To present the basic theory and ideas showing when it is possible to reconstruct sparse or nearly sparse signals from undersampled data
- To expose students to recent ideas in modern convex optimization allowing rapid signal recovery
- To give students a sense of real time applications that might benefit from compressive sensing ideas

**UNIT I INTRODUCTION TO COMPRESSED SENSING 9**

Introduction; Motivation; Mathematical Background; Traditional Sampling; Traditional Compression; Conventional Data Acquisition System; Drawbacks of Transform coding; Compressed Sensing (CS).

**UNIT II SPARSITY AND SIGNAL RECOVERY 9**

Signal Representation; Basis vectors; Sensing matrices; Restricted Isometric Property; Coherence; Stable recovery; Number of measurements.

**UNIT III RECOVERY ALGORITHMS 9**

Basis Pursuit algorithm: L1 minimization; Matching pursuit: Orthogonal Matching Pursuit(OMP), Stagewise OMP, Regularized OMP, Compressive Sampling Matching Pursuit (CoSaMP); Iterative Thresholding algorithm: Hard thresholding, Soft thresholding; Model based : Model based CoSaMP, Model based HIT.

**UNIT IV COMPRESSIVE SENSING FOR WSN 9**

Basics of WSN; Wireless Sensor without Compressive Sensing; Wireless Sensor with Compressive Sensing; Compressive Wireless Sensing: Spatial compression in WSNs, Projections in WSNs, Compressed Sensing in WSNs.

**UNIT V APPLICATIONS OF COMPRESSIVE SENSING 9**

Compressed Sensing for Real-Time Energy-Efficient Compression on Wireless Body Sensor Nodes; Compressive sensing in video surveillance; An Application of Compressive Sensing for Image Fusion; Single-Pixel Imaging via Compressive Sampling.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Appreciate the motivation and the necessity for compressed sensing technology.
- Design a new algorithm or modify an existing algorithm for different application areas in wireless sensor network.

**TEXT BOOKS:**

1. Radha S, Hemalatha R, Aasha Nandhini S, "Compressive Sensing for Wireless Communication: Challenges and Opportunities", River publication, 2016. (UNIT I-V)
2. Mark A. Davenport, Marco F. Duarte, Yonina C. Eldar and Gitta Kutyniok, "Introduction to Compressed Sensing," in Compressed Sensing: Theory and Applications, Y. Eldar and G. Kutyniok, eds., Cambridge University Press, 2011 (UNIT I)

**REFERENCES:**

1. Duarte, M.F.; Davenport, M.A.; Takhar, D.; Laska, J.N.; Ting Sun; Kelly, K.F.; Baraniuk, R.G.; , "Single-Pixel Imaging via Compressive Sampling," Signal Processing Magazine, IEEE, vol.25, no.2, pp.83-91, March 2008.
2. Tao Wan.; Zengchang Qin.; , "An application of compressive sensing for image fusion", CIVR '10 Proceedings of the ACM International Conference on Image and Video Retrieval, Pages 3-9.
3. H. Mamaghanian , N. Khaled , D. Atienza and P. Vandergheynst "Compressed sensing for real-time energy-efficient ecg compression on wireless body sensor nodes", IEEE Trans. Biomed. Eng., vol. 58, no. 9, pp.2456 -2466 2011.
4. Mohammadreza Balouchestani.; Kaamran Raahemifar.; and Sridhar Krishnan.;, "COMPRESSED SENSING IN WIRELESS SENSOR NETWORKS: SURVEY" , Canadian Journal on Multimedia and Wireless Networks Vol. 2, No. 1, February 2011.

**OBJECTIVES:**

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

**UNIT I DIGITAL IMAGE FUNDAMENTALS 9**

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

**UNIT II IMAGE ENHANCEMENT 9**

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

**UNIT III IMAGE RESTORATION 9**

Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering

**UNIT IV IMAGE SEGMENTATION 9**

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

**UNIT V IMAGE COMPRESSION AND RECOGNITION 9**

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

**TOTAL :45 PERIODS****OUTCOMES:**

**At the end of the course, the students should be able to:**

- Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
- Operate on images using the techniques of smoothing, sharpening and enhancement.
- Understand the restoration concepts and filtering techniques.
- Learn the basics of segmentation, features extraction, compression and recognition methods for color models.

**TEXT BOOKS:**

1. Rafael C. Gonzalez, Richard E. Woods, 'Digital Image Processing', Pearson, Third Edition, 2010.
2. Anil K. Jain, 'Fundamentals of Digital Image Processing', Pearson, 2002.

**REFERENCES**

1. Kenneth R. Castleman, 'Digital Image Processing', Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, 'Digital Image Processing using MATLAB', Pearson Education, Inc., 2011.
3. D.E. Dudgeon and RM. Mersereau, 'Multidimensional Digital Signal Processing', Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, 'Digital Image Processing', John Wiley, New York, 2002
5. Milan Sonka et al 'Image processing, analysis and machine vision', Brookes/Cole, Vikas Publishing House, 2nd edition, 1999.

**GE8076****PROFESSIONAL ETHICS IN ENGINEERING****LT P C  
3 0 0 3****OBJECTIVE:**

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

**UNIT I HUMAN VALUES****10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

**UNIT II ENGINEERING ETHICS****9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

**UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION****9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

**UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS****9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

**UNIT V GLOBAL ISSUES****8**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

**TEXT BOOKS:**

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

**REFERENCES:**

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd., New Delhi, 2013.
6. World Community Service Centre, ' Value Education', Vethathiri publications, Erode, 2011.

**Web sources:**

1. [www.onlineethics.org](http://www.onlineethics.org)
2. [www.nspe.org](http://www.nspe.org)
3. [www.globalethics.org](http://www.globalethics.org)
4. [www.ethics.org](http://www.ethics.org)

**EC8010****VIDEO ANALYTICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:****The student should be made:**

- To understand the need for video Analytics
- To understand the basic configuration of video analytics
- To understand the functional blocks of a video analytic system
- To get exposed to the various applications of video analytics

**UNIT I VIDEO ANALYTIC COMPONENTS****9**

Need for Video Analytics-Overview of video Analytics- Foreground extraction- Feature extraction-classifier - Preprocessing- edge detection- smoothening- Feature space-PCA-FLD-SIFT features

**UNIT II FOREGROUND EXTRACTION****9**

Background estimation- Averaging- Gaussian Mixture Model- Optical Flow based- Image Segmentation- Region growing- Region splitting-Morphological operations- erosion-Dilation-Tracking in a multiple camera environment

**UNIT III CLASSIFIERS****9**

Neural networks (back propagation) - Deep learning networks- Fuzzy Classifier- Bayesian classifier-HMM based classifier

**UNIT IV VIDEO ANALYTICS FOR SECURITY 9**  
 Abandoned object detection- human behavioral analysis -human action recognition- perimeter security- crowd analysis and prediction of crowd congestion

**UNIT V VIDEO ANALYTICS FOR BUSINESS INTELLIGENCE & TRAFFIC MONITIRING AND ASSISTANCE 9**  
 Customer behavior analysis - people counting- Traffic rule violation detection- traffic congestion identification for route planning- driver assistance- lane change warning

**TOTAL :45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design video analytic algorithms for security applications
- Design video analytic algorithms for business intelligence
- Design custom made video analytics system for the given target application

**REFERENCES:**

1. Graeme A. Jones (Editor), Nikos Paragios (Editor), Carlo S. Regazzoni (Editor) Video-Based Surveillance Systems: Computer Vision and Distributed Processing , Kluwer academic publisher, 2001
2. Nilanjan Dey (Editor), Amira Ashour (Editor) and Suvojit Acharjee (Editor), Applied Video Processing in Surveillance and Monitoring Systems (IGI global) 2016
3. Zhihao Chen (Author), Ye Yang (Author), Jingyu Xue (Author), Liping Ye (Author), Feng Guo (Author), The Next Generation of Video Surveillance and Video Analytics: The Unified Intelligent Video Analytics Suite, CreateSpace Independent Publishing Platform, 2014
4. Caifeng Shan (Editor), Fatih Porikli (Editor), Tao Xiang (Editor), Shaogang Gong (Editor) Video Analytics for Business Intelligence, Springer, 2012

<b>EC8011</b>	<b>DSP PROCESSOR ARCHITECTURE AND PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

**The objective of this course is to provide knowledge on:**

- Basics on Digital Signal Processors
- Programmable DSP's Architecture, On-chip Peripherals and Instruction set
- Programming for signal processing applications
- Advanced Programmable DSP Processors

**UNIT I FUNDAMENTALS OF PROGRAMMABLE DSPs 9**  
 Introduction to Programmable DSPs, Architectural Features of PDSPs - Multiplier and Multiplier accumulator – Modified Bus Structures and Memory access – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining – Special Addressing modes in P-DSPs – On chip Peripherals, Applications of Programmable DSPs.

**UNIT II TMS320C5X PROCESSOR 9**  
 Architecture of C5X Processor – Addressing modes – Assembly language Instructions - Pipeline structure, On-chip Peripherals – Block Diagram of DSP starter kit (DSK) – Software Tools, DSK on-board peripherals, Application Programs for processing real time signals.

**UNIT III TMS320C6X PROCESSOR 9**

Architecture of the C6x Processor - Instruction Set – Addressing modes, Assembler directives, On-chip peripherals, DSP Development System: DSP Starter Kit - Code Composer Studio - Support Files – Introduction to AIC23 codec and other on-board peripherals, Real-Time Programming Examples for Signals and Noise generation, Frequency analysis, Filter design.

**UNIT IV ADSP PROCESSORS 9**

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.

**UNIT V ADVANCED PROCESSORS 9**

Study of TI's advanced processors - TMS320C674x and TMS320C55x DSPs, ADSP's Blackfin and SigmaDSP Processors, NXP's DSP56Fxx Family of DSP Processors, Comparison of the features of TI, ADSP and NXP DSP family processors.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Analyze the concepts of Digital Signal Processors
- Demonstrate their ability to program the DSP processor for signal processing applications
- Discuss, compare and select the suitable Advanced DSP Processors for real-time signal processing applications

**REFERENCES:**

1. B. Venkataramani and M. Bhaskar, "Digital Signal Processors – Architecture, Programming and Applications" – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.
2. Avtar Singh and S. Srinivasan, Digital Signal Processing – Implementations using DSP Microprocessors with Examples from TMS320C54xx, Cengage Learning India Private Limited, Delhi 2012.
3. Rulph Chassaing and Donald Reay, Digital Signal Processing and Applications with the C6713 and C6416 DSK, John Wiley & Sons, Inc., Publication, 2012 (Reprint).
4. User guides Texas Instruments, Analog Devices and NXP.

**EC8094 SATELLITE COMMUNICATION L T P C**  
**3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Understand the basics of satellite orbits
- Understand the satellite segment and earth segment
- Analyze the various methods of satellite access
- Understand the applications of satellites
- Understand the basics of satellite Networks

**UNIT I SATELLITE ORBITS 9**

Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility – eclipse-Sub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion.

<b>UNIT II</b>	<b>SPACE SEGMENT</b>	<b>9</b>
Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command-Transponders-The Antenna Subsystem.		
<b>UNIT III</b>	<b>SATELLITE LINK DESIGN</b>	<b>9</b>
Basic link analysis, Interference analysis, Rain induced attenuation and interference, Ionospheric characteristics, Link Design with and without frequency reuse.		
<b>UNIT IV</b>	<b>SATELLITE ACCESS AND CODING METHODS</b>	<b>9</b>
Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, DAMA Assignment Methods, compression – encryption, Coding Schemes.		
<b>UNIT V</b>	<b>SATELLITE APPLICATIONS</b>	<b>9</b>
INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. GPS Position Location Principles, Differential GPS, Direct Broadcast satellites (DBS/DTH).		
		<b>TOTAL:45 PERIODS</b>

**OUTCOMES:**

**At the end of the course, the student would be able to:**

- Analyze the satellite orbits
- Analyze the earth segment and space segment
- Analyze the satellite Link design
- Design various satellite applications

**TEXT BOOKS:**

1. Dennis Roddy, "Satellite Communication", 4th Edition, Mc Graw Hill International, 2006.
2. Timothy,Pratt,Charles,W.Bostain,JeremyE.Allnutt,"SatelliteCommunication",2<sup>nd</sup> Edition, Wiley Publications,2002

**REFERENCES:**

1. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, "Satellite Communication Systems Engineering", Prentice Hall/Pearson, 2007.
2. N.Agarwal, "Design of Geosynchronous Space Craft", Prentice Hall, 1986.
3. Bruce R. Elbert, "The Satellite Communication Applications", Hand Book, Artech House Boston London, 1997.
4. Tri T. Ha, "Digital Satellite Communication", II nd edition, 1990.
5. Emanuel Fthenakis, "Manual of Satellite Communications", Mc Graw Hill Book Co., 1984.
6. Robert G. Winch, "Telecommunication Trans Mission Systems", Mc Graw-Hill Book Co., 1983.
7. Brian Ackroyd, "World Satellite Communication and earth station Design", BSP professional Books, 1990.
8. G.B.Bleazard, "Introducing Satellite communications", NCC Publication, 1985.
9. M.Richharia, "Satellite Communication Systems-Design Principles", Macmillan 2003.

**OBJECTIVES:**

- To learn the basic concepts of Soft Computing
- To become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems.
- To apply soft computing techniques to solve problems.

**UNIT I INTRODUCTION TO SOFT COMPUTING 9**

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.

**UNIT II ARTIFICIAL NEURAL NETWORKS 9**

Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network- Bi-directional Associative Memory -Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models.

**UNIT III FUZZY SYSTEMS 9**

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.

**UNIT IV GENETIC ALGORITHMS 9**

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion -Mutation Operator - Bit-wise Operators -Convergence of Genetic Algorithm.

**UNIT V HYBRID SYSTEMS 9**

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP - Fuzzy ArtMap: A Brief Introduction - Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon completion of this course, the students should be able to**

- Apply suitable soft computing techniques for various applications.
- Integrate various soft computing techniques for complex problems.

**TEXT BOOKS:**

1. N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.
2. S.N.Sivanandam, S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt.Ltd., 2nd Edition, 2011.
3. S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications", PHI Learning Pvt.Ltd., 2017.

**REFERENCES:**

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2002.



2. Ben Gold and Nelson Morgan "Speech and Audio signal processing- processing and perception of speech and music", John Wiley and sons 2006

## REFERENCES

1. Lawrence Rabiner, Biiing and– Hwang Juang and B.Yegnanarayana "Fundamentals of Speech Recognition", Pearson Education, 2009
2. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons, 1999
3. Donglos O shanhnessy "Speech Communication: Human and Machine ", 2nd Ed. University press 2001.

**GE8073**

**FUNDAMENTALS OF NANOSCIENCE**

**L T P C**  
**3 0 0 3**

### OBJECTIVE:

To learn about basis of nanomaterial science, preparation method, types and application

### UNIT I INTRODUCTION

**8**

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires- ultra-thin films-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

### UNIT II GENERAL METHODS OF PREPARATION

**9**

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

### UNIT III NANOMATERIALS

**12**

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO<sub>2</sub>,MgO, ZrO<sub>2</sub>, NiO, Nano alumina, CaO, AgTiO<sub>2</sub>, Ferrites, Nano clays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

### UNIT IV CHARACTERIZATION TECHNIQUES

**9**

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

### UNIT V APPLICATIONS

**7**

Nano InfoTech: Information storage- Nano computer, molecular switch, super chip, nanocrystal, Nano biotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targeted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nano sensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sun barrier products - In Photostat, printing, solar cell, battery.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

**TEXT BOOKS:**

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale Characterization of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

**REFERENCES:**

1. G Timp, "Nanotechnology", AIP press/Springer, 1999.
2. Akhlesh Lakhtakia, "The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

**ANNA UNIVERSITY, CHENNAI**  
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**B.E. ELECTRICAL AND ELECTRONICS ENGINEERING**  
**REGULATIONS – 2017**  
**CHOICE BASED CREDIT SYSTEM**

**Educational Objectives**

Bachelor of Electrical and Electronics Engineering curriculum is designed to prepare the graduates having attitude and knowledge to

1. Have successful technical and professional careers in their chosen fields such as circuit theory, Field theory, control theory and computational platforms.
2. Engross in life long process of learning to keep themselves abreast of new developments in the field of Electronics and their applications in power engineering.

**Programme Outcomes**

The graduates will have the ability to

- a. Apply the Mathematical knowledge and the basics of Science and Engineering to solve the problems pertaining to Electronics and Instrumentation Engineering.
- b. Identify and formulate Electrical and Electronics Engineering problems from research literature and be able to analyze the problem using first principles of Mathematics and Engineering Sciences.
- c. Come out with solutions for the complex problems and to design system components or process that fulfill the particular needs taking into account public health and safety and the social, cultural and environmental issues.
- d. Draw well-founded conclusions applying the knowledge acquired from research and research methods including design of experiments, analysis and interpretation of data and synthesis of information and to arrive at significant conclusion.
- e. Form, select and apply relevant techniques, resources and Engineering and IT tools for Engineering activities like electronic prototyping, modeling and control of systems and also being conscious of the limitations.
- f. Understand the role and responsibility of the Professional Electrical and Electronics Engineer and to assess societal, health, safety issues based on the reasoning received from the contextual knowledge.
- g. Be aware of the impact of professional Engineering solutions in societal and environmental contexts and exhibit the knowledge and the need for Sustainable Development.
- h. Apply the principles of Professional Ethics to adhere to the norms of the engineering practice and to discharge ethical responsibilities.
- i. Function actively and efficiently as an individual or a member/leader of different teams and multidisciplinary projects.
- j. Communicate efficiently the engineering facts with a wide range of engineering community and others, to understand and prepare reports and design documents; to make effective presentations and to frame and follow instructions.
- k. Demonstrate the acquisition of the body of engineering knowledge and insight and Management Principles and to apply them as member / leader in teams and multidisciplinary environments.
- l. Recognize the need for self and life-long learning, keeping pace with technological challenges in the broadest sense.

PEO \ PO	a	b	c	d	e	f	g	h	i	j	k	l
1	✓	✓	✓	✓	✓	✓	✓					✓
2	✓	✓	✓	✓	✓	✓	✓	✓		✓		

SEMESTER	NAME OF THE SUBJECT	PROGRAM OUTCOMES												
		a	b	c	d	e	f	g	h	i	j	k	l	
	<b>THEORY</b>													
SEM I	Communicative English									✓	✓		✓	
	Engineering Mathematics - I	✓	✓			✓							✓	
	Engineering Physics	✓	✓	✓		✓		✓					✓	
	Engineering Chemistry	✓	✓	✓		✓							✓	
	Problem Solving and Python Programming	✓	✓	✓	✓	✓							✓	
	Engineering Graphics			✓	✓									
	<b>PRACTICAL</b>													
	Problem Solving and Python Programming Laboratory	✓		✓	✓	✓	✓				✓			✓
	Physics and Chemistry Laboratory	✓	✓											
	<b>THEORY</b>													
SEM II	Technical English									✓	✓		✓	
	Engineering Mathematics - II	✓	✓	✓		✓							✓	
	Physics For Electronics Engineering	✓	✓	✓		✓		✓					✓	
	Basic Civil and Mechanical Engineering				✓		✓							
	Circuit Theory	✓	✓	✓	✓	✓							✓	
	Environmental Science and Engineering	✓	✓			✓	✓	✓	✓				✓	
	<b>PRACTICALS</b>													
	Engineering Practices Laboratory	✓		✓	✓	✓	✓				✓			
	Electric Circuits Lab	✓		✓	✓	✓	✓				✓			✓
	<b>THEORY</b>													
SEM III	Transforms and Partial Differential Equations	✓	✓			✓							✓	
	Digital Logic Circuits				✓	✓								
	Electromagnetic Theory	✓	✓	✓	✓	✓					✓		✓	
	Electrical Machines – I	✓	✓	✓	✓	✓					✓			

	Electron Devices and Circuits	✓	✓	✓	✓	✓							✓	
	Power Plant Engineering			✓	✓	✓		✓	✓	✓				
	<b>PRACTICALS</b>													
	Electronics Laboratory	✓			✓	✓						✓	✓	
	Electrical Machines Laboratory - I	✓			✓	✓						✓	✓	
	<b>THEORY</b>													
<b>SEM IV</b>	Numerical Methods	✓	✓	✓									✓	
	Electrical Machines – II	✓	✓	✓	✓	✓		✓					✓	
	Transmission and Distribution	✓	✓	✓	✓	✓		✓					✓	
	Measurements and Instrumentation	✓	✓	✓	✓	✓							✓	
	Linear Integrated Circuits and Applications	✓	✓	✓		✓								
	Control Systems	✓	✓	✓	✓	✓							✓	
	<b>PRACTICALS</b>													
	Electrical Machines Lab II	✓	✓	✓	✓	✓							✓	
	Linear and Digital Integrated Circuits Laboratory	✓			✓	✓						✓	✓	✓
	Technical Seminar										✓	✓	✓	
	<b>THEORY</b>													
<b>SEM V</b>	Power System Analysis	✓	✓	✓	✓	✓		✓					✓	
	Microprocessors and Microcontrollers	✓			✓		✓		✓	✓		✓	✓	
	Power Electronics	✓	✓	✓	✓	✓		✓						
	Digital Signal Processing	✓	✓	✓	✓	✓		✓					✓	
	Object Oriented Programming				✓	✓	✓						✓	
	Open Elective I													
	<b>PRACTICALS</b>													
	Control and Instrumentation Laboratory				✓	✓	✓	✓			✓	✓		

	Professional Communication									✓	✓	✓	
	Object Oriented Programming Laboratory			✓	✓	✓							✓
	<b>THEORY</b>												
<b>SEM VI</b>	Solid State Drives	✓	✓	✓	✓	✓		✓					
	Protection and Switchgear	✓	✓	✓	✓	✓		✓					✓
	Embedded Systems												
	Professional Elective I												
	Professional Elective II												
	<b>PRACTICALS</b>												
	Power Electronics and Drives Laboratory	✓		✓	✓						✓	✓	✓
	Microprocessors and Microcontrollers Laboratory	✓		✓	✓						✓	✓	✓
Mini Project	✓		✓	✓						✓	✓	✓	
	<b>THEORY</b>												
<b>SEM VII</b>	High Voltage Engineering	✓	✓	✓	✓	✓		✓					✓
	Power System Operation and Control	✓	✓	✓	✓	✓		✓					✓
	Renewable Energy Systems	✓	✓	✓	✓	✓		✓					✓
	Open Elective II												
	Professional Elective III												
	Professional Elective IV												
	<b>PRACTICALS</b>												
	Power System Simulation Laboratory	✓		✓	✓						✓	✓	✓
Renewable Energy Systems Laboratory	✓		✓	✓						✓	✓	✓	
<b>SEM VIII</b>	<b>THEORY</b>												
	Professional Elective V												

	Professional Elective VI												
	<b>PRACTICALS</b>												
	Project Work	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

**PROFESSIONAL ELECTIVE**

SL.NO.	NAME OF THE SUBJECT	PROGRAM OUTCOMES											
		a	b	c	d	e	f	g	h	i	j	k	l
	<b>THEORY</b>												
<b>ELECTIVE – I</b>	Advanced Control System		✓	✓					✓	✓			
	Visual Languages and Applications	✓	✓		✓	✓							
	Design of Electrical Apparatus	✓		✓	✓	✓		✓					
	Power Systems Stability				✓	✓							
	Modern Power Converters	✓		✓	✓	✓		✓					
	Intellectual Property Rights								✓		✓		✓
<b>ELECTIVE – II</b>	Principles of Robotics	✓		✓		✓							
	Special Electrical Machines	✓		✓	✓	✓			✓				
	Power Quality	✓		✓	✓	✓			✓				✓
	EHVAC Transmission	✓		✓	✓	✓			✓				✓
	Communication Engineering												
<b>ELECTIVE – III</b>	Disaster Management	✓		✓		✓	✓					✓	✓
	Human Rights			✓	✓	✓	✓						
	Operations Research	✓	✓	✓					✓	✓			✓
	Probability and Statistics												
	Fibre Optics and Laser Instrumentation	✓	✓			✓						✓	✓
	Foundation Skills in Integrated Product Development												

<b>ELECTIVE – IV</b>	System Identification and Adaptive Control	✓	✓	✓		✓							
	Computer Architecture	✓		✓		✓							
	Control of Electrical Drives	✓		✓		✓			✓				✓
	VLSI Design	✓	✓	✓			✓	✓					
	Power Systems Transients		✓		✓	✓							
	Total Quality Management		✓			✓	✓	✓	✓	✓	✓		
<b>ELECTIVE – V</b>	Flexible AC Transmission Systems	✓	✓	✓		✓					✓		✓
	Soft Computing Techniques	✓		✓		✓							
	Power Systems Dynamics	✓		✓		✓							
	SMPS and UPS	✓		✓		✓							
	Electric Energy Generation, Utilization and Conservation	✓	✓	✓	✓	✓		✓					✓
	Professional Ethics in Engineering	✓	✓		✓			✓				✓	✓
	Principals of Management					✓	✓			✓			
<b>ELECTIVE – VI</b>	Energy Management and Auditing		✓			✓	✓	✓	✓	✓	✓		
	Data Structures					✓	✓			✓			
	High Voltage Direct Current Transmission	✓	✓	✓					✓	✓			✓
	Microcontroller Based System Design	✓	✓	✓					✓	✓			✓
	Smart Grid	✓	✓	✓					✓	✓			✓
	Biomedical Instrumentation	✓		✓	✓	✓	✓						
	Fundamentals of Nano Science												

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**REGULATIONS – 2017**  
**CHOICE BASED CREDIT SYSTEM**  
**I TO VIII SEMESTERS CURRICULA & SYLLABI**

**SEMESTER I**

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	HS8151	Communicative English	HS	4	4	0	0	4
2.	MA8151	Engineering Mathematics - I	BS	4	4	0	0	4
3.	PH8151	Engineering Physics	BS	3	3	0	0	3
4.	CY8151	Engineering Chemistry	BS	3	3	0	0	3
5.	GE8151	Problem Solving and Python Programming	ES	3	3	0	0	3
6.	GE8152	Engineering Graphics	ES	6	2	0	4	4
<b>PRACTICALS</b>								
7.	GE8161	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
8.	BS8161	Physics and Chemistry Laboratory	BS	4	0	0	4	2
<b>TOTAL</b>				<b>31</b>	<b>19</b>	<b>0</b>	<b>12</b>	<b>25</b>

**SEMESTER II**

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	HS8251	Technical English	HS	4	4	0	0	4
2.	MA8251	Engineering Mathematics - II	BS	4	4	0	0	4
3.	PH8253	Physics for Electronics Engineering	BS	3	3	0	0	3
4.	BE8252	Basic Civil and Mechanical Engineering	ES	4	4	0	0	4
5.	EE8251	Circuit Theory	PC	4	2	2	0	3
6.	GE8291	Environmental Science and Engineering	HS	3	3	0	0	3
<b>PRACTICALS</b>								
7.	GE8261	Engineering Practices Laboratory	ES	4	0	0	4	2
8.	EE8261	Electric Circuits Laboratory	PC	4	0	0	4	2
<b>TOTAL</b>				<b>30</b>	<b>20</b>	<b>2</b>	<b>8</b>	<b>25</b>

### SEMESTER III

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MA8353	Transforms and Partial Differential Equations	BS	4	4	0	0	4
2.	EE8351	Digital Logic Circuits	PC	4	2	2	0	3
3.	EE8391	Electromagnetic Theory	PC	4	2	2	0	3
4.	EE8301	Electrical Machines - I	PC	4	2	2	0	3
5.	EC8353	Electron Devices and Circuits	ES	3	3	0	0	3
6.	ME8792	Power Plant Engineering	ES	3	3	0	0	3
<b>PRACTICALS</b>								
7.	EC8311	Electronics Laboratory	ES	4	0	0	4	2
8.	EE8311	Electrical Machines Laboratory - I	PC	4	0	0	4	2
<b>TOTAL</b>				<b>30</b>	<b>16</b>	<b>6</b>	<b>8</b>	<b>23</b>

### SEMESTER IV

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MA8491	Numerical Methods	BS	4	4	0	0	4
2.	EE8401	Electrical Machines - II	PC	4	2	2	0	3
3.	EE8402	Transmission and Distribution	PC	3	3	0	0	3
4.	EE8403	Measurements and Instrumentation	PC	3	3	0	0	3
5.	EE8451	Linear Integrated Circuits and Applications	PC	3	3	0	0	3
6.	IC8451	Control Systems	PC	5	3	2	0	4
<b>PRACTICALS</b>								
7.	EE8411	Electrical Machines Laboratory - II	PC	4	0	0	4	2
8.	EE8461	Linear and Digital Integrated Circuits Laboratory	PC	4	0	0	4	2
9.	EE8412	Technical Seminar	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>32</b>	<b>18</b>	<b>4</b>	<b>10</b>	<b>25</b>

### SEMESTER V

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	EE8501	Power System Analysis	PC	3	3	0	0	3
2.	EE8551	Microprocessors and Microcontrollers	PC	3	3	0	0	3
3.	EE8552	Power Electronics	PC	3	3	0	0	3
4.	EE8591	Digital Signal Processing	PC	4	2	2	0	3
5.	CS8392	Object Oriented Programming	ES	3	3	0	0	3
6.		Open Elective I*	OE	3	3	0	0	3
<b>PRACTICALS</b>								
7.	EE8511	Control and Instrumentation Laboratory	PC	4	0	0	4	2
8.	HS8581	Professional Communication	EEC	2	0	0	2	1
9.	CS8383	Object Oriented Programming Laboratory	ES	4	0	0	4	2
<b>TOTAL</b>				<b>29</b>	<b>17</b>	<b>2</b>	<b>10</b>	<b>23</b>

### SEMESTER VI

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	EE8601	Solid State Drives	PC	3	3	0	0	3
2.	EE8602	Protection and Switchgear	PC	3	3	0	0	3
3.	EE8691	Embedded Systems	ES	3	3	0	0	3
4.		Professional Elective I	PE	3	3	0	0	3
5.		Professional Elective II	PE	3	3	0	0	3
<b>PRACTICALS</b>								
6.	EE8661	Power Electronics and Drives Laboratory	PC	4	0	0	4	2
7.	EE8681	Microprocessors and Microcontrollers Laboratory	PC	4	0	0	4	2
8.	EE8611	Mini Project	EEC	4	0	0	4	2
<b>TOTAL</b>				<b>27</b>	<b>15</b>	<b>0</b>	<b>12</b>	<b>21</b>

### SEMESTER VII

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	EE8701	High Voltage Engineering	PC	3	3	0	0	3
2.	EE8702	Power System Operation and Control	PC	3	3	0	0	3
3.	EE8703	Renewable Energy Systems	PC	3	3	0	0	3
4.		Open Elective II*	OE	3	3	0	0	3
5.		Professional Elective III	PE	3	3	0	0	3
6.		Professional Elective IV	PE	3	3	0	0	3
<b>PRACTICALS</b>								
7.	EE8711	Power System Simulation Laboratory	PC	4	0	0	4	2
8.	EE8712	Renewable Energy Systems Laboratory	PC	4	0	0	4	2
<b>TOTAL</b>				<b>26</b>	<b>18</b>	<b>0</b>	<b>8</b>	<b>22</b>

### SEMESTER VIII

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.		Professional Elective V	PE	3	3	0	0	3
2.		Professional Elective VI	PE	3	3	0	0	3
<b>PRACTICALS</b>								
3.	EE8811	Project Work	EEC	20	0	0	20	10
<b>TOTAL</b>				<b>26</b>	<b>6</b>	<b>0</b>	<b>20</b>	<b>16</b>

**TOTAL NO. OF CREDITS: 180**

\*Course from the curriculum of other UG Programmes.

**PROFESSIONAL ELECTIVE – I ( VI SEMESTER)**

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	IC8651	Advanced Control System	PE	4	2	2	0	3
2.	EE8001	Visual Languages and Applications	PE	3	3	0	0	3
3.	EE8002	Design of Electrical Apparatus	PE	3	3	0	0	3
4.	EE8003	Power Systems Stability	PE	3	3	0	0	3
5.	EE8004	Modern Power Converters	PE	3	3	0	0	3
6.	GE8075	Intellectual Property Rights	PE	3	3	0	0	3

**PROFESSIONAL ELECTIVE – II ( VI SEMESTER)**

1.	RO8591	Principles of Robotics	PE	3	3	0	0	3
2.	EE8005	Special Electrical Machines	PE	3	3	0	0	3
3.	EE8006	Power Quality	PE	3	3	0	0	3
4.	EE8007	EHVAC Transmission	PE	3	3	0	0	3
5.	EC8395	Communication Engineering	PE	3	3	0	0	3

**PROFESSIONAL ELECTIVE – III ( VII SEMESTER)**

1.	GE8071	Disaster Management	PE	3	3	0	0	3
2.	GE8074	Human Rights	PE	3	3	0	0	3
3.	MG8491	Operations Research	PE	3	3	0	0	3
4.	MA8391	Probability and Statistics	PE	4	4	0	0	4
5.	EI8075	Fibre Optics and Laser Instrumentation	PE	3	3	0	0	3
6.	GE8072	Foundation Skills in Integrated Product Development	PE	3	3	0	0	3

**PROFESSIONAL ELECTIVE – IV ( VII SEMESTER)**

1.	EE8008	System Identification and Adaptive Control	PE	3	3	0	0	3
2.	CS8491	Computer Architecture	PE	3	3	0	0	3
3.	EE8009	Control of Electrical Drives	PE	3	3	0	0	3
4.	EC8095	VLSI Design	PE	3	3	0	0	3
5.	EE8010	Power Systems Transients	PE	3	3	0	0	3
6.	GE8077	Total Quality Management	PE	3	3	0	0	3

**PROFESSIONAL ELECTIVE – V ( VIII SEMESTER)**

1.	EE8011	Flexible AC Transmission Systems	PE	3	3	0	0	3
2.	EE8012	Soft Computing Techniques	PE	3	3	0	0	3
3.	EE8013	Power Systems Dynamics	PE	3	3	0	0	3
4.	EE8014	SMPS and UPS	PE	3	3	0	0	3
5.	EE8015	Electric Energy Generation, Utilization and Conservation	PE	3	3	0	0	3
6.	GE8076	Professional Ethics in Engineering	PE	3	3	0	0	3
7.	MG8591	Principles of Management	PE	3	3	0	0	3

**PROFESSIONAL ELECTIVE – VI ( VIII SEMESTER)**

1.	EE8016	Energy Management and Auditing	PE	3	3	0	0	3
2.	CS8391	Data Structures	PE	3	3	0	0	3
3.	EE8017	High Voltage Direct Current Transmission	PE	3	3	0	0	3
4.	EE8018	Microcontroller Based System Design	PE	3	3	0	0	3
5.	EE8019	Smart Grid	PE	3	3	0	0	3
6.	EI8073	Biomedical Instrumentation	PE	3	3	0	0	3
7.	GE8073	Fundamentals of Nanoscience	PE	3	3	0	0	3

**\*Professional Electives are grouped according to elective number as was done previously.**

### HUMANITIES AND SOCIALSCIENCES (HS)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	HS8151	Communicative English	HS	4	4	0	0	4
2.	HS8251	Technical English	HS	4	4	0	0	4
3.	GE8291	Environmental Science and Engineering	HS	3	3	0	0	3

### BASIC SCIENCES (BS)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MA8151	Engineering Mathematics I	BS	4	4	0	0	4
2.	PH8151	Engineering Physics	BS	3	3	0	0	3
3.	CY8151	Engineering Chemistry	BS	3	3	0	0	3
4.	BS8161	Physics and Chemistry Laboratory	BS	4	0	0	4	2
5.	MA8251	Engineering Mathematics II	BS	4	4	0	0	4
6.	PH8253	Physics For Electronics Engineering	BS	3	3	0	0	3
7.	MA8353	Transforms and Partial Differential Equations	BS	4	4	0	0	4
8.	MA8491	Numerical Methods	BS	4	4	0	0	4

### ENGINEERING SCIENCES (ES)

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	GE8151	Problem Solving and Python programming	ES	3	3	0	0	3
2.	GE8152	Engineering Graphics	ES	6	2	0	4	4
3.	GE8161	Problem Solving and	ES		0	0	4	2

		Python programming Laboratory		4				
4.	BE8252	Basic Civil and Mechanical Engineering	ES	4	4	0	0	4
5.	GE8261	Engineering Practices Laboratory	ES	4	0	0	4	2
6.	EC8353	Electron Devices and Circuits	ES	3	3	0	0	3
7.	ME8792	Power Plant Engineering	ES	3	3	0	0	3
8.	EC8311	Electronics Laboratory	ES	4	0	0	4	2
9.	CS8392	Object Oriented Programming	ES	3	3	0	0	3
10.	CS8383	Object Oriented Programming Laboratory	ES	4	0	0	4	2
11.	EE8691	Embedded Systems	ES	3	3	0	0	3

#### PROFESSIONAL CORE (PC)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	EE8251	Circuit Theory	PC	4	2	2	0	3
2.	EE8261	Electric Circuits Laboratory	PC	4	0	0	4	2
3.	EE8351	Digital Logic Circuits	PC	4	2	2	0	3
4.	EE8391	Electromagnetic Theory	PC	4	2	2	0	3
5.	EE8301	Electrical Machines - I	PC	4	2	2	0	3
6.	EE8311	Electrical Machines Laboratory - I	PC	4	0	0	4	2
7.	EE8401	Electrical Machines - II	PC	4	2	2	0	3
8.	EE8402	Transmission and Distribution	PC	3	3	0	0	3
9.	EE8403	Measurements and Instrumentation	PC	3	3	0	0	3
10.	EE8451	Linear Integrated Circuits and Applications	PC	3	3	0	0	3
11.	IC8451	Control Systems	PC	5	3	2	0	4
12.	EE8411	Electrical Machines Laboratory II	PC	4	0	0	4	2

13.	EE8461	Linear and Digital Integrated Circuits Laboratory	PC	4	0	0	4	2
14.	EE8501	Power System Analysis	PC	3	3	0	0	3
15.	EE8551	Microprocessors and Microcontrollers	PC	3	3	0	0	3
16.	EE8552	Power Electronics	PC	3	3	0	0	3
17.	EE8591	Digital Signal Processing	PC	4	2	2	0	3
18.	EE8511	Control and Instrumentation Laboratory	PC	4	0	0	4	2
19.	EE8601	Solid State Drives	PC	3	3	0	0	3
20.	EE8602	Protection and Switchgear	PC	3	3	0	0	3
21.	EE8661	Power Electronics and Drives Laboratory	PC	4	0	0	4	2
22.	EE8681	Microprocessors and Microcontrollers Laboratory	PC	4	0	0	4	2
23.	EE8701	High Voltage Engineering	PC	3	3	0	0	3
24.	EE8702	Power System Operation and Control	PC	3	3	0	0	3
25.	EE8703	Renewable Energy Systems	PC	3	3	0	0	3
26.	EE8711	Power System Simulation Laboratory	PC	4	0	0	4	2
27.	EE8712	Renewable Energy Systems Laboratory	PC	4	0	0	4	2

#### EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	EE8412	Technical seminar	EEC	2	0	0	2	1
2.	HS8581	Professional Communication	EEC	2	0	0	2	1
3.	EE8611	Mini Project	EEC	4	0	0	4	2
4.	EE8811	Project work	EEC	20	0	0	20	10

## SUMMARY

S.NO.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1.	HS	4	7	-	-	-	-	-		11
2.	BS	12	7	4	4	-	-	-		27
3.	ES	9	6	8	-	5	3	-		31
4.	PC	-	5	11	20	14	10	13	-	73
5.	PE						6	6	6	18
6.	OE					3	-	3		6
7.	EEC				1	1	2		10	14
	<b>Total</b>	<b>25</b>	<b>25</b>	<b>23</b>	<b>25</b>	<b>23</b>	<b>21</b>	<b>22</b>	<b>16</b>	<b>180</b>
	<b>Non Credit / Mandatory</b>	-	-	-	-	-	-	-	-	0

**OBJECTIVES:**

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

**UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS 12**

**Reading-** short comprehension passages, practice in skimming-scanning and predicting- **Writing-** completing sentences- - developing hints. **Listening-** short texts- short formal and informal conversations. **Speaking-** introducing oneself - exchanging personal information- **Language development-** Wh- Questions- asking and answering-yes or no questions- parts of speech. **Vocabulary development--** prefixes- suffixes- articles.- count/ uncount nouns.

**UNIT II GENERAL READING AND FREE WRITING 12**

**Reading** - comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- **Writing** – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –**Listening-** telephonic conversations. **Speaking** – sharing information of a personal kind—greeting – taking leave- **Language development** – prepositions, conjunctions **Vocabulary development-** guessing meanings of words in context.

**UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12**

**Reading-** short texts and longer passages (close reading) **Writing-** understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences **Listening** – listening to longer texts and filling up the table- product description- narratives from different sources. **Speaking-** asking about routine actions and expressing opinions. **Language development-** degrees of comparison- pronouns- direct vs indirect questions- **Vocabulary development** – single word substitutes- adverbs.

**UNIT IV READING AND LANGUAGE DEVELOPMENT 12**

**Reading-** comprehension-reading longer texts- reading different types of texts- magazines **Writing-** letter writing, informal or personal letters-e-mails-conventions of personal email- **Listening-** listening to dialogues or conversations and completing exercises based on them. **Speaking-** speaking about oneself- speaking about one's friend- **Language development-** Tenses- simple present-simple past-present continuous and past continuous- **Vocabulary development-** synonyms-antonyms- phrasal verbs

## UNIT V EXTENDED WRITING

12

**Reading**- longer texts- close reading –**Writing**- brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing-**Listening** – listening to talks- conversations- **Speaking** – participating in conversations- short group conversations-**Language development**-modal verbs- present/ past perfect tense - **Vocabulary development**-collocations- fixed and semi-fixed expressions

**TOTAL: 60 PERIODS**

**OUTCOMES: At the end of the course, learners will be able to:**

- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English.

### TEXT BOOKS:

1. Board of Editors. **Using English** A Coursebook for Undergraduate Engineers and Technologists. Orient BlackSwan Limited, Hyderabad: 2015
2. Richards, C. Jack. **Interchange Students' Book-2** New Delhi: CUP, 2015.

### REFERENCES

- 1 Bailey, Stephen. **Academic Writing: A practical guide for students**. New York: Rutledge,2011.
- 2 Comfort, Jeremy, et al. **Speaking Effectively : Developing Speaking Skillsfor BusinessEnglish**. Cambridge University Press, Cambridge: Reprint 2011
- 3 Dutt P. Kiranmai and RajeevanGeeta. **Basic Communication Skills**, Foundation Books: 2013
- 4 Means,L. Thomas and Elaine Langlois. **English & Communication For Colleges**. CengageLearning ,USA: 2007
- 5 Redston, Chris & Gillies Cunningham **Face2Face** (Pre-intermediate Student's Book & Workbook) Cambridge University Press, New Delhi: 2005

**OBJECTIVES :**

- The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

**UNIT I DIFFERENTIAL CALCULUS****12**

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

**UNIT II FUNCTIONS OF SEVERAL VARIABLES****12**

Partial differentiation – Homogeneous functions and Euler’s theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor’s series for functions of two variables – Maxima and minima of functions of two variables – Lagrange’s method of undetermined multipliers.

**UNIT III INTEGRAL CALCULUS****12**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

**UNIT IV MULTIPLE INTEGRALS****12**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

**UNIT V DIFFERENTIAL EQUATIONS****12**

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler’s and Legendre’s type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

**TOTAL : 60 PERIODS****OUTCOMES :**

After completing this course, students should demonstrate competency in the following skills:

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.

- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.

#### TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43<sup>rd</sup> Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7<sup>th</sup> Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

#### REFERENCES :

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10<sup>th</sup> Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3<sup>rd</sup> Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
5. Weir, M.D and Joel Hass, "Thomas Calculus", 12<sup>th</sup> Edition, Pearson India, 2016.

**PH8151**

**ENGINEERING PHYSICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

#### OBJECTIVES:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

#### UNIT I PROPERTIES OF MATTER

**9**

Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.

#### UNIT II WAVES AND FIBER OPTICS

**9**

Oscillatory motion – forced and damped oscillations: differential equation and its solution – plane progressive waves – wave equation. Lasers : population of energy levels, Einstein’s A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle -

types of optical fibres (material, refractive index, mode) – losses associated with optical fibers - fibre optic sensors: pressure and displacement.

**UNIT III THERMAL PHYSICS 9**

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conduction in solids – thermal conductivity - Forbe’s and Lee’s disc method: theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.

**UNIT IV QUANTUM PHYSICS 9**

Black body radiation – Planck’s theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger’s wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – tunnelling (qualitative) - scanning tunnelling microscope.

**UNIT V CRYSTAL PHYSICS 9**

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

Upon completion of this course,

- the students will gain knowledge on the basics of properties of matter and its applications,
- the students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
- the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
- the students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
- the students will understand the basics of crystals, their structures and different crystal growth techniques.

**TEXT BOOKS:**

1. Bhattacharya, D.K. & Poonam, T. “Engineering Physics”. Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. “Engineering Physics”. Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. “Engineering Physics”. Cengage Learning India, 2012.

**REFERENCES:**

1. Halliday, D., Resnick, R. & Walker, J. “Principles of Physics”. Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. “Physics for Scientists and Engineers”. Cengage Learning, 2010.
3. Tipler, P.A. & Mosca, G. “Physics for Scientists and Engineers with Modern Physics”. W.H.Freeman, 2007.

**OBJECTIVES:**

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

**UNIT I WATER AND ITS TREATMENT****9**

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

**UNIT II SURFACE CHEMISTRY AND CATALYSIS****9**

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions – adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – kinetics of surface reactions, unimolecular reactions, Langmuir - applications of adsorption on pollution abatement.

Catalysis: Catalyst – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis– Michaelis – Menten equation.

**UNIT III ALLOYS AND PHASE RULE****9**

Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

**UNIT IV FUELS AND COMBUSTION****9**

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel. Combustion of fuels: Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

**UNIT V ENERGY SOURCES AND STORAGE DEVICES****9**

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of

batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H<sub>2</sub>-O<sub>2</sub> fuel cell.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

**TEXT BOOKS:**

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

**REFERENCES:**

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

**GE8151**

**PROBLEM SOLVING AND PYTHON PROGRAMMING**

**L T P C  
3 0 0 3**

**COURSE OBJECTIVES:**

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures -- lists, tuples, dictionaries.
- To do input/output with files in Python.

**UNIT I ALGORITHMIC PROBLEM SOLVING**

**9**

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

**UNIT II DATA, EXPRESSIONS, STATEMENTS**

**9**

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

### **UNIT III CONTROL FLOW, FUNCTIONS**

**9**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

### **UNIT IV LISTS, TUPLES, DICTIONARIES**

**9**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

### **UNIT V FILES, MODULES, PACKAGES**

**9**

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

### **COURSE OUTCOMES:**

**Upon completion of the course, students will be able to**

- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.

**TOTAL : 45 PERIODS**

### **TEXT BOOKS:**

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2<sup>nd</sup> edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (<http://greenteapress.com/wp/think-python/>)
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

### **REFERENCES:**

1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
2. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press , 2013
3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
6. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.

**OBJECTIVES:**

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

**CONCEPTS AND CONVENTIONS (Not for Examination)****1**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

**UNIT I PLANE CURVES AND FREEHAND SKETCHING****7+12**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

**UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE****6+12**

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

**UNIT III PROJECTION OF SOLIDS****5+12**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

**UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES****5+12**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

**UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS****6+12**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

**TOTAL: 90 PERIODS****OUTCOMES:**

On successful completion of this course, the student will be able to

- familiarize with the fundamentals and standards of Engineering graphics
- perform freehand sketching of basic geometrical constructions and multiple views of objects.
- project orthographic projections of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- visualize and to project isometric and perspective sections of simple solids.

**TEXT BOOK:**

1. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

**REFERENCES:**

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
2. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50<sup>th</sup> Edition, 2010.
3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. and Duff, John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N S Parthasarathy And Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2<sup>nd</sup> Edition, 2009.

**Publication of Bureau of Indian Standards:**

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

**Special points applicable to University Examinations on Engineering Graphics:**

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

**GE8161****PROBLEM SOLVING AND PYTHON PROGRAMMING  
LABORATORY****LT P C  
0 0 4 2****COURSE OBJECTIVES:**

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

## LIST OF PROGRAMS

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

## PLATFORM NEEDED

Python 3 interpreter for Windows/Linux

## COURSE OUTCOMES:

Upon completion of the course, students will be able to

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

**TOTAL :60 PERIODS**

**BS8161**

**PHYSICS AND CHEMISTRY LABORATORY**  
**(Common to all branches of B.E. / B.Tech Programmes)**

**L T P C**  
**0 0 4 2**

## OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

## LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser  
(b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

**TOTAL: 30 PERIODS**

**OUTCOMES:**

Upon completion of the course, the students will be able to

- apply principles of elasticity, optics and thermal properties for engineering applications.

**CHEMISTRY LABORATORY: (Any seven experiments to be conducted)**

**OBJECTIVES:**

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
  - To acquaint the students with the determination of molecular weight of a polymer by viscometry.
1. Estimation of HCl using  $\text{Na}_2\text{CO}_3$  as primary standard and Determination of alkalinity in water sample.
  2. Determination of total, temporary & permanent hardness of water by EDTA method.
  3. Determination of DO content of water sample by Winkler's method.
  4. Determination of chloride content of water sample by argentometric method.
  5. Estimation of copper content of the given solution by Iodometry.
  6. Determination of strength of given hydrochloric acid using pH meter.
  7. Determination of strength of acids in a mixture of acids using conductivity meter.
  8. Estimation of iron content of the given solution using potentiometer.
  9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
  10. Estimation of sodium and potassium present in water using flame photometer.
  11. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
  12. Pseudo first order kinetics-ester hydrolysis.
  13. Corrosion experiment-weight loss method.
  14. Determination of CMC.
  15. Phase change in a solid.
  16. Conductometric titration of strong acid vs strong base.

**OUTCOMES:**

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

**TOTAL: 30 PERIODS**

**TEXTBOOKS:**

1. Vogel's Textbook of Quantitative Chemical Analysis (8<sup>TH</sup> edition, 2014)

HS8251

TECHNICAL ENGLISH

L	T	P	C
4	0	0	4

**OBJECTIVES:** The Course prepares second semester engineering and Technology students to:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations , participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

**UNIT I INTRODUCTION TECHNICAL ENGLISH 12**

**Listening-** Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- **Speaking** –Asking for and giving directions- **Reading** – reading short technical texts from journals- newspapers- **Writing-** purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-**Vocabulary Development-** technical vocabulary **Language Development** –subject verb agreement - compound words.

**UNIT II READING AND STUDY SKILLS 12**

**Listening-** Listening to longer technical talks and completing exercises based on them-**Speaking** – describing a process-**Reading** – reading longer technical texts- identifying the various transitions in a text- paragraphing- **Writing-** interpreting charts, graphs- **Vocabulary Development-**vocabulary used in formal letters/emails and reports **Language Development-** impersonal passive voice, numerical adjectives.

**UNIT III TECHNICAL WRITING AND GRAMMAR 12**

**Listening-** Listening to classroom lectures/ talks on engineering/technology -**Speaking** – introduction to technical presentations- **Reading** – longer texts both general and technical, practice in speed reading; **Writing-**Describing a process, use of sequence words- **Vocabulary Development-** sequence words- Misspelled words. **Language Development-** embedded sentences

**UNIT IV REPORT WRITING 12**

**Listening-** Listening to documentaries and making notes. **Speaking** – mechanics of presentations- **Reading** – reading for detailed comprehension- **Writing-** email etiquette- job application – cover letter –Résumé preparation( via email and hard copy)- analytical essays and issue based essays-- **Vocabulary Development-** finding suitable synonyms-paraphrasing-. **Language Development-** clauses- if conditionals.

**UNIT V GROUP DISCUSSION AND JOB APPLICATIONS 12**

**Listening-** TED/Ink talks; **Speaking** –participating in a group discussion -**Reading**– reading and understanding technical articles **Writing**– Writing reports- minutes of a meeting- accident and survey- **Vocabulary Development-** verbal analogies **Language Development-** reported speech

**TOTAL : 60 PERIODS**

**OUTCOMES: At the end of the course learners will be able to:**

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

**TEXT BOOKS:**

1. Board of editors. **Fluency in English A Course book for Engineering and Technology.** Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. **English for Technical Communication.** Cambridge University Press: New Delhi, 2016.

**REFERENCES**

1. Booth-L. Diana, **Project Work**, Oxford University Press, Oxford: 2014.
2. Grussendorf, Marion, **English for Presentations**, Oxford University Press, Oxford: 2007
3. Kumar, Suresh. E. **Engineering English.** Orient Blackswan: Hyderabad,2015
4. Means, L. Thomas and Elaine Langlois, **English & Communication For Colleges.** Cengage Learning, USA: 2007
5. Raman, Meenakshi and Sharma, Sangeetha- **Technical Communication Principles and Practice.**Oxford University Press: New Delhi,2014.

**Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.**

**MA8251**

**ENGINEERING MATHEMATICS – II**

**L T P C**  
**4 0 0 4**

**OBJECTIVES :**

- This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

**UNIT I MATRICES**

**12**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

**UNIT II VECTOR CALCULUS**

**12**

Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved

surface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

### UNIT III ANALYTIC FUNCTIONS

12

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions  $w = z + c, cz, \frac{1}{z}, z^2$  - Bilinear transformation.

### UNIT IV COMPLEX INTEGRATION

12

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour.

### UNIT V LAPLACE TRANSFORMS

12

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

**TOTAL: 60 PERIODS**

### OUTCOMES :

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

### TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43<sup>rd</sup> Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10<sup>th</sup> Edition, New Delhi, 2016.

### REFERENCES :

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7<sup>th</sup> Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., " Advanced Engineering Mathematics ", Narosa Publications, New Delhi , 3<sup>rd</sup> Edition, 2007.
3. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.

4. Sastry, S.S, "Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4<sup>th</sup> Edition, New Delhi, 2014.
5. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

<b>PH8253</b>	<b>PHYSICS FOR ELECTRONICS ENGINEERING</b> (Common to BME, ME, CC, ECE, EEE, E&I, ICE)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the essential principles of Physics of semiconductor device and Electron transport properties. Become proficient in magnetic, dielectric and optical properties of materials and nano devices.

**UNIT I ELECTRICAL PROPERTIES OF MATERIALS 9**

Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Wiedemann-Franz law – Success and failures - electrons in metals – Particle in a three dimensional box – degenerate states – Fermi- Dirac statistics – Density of energy states – Electron in periodic potential: Bloch theorem – metals and insulators - Energy bands in solids– tight binding approximation - Electron effective mass – concept of hole.

**UNIT II SEMICONDUCTOR PHYSICS 9**

Intrinsic Semiconductors – Energy band diagram – direct and indirect semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Carrier transport: Velocity-electric field relations – drift and diffusion transport - Einstein’s relation – Hall effect and devices – Zener and avalanche breakdown in p-n junctions - Ohmic contacts – tunnel diode - Schottky diode – MOS capacitor - power transistor.

**UNIT III MAGNETIC AND DIELECTRIC PROPERTIES OF MATERIALS 9**

Magnetism in materials – magnetic field and induction – magnetization - magnetic permeability and susceptibility–types of magnetic materials – microscopic classification of magnetic materials - Ferromagnetism: origin and exchange interaction- saturation magnetization and Curie temperature – Domain Theory. Dielectric materials: Polarization processes – dielectric loss – internal field – Clausius-Mosotti relation- dielectric breakdown – high-k dielectrics.

**UNIT IV OPTICAL PROPERTIES OF MATERIALS 9**

Classification of optical materials – carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and Semiconductors (concepts only) - photo current in a P- N diode – solar cell –photo detectors - LED – Organic LED – Laser diodes – excitons - quantum confined Stark effect – quantum dot laser.

**UNIT V NANO ELECTRONIC DEVICES 9**

Introduction - electron density in bulk material – Size dependence of Fermi energy– quantum confinement – quantum structures - Density of states in quantum well, quantum wire and quantum dot structures –Zener-Bloch oscillations – resonant tunneling – quantum interference effects – mesoscopic structures: conductance fluctuations and coherent transport – Coulomb blockade effects - Single electron phenomena and Single electron Transistor – magnetic semiconductors– spintronics - Carbon nanotubes: Properties and applications.

**TOTAL : 45 PERIODS**

## OUTCOMES:

At the end of the course, the students will be able to

- gain knowledge on classical and quantum electron theories, and energy band structures,
- acquire knowledge on basics of semiconductor physics and its applications in various devices,
- get knowledge on magnetic and dielectric properties of materials,
- have the necessary understanding on the functioning of optical materials for optoelectronics,
- understand the basics of quantum structures and their applications in spintronics and carbon electronics.

## TEXT BOOKS:

1. Kasap, S.O. "Principles of Electronic Materials and Devices", McGraw-Hill Education, 2007.
2. Umesh K Mishra & Jasprit Singh, "Semiconductor Device Physics and Design", Springer, 2008.
3. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials". Narosa Publishing House, 2009.

## REFERENCES

1. Garcia, N. & Damask, A. "Physics for Computer Science Students". Springer-Verlag, 2012.
2. Hanson, G.W. "Fundamentals of Nanoelectronics". Pearson Education, 2009
3. Rogers, B., Adams, J. & Pennathur, S. "Nanotechnology: Understanding Small Systems". CRC Press, 2014

BE8252

**BASIC CIVIL AND MECHANICAL ENGINEERING**

**L T P C**  
**4 0 0 4**

## OBJECTIVES:

- To impart basic knowledge on Civil and Mechanical Engineering.
- To familiarize the materials and measurements used in Civil Engineering.
- To provide the exposure on the fundamental elements of civil engineering structures.
- To enable the students to distinguish the components and working principle of power plant units, IC engines, and R & AC system.

## **A – OVER VIEW**

### **UNIT I SCOPE OF CIVIL AND MECHANICAL ENGINEERING**

**10**

**Overview of Civil Engineering** - Civil Engineering contributions to the welfare of Society – Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering

**Overview of Mechanical Engineering** - Mechanical Engineering contributions to the welfare of Society –Specialized sub disciplines in Mechanical Engineering - Production, Automobile, Energy Engineering - Interdisciplinary concepts in Civil and Mechanical Engineering.

## **B – CIVIL ENGINEERING**

**UNIT II SURVEYING AND CIVIL ENGINEERING MATERIALS****10**

**Surveying:** Objects – classification – principles – measurements of distances – angles – leveling – determination of areas– contours - examples.

**Civil Engineering Materials:**Bricks – stones – sand – cement – concrete – steel - timber - modern materials

**UNIT III BUILDING COMPONENTS AND STRUCTURES****15**

**Foundations:** Types of foundations - Bearing capacity and settlement – Requirement of good foundations.

**Civil Engineering Structures:** Brickmasonry – stonemasonry – beams – columns – lintels – roofing – flooring – plastering – floor area, carpet area and floor space index - Types of Bridges and Dams – water supply - sources and quality of water - Rain water harvesting - introduction to high way and rail way.

**C – MECHANICAL ENGINEERING****UNIT IV INTERNAL COMBUSTION ENGINES AND POWER PLANTS****15**

Classification of Power Plants - Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Working principle of steam, Gas, Diesel, Hydro - electric and Nuclear Power plants – working principle of Boilers, Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps

**UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM****10**

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system–Layout of typical domestic refrigerator–Window and Split type room Air conditioner.

**OUTCOMES:**

On successful completion of this course, the student will be able to

- appreciate the Civil and Mechanical Engineering components of Projects.
- explain the usage of construction material and proper selection of construction materials.
- measure distances and area by surveying
- identify the components used in power plant cycle.
- demonstrate working principles of petrol and diesel engine.
- elaborate the components of refrigeration and Air conditioning cycle.

**TOTAL: 60 PERIODS****TEXTBOOKS:**

1. Shanmugam Gand Palanichamy MS,“Basic Civil and Mechanical Engineering”,Tata McGraw Hill PublishingCo.,NewDelhi,1996.

**REFERENCES:**

1. Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 2010.
2. Ramamrutham S.,“Basic Civil Engineering”, Dhanpat Rai Publishing Co.(P) Ltd.1999.
3. Seetharaman S.,“BasicCivil Engineering”,AnuradhaAgencies,2005.
4. ShanthaKumar SRJ.,“Basic Mechanical Engineering”, Hi-tech Publications, Mayiladuthurai, 2000.

5. Venugopal K. and Prahua Raja V., “Basic Mechanical Engineering”, Anuradha Publishers, Kumbakonam,2000.

<b>EE8251</b>	<b>CIRCUIT THEORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>2</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To introduce electric circuits and its analysis
- To impart knowledge on solving circuit equations using network theorems
- To introduce the phenomenon of resonance in coupled circuits.
- To educate on obtaining the transient response of circuits.
- To introduce Phasor diagrams and analysis of three phase circuits

**UNIT I BASIC CIRCUITS ANALYSIS 6+6**

Resistive elements - Ohm’s Law Resistors in series and parallel circuits – Kirchoffs laws – Mesh current and node voltage - methods of analysis.

**UNIT II NETWORK REDUCTION AND THEOREMS FOR DC AND AC IRCUITS 6+6**

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Norton Theorems – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem – Millman’s theorem.

**UNIT III TRANSIENT RESPONSE ANALYSIS 6+6**

L and C elements -Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. sinusoidal input.

**UNIT IV THREE PHASE CIRCUITS 6+6**

A.C. circuits – Average and RMS value - Phasor Diagram – Power, Power Factor and Energy.- Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power measurement in three phase circuits.

**UNIT V RESONANCE AND COUPLED CIRCUITS 6+6**

Series and parallel resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

**TOTAL : 60 PERIODS**

**OUTCOMES:**

- Ability to analyse electrical circuits
- Ability to apply circuit theorems
- Ability to analyse transients

**TEXT BOOKS:**

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, “Engineering Circuits Analysis”, McGraw Hill publishers, edition, New Delhi, 2013.
2. Charles K. Alexander, Mathew N.O. Sadiku, “Fundamentals of Electric Circuits”, Second Edition, McGraw Hill, 2013.

3. Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 2013.

## REFERENCES

1. Chakrabarti A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, 1999.
2. Jegatheesan, R., "Analysis of Electric Circuits," McGraw Hill, 2015.
3. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, McGraw-Hill, New Delhi, 2010.
4. M E Van Valkenburg, "Network Analysis", Prentice-Hall of India Pvt Ltd, New Delhi, 2015.
5. Mahadevan, K., Chitra, C., "Electric Circuits Analysis," Prentice-Hall of India Pvt Ltd., New Delhi, 2015.
6. Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 7th Edition, John Wiley & Sons, Inc. 2015.
7. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", McGraw Hill, 2015.

GE8291

ENVIRONMENTAL SCIENCE AND ENGINEERING

L T P C  
3 0 0 3

## OBJECTIVES:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

## UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local

levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

## **UNIT II ENVIRONMENTAL POLLUTION**

**8**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

## **UNIT III NATURAL RESOURCES**

**10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

## **UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT**

**7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

## **UNIT V HUMAN POPULATION AND THE ENVIRONMENT**

**6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

**TOTAL: 45 PERIODS**

### **OUTCOMES:**

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

### **TEXTBOOKS:**

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.

2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2<sup>nd</sup> edition, Pearson Education, 2004.

**REFERENCES :**

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hyderabad, 2015.
3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

**GE8261**

**ENGINEERING PRACTICES LABORATORY**

**L T P C  
0 0 4 2**

**OBJECTIVES:**

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

**GROUP A (CIVIL & MECHANICAL)**

**I CIVIL ENGINEERING PRACTICE**

**13**

**Buildings:**

- (a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

**Plumbing Works:**

- (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- (b) Study of pipe connections requirements for pumps and turbines.
- (c) Preparation of plumbing line sketches for water supply and sewage works.
- (d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

- (e) Demonstration of plumbing requirements of high-rise buildings.

**Carpentry using Power Tools only:**

- (a) Study of the joints in roofs, doors, windows and furniture.
- (b) Hands-on-exercise:  
Wood work, joints by sawing, planing and cutting.

**II MECHANICAL ENGINEERING PRACTICE**

**18**

**Welding:**

- (a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
- (b) Gas welding practice

**Basic Machining:**

- (a) Simple Turning and Taper turning
- (b) Drilling Practice

**Sheet Metal Work:**

- (a) Forming & Bending:
- (b) Model making – Trays and funnels.
- (c) Different type of joints.

**Machine assembly practice:**

- (a) Study of centrifugal pump
- (b) Study of air conditioner

**Demonstration on:**

- (a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
- (b) Foundry operations like mould preparation for gear and step cone pulley.
- (c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

**GROUP B (ELECTRICAL & ELECTRONICS)**

<b>III</b>	<b>ELECTRICAL ENGINEERING PRACTICE</b>	<b>13</b>
	<ul style="list-style-type: none"> <li>1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.</li> <li>2. Fluorescent lamp wiring.</li> <li>3. Stair case wiring</li> <li>4. Measurement of electrical quantities – voltage, current, power &amp; power factor in RLC circuit.</li> <li>5. Measurement of energy using single phase energy meter.</li> <li>6. Measurement of resistance to earth of an electrical equipment.</li> </ul>	
<b>IV</b>	<b>ELECTRONICS ENGINEERING PRACTICE</b>	<b>16</b>
	<ul style="list-style-type: none"> <li>1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.</li> <li>2. Study of logic gates AND, OR, EX-OR and NOT.</li> <li>3. Generation of Clock Signal.</li> <li>4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.</li> <li>5. Measurement of ripple factor of HWR and FWR.</li> </ul>	

**TOTAL: 60 PERIODS**

**OUTCOMES:**

On successful completion of this course, the student will be able to

- fabricate carpentry components and pipe connections including plumbing works.
- use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundry and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

## LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

### CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 Sets.
2. Carpentry vice (fitted to work bench)	15 Nos.
3. Standard woodworking tools	15 Sets.
4. Models of industrial trusses, door joints, furniture joints	5 each
5. Power Tools: (a) Rotary Hammer	2 Nos
(b) Demolition Hammer	2 Nos
(c) Circular Saw	2 Nos
(d) Planer	2 Nos
(e) Hand Drilling Machine	2 Nos
(f) Jigsaw	2 Nos

### MECHANICAL

1. Arc welding transformer with cables and holders	5 Nos.
2. Welding booth with exhaust facility	5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos.
5. Centre lathe	2 Nos.
6. Hearth furnace, anvil and smithy tools	2 Sets.
7. Moulding table, foundry tools	2 Sets.
8. Power Tool: Angle Grinder	2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner	One each.

### ELECTRICAL

1. Assorted electrical components for house wiring	15 Sets
2. Electrical measuring instruments	10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp	1 each
4. Megger (250V/500V)	1 No.
5. Power Tools: (a) Range Finder	2 Nos
(b) Digital Live-wire detector	2 Nos

### ELECTRONICS

1. Soldering guns	10 Nos.
2. Assorted electronic components for making circuits	50 Nos.
3. Small PCBs	10 Nos.
4. Multimeters	10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply	

**EE8261**

**ELECTRIC CIRCUITS LABORATORY**

**L T P C**  
**0 0 4 2**

**OBJECTIVES:**

- To simulate various electric circuits using Pspice/ Matlab/e-Sim / Scilab
- To gain practical experience on electric circuits and verification of theorems.

**LIST OF EXPERIMENTS**

1. Simulation and experimental verification of electrical circuit problems using Kirchhoff's voltage and current laws.
2. Simulation and experimental verification of electrical circuit problems using Thevenin's theorem.
3. Simulation and experimental verification of electrical circuit problems using Norton's theorem.
4. Simulation and experimental verification of electrical circuit problems using Superposition theorem.
5. Simulation and experimental verification of Maximum Power transfer Theorem.
6. Study of Analog and digital oscilloscopes and measurement of sinusoidal voltage, frequency and power factor.
7. Simulation and Experimental validation of R-C electric circuit transients.
8. Simulation and Experimental validation of frequency response of RLC electric circuit.
9. Design and Simulation of series resonance circuit.
10. Design and Simulation of parallel resonant circuits.
11. Simulation of three phase balanced and unbalanced star, delta networks circuits.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

- Understand and apply circuit theorems and concepts in engineering applications.
- Simulate electric circuits.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

- 1 Regulated Power Supply: 0 – 15 V D.C - 10 Nos / Distributed Power Source.
- 2 Function Generator (1 MHz) - 10 Nos.
- 3 Single Phase Energy Meter - 1 No.
- 4 Oscilloscope (20 MHz) - 10 Nos.
- 5 Digital Storage Oscilloscope (20 MHz) – 1 No.
- 6 10 Nos. of PC with Circuit Simulation Software (min 10 Users) ( e-Sim / Scilab/ Pspice / MATLAB /other Equivalent software Package) and Printer (1 No.)
- 7 AC/DC - Voltmeters (10 Nos.), Ammeters (10 Nos.) and Multi-meters (10 Nos.)
- 8 Single Phase Wattmeter – 3 Nos.
- 9 Decade Resistance Box, Decade Inductance Box, Decade Capacitance Box - 6 Nos each.
- 10 Circuit Connection Boards - 10 Nos.

Necessary Quantities of Resistors, Inductors, Capacitors of various capacities (Quarter Watt to 10 Watt)

**MA8353 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS****L T P C**  
**4 0 0 4****OBJECTIVES :**

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

**UNIT I PARTIAL DIFFERENTIAL EQUATIONS****12**

Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

**UNIT II FOURIER SERIES****12**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

**UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS****12**

Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

**UNIT IV FOURIER TRANSFORMS****12**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

**UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS****12**

Z-transforms - Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems - Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

**TOTAL : 60 PERIODS****OUTCOMES :**

Upon successful completion of the course, students should be able to:

- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.

- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

### TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", 43<sup>rd</sup> Edition, Khanna Publishers, New Delhi, 2014.
2. Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

### REFERENCES :

1. Andrews, L.C and Shivamoggi, B, "Integral Transforms for Engineers" SPIE Press, 1999.
2. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 9<sup>th</sup> Edition, Laxmi Publications Pvt. Ltd, 2014.
3. Erwin Kreyszig, "Advanced Engineering Mathematics ", 10<sup>th</sup> Edition, John Wiley, India, 2016.
4. James, G., "Advanced Modern Engineering Mathematics", 3<sup>rd</sup> Edition, Pearson Education, 2007.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

**EE8351**

**DIGITAL LOGIC CIRCUITS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>2</b>	<b>2</b>	<b>0</b>	<b>3</b>

### OBJECTIVES:

- To study various number systems and simplify the logical expressions using Boolean functions
- To study combinational circuits
- To design various synchronous and asynchronous circuits.
- To introduce asynchronous sequential circuits and PLDs
- To introduce digital simulation for development of application oriented logic circuits.

### UNIT I NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES

**6+6**

Review of number systems, binary codes, error detection and correction codes (Parity and Hamming code) - Digital Logic Families -comparison of RTL, DTL, TTL, ECL and MOS families -operation, characteristics of digital logic family.

### UNIT II COMBINATIONAL CIRCUITS

**6+6**

Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps - simplification and implementation of combinational logic – multiplexers and de multiplexers - code converters, adders, subtractors, Encoders and Decoders.





## REFERENCES

1. V.V.Sarwate, 'Electromagnetic fields and waves', First Edition, Newage Publishers, 1993.
2. J.P.Tewari, 'Engineering Electromagnetics - Theory, Problems and Applications', Second Edition, Khanna Publishers.
3. Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Third Edition (Schaum's Outline Series), McGraw Hill, 2010.
4. S.P.Ghosh, Lipika Datta, 'Electromagnetic Field Theory', First Edition, McGraw Hill Education(India) Private Limited, 2012.
5. K A Gangadhar, 'Electromagnetic Field Theory', Khanna Publishers; Eighth Reprint : 2015

**EE8301**

### **ELECTRICAL MACHINES – I**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>2</b>	<b>2</b>	<b>0</b>	<b>3</b>

#### **OBJECTIVES:**

To impart knowledge on the following Topics

- Magnetic-circuit analysis and introduce magnetic materials
- Constructional details, the principle of operation, prediction of performance, the methods of testing the transformers and three phase transformer connections.
- Working principles of electrical machines using the concepts of electromechanical energy conversion principles and derive expressions for generated voltage and torque developed in all Electrical Machines.
- Working principles of DC machines as Generator types, determination of their no-load/load characteristics, starting and methods of speed control of motors.
- Various losses taking place in D.C. Motor and to study the different testing methods to arrive at their performance.

#### **UNIT I            MAGNETIC CIRCUITS AND MAGNETIC MATERIALS            6+6**

Magnetic circuits –Laws governing magnetic circuits - Flux linkage, Inductance and energy – Statically and Dynamically induced EMF - Torque – Properties of magnetic materials, Hysteresis and Eddy Current losses - AC excitation, introduction to permanent magnets-Transformer as a magnetically coupled circuit.

#### **UNIT II            TRANSFORMERS            6+6**

Construction – principle of operation – equivalent circuit parameters – phasor diagrams, losses – testing – efficiency and voltage regulation-all day efficiency-Sumpner's test, per unit representation – inrush current - three phase transformers-connections – Scott Connection – Phasing of transformer– parallel operation of three phase transformers-auto transformer – tap changing transformers- tertiary winding.

#### **UNIT III            ELECTROMECHANICAL ENERGY CONVERSION AND CONCEPTS            6+6 IN ROTATING MACHINES**

Energy in magnetic system – Field energy and co energy-force and torque equations – singly and multiply excited magnetic field systems-mmF of distributed windings – Winding Inductances-, magnetic fields in rotating machines – rotating mmf waves – magnetic

saturation and leakage fluxes.

#### **UNIT IV DC GENERATORS**

**6+6**

Construction and components of DC Machine – Principle of operation - Lap and wave windings-EMF equations– circuit model – armature reaction –methods of excitation-commutation - interpoles compensating winding –characteristics of DC generators.

#### **UNIT V DC MOTORS**

**6+6**

Principle and operations - types of DC Motors – Speed Torque Characteristics of DC Motors-starting and speed control of DC motors –Plugging, dynamic and regenerative braking-testing and efficiency – Retardation test- Swinburne’s test and Hopkinson’s test - Permanent Magnet DC (PMD)motors-applications of DC Motor

**TOTAL : 60 PERIODS**

#### **OUTCOMES:**

- Ability to analyze the magnetic-circuits.
- Ability to acquire the knowledge in constructional details of transformers.
- Ability to understand the concepts of electromechanical energy conversion.
- Ability to acquire the knowledge in working principles of DC Generator.
- Ability to acquire the knowledge in working principles of DC Motor
- Ability to acquire the knowledge in various losses taking place in D.C. Machines

#### **TEXT BOOKS:**

1. Stephen J. Chapman, 'Electric Machinery Fundamentals'4<sup>th</sup> edition, McGraw Hill Education Pvt. Ltd, 2010.
2. P.C. Sen'Principles of Electric Machines and Power Electronics' John Wiley & Sons; 3rd Edition 2013.
3. Nagrath, I.J. and Kothari.D.P., 'Electric Machines', McGraw-Hill Education, 2004

#### **REFERENCES**

1. Theodore Wildi, "Electrical Machines, Drives, and Power Systems", Pearson Education., (5th Edition), 2002.
2. B.R. Gupta ,'Fundamental of Electric Machines' New age International Publishers,3<sup>rd</sup> Edition ,Reprint 2015.
3. S.K. Bhattacharya, 'Electrical Machines' McGraw - Hill Education, New Delhi, 3<sup>rd</sup> Edition,2009.
4. Vincent Del Toro, 'Basic Electric Machines' Pearson India Education, 2016.
5. Surinder Pal Bali, 'Electrical Technology Machines & Measurements, Vol.II, Pearson, 2013.
6. Fitzgerald. A.E., Charles Kingsely Jr, Stephen D.Umans, 'Electric Machinery', Sixth edition, McGraw Hill Books Company, 2003.

**OBJECTIVES:****The student should be made to:**

- Understand the structure of basic electronic devices.
- Be exposed to active and passive circuit elements.
- Familiarize the operation and applications of transistor like BJT and FET.
- Explore the characteristics of amplifier gain and frequency response.
- Learn the required functionality of positive and negative feedback systems.

**UNIT I PN JUNCTION DEVICES 9**

PN junction diode –structure, operation and V-I characteristics, diffusion and transition capacitance - Rectifiers – Half Wave and Full Wave Rectifier,– Display devices- LED, Laser diodes, Zener diode characteristics- Zener Reverse characteristics – Zener as regulator

**UNIT II TRANSISTORS AND THYRISTORS 9**

BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristors and IGBT - Structure and characteristics.

**UNIT III AMPLIFIERS 9**

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

**UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER 9**

BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers –Types (Qualitative analysis).

**UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS 9**

Advantages of negative feedback – voltage / current, series , Shunt feedback –positive feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

**TOTAL : 45 PERIODS****OUTCOMES:****Upon Completion of the course, the students will be able to:**

- Explain the structure and working operation of basic electronic devices.
- Able to identify and differentiate both active and passive elements
- Analyze the characteristics of different electronic devices such as diodes and transistors
- Choose and adapt the required components to construct an amplifier circuit.
- Employ the acquired knowledge in design and analysis of oscillators

**TEXT BOOKS:**

1. . David A. Bell ,”Electronic devices and circuits”, Oxford University higher education, 5<sup>th</sup> edition 2008.
2. Sedra and smith, “Microelectronic circuits”,7<sup>th</sup> Ed., Oxford University Press

## REFERENCES:

1. Balbir Kumar, Shail.B.Jain, "Electronic devices and circuits" PHI learning private limited, 2<sup>nd</sup> edition 2014.
2. Thomas L.Floyd, "Electronic devices" Conventional current version, Pearson prentice hall, 10<sup>th</sup> Edition, 2017.
3. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.
4. Robert L.Boylestad, "Electronic devices and circuit theory", 2002.
5. Robert B. Northrop, "Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation", CRC Press, 2004.

ME8792

POWER PLANT ENGINEERING

L	T	P	C
3	0	0	3

## OBJECTIVE:

- Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

### UNIT I COAL BASED THERMAL POWER PLANTS 9

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

### UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 9

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

### UNIT III NUCLEAR POWER PLANTS 9

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : *Boiling Water Reactor (BWR)*, *Pressurized Water Reactor (PWR)*, CANada Deuterium- Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

### UNIT IV POWER FROM RENEWABLE ENERGY 9

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, *Solar Photo Voltaic (SPV)*, Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

### UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS 9

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Explain the layout, construction and working of the components inside a thermal power plant.
- CO2 Explain the layout, construction and working of the components inside a Diesel, Gas and Combined cycle power plants.
- CO3 Explain the layout, construction and working of the components inside nuclear power plants.
- CO4 Explain the layout, construction and working of the components inside Renewable energy power plants.
- CO5 Explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.

**TEXT BOOK:**

- 1. Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008.

**REFERENCES:**

- 1. El-Wakil. M.M., "Power Plant Technology", Tata McGraw – Hill Publishing Company Ltd., 2010.
- 2. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.
- 3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, "Power Plant Engineering", Second Edition, Standard Handbook of McGraw – Hill, 1998.

**EC8311**

**ELECTRONICS LABORATORY**

**L T P C**  
**0 0 4 2**

**OBJECTIVES:**

- To enable the students to understand the behavior of semiconductor device based on experimentation.

**LIST OF EXPERIMENTS**

- 1. Characteristics of Semiconductor diode and Zener diode
- 2. Characteristics of a NPN Transistor under common emitter , common collector and common base configurations
- 3. Characteristics of JFET and draw the equivalent circuit
- 4. Characteristics of UJT and generation of saw tooth waveforms
- 5. Design and Frequency response characteristics of a Common Emitter amplifier
- 6. Characteristics of photo diode & photo transistor, Study of light activated relay circuit
- 7. Design and testing of RC phase shift and LC oscillators
- 8. Single Phase half-wave and full wave rectifiers with inductive and capacitive filters
- 9. Differential amplifiers using FET
- 10. Study of CRO for frequency and phase measurements

11. Realization of passive filters

**TOTAL: 60 PERIODS**

**OUTCOMES:**

- Ability to understand and analyse electronic circuits.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Semiconductor devices like Diode, Zener Diode, NPN Transistors, JFET, UJT, Photo diode, Photo Transistor
2. Resistors, Capacitors and inductors
3. Necessary digital IC 8
4. Function Generators 10
5. Regulated 3 output Power Supply 5,  $\pm 15V$  10
6. CRO 10
7. Storage Oscilloscope 1
8. Bread boards
9. Atleast one demo module each for the listed equipments.
10. Component data sheets to be provided

**EE8311**

**ELECTRICAL MACHINES LABORATORY-I**

**L T P C**  
**0 0 4 2**

**OBJECTIVES:**

- To expose the students to the operation of D.C. machines and transformers and give them experimental skill.

**LIST OF EXPERIMENTS**

1. Open circuit and load characteristics of DC shunt generator- critical resistance and critical speed.
2. Load characteristics of DC compound generator with differential and cumulative connections.
3. Load test on DC shunt motor.
4. Load test on DC compound motor.
5. Load test on DC series motor.
6. Swinburne's test and speed control of DC shunt motor.
7. Hopkinson's test on DC motor – generator set.
8. Load test on single-phase transformer and three phase transformers.
9. Open circuit and short circuit tests on single phase transformer.
10. Sumpner's test on single phase transformers.
11. Separation of no-load losses in single phase transformer.
12. Study of starters and 3-phase transformers connections.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

- Ability to understand and analyze DC Generator

- Ability to understand and analyze DC Motor
- Ability to understand and analyse Transformers.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. DC Shunt Motor with Loading Arrangement – 3 nos
2. DC Shunt Motor Coupled with Three phase Alternator – 1 No.
3. Single Phase Transformer – 4 nos
4. DC Series Motor with Loading Arrangement – 1 No.
5. DC compound Motor with Loading Arrangement – 1 No.
6. Three Phase Induction Motor with Loading Arrangement – 2 nos
7. Single Phase Induction Motor with Loading Arrangement – 1 No.
8. DC Shunt Motor Coupled With DC Compound Generator – 2 nos
9. DC Shunt Motor Coupled With DC Shunt Motor – 1 No.
10. Tachometer -Digital/Analog – 8 nos
11. Single Phase Auto Transformer – 2 nos
12. Three Phase Auto Transformer – 1 No.
13. Single Phase Resistive Loading Bank – 2 nos
14. Three Phase Resistive Loading Bank. – 2 nos

**MA8491**

**NUMERICAL METHODS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**OBJECTIVES :**

- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals in real life situations.
- To acquaint the student with understanding of numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.
- To understand the knowledge of various techniques and methods of solving various types of partial differential equations.

**UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS**

**12**

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

**UNIT II INTERPOLATION AND APPROXIMATION****12**

Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Difference operators and relations - Interpolation with equal intervals - Newton's forward and backward difference formulae.

**UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION****12**

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's Method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

**UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS****12**

Single step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge - Kutta method for solving first order equations - Multi step methods - Milne's and Adams - Bash forth predictor corrector methods for solving first order equations.

**UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS****12**

Finite difference methods for solving second order two - point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

**TOTAL : 60 PERIODS****OUTCOMES :**

Upon successful completion of the course, students should be able to:

- Understand the basic concepts and techniques of solving algebraic and transcendental equations.
- Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations.
- Apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

**TEXTBOOKS :**

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9<sup>th</sup> Edition, Cengage Learning, 2016.
2. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10<sup>th</sup> Edition, New Delhi, 2015.

**REFERENCES :**

1. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education, Asia, New Delhi, 2007.
2. Gerald. C. F. and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6<sup>th</sup> Edition, New Delhi, 2006.
3. Mathews, J.H. "Numerical Methods for Mathematics, Science and Engineering", 2<sup>nd</sup> Edition, Prentice Hall, 1992.
4. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, 3<sup>rd</sup> Edition, New Delhi, 2007.
5. Sastry, S.S, "Introductory Methods of Numerical Analysis", PHI Learning Pvt. Ltd, 5<sup>th</sup> Edition, 2015.

**OBJECTIVES:**

To impart knowledge on the following Topics

- Construction and performance of salient and non – salient type synchronous generators.
- Principle of operation and performance of synchronous motor.
- Construction, principle of operation and performance of induction machines.
- Starting and speed control of three-phase induction motors.
- Construction, principle of operation and performance of single phase induction motors and special machines.

**UNIT I                    SYNCHRONOUS GENERATOR                    6+6**

Constructional details – Types of rotors –winding factors- emf equation – Synchronous reactance – Armature reaction – Phasor diagrams of non salient pole synchronous generator connected to infinite bus--Synchronizing and parallel operation – Synchronizing torque -Change of excitation and mechanical input- Voltage regulation – EMF, MMF, ZPF and A.S.A methods – steady state power- angle characteristics– Two reaction theory –slip test -short circuit transients - Capability Curves

**UNIT II                    SYNCHRONOUS MOTOR                    6+6**

Principle of operation – Torque equation – Operation on infinite bus bars - V and Inverted V curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed-Hunting – natural frequency of oscillations – damper windings- synchronous condenser.

**UNIT III                    THREE PHASE INDUCTION MOTOR                    6+6**

Constructional details – Types of rotors -- Principle of operation – Slip –cogging and crawling- Equivalent circuit – Torque-Slip characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram – Separation of losses – Double cage induction motors –Induction generators – Synchronous induction motor.

**UNIT IV                    STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR                    6+6**

Need for starting – Types of starters – DOL, Rotor resistance, Autotransformer and Star-delta starters – Speed control – Voltage control, Frequency control and pole changing – Cascaded connection-V/f control – Slip power recovery scheme-Braking of three phase induction motor: Plugging, dynamic braking and regenerative braking.

**UNIT V                    SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES                    6+6**

Constructional details of single phase induction motor – Double field revolving theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis – Starting methods of single-phase induction motors – Capacitor-start capacitor run Induction motor- Shaded pole induction motor - Linear induction motor – Repulsion motor - Hysteresis motor - AC series motor- Servo motors- Stepper motors - introduction to magnetic levitation systems.

**TOTAL : 60 PERIODS**

**OUTCOMES:**

- Ability to understand the construction and working principle of Synchronous Generator
- Ability to understand MMF curves and armature windings.
- Ability to acquire knowledge on Synchronous motor.
- Ability to understand the construction and working principle of Three phase Induction Motor
- Ability to understand the construction and working principle of Special Machines
- Ability to predetermine the performance characteristics of Synchronous Machines.

**TEXT BOOKS:**

1. A.E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, 'Electric Machinery', Mc Graw Hill publishing Company Ltd, 2003.
2. Vincent Del Toro, 'Basic Electric Machines' Pearson India Education, 2016.
3. Stephen J. Chapman, 'Electric Machinery Fundamentals'4<sup>th</sup> edition, McGraw Hill Education Pvt. Ltd, 2010.

**REFERENCES**

1. D.P. Kothari and I.J. Nagrath, 'Electric Machines', McGraw Hill Publishing Company Ltd, 2002.
2. P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, 2003.
3. M.N. Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2009.
4. B.R.Gupta, 'Fundamental of Electric Machines' New age International Publishers,3<sup>rd</sup> Edition ,Reprint 2015.
5. Murugesh Kumar, 'Electric Machines', Vikas Publishing House Pvt. Ltd, 2002.
6. Alexander S. Langsdorf, 'Theory of Alternating-Current Machinery', McGraw Hill Publications, 2001.

**EE8402****TRANSMISSION AND DISTRIBUTION**

L	T	P	C
3	0	0	3

**OBJECTIVES:**

- To study the structure of electric power system and to develop expressions for the computation of transmission line parameters.
- To obtain the equivalent circuits for the transmission lines based on distance and to determine voltage regulation and efficiency.
- To understand the mechanical design of transmission lines and to analyze the voltage distribution in insulator strings to improve the efficiency.
- To study the types, construction of cables and methods to improve the efficiency.
- To study about distribution systems, types of substations, methods of grounding, EHVAC, HVDC and FACTS.

**UNIT I TRANSMISSION LINE PARAMETERS****9**

Structure of Power System - Parameters of single and three phase transmission lines with single and double circuits -Resistance, inductance and capacitance of solid, stranded and bundled conductors, Symmetrical and unsymmetrical spacing and transposition - application of self and mutual GMD; skin and proximity effects -Typical configurations, conductor types and electrical parameters of EHV lines.

**UNIT II            MODELLING AND PERFORMANCE OF TRANSMISSION LINES            9**

Performance of Transmission lines - short line, medium line and long line - equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance - transmission efficiency and voltage regulation, real and reactive power flow in lines - Power Circle diagrams - Formation of Corona – Critical Voltages – Effect on Line Performance.

**UNIT III            MECHANICAL DESIGN OF LINES            9**

Mechanical design of OH lines – Line Supports –Types of towers – Stress and Sag Calculation – Effects of Wind and Ice loading. Insulators: Types, voltage distribution in insulator string, improvement of string efficiency, testing of insulators.

**UNIT IV            UNDER GROUND CABLES            9**

Underground cables - Types of cables – Construction of single core and 3 core cables - Insulation Resistance – Potential Gradient - Capacitance of Single-core and 3 core cables - Grading of cables - Power factor and heating of cables – DC cables.

**UNIT V            DISTRIBUTION SYSTEMS            9**

Distribution Systems – General Aspects – Kelvin’s Law – AC and DC distributions - Techniques of Voltage Control and Power factor improvement – Distribution Loss –Types of Substations -Methods of Grounding – Trends in Transmission and Distribution: EHVAC, HVDC and FACTS (Qualitative treatment only).

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- To understand the importance and the functioning of transmission line parameters.
- To understand the concepts of Lines and Insulators.
- To acquire knowledge on the performance of Transmission lines.
- To understand the importance of distribution of the electric power in power system.
- To acquire knowledge on Underground Cables
- To become familiar with the function of different components used in Transmission and Distribution levels of power system and modelling of these components.

**TEXT BOOKS:**

1. D.P.Kothari, I.J. Nagarath, ‘Power System Engineering’, Mc Graw-Hill Publishing Company limited, New Delhi, Second Edition, 2008.
2. C.L.Wadhwa, ‘Electrical Power Systems’, New Academic Science Ltd, 2009.
3. S.N. Singh, ‘Electric Power Generation, Transmission and Distribution’, Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 2011.

**REFERENCES**

1. B.R.Gupta, ‘Power System Analysis and Design’ S. Chand, New Delhi, Fifth Edition, 2008.
2. Luces M.Fualken berry, Walter Coffey, ‘Electrical Power Distribution and Transmission’, Pearson Education, 2007.
3. Arun Ingole, "power transmission and distribution" Pearson Education, 2017
4. J.Brian, Hardy and Colin R.Bayliss ‘Transmission and Distribution in Electrical Engineering’, Newnes; Fourth Edition, 2012.
5. G.Ramamurthy, “Handbook of Electrical power Distribution,” Universities Press, 2013.

6. V.K.Mehta, Rohit Mehta, 'Principles of power system', S. Chand & Company Ltd, New Delhi, 2013

<b>EE8403</b>	<b>MEASUREMENTS AND INSTRUMENTATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

To impart knowledge on the following Topics

- Basic functional elements of instrumentation
- Fundamentals of electrical and electronic instruments
- Comparison between various measurement techniques
- Various storage and display devices
- Various transducers and the data acquisition systems

**UNIT I INTRODUCTION 9**

Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration- Principle and types of analog and digital voltmeters, ammeters.

**UNIT II ELECTRICAL AND ELECTRONIC INSTRUMENTS 9**

Principle and types of multi meters – Single and three phase watt meters and energy meters – Magnetic measurements – Determination of B-H curve and measurements of iron loss – Instrument transformers – Instruments for measurement of frequency and phase.

**UNIT III COMPARATIVE METHODS OF MEASUREMENTS 9**

D.C potentiometers, D.C (Wheat stone, Kelvin and Kelvin Double bridge) & A.C bridges (Maxwell, Anderson and Schering bridges), transformer ratio bridges, self-balancing bridges. Interference & screening – Multiple earth and earth loops - Electrostatic and electromagnetic Interference – Grounding techniques.

**UNIT IV STORAGE AND DISPLAY DEVICES 9**

Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & Dot matrix display – Data Loggers.

**UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9**

Classification of transducers – Selection of transducers – Resistive, capacitive & inductive Transducers – Piezoelectric, Hall effect, optical and digital transducers – Elements of data acquisition system – Smart sensors-Thermal Imagers.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- To acquire knowledge on Basic functional elements of instrumentation
- To understand the concepts of Fundamentals of electrical and electronic instruments
- Ability to compare between various measurement techniques
- To acquire knowledge on Various storage and display devices
- To understand the concepts Various transducers and the data acquisition systems
- Ability to model and analyze electrical and electronic Instruments and understand the operational features of display Devices and Data Acquisition System.

**TEXT BOOKS:**

1. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2010.
2. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi, 2013.
3. Doebelin E.O. and Manik D.N., Measurement Systems – Applications and Design, Special Indian Edition, McGraw Hill Education Pvt. Ltd., 2007.

**REFERENCES**

1. H.S. Kalsi, 'Electronic Instrumentation', McGraw Hill, III Edition 2010.
2. D.V.S. Murthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2015.
3. David Bell, ' Electronic Instrumentation & Measurements', Oxford University Press, 2013.
4. Martin Reissland, 'Electrical Measurements', New Age International (P) Ltd., Delhi, 2001.
5. Alan. S. Morris, Principles of Measurements and Instrumentation, 2nd Edition, Prentice Hall of India, 2003.

<b>EE8451</b>	<b>LINEAR INTEGRATED CIRCUITS AND APPLICATIONS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

To impart knowledge on the following topics

- Signal analysis using Op-amp based circuits.
- Applications of Op-amp.
- Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.
- IC fabrication procedure.

**UNIT I IC FABRICATION 9**

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance, FETs and PV Cell.

**UNIT II CHARACTERISTICS OF OPAMP 9**

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – Inverting and Non-inverting Amplifiers, summer, differentiator and integrator-V/I & I/V converters.

**UNIT III APPLICATIONS OF OPAMP 9**

Instrumentation amplifier and its applications for transducer Bridge, Log and Antilog Amplifiers- Analog multiplier & Divider, first and second order active filters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using opamps.

**UNIT IV SPECIAL ICs 9**

Functional block, characteristics of 555 Timer and its PWM application - IC-566 voltage controlled oscillator IC; 565-phase locked loop IC, AD633 Analog multiplier ICs.

**UNIT V APPLICATION ICs 9**

AD623 Instrumentation Amplifier and its application as load cell weight measurement - IC voltage regulators –LM78XX, LM79XX; Fixed voltage regulators its application as Linear power supply - LM317, 723 Variability voltage regulators, switching regulator- SMPS - ICL 8038 function generator IC.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to acquire knowledge in IC fabrication procedure
- Ability to analyze the characteristics of Op-Amp
- To understand the importance of Signal analysis using Op-amp based circuits.
- Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.
- To understand and acquire knowledge on the Applications of Op-amp
- Ability to understand and analyse, linear integrated circuits their Fabrication and Application.

**TEXT BOOKS:**

1. David A. Bell, 'Op-amp & Linear ICs', Oxford, 2013.
2. D. Roy Choudhary, Sheil B. Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.
3. Ramakant A. Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI. 2000.

**REFERENCES**

1. Fiore, "Opamps & Linear Integrated Circuits Concepts & applications", Cengage, 2010.
2. Floyd ,Buchla, "Fundamentals of Analog Circuits, Pearson, 2013.
3. Jacob Millman, Christos C. Halkias, 'Integrated Electronics - Analog and Digital circuits system', McGraw Hill, 2003.
4. Robert F. Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', Pearson, 6th edition, 2012.
5. Sergio Franco, 'Design with Operational Amplifiers and Analog Integrated Circuits', Mc Graw Hill, 2016.
6. Muhammad H. Rashid, 'Microelectronic Circuits Analysis and Design' Cengage Learning, 2011.

**IC8451**

**CONTROL SYSTEMS**

**LT P C  
3 2 0 4**

**COURSE OBJECTIVES**

- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed-loop frequency responses of systems.
- To introduce stability analysis and design of compensators



**OBJECTIVES:**

- To expose the students to the operation of synchronous machines and induction motors and give them experimental skill.

**LIST OF EXPERIMENTS**

1. Regulation of three phase alternator by EMF and MMF methods.
2. Regulation of three phase alternator by ZPF and ASA methods.
3. Regulation of three phase salient pole alternator by slip test.
4. Measurements of negative sequence and zero sequence impedance of alternators.
5. V and Inverted V curves of Three Phase Synchronous Motor.
6. Load test on three-phase induction motor.
7. No load and blocked rotor tests on three-phase induction motor (Determination of equivalent circuit parameters).
8. Separation of No-load losses of three-phase induction motor.
9. Load test on single-phase induction motor.
10. No load and blocked rotor test on single-phase induction motor.
11. Study of Induction motor Starters

**TOTAL: 60 PERIODS****OUTCOMES:**

At the end of the course, the student should have the :

- Ability to understand and analyze EMF and MMF methods
- Ability to analyze the characteristics of V and Inverted V curves
- Ability to understand the importance of Synchronous machines
- Ability to understand the importance of Induction Machines
- Ability to acquire knowledge on separation of losses

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Synchronous Induction motor 3HP – 1 No.
2. DC Shunt Motor Coupled With Three phase Alternator – 4 nos
3. DC Shunt Motor Coupled With Three phase Slip ring Induction motor – 1 No.
4. Three Phase Induction Motor with Loading Arrangement – 2 nos
5. Single Phase Induction Motor with Loading Arrangement – 2 nos
6. Tachometer -Digital/Analog – 8 nos
7. Single Phase Auto Transformer – 2 nos
8. Three Phase Auto Transformer – 3 nos
9. Single Phase Resistive Loading Bank – 2 nos
10. Three Phase Resistive Loading Bank – 2 nos
11. Capacitor Bank – 1 No.

EE8461

**LINEAR AND DIGITAL INTEGRATED CIRCUITS  
LABORATORY**

**L T P C  
0 0 4 2**

**OBJECTIVES:**

- To learn design, testing and characterizing of circuit behavior with digital and analog ICs.

**LIST OF EXPERIMENTS**

1. Implementation of Boolean Functions, Adder and Subtractor circuits.
2. Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa
3. Parity generator and parity checking
4. Encoders and Decoders
5. Counters: Design and implementation of 3-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.
6. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitability IC's.
7. Study of multiplexer and de multiplexer
8. Timer IC application: Study of NE/SE 555 timer in Astability, Monostability operation.
9. Application of Op-Amp: inverting and non-inverting amplifier, Adder, comparator, Integrator and Differentiator.
10. Voltage to frequency characteristics of NE/ SE 566 IC.
11. Variability Voltage Regulator using IC LM317.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

At the end of the course, the student should have the :

- Ability to understand and implement Boolean Functions.
- Ability to understand the importance of code conversion
- Ability to Design and implement 4-bit shift registers
- Ability to acquire knowledge on Application of Op-Amp
- Ability to Design and implement counters using specific counter IC.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS: (3 per Batch)**

S.No	Name of the equipments / Components	Quantity Required	Remarks
1	Dual ,(0-30V) variability Power Supply	10	-
2	CRO	9	30MHz
3	Digital Multimeter	10	Digital
4	Function Generator	8	1 MHz
5	IC Tester (Analog)	2	
6	Bread board	10	

7	Computer (PSPICE installed)	1	
<b>Consumabilitys (sufficient quantity)</b>			
1	IC 741/ IC NE555/566/565		
2	Digital IC types		
3	LED		
4	LM317		
5	LM723		
6	ICSG3524 / SG3525		
7	Transistor – 2N3391		
8	Diodes, IN4001,BY126		
9	Zener diodes		
10	Potentiometer		
11	Step-down transformer 230V/12-0-12V		
12	Capacitor		
13	Resistors 1/4 Watt Assorted		
14	Single Strand Wire		

**EE8412**

**TECHNICAL SEMINAR**

**LT P C  
0 0 2 1**

**OBJECTIVES:**

- To encourage the students to study advanced engineering developments
- To prepare and present technical reports.
- To encourage the students to use various teaching aids such as overhead projectors, power point presentation and demonstrative models.

**METHOD OF EVALUATION:**

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for a duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. Each student is expected to present atleast twice during the semester and the student is evaluated based on that. At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are given based on the report. A Faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also. Evaluation is 100% internal.

**TOTAL: 30 PERIODS**

**OUTCOMES:**

- Ability to review, prepare and present technological developments
- Ability to face the placement interviews

**EE8501****POWER SYSTEM ANALYSIS**

L	T	P	C
3	0	0	3

**OBJECTIVES:**

- To model the power system under steady state operating condition
- To understand and apply iterative techniques for power flow analysis
- To model and carry out short circuit studies on power system
- To model and analyze stability problems in power system

**UNIT I POWER SYSTEM****9**

Need for system planning and operational studies - Power scenario in India - Power system components – Representation - Single line diagram - per unit quantities - p.u. impedance diagram - p.u. reactance diagram - Network graph, Bus incidence matrix, Primitive parameters, Bus admittance matrix from primitive parameters - Representation of off-nominal transformer - Formation of bus admittance matrix of large power network.

**UNIT II POWER FLOW ANALYSIS****9**

Bus classification - Formulation of Power Flow problem in polar coordinates - Power flow solution using Gauss Seidel method - Handling of Voltage controlled buses - Power Flow Solution by Newton Raphson method.

**UNIT III SYMMETRICAL FAULT ANALYSIS****9**

Assumptions in short circuit analysis - Symmetrical short circuit analysis using Thevenin's theorem - Bus Impedance matrix building algorithm (without mutual coupling) - Symmetrical fault analysis through bus impedance matrix - Post fault bus voltages - Fault level - Current limiting reactors.

**UNIT IV UNSYMMETRICAL FAULT ANALYSIS****9**

Symmetrical components - Sequence impedances - Sequence networks - Analysis of unsymmetrical faults at generator terminals: LG, LL and LLG - unsymmetrical fault occurring at any point in a power system - computation of post fault currents in symmetrical component and phasor domains.

**UNIT V STABILITY ANALYSIS****9**

Classification of power system stability – Rotor angle stability - Swing equation - Swing curve - Power-Angle equation - Equal area criterion - Critical clearing angle and time - Classical step-by-step solution of the swing equation – modified Euler method.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Ability to model the power system under steady state operating condition
- Ability to understand and apply iterative techniques for power flow analysis
- Ability to model and carry out short circuit studies on power system
- Ability to model and analyze stability problems in power system



**UNIT IV PERIPHERAL INTERFACING 9**

Study on need, Architecture, configuration and interfacing, with ICs: 8255, 8259, 8254, 8279, - A/D and D/A converters & Interfacing with 8085 & 8051.

**UNIT V MICRO CONTROLLER PROGRAMMING & APPLICATIONS 9**

Simple programming exercises- key board and display interface –Control of servo motor- stepper motor control- Application to automation systems.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to acquire knowledge in Addressing modes & instruction set of 8085 & 8051.
- Ability to need & use of Interrupt structure 8085 & 8051.
- Ability to understand the importance of Interfacing
- Ability to explain the architecture of Microprocessor and Microcontroller.
- Ability to write the assembly language programme.
- Ability to develop the Microprocessor and Microcontroller based applications.

**TEXT BOOKS:**

1. Sunil Mathur & Jeebananda Panda, "Microprocessor and Microcontrollers", PHI Learning Pvt. Ltd, 2016.
2. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013.
3. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D. Kinley 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.

**REFERENCES**

1. Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi, 2007.
2. B.RAM, "Computer Fundamentals Architecture and Organization" New age International Private Limited, Fifth edition, 2017.
3. Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085, 8086, 8051, McGraw Hill Edu, 2013.
4. Ajay V. Deshmukh, 'Microcontroller Theory & Applications', McGraw Hill Edu, 2016
5. Douglas V. Hall, 'Microprocessor and Interfacing', McGraw Hill Edu, 2016.

**EE8552**

**POWER ELECTRONICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

To impart knowledge on the following Topics

- Different types of power semiconductor devices and their switching
- Operation, characteristics and performance parameters of controlled rectifiers
- Operation, switching techniques and basics topologies of DC-DC switching regulators.
- Different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- Operation of AC voltage controller and various configurations.

<b>UNIT I</b>	<b>POWER SEMI-CONDUCTOR DEVICES</b>	<b>9</b>
Study of switching devices, SCR, TRIAC, GTO, BJT, MOSFET, IGBT and IGCT- Static characteristics: SCR, MOSFET and IGBT - Triggering and commutation circuit for SCR- Introduction to Driver and snubber circuits.		
<b>UNIT II</b>	<b>PHASE-CONTROLLED CONVERTERS</b>	<b>9</b>
2-pulse, 3-pulse and 6-pulse converters– performance parameters –Effect of source inductance— Firing Schemes for converter–Dual converters, Applications-light dimmer, Excitation system, Solar PV systems.		
<b>UNIT III</b>	<b>DC TO DC CONVERTERS</b>	<b>9</b>
Step-down and step-up chopper-control strategy– Introduction to types of choppers-A, B, C, D and E -Switched mode regulators- Buck, Boost, Buck- Boost regulator, Introduction to Resonant Converters, Applications-Battery operated vehicles.		
<b>UNIT IV</b>	<b>INVERTERS</b>	<b>9</b>
Single phase and three phase voltage source inverters (both 120° mode and 180° mode)– Voltage & harmonic control–PWM techniques: Multiple PWM, Sinusoidal PWM, modified sinusoidal PWM – Introduction to space vector modulation –Current source inverter, Applications-Induction heating, UPS.		
<b>UNIT V</b>	<b>AC TO AC CONVERTERS</b>	<b>9</b>
Single phase and Three phase AC voltage controllers–Control strategy- Power Factor Control – Multistage sequence control –single phase and three phase cyclo converters – Introduction to Matrix converters, Applications –welding .		

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to analyse AC-AC and DC-DC and DC-AC converters.
- Ability to choose the converters for real time applications.

**TEXT BOOKS:**

1. M.H. Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, Third Edition, New Delhi, 2004.
2. P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition, 2003.
3. Ashfaq Ahmed 'Power Electronics for Technology', Pearson Education, Indian reprint, 2003.

**REFERENCES**

1. Joseph Vithayathil, 'Power Electronics, Principles and Applications', McGraw Hill Series, 6<sup>th</sup> Reprint, 2013.
2. Philip T. Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.
3. L. Umanand, "Power Electronics Essentials and Applications", Wiley, 2010.
4. Ned Mohan Tore. M. Undel and, William. P. Robbins, 'Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition, 2003.
5. S.Rama Reddy, 'Fundamentals of Power Electronics', Narosa Publications, 2014.
6. M.D. Singh and K.B. Khanchandani, "Power Electronics," Mc Graw Hill India, 2013.
7. JP Agarwal, "Power Electronic Systems: Theory and Design" 1e, Pearson Education, 2002.

EE8591

**DIGITAL SIGNAL PROCESSING**

L	T	P	C
2	2	0	3

**OBJECTIVES:** To impart knowledge about the following topics:

- Signals and systems & their mathematical representation.
- Discrete time systems.
- Transformation techniques & their computation.
- Filters and their design for digital implementation.
- Programmability digital signal processor & quantization effects.

**UNIT I INTRODUCTION**

**6+6**

Classification of systems: Continuous, discrete, linear, causal, stability, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect.

**UNIT II DISCRETE TIME SYSTEM ANALYSIS**

**6+6**

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems - Stability analysis, frequency response – Convolution – Discrete Time Fourier transform , magnitude and phase representation.

**UNIT III DISCRETE FOURIER TRANSFORM & COMPUTATION**

**6+6**

Discrete Fourier Transform- properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT & DIF using radix 2 FFT – Butterfly structure.

**UNIT IV DESIGN OF DIGITAL FILTERS**

**6+6**

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. Analog filter design – Butterworth and Chebyshev approximations; IIR Filters, digital design using impulse invariant and bilinear transformation Warping, pre warping.

**UNIT V DIGITAL SIGNAL PROCESSORS**

**6+6**

Introduction – Architecture – Features – Addressing Formats – Functional modes - Introduction to Commercial DS Processors.

**TOTAL : 60 PERIODS**

**OUTCOMES:**

1. Ability to understand the importance of Fourier transform, digital filters and DS Processors.
2. Ability to acquire knowledge on Signals and systems & their mathematical representation.
3. Ability to understand and analyze the discrete time systems.
4. Ability to analyze the transformation techniques & their computation.
5. Ability to understand the types of filters and their design for digital implementation.
6. Ability to acquire knowledge on programmability digital signal processor & quantization effects.

**TEXT BOOKS:**

1. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms

and Applications', Pearson Education, New Delhi, PHI. 2003.

2. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', McGraw Hill Edu, 2013.
3. Lonnie C.Ludeman, "Fundamentals of Digital Signal Processing", Wiley, 2013

## REFERENCES

1. Poorna Chandra S, Sasikala. B, Digital Signal Processing, Vijay Nicole/TMH, 2013.
2. Robert Schilling & Sandra L.Harris, Introduction to Digital Signal Processing using Matlab", Cengage Learning, 2014.
3. B.P.Lathi, 'Principles of Signal Processing and Linear Systems', Oxford University Press, 2010 3. Taan S. ElAli, 'Discrete Systems and Digital Signal Processing with Mat Lab', CRC Press, 2009.
4. SenM.kuo, woonseng...s.gan, "Digital Signal Processors, Architecture, Implementations & Applications, Pearson, 2013
5. DimitrisG.Manolakis, Vinay K. Ingle, applied Digital Signal Processing, Cambridge, 2012

**CS8392**

**OBJECT ORIENTED PROGRAMMING**

**L T P C**  
**3 0 0 3**

## OBJECTIVES:

- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the principles of packages, inheritance and interfaces
- To define exceptions and use I/O streams
- To develop a java application with threads and generics classes
- To design and build simple Graphical User Interfaces

## **UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 10**

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File -Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays, Packages - JavaDoc comments.

## **UNIT II INHERITANCE AND INTERFACES 9**

Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning -inner classes, Array Lists - Strings

## **UNIT III EXCEPTION HANDLING AND I/O 9**

Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

## **UNIT IV MULTITHREADING AND GENERIC PROGRAMMING 8**

Differences between multi-threading and multitasking, thread life cycle, creating threads,



**INSTRUMENTATION:**

8. Bridge Networks –AC and DC Bridges
9. Dynamics of Sensors/Transducers
  - (a) Temperature (b) pressure (c) Displacement (d) Optical (e) Strain (f) Flow
10. Power and Energy Measurement
11. Signal Conditioning
  - (a) Instrumentation Amplifier
  - (b) Analog – Digital and Digital –Analog converters (ADC and DACs)
12. Process Simulation

**TOTAL: 60 PERIODS**

**OUTCOMES:**

- Ability to understand control theory and apply them to electrical engineering problems.
- Ability to analyze the various types of converters.
- Ability to design compensators
- Ability to understand the basic concepts of bridge networks.
- Ability to the basics of signal conditioning circuits.
- Ability to study the simulation packages.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:****CONTROLSYSTEMS:**

1. PID controller simulation and learner kit – 1 No.
2. Digital storage Oscilloscope for capturing transience- 1 No  
  
2 Personal Computer with control system simulation packages - 10 Nos
3. DC motor –Generator test set-up for evaluation of motor parameters
4. CRO 30MHz – 1 No.
5. 2MHz Function Generator – 1No.
6. Position Control Systems Kit (with manual) – 1 No., Tacho Generator Coupling set
7. AC Synchro transmitter& receiver – 1No.
8. Sufficient number of Digital multi meters, speed and torque sensors

**INSTRUMENTATION:**

9. R, L, C Bridge kit (with manual)
10. a) Electric heater – 1No.  
Thermometer – 1No. Thermistor (silicon type) RTD nickel type – 1No.  
  
b) 30 psi Pressure chamber (complete set) – 1No. Current generator (0 – 20mA) Air foot pump – 1 No. (with necessary connecting tubes)  
  
c) LVDT20mm core length movability type – 1No. CRO 30MHz – 1No.  
  
d) Optical sensor – 1 No. Light source  
  
e) Strain Gauge Kit with Handy lever beam – 1No.

- 100gm weights – 10 nos  
 f) Flow measurement Trainer kit – 1 No.  
 (1/2 HP Motor, Water tank, Digital Milliammeter, complete set)
11. Single phase Auto transformer – 1No. Watt-hour meter (energy meter) – 1No. Ammeter  
 Voltmeter Rheostat Stop watch  
 Connecting wires (3/20)
  12. IC Transistor kit – 1No.
  13. Instrumentation Amplifier kit-1 No
  14. Analog – Digital and Digital –Analog converters (ADC and DACs)- 1 No

**HS8581**

**PROFESSIONAL COMMUNICATION**

**L T P C  
 0 0 2 1**

**OBJECTIVES: The course aims to:**

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employability Graduates
- Develop their confidence and help them attend interviews successfully.

**UNIT I**

Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

**UNIT II**

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

**UNIT III**

Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic — questioning and clarifying –GD strategies- activities to improve GD skills

**UNIT IV**

Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview & panel interview – FAQs related to job interviews

**UNIT V**

Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes.

**TOTAL : 30 PERIODS**

**OUTCOMES: At the end of the course Learners will be able to:**

- Make effective presentations

- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

### Recommended Software

1. Open Source Software
2. Win English

### REFERENCES:

1. Butterfield, Jeff **Soft Skills for Everyone**. Cengage Learning: New Delhi, 2015
2. **Interact** English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
3. E. Suresh Kumar et al. **Communication for Professional Success**. Orient Blackswan: Hyderabad, 2015
4. Raman, Meenakshi and Sangeeta Sharma. **Professional Communication**. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. **Soft Skills**. MJP Publishers: Chennai, 2010.

CS8383

### OBJECT ORIENTED PROGRAMMING LABORATORY

LT P C  
0 0 4 2

### COURSE OBJECTIVES

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, arraylist, exception handling and file processing.
- To develop applications using generic programming and event handling.

### List of experiments

1. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection(i.e domestic or commercial). Compute the bill amount using the following tariff. If the type of the EB connection is domestic, calculate the amount to be paid as follows:
  - First 100 units - Rs. 1 per unit
  - 101-200 units - Rs. 2.50 per unit
  - 201 -500 units - Rs. 4 per unit
  - > 501 units - Rs. 6 per unit
 If the type of the EB connection is commercial, calculate the amount to be paid as follows:
  - First 100 units - Rs. 2 per unit
  - 101-200 units - Rs. 4.50 per unit
  - 201 -500 units - Rs. 6 per unit
  - > 501 units - Rs. 7 per unit
2. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa) , time converter (hours to minutes, seconds and vice versa) using packages.
3. Develop a java application with Employee class with Emp\_name, Emp\_id, Address, Mail\_id, Mobile\_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the

inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.

4. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.
5. Write a program to perform string operations using ArrayList. Write functions for the following
  - a. Append - add at end
  - b. Insert – add at particular index
  - c. Search
  - d. List all string starts with given letter
6. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
7. Write a Java program to implement user defined exception handling.
8. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.
9. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
10. Write a java program to find the maximum value from the given type of elements using a generic function.
11. Design a calculator using event-driven programming paradigm of Java with the following options.
  - a) Decimal manipulations
  - b) Scientific manipulations
12. Develop a mini project for any application using Java concepts.

**TOTAL : 60 PERIODS**

### **COURSE OUTCOMES**

Upon completion of the course, the students will be able to

- Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.
- Develop and implement Java programs with arraylist, exception handling and multithreading .
- Design applications using file processing, generic programming and event handling.

**OBJECTIVES:**

To impart knowledge on the following Topics

- Steady state operation and transient dynamics of a motor load system.
- Analyze the operation of the converter/chopper fed dc drive, both qualitatively and quantitatively.
- Operation and performance of AC motor drives.
- Analyze and design the current and speed controllers for a closed loop solid state DC motor drive.

**UNIT I DRIVE CHARACTERISTICS 9**

Electric drive – Equations governing motor load dynamics – steady state stability – multi quadrant Dynamics: acceleration, deceleration, starting & stopping – typical load torque characteristics – Selection of motor.

**UNIT II CONVERTER / CHOPPER FED DC MOTOR DRIVE 9**

Steady state analysis of the single and three phase converter fed separately excited DC motor drive– continuous conduction – Time ratio and current limit control – 4 quadrant operation of converter / chopper fed drive-Applications.

**UNIT III INDUCTION MOTOR DRIVES 9**

Stator voltage control–V/f control– Rotor Resistance control-qualitative treatment of slip power recovery drives-closed loop control— vector control- Applications.

**UNIT IV SYNCHRONOUS MOTOR DRIVES 9**

V/f control and self-control of synchronous motor: Margin angle control and power factor control- Three phase voltage/current source fed synchronous motor- Applications.

**UNIT V DESIGN OF CONTROLLERS FOR DRIVES 9**

Transfer function for DC motor / load and converter – closed loop control with Current and speed feedback–armature voltage control and field weakening mode – Design of controllers; current controller and speed controller- converter selection and characteristics.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand and suggest a converter for solid state drive.
- Ability to select suitability drive for the given application.
- Ability to study about the steady state operation and transient dynamics of a motor load system.
- Ability to analyze the operation of the converter/chopper fed dc drive.
- Ability to analyze the operation and performance of AC motor drives.
- Ability to analyze and design the current and speed controllers for a closed loop solid state DC motor drive.

**TEXT BOOKS:**

1. Gopal K.Dubey, Fundamentals of Electrical Drives, Narosa Publishing House, 1992.
2. Bimal K.Bose. Modern Power Electronics and AC Drives, Pearson Education, 2002.
3. R.Krishnan, Electric Motor & Drives: Modeling, Analysis and Control, Pearson, 2001.

**REFERENCES**

1. Vedam Subramanyam, “ Electric Drives Concepts and Applications ”, 2e, McGraw Hill, 2016

2. Shaahin Felizadeh, "Electric Machines and Drives", CRC Press (Taylor and Francis Group), 2013.
3. John Hindmarsh and Alasdain Renfrew, "Electrical Machines and Drives System," Elsevier 2012.
4. Theodore Wildi, "Electrical Machines, Drives and power systems", 6<sup>th</sup> edition, Pearson Education, 2015
5. N.K. De., P.K. SEN "Electric drives" PHI, 2012.

**EE8602**

**PROTECTION AND SWITCHGEAR**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

To impart knowledge on the following Topics

- Causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
- Characteristics and functions of relays and protection schemes.
- Apparatus protection, static and numerical relays
- Functioning of circuit breaker

**UNIT I PROTECTION SCHEMES**

**9**

Principles and need for protective schemes – nature and causes of faults – types of faults – Methods of Grounding - Zones of protection and essential qualities of protection – Protection scheme

**UNIT II ELECTROMAGNETIC RELAYS**

**9**

Operating principles of relays - the Universal relay – Torque equation – R-X diagram – Electromagnetic Relays – Over current, Directional, Distance, Differential, Negative sequence and Under frequency relays.

**UNIT III APPARATUS PROTECTION**

**9**

Current transformers and Potential transformers and their applications in protection schemes - Protection of transformer, generator, motor, bus bars and transmission line.

**UNIT IV STATIC RELAYS AND NUMERICAL PROTECTION**

**9**

Static relays – Phase, Amplitude Comparators – Synthesis of various relays using Static comparators – Block diagram of Numerical relays – Over current protection, transformer differential protection, distant protection of transmission lines.

**UNIT V CIRCUIT BREAKERS**

**9**

Physics of arcing phenomenon and arc interruption - DC and AC circuit breaking – re-striking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching - current chopping - interruption of capacitive current - Types of circuit breakers – air blast, air break, oil, SF6, MCBs, MCCBs and vacuum circuit breakers – comparison of different circuit breakers – Rating and selection of Circuit breakers.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand and analyze Electromagnetic and Static Relays.
- Ability to suggest suitability circuit breaker.
- Ability to find the causes of abnormal operating conditions of the apparatus and system.

- Ability to analyze the characteristics and functions of relays and protection schemes.
- Ability to study about the apparatus protection, static and numerical relays.
- Ability to acquire knowledge on functioning of circuit breaker.

**TEXT BOOKS:**

1. Sunil S.Rao, 'Switchgear and Protection', Khanna Publishers, New Delhi, 2008.
2. B.Rabindranath and N.Chander, 'Power System Protection and Switchgear', New Age International (P) Ltd., First Edition 2011.
3. Arun Ingole, 'Switch Gear and Protection' Pearson Education, 2017.

**REFERENCES**

1. BadriRam ,B.H. Vishwakarma, 'Power System Protection and Switchgear', New Age International Pvt Ltd Publishers, Second Edition 2011.
2. Y.G.Paithankar and S.R.Bhide, 'Fundamentals of power system protection', Second Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
3. C.L.Wadhwa, 'Electrical Power Systems', 6th Edition, New Age International (P) Ltd., 2010
4. RavindraP.Singh, 'Switchgear and Power System Protection', PHI Learning Private Ltd., New Delhi, 2009.
5. VK Metha," Principles of Power Systems" S. Chand, 2005.
6. Bhavesh Bhalja, R.P. Maheshwari, Nilesh G. Chotani,'Protection and Switchgear' Oxford University Press, 2011.

**EE8691**

**EMBEDDED SYSTEMS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

To impart knowledge on the following Topics

- Building Blocks of Embedded System
- Various Embedded Development Strategies
- Bus Communication in processors, Input/output interfacing.
- Various processor scheduling algorithms.
- Basics of Real time operating system and example tutorials to discuss on one real time operating system tool.

**UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9**

Introduction to Embedded Systems –Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

**UNIT II EMBEDDED NETWORKING 9**

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols RS232 standard – RS422 – RS 485 - CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I<sup>2</sup>C) –need for device drivers.

**UNIT III EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT 9**

Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model,

Sequential Program Model, concurrent Model, object oriented Model.

**UNIT IV RTOS BASED EMBEDDED SYSTEM DESIGN 9**

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance.

**UNIT V EMBEDDED SYSTEM APPLICATION AND DEVELOPMENT 9**

Case Study of Washing Machine- Automotive Application- Smart card System Application-ATM machine –Digital camera

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand and analyze Embedded systems.
- Ability to suggest an embedded system for a given application.
- Ability to operate various Embedded Development Strategies
- Ability to study about the bus Communication in processors.
- Ability to acquire knowledge on various processor scheduling algorithms.
- Ability to understand basics of Real time operating system.

**TEXT BOOKS:**

1. Peckol, "Embedded system Design", John Wiley & Sons,2010
2. Lyla B Das," Embedded Systems-An Integrated Approach", Pearson, 2013
3. Shibu. K.V, "Introduction to Embedded Systems", 2e, Mc graw Hill, 2017.

**REFERENCES**

1. Raj Kamal, 'Embedded System-Architecture, Programming, Design', Mc Graw Hill, 2013.
2. C.R.Sarma, "Embedded Systems Engineering", University Press (India) Pvt. Ltd, 2013.
3. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.
4. Han-Way Huang, "Embedded system Design Using C8051", Cengage Learning, 2009.
5. Rajib Mall "Real-Time systems Theory and Practice" Pearson Education, 2007.

**EE8661 POWER ELECTRONICS AND DRIVES LABORATORY L T P C**  
**0 0 4 2**

**OBJECTIVES:**

- To provide hands on experience with power electronic converters and testing.

**LIST OF EXPERIMENTS**

- 1 Gate Pulse Generation using R, RC and UJT.
- 2 Characteristics of SCR and TRIAC
- 3 Characteristics of MOSFET and IGBT
- 4 AC to DC half controlled converter
- 5 AC to DC fully controlled Converter
- 6 Step down and step up MOSFET based choppers
- 7 IGBT based single phase PWM inverter

- 8 IGBT based three phase PWM inverter
- 9 AC Voltage controller
- 10 Switched mode power converter.
- 11 Simulation of PE circuits (1 $\Phi$  & 3 $\Phi$  semi converters, 1 $\Phi$  & 3 $\Phi$  full converters, DC-DC converters, AC voltage controllers).
- 12 Characteristics of GTO & IGCT.
- 13 Characteristics of PMSBLDC motor

**TOTAL: 60 PERIODS**

**OUTCOMES:**

- Ability to practice and understand converter and inverter circuits and apply software for engineering problems.
- Ability to experiment about switching characteristics various switches.
- Ability to analyze about AC to DC converter circuits.
- Ability to analyze about DC to AC circuits.
- Ability to acquire knowledge on AC to AC converters
- Ability to acquire knowledge on simulation software.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Device characteristics(for SCR, MOSFET, TRIAC,GTO,IGCT and IGBT kit with built-in / discrete power supply and meters) - 2 each
2. SinglephaseSCRbasedhalfcontrolledconverterandfullycontrolledconverteralong with built-in/separate/firing circuit/module and meter – 2 each
3. MOSFET based step up and step down choppers (Built in/ Discrete) – 1 each
4. IGBT based single phase PWM inverter module/Discrete Component – 2
5. IGBT based three phase PWM inverter module/Discrete Component – 2
6. Switched mode power converter module/Discrete Component – 2
7. SCR & TRIAC based 1 phase AC controller along with lamp or rheostat load - 2
8. Cyclo converter kit with firing module – 1
9. Dual regulated DC power supply with common ground
10. Cathode ray Oscilloscope –10
11. Isolation Transformer – 5
12. Single phase Auto transformer –3
13. Components (Inductance, Capacitance ) 3 set for each
14. Multimeter – 5
15. LCR meter – 3
16. Rheostats of various ranges – 2 sets of 10 value
17. Work tabilitys – 10
18. DC and AC meters of required ranges – 20
19. Component data sheets to be provided

EE8681

**MICROPROCESSORS AND MICROCONTROLLERS  
LABORATORY**

**L T P C  
0 0 4 2**

**OBJECTIVES:**

- To provide training on programming of microprocessors and microcontrollers and understand the interface requirements.
- To simulate various microprocessors and microcontrollers using KEIL or Equivalent simulator.

**LIST OF EXPERIMENTS**

- 1 Simple arithmetic operations: addition / subtraction / multiplication / division.
- 2 Programming with control instructions:
  - (i) Ascending / Descending order, Maximum / Minimum of numbers.
  - (ii) Programs using Rotate instructions.
  - (iii) Hex / ASCII / BCD code conversions.
- 3 Interface Experiments: with 8085
  - (i) A/D Interfacing. & D/A Interfacing.
- 4 Traffic light controller.
- 5 I/O Port / Serial communication
- 6 Programming Practices with Simulators/Emulators/open source
- 7 Read a key ,interface display
- 8 Demonstration of basic instructions with 8051 Micro controller execution, including:
  - (i) Conditional jumps & looping
  - (ii) Calling subroutines.
- 9 Programming I/O Port and timer of 8051
  - (i) study on interface with A/D & D/A
  - (ii) Study on interface with DC & AC motors
- 10 Application hardware development using embedded processors.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

- Ability to understand and apply computing platform and software for engineering problems.
- Ability to programming logics for code conversion.
- Ability to acquire knowledge on A/D and D/A.
- Ability to understand basics of serial communication.
- Ability to understand and impart knowledge in DC and AC motor interfacing.
- Ability to understand basics of software simulators.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

SI.No.	Description of Equipment	Quantity required
1.	8085 Microprocessor Trainer with Power Supply	15
2.	8051 Micro Controller Trainer Kit with power supply	15
3.	8255 Interface boards	5
4.	8251 Interface boards	5

5.	8259 Interface boards	5
6.	8279 Keyboard / Display Interface boards	5
7.	8254 timer/ counters	5
8.	ADC and DAC cards	5
9.	AC & DC motor with Controller s	5
10.	Traffic Light Control Systems	5

**EE8611**

**MINI PROJECT**

**LT P C**  
**0 0 4 2**

**OBJECTIVES:**

- To develop their own innovative prototype of ideas.
- To train the students in preparing mini project reports and examination.

The students in a group of 5 to 6 works on a topic approved by the head of the department and prepares a comprehensive mini project report after completing the work to the satisfaction. The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A mini project report is required at the end of the semester. The mini project work is evaluated based on oral presentation and the mini project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

- On Completion of the mini project work students will be in a position to take up their final year project work and find solution by formulating proper methodology.

**EE8701**

**HIGH VOLTAGE ENGINEERING**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

To impart knowledge on the following Topics

- Various types of over voltages in power system and protection methods.
- Generation of over voltages in laboratories.
- Measurement of over voltages.
- Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
- Testing of power apparatus and insulation coordination

**UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 9**

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages, Corona and its effects – Bewley lattice diagram- Protection against over voltages.

**UNIT II DIELECTRIC BREAKDOWN 9**

Properties of Dielectric materials - Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids, Maintenance of oil Quality – Breakdown mechanisms in solid and composite dielectrics- Applications of insulating materials in electrical equipments.

**UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS 9**

Generation of High DC voltage: Rectifiers, voltage multipliers, vandigrav generator: generation of high impulse voltage: single and multistage Marx circuits – generation of high AC voltages: cascaded transformers, resonant transformer and tesla coil- generation of switching surges – generation of impulse currents - Triggering and control of impulse generators.

**UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS 9**

High Resistance with series ammeter – Dividers, Resistance, Capacitance and Mixed dividers - Peak Voltmeter, Generating Voltmeters - Capacitance Voltage Transformers, Electrostatic Voltmeters – Sphere Gaps - High current shunts- Digital techniques in high voltage measurement.

**UNIT V HIGH VOLTAGE TESTING & INSULATION COORDINATION 9**

High voltage testing of electrical power apparatus as per International and Indian standards – Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers- Insulation Coordination& testing of cables.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand Transients in power system.
- Ability to understand Generation and measurement of high voltage.
- Ability to understand High voltage testing.
- Ability to understand various types of over voltages in power system.
- Ability to measure over voltages.
- Ability to test power apparatus and insulation coordination

**TEXT BOOKS:**

1. S.Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, Fifth Edition, 2013.
2. E. Kuffel and W.S. Zaengl, J.Kuffel, 'High voltage Engineering fundamentals', Newnes Second Edition Elsevier , New Delhi, 2005.
3. C.L. Wadhwa, 'High voltage Engineering', New Age International Publishers, Third Edition, 2010.

**REFERENCES**

1. L.L. Alston, 'High Voltage Technology', Oxford University Press, First Indian Edition, 2011.
2. Mazen Abdel – Salam, Hussein Anis, Ahdab A-Morshedy, Roshday Radwan, High Voltage Engineering – Theory &Practice, Second Edition Marcel Dekker, Inc., 2010.
3. Subir Ray,' An Introduction to High Voltage Engineering' PHI Learning Private Limited, New Delhi, Second Edition, 2013.



**OUTCOMES:**

- Ability to understand the day-to-day operation of electric power system.
- Ability to analyze the control actions to be implemented on the system to meet the minute-to-minute variation of system demand.
- Ability to understand the significance of power system operation and control.
- Ability to acquire knowledge on real power-frequency interaction.
- Ability to understand the reactive power-voltage interaction.
- Ability to design SCADA and its application for real time operation.

**TEXT BOOKS:**

1. Olle.I.Elgerd, 'Electric Energy Systems theory - An introduction', McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010.
2. Allen. J. Wood and Bruce F. Wollen berg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2016.
3. Abhijit Chakrabarti and Sunita Halder, 'Power System Analysis Operation and Control', PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.

**REFERENCES**

1. Kothari D.P. and Nagrath I.J., 'Power System Engineering', Tata McGraw-Hill Education, Second Edition, 2008.
2. Hadi Saadat, 'Power System Analysis', McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.
3. Kundur P., 'Power System Stability and Control, McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.

<b>EE8703</b>	<b>RENEWABLE ENERGY SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

To impart knowledge on the following Topics

- Awareness about renewable Energy Sources and technologies.
- Adequate inputs on a variety of issues in harnessing renewable Energy.
- Recognize current and possible future role of renewable energy sources.

**UNIT I RENEWABLE ENERGY (RE) SOURCES 9**

Environmental consequences of fossil fuel use, Importance of renewable sources of energy, Sustainable Design and development, Types of RE sources, Limitations of RE sources, Present Indian and international energy scenario of conventional and RE sources.

**UNIT II WIND ENERGY 9**

Power in the Wind – Types of Wind Power Plants(WPPs)–Components of WPPs-Working of WPPs- Siting of WPPs-Grid integration issues of WPPs.

**UNIT III SOLAR PV AND THERMAL SYSTEMS 9**

Solar Radiation, Radiation Measurement, Solar Thermal Power Plant, Central Receiver Power Plants, Solar Ponds.- Thermal Energy storage system with PCM- Solar Photovoltaic systems : Basic Principle of SPV conversion – Types of PV Systems- Types of Solar Cells, Photovoltaic cell concepts: Cell, module, array ,PV Module I-V Characteristics, Efficiency & Quality of the Cell, series and parallel connections, maximum power point tracking, Applications.

**UNIT IV BIOMASS ENERGY 9**

Introduction-Bio mass resources –Energy from Bio mass: conversion processes-Biomass Cogeneration-Environmental Benefits. Geothermal Energy: Basics, Direct Use, Geothermal Electricity. Mini/micro hydro power: Classification of hydropower schemes, Classification of water turbine, Turbine theory, Essential components of hydroelectric system.

**UNIT V OTHER ENERGY SOURCES 9**

Tidal Energy: Energy from the tides, Barrage and Non Barrage Tidal power systems. Wave Energy: Energy from waves, wave power devices. Ocean Thermal Energy Conversion (OTEC)- Hydrogen Production and Storage- Fuel cell : Principle of working- various types - construction and applications. Energy Storage System- Hybrid Energy Systems.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to create awareness about renewable Energy Sources and technologies.
- Ability to get adequate inputs on a variety of issues in harnessing renewable Energy.
- Ability to recognize current and possible future role of renewable energy sources.
- Ability to explain the various renewable energy resources and technologies and their applications.
- Ability to understand basics about biomass energy.
- Ability to acquire knowledge about solar energy.

**TEXT BOOKS:**

1. Joshua Earnest, Tore Wizeliu, 'Wind Power Plants and Project Development', PHI Learning Pvt.Ltd, New Delhi, 2011.
2. D.P.Kothari, K.C Singal, Rakesh Ranjan "Renewable Energy Sources and Emerging Technologies", PHI Learning Pvt.Ltd, New Delhi, 2013.
3. Scott Grinnell, "Renewable Energy & Sustainable Design", CENGAGE Learning, USA, 2016.

**REFERENCES**

1. A.K.Mukerjee and Nivedita Thakur," Photovoltaic Systems: Analysis and Design", PHI Learning Private Limited, New Delhi, 2011
2. Richard A. Dunlap," Sustainable Energy" Cengage Learning India Private Limited, Delhi, 2015.
3. Chetan Singh Solanki, " Solar Photovoltaics : Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi, 2011
4. Bradley A. Striebig,Adebayo A.Ogundipe and Maria Papadakis," Engineering Applications in Sustainable Design and Development", Cengage Learning India Private Limited, Delhi, 2016.
5. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.
6. Shobh Nath Singh, 'Non-conventional Energy resources' Pearson Education ,2015.

EE8711

**POWER SYSTEM SIMULATION LABORATORY**

L T P C  
0 0 4 2

**OBJECTIVES:**

- To provide better understanding of power system analysis through digital simulation.

**LIST OF EXPERIMENTS**

- 1 Computation of Transmission Line Parameters
- 2 Formation of Bus Admittance and Impedance Matrices and Solution of Networks
- 3 Power Flow Analysis using Gauss-Seidel Method
- 4 Power Flow Analysis using Newton Raphson Method
- 5 Symmetric and unsymmetrical fault analysis
- 6 Transient stability analysis of SMIB System
- 7 Economic Dispatch in Power Systems
- 8 Load – Frequency Dynamics of Single- Area and Two-Area Power Systems
- 9 State estimation: Weighted least square estimation
- 10 Electromagnetic Transients in Power Systems : Transmission Line Energization

**TOTAL: 60 PERIODS**

**OUTCOMES:**

Ability to

- Ability to understand power system planning and operational studies.
- Ability to acquire knowledge on Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
- Ability to analyze the power flow using GS and NR method
- Ability to find Symmetric and Unsymmetrical fault
- Ability to understand the economic dispatch.
- Ability to analyze the electromagnetic transients.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

1. Personal computers (Intel i3, 80GB, 2GBRAM) – 30 nos
2. Printer laser- 1 No.
3. Dot matrix- 1 No.
4. Server (Intel i5, 80GB, 2GBRAM) (High Speed Processor) – 1 No.
5. Software: any power system simulation software with 5 user license
6. Compilers: C, C++, VB, VC++ - 30 users

**OBJECTIVES:**

- To train the students in Renewable Energy Sources and technologies.
- To provide adequate inputs on a variety of issues in harnessing Renewable Energy.
- To recognize current and possible future role of Renewable energy sources.

**LIST OF EXPERIMENTS**

- 1 Simulation study on Solar PV Energy System.
- 2 Experiment on “VI-Characteristics and Efficiency of 1kWp Solar PV System”.
- 3 Experiment on “Shadowing effect & diode based solution in 1kWp Solar PV System”.
- 4 Experiment on Performance assessment of Grid connected and Standalone 1kWp Solar Power System.
- 5 Simulation study on Wind Energy Generator.
- 6 Experiment on Performance assessment of micro Wind Energy Generator.
- 7 Simulation study on Hybrid (Solar-Wind) Power System.
- 8 Experiment on Performance Assessment of Hybrid (Solar-Wind) Power System.
- 9 Simulation study on Hydel Power.
- 10 Experiment on Performance Assessment of 100W Fuel Cell.
- 11 Simulation study on Intelligent Controllers for Hybrid Systems.

**TOTAL: 60 PERIODS****OUTCOMES:**

- Ability to understand and analyze Renewable energy systems.
- Ability to train the students in Renewable Energy Sources and technologies.
- Ability to provide adequate inputs on a variety of issues in harnessing Renewable Energy.
- Ability to simulate the various Renewable energy sources.
- Ability to recognize current and possible future role of Renewable energy sources.
- Ability to understand basics of Intelligent Controllers.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

S.No	Name of the equipments / Components	Quantity Required	Remarks
1.	Personal computers (Intel i3, 80GB, 2GBRAM)	15	-
2.	CRO	9	30MHz
3.	Digital Multimeter	10	Digital
4.	PV panels - 100W, 24V	1	
5.	Battery storage system with charge and discharge control 40Ah	1	
6.	PV Emulator	1	
7.	Micro Wind Energy Generator module	1	

<b>Consumabilitys (Minimum of 5 Nos. each)</b>			
8.	Potentiometer	5	-
9.	Step-down transformer	5	230V/12-0-12V
10	Component data sheets to be provided		

**EE8811**

**PROJECT WORK**

**L T P C**  
**0 0 20 10**

**OBJECTIVES:**

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL: 300 PERIODS**

**OUTCOMES:**

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

**IC8651**

**ADVANCED CONTROL SYSTEM**

**L T P C**  
**2 2 0 3**

**OBJECTIVES:**

- To provide knowledge on design state feedback control and state observer.
- To provide knowledge in phase plane analysis.
- To give basic knowledge in describing function analysis.
- To study the design of optimal controller.
- To study the design of optimal estimator including Kalman Filter

**UNIT I STATE VARIABLE ANALYSIS**

**6+6**

Introduction- concepts of state variables and state model-State model for linear continuous time systems, Diagonalisation- solution of state equations- Concepts of controllability and observability.

**UNIT II STATE VARIABLE DESIGN**

**6+6**

Introduction to state model: Effect of state feedback - Pole placement design: Necessary and sufficient condition for arbitrary pole placement, State regulator design Design of state observers- Separation principle- Design of servo systems: State feedback with integral control.

**UNIT III SAMPLED DATA ANALYSIS****6+6**

Introduction spectrum analysis of sampling process signal reconstruction difference equations The Z transform function, the inverse Z transform function, response of Linear discrete system, the Z transform analysis of sampled data control systems, response between sampling instants, the Z and S domain relationship. Stability analysis and compensation techniques.

**UNIT IV NON LINEAR SYSTEMS****6+6**

Introduction, common physical nonlinearities, The phase plane method: concepts, singular points, stability of non linear systems, construction of phase trajectories system analysis by phase plane method. The describing function method, stability analysis by describing function method, Jump resonance.

**UNIT V OPTIMAL CONTROL****6+6**

Introduction: Classical control and optimization, formulation of optimal control problem, Typical optimal control performance measures - Optimal state regulator design: Lyapunov equation, Matrix Riccati equation - LQR steady state optimal control – Application examples.

**TOTAL: 60 PERIODS****OUTCOMES:**

- i. Able to design state feedback controller and state observer.
- ii. Able to understand and analyse linear and nonlinear systems using phase plane method.
- iii. Able to understand and analyse nonlinear systems using describing function method.
- iv. Able to understand and design optimal controller.
- v. Able to understand optimal estimator including Kalman Filter.
- vi. Ability to apply advanced control strategies to practical engineering problems.

**TEXT BOOKS:**

1. M.Gopal, "Digital Control and State Variable Methods", 4<sup>th</sup> edition, Mc Graw Hill India, 2012
2. K. Ogata, 'Modern Control Engineering', 5th Edition, Pearson, 2012.
3. K. P. Mohandas, "Modern Control Engineering", Sanguine Technical Publishers, 2006.

**REFERENCES:**

1. M.Gopal, Modern Control System Theory, 3<sup>rd</sup> edition, New Age International Publishers, 2014.
2. William S Levine, "Control System Fundamentals," The Control Handbook, CRC Press, Taylor and Francis Group, 2011.
3. Ashish Tewari, 'Modern Control Design with Matlab and Simulink', John Wiley, New Delhi, 2002.
4. T. Glad and L. Ljung,, "Control Theory –Multivariable and Non-Linear Methods", Taylor & Francis, 2002.
5. D.S.Naidu, "Optimal Control Systems" First Indian Reprint, CRC Press, 2009.

**EE8001****VISUAL LANGUAGES AND APPLICATIONS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:** To impart knowledge about the following topics:

- To study about the concepts of windows programming models, MFC applications, drawing with the GDI, getting inputs from Mouse and the Keyboard.
- To study the concepts of Menu basics, menu magic and classic controls of the windows programming using VC++.
- To study the concept of Document/View Architecture with single & multiple document

interface, toolbars, status bars and File I/O Serialization.

- To study about the integrated development programming event driven programming, variabilitys, constants, procedures and basic ActiveX controls in visual basic.
- To understand the database and the database management system, visual data manager, data bound controls and ADO controls in VB.

#### **UNIT I                    FUNDAMENTALS OF WINDOWS AND MFC                    9**

Messages - Windows programming - SDK style - Hungarian notation and windows data types - SDK programming in perspective. The benefits of C++ and MFC - MFC design philosophy – Document / View architecture - MFC class hierarchy - AFX functions. Application object - Frame window object - Message map. Drawing the lines – Curves – Ellipse – Polygons and other shapes. GDI pens – Brushes - GDI fonts - Deleting GDI objects and deselecting GDI objects. Getting input from the mouse: Client & Non-client - Area mouse messages - Mouse wheel - Cursor. Getting input from the keyboard: Input focus - Keystroke messages - Virtual key codes - Character & dead key messages.

#### **UNIT II                    RESOURCES AND CONTROLS                    9**

Creating a menu – Loading and displaying a menu – Responding to menu commands – Command ranges - Updating the items in menu, update ranges – Keyboard accelerators. Creating menus programmatically - Modifying menus programmatically - The system menu - Owner draw menus – Cascading menus - Context menus. The C button class – C list box class – C static class - The font view application – C edit class – C combo box class – C scrollbar class. Model dialog boxes – Modeless dialog boxes.

#### **UNIT III                    DOCUMENT / VIEW ARCHITECTURE                    9**

The in existence function revisited – Document object – View object – Frame window object – Dynamic object creation. SDI document template - Command routing. Synchronizing multiple views of a document – Mid squares application – Supporting multiple document types – Alternatives to MDI. Splitter Windows: Dynamic splitter window – Static splitter windows. Creating & initializing a toolbar - Controlling the toolbar's visibility – Creating & initializing a status bar - Creating custom status bar panes – Status bar support in appwizard. Opening, closing and creating the files - Reading & Writing – C file derivatives – Serialization basics - Writing serializability classes.

#### **UNIT IV                    FUNDAMENTALS OF VISUAL BASIC                    9**

Menu bar – Tool bar – Project explorer – Toolbox – Properties window – Form designer – Form layout – Intermediate window. Designing the user interface: Aligning the controls – Running the application – Visual development and event driven programming.

Variabilitys: Declaration – Types – Converting variability types – User defined data types - Lifetime of a variability. Constants - Arrays – Types of arrays. Procedures: Subroutines – Functions – Calling procedures. Text box controls – List box & Combo box controls – Scroll bar and slider controls – File controls.

#### **UNIT V                    DATABASE PROGRAMMING WITH VB                    9**

Record sets – Data control – Data control properties, methods. Visual data manager: Specifying indices with the visual data manager – Entering data with the visual data manager. Data bound list control – Data bound combo box – Data bound grid control. Mapping databases: Database object – Tablility def object, Query def object. Programming the active database objects – ADO object model – Establishing a connection - Executing SQL statements – Cursor types and locking mechanism – Manipulating the record set

object – Simple record editing and updating.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand and apply computing platform and software for engineering problems
- Ability to study about the concepts of windows programming models.
- Ability to study the concepts of Menu basics, menu magic and classic controls.
- Ability to study the concept of Document/View Architecture with single & multiple document interface.
- Ability to study about the integrated development programming event driven programming.
- Ability to understand the database and the database management system.

**TEXT BOOKS:**

1. Jeff Proise, 'Programming Windows With MFC', Second Edition, WP Publishers & Distributors (P) Ltd, Reprinted, 2002.
2. Evangelos Petroustos, 'Mastering Visual Basic 6.0', BPB Publications, 2002.

**REFERENCES**

1. Herbert Schildt, 'MFC Programming From the Ground Up', Second Edition, McGraw Hill, reprinted, 2002.
2. John Paul Muller, 'Visual C++ 6 From the Ground Up Second Edition', McGraw Hill, Reprinted, 2002.
3. Curtis Smith & Micheal Amundsen, 'Teach Yourself Database Programming with Visual Basic 6 in 21 days', Techmedia Pub, 1999.

<b>EE8002</b>	<b>DESIGN OF ELECTRICAL APPARATUS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:** To impart knowledge about the following topics:

- Magnetic circuit parameters and thermal rating of various types of electrical machines.
- Armature and field systems for D.C. machines.
- Core, yoke, windings and cooling systems of transformers.
- Design of stator and rotor of induction machines and synchronous machines.
- The importance of computer aided design method.

**UNIT I DESIGN OF FIELD SYSTEM AND ARMATURE 9**

Major considerations in Electrical Machine Design – Materials for Electrical apparatus – Design of Magnetic circuits – Magnetising current – Flux leakage – Leakage in Armature. Design of lap winding and wave winding.

**UNIT II DESIGN OF TRANSFORMERS 9**

Construction - KVA output for single and three phase transformers – Overall dimensions – design of yoke, core and winding for core and shell type transformers – Estimation of No load current – Temperature rise in Transformers – Design of Tank and cooling tubes of Transformers. Computer program: Complete Design of single phase core transformer

**UNIT III DESIGN OF DC MACHINES 9**

Construction - Output Equations – Main Dimensions – Choice of specific loadings – Selection of number of poles – Design of Armature – Design of commutator and brushes – design of field Computer program: Design of Armature main dimensions

**UNIT IV DESIGN OF INDUCTION MOTORS 9**

Construction - Output equation of Induction motor – Main dimensions – choice of specific loadings – Design of squirrel cage rotor and wound rotor –Magnetic leakage calculations – Operating characteristics : Magnetizing current - Short circuit current – Circle diagram - Computer program: Design of slip-ring rotor

**UNIT V DESIGN OF SYNCHRONOUS MACHINES 9**

Output equations – choice of specific loadings – Design of salient pole machines – Short circuit ratio – Armature design – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field MMF – Design of field winding – Design of turbo alternators -Computer program: Design of Stator main dimensions-Brushless DC Machines

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand basics of design considerations for rotating and static electrical machines
- Ability to design of field system for its application.
- Ability to design single and three phase transformer.
- Ability to design armature and field of DC machines.
- Ability to design stator and rotor of induction motor.
- Ability to design and analyze synchronous machines.

**TEXT BOOKS:**

1. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, Fifth Edition, 1984.
2. M V Deshpande 'Design and Testing of Electrical Machines' PHI learning Pvt Lt, 2011.
3. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, Second Edition, 2009.

**REFERENCES**

1. A.Shanmugasundaram, G.Gangadharan, R.Palani 'Electrical Machine Design Data Book', New Age International Pvt. Ltd., Reprint 2007.
2. 'Electrical Machine Design', Balbir Singh, Vikas Publishing House Private Limited, 1981.
3. V Rajini, V.S Nagarajan, 'Electrical Machine Design', Pearson, 2017.
4. K.M.Vishnumurthy 'Computer aided design of electrical machines' B S Publications, 2008

**OBJECTIVES:**

- To understand the fundamental concepts of stability of power systems and its classification.
- To expose the students to dynamic behaviour of the power system for small and large disturbances.
- To understand and enhance the stability of power systems.

**UNIT I INTRODUCTION TO STABILITY 9**

Fundamental concepts - Stability and energy of a system - Power System Stability: Definition, Causes, Nature and Effects of disturbances, Classification of stability, Modelling of electrical components - Basic assumptions made in stability studies- Modelling of Synchronous machine for stability studies(classical model) - Rotor dynamics and the swing equation.

**UNIT II SMALL-SIGNAL STABILITY 9**

Basic concepts and definitions – State space representation, Physical Interpretation of small-signal stability, Eigen properties of the state matrix: Eigenvalues and eigenvectors, modal matrices, eigenvalue and stability, mode shape and participation factor. Small-signal stability analysis of a Single-Machine Infinite Bus (SMIB) Configuration with numerical example.

**UNIT III TRANSIENT STABILITY 9**

Review of numerical integration methods: modified Euler and Fourth Order Runge-Kutta methods, Numerical stability,. Interfacing of Synchronous machine (classical machine) model to the transient stability algorithm (TSA) with partitioned – explicit approaches- Application of TSA to SMIB system.

**UNIT IV VOLTAGE STABILITY 9**

Factors affecting voltage stability- Classification of Voltage stability-Transmission system characteristics- Generator characteristics- Load characteristics- Characteristics of reactive power compensating Devices- Voltage collapse.

**UNIT V ENHANCEMENT OF SMALL-SIGNAL STABILITY AND TRANSIENT STABILITY 9**

Power System Stabilizer –. Principle behind transient stability enhancement methods: high-speed fault clearing, regulated shunt compensation, dynamic braking, reactor switching, independent pole-operation of circuit-breakers, single-pole switching, fast-valving, high-speed excitation systems.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Learners will attain knowledge about the stability of power system
- Learners will have knowledge on small-signal stability, transient stability and voltage stability.
- Learners will be able to understand the dynamic behaviour of synchronous generator for different disturbances.

- Learners will be able to understand the various methods to enhance the stability of a power system.

**TEXT BOOKS:**

1. Power system stability and control ,P. Kundur ; edited by Neal J. Balu, Mark G. Lauby, McGraw-Hill, 1994.
2. R.Ramnujam,” Power System Dynamics Analysis and Simulation, PHI Learning Private Limited, New Delhi, 2009
3. T.V. Cutsem and C.Vournas, “Voltage Stability of Electric Power Systems”, Kluwer publishers, 1998.

**REFERENCES**

1. Peter W., Saucer, Pai M.A., “Power System Dynamics and Stability, Pearson Education (Singapore), 9th Edition, 2007.
2. EW. Kimbark., “Power System Stability”, John Wiley & Sons Limited, New Jersey, 2013.
3. SB. Crary., “Power System Stability”, John Wiley & Sons Limited, New Jersey, 1955.
4. K.N. Shubhanga, “Power System Analysis” Pearson, 2017.
5. Power systems dynamics: Stability and control / K.R. Padiyar, BS Publications, 2008
6. Power system control and Stability P.M. Anderson, A.A. Foud, Iowa State University Press, 1977.

**EE8004**

**MODERN POWER CONVERTERS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:** To impart knowledge about the following topics:

- Switched mode power supplies
- Matrix Converter
- Soft switched converters

**UNIT I SWITCHED MODE POWER SUPPLIES (SMPS) 9**

DC Power supplies and Classification; Switched mode dc power supplies - with and without isolation, single and multiple outputs; Closed loop control and regulation; Design examples on converter and closed loop performance.

**UNIT II AC-DC CONVERTERS 9**

Switched mode AC-DC converters. synchronous rectification - single and three phase topologies - switching techniques - high input power factor . reduced input current harmonic distortion. improved efficiency. with and without input-output isolation. performance indices design examples

**UNIT III DC-AC CONVERTERS 9**

Multi-level Inversion - concept, classification of multilevel inverters, Principle of operation, main features and analysis of Diode clamped, Flying capacitor and cascaded multilevel inverters; Modulation schemes.

**UNIT IV AC-AC CONVERTERS WITH AND WITHOUT DC LINK 9**

Matrix converters. Basic topology of matrix converter; Commutation – current path; Modulation techniques - scalar modulation, indirect modulation; Matrix converter as only



**UNIT IV DIGITAL PRODUCTS AND LAW 9**  
Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

**UNIT V ENFORCEMENT OF IPRs 7**  
Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

**TOTAL:45 PERIODS**

**OUTCOME:**

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

**TEXT BOOKS**

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S. V. Satakar, "Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002

**REFERENCES:**

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

**RO8591**

**PRINCIPLES OF ROBOTICS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To introduce the functional elements of Robotics
- To impart knowledge on the direct and inverse kinematics
- To introduce the manipulator differential motion and control
- To educate on various path planning techniques
- To introduce the dynamics and control of manipulators

**UNIT I BASIC CONCEPTS 9**  
Brief history-Types of Robot–Technology-Robot classifications and specifications-Design and control issues- Various manipulators – Sensors - work cell - Programming languages.

**UNIT II DIRECT AND INVERSE KINEMATICS 9**  
Mathematical representation of Robots - Position and orientation – Homogeneous transformation- Various joints- Representation using the Denavit Hattenberg parameters -Degrees of freedom-Direct kinematics-Inverse kinematics- SCARA robots- Solvability – Solution methods-Closed form solution.

**UNIT III MANIPULATOR DIFFERENTIAL MOTION AND STATICS 9**  
Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance.

**UNIT IV PATH PLANNING****9**

Definition-Joint space technique-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation planning.

**UNIT V DYNAMICS AND CONTROL****9**

Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model –Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Ability to understand basic concept of robotics.
- To analyze Instrumentation systems and their applications to various
- To know about the differential motion and statics in robotics
- To know about the various path planning techniques.
- To know about the dynamics and control in robotics industries.

**TEXT BOOKS:**

1. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2005.
2. JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.
3. M.P.Groover, M.Weiss, R.N. Nageland N. G.Odrej, Industrial Robotics, McGraw-Hill Singapore, 1996.

**REFERENCES:**

1. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
2. K. K.Appu Kuttan, Robotics, I K International, 2007.
3. Edwin Wise, Applied Robotics, Cengage Learning, 2003.
4. R.D.Klafter,T.A.Chimielewski and M.Negin, Robotic Engineering–An Integrated Approach, Prentice Hall of India, New Delhi, 1994.
5. B.K.Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers,Chennai, 1998.
6. S.Ghoshal, “ Embedded Systems & Robotics” – Projects using the 8051 Microcontroller”, Cengage Learning, 2009.

**OBJECTIVES:**

To impart knowledge on the following Topics

- Construction, principle of operation, control and performance of stepping motors.
- Construction, principle of operation, control and performance of switched reluctance motors.
- Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
- Construction, principle of operation and performance of permanent magnet synchronous motors.
- Construction, principle of operation and performance of other special Machines.

**UNIT I STEPPER MOTORS****9**

Constructional features –Principle of operation –Types – Torque predictions – Linear Analysis – Characteristics – Drive circuits – Closed loop control – Concept of lead angle - Applications.

**UNIT II SWITCHED RELUCTANCE MOTORS (SRM)****9**

Constructional features –Principle of operation- Torque prediction–Characteristics Steady state performance prediction – Analytical Method – Power controllers – Control of SRM drive- Sensor less operation of SRM – Applications.

**UNIT III PERMANENT MAGNET BRUSHLESS D.C. MOTORS****9**

Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis- EMF and Torque equations- Power Converter Circuits and their controllers - Characteristics and control- Applications.

**UNIT IV PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM)****9**

Constructional features -Principle of operation – EMF and Torque equations - Sine wave motor with practical windings - Phasor diagram - Power controllers – performance characteristics -Digital controllers – Applications.

**UNIT V OTHER SPECIAL MACHINES****9**

Constructional features – Principle of operation and Characteristics of Hysteresis motor- Synchronous Reluctance Motor–Linear Induction motor-Repulsion motor- Applications.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Ability to analyze and design controllers for special Electrical Machines.
- Ability to acquire the knowledge on construction and operation of stepper motor.
- Ability to acquire the knowledge on construction and operation of stepper switched reluctance motors.
- Ability to construction, principle of operation, switched reluctance motors.
- Ability to acquire the knowledge on construction and operation of permanent magnet brushless D.C. motors.
- Ability to acquire the knowledge on construction and operation of permanent magnet synchronous motors.
- Ability to select a special Machine for a particular application.

**TEXT BOOKS:**

- K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
- T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984
- E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014.

**REFERENCES**

1. R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001.
2. T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.
3. T.J.E.Miller, 'Brushless Permanent-Magnet and Reluctance Motor Drives', Oxford University Press, 1989.
4. R.Srinivasan, 'Special Electrical Machines', Lakshmi Publications, 2013.

**EE8006****POWER QUALITY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:** To impart knowledge about the following topics:

- Causes & Mitigation techniques of various PQ events.
- Various Active & Passive power filters.

**UNIT I INTRODUCTION TO POWER QUALITY****9**

Terms and definitions & Sources – Overloading, under voltage, over voltage - Concepts of transients - Short duration variations such as interruption - Long duration variation such as sustained interruption - Sags and swells - Voltage sag - Voltage swell - Voltage imbalance – Voltage fluctuations - Power frequency variations - International standards of power quality – Computer Business Equipment Manufacturers Associations (CBEMA) curve

**UNIT II VOLTAGE SAG AND SWELL****9**

Estimating voltage sag performance - Thevenin's equivalent source - Analysis and calculation of various faulted condition - Estimation of the sag severity - Mitigation of voltage sag, Static transfer switches and fast transfer switches. - Capacitor switching – Lightning - Ferro resonance - Mitigation of voltage swell.

**UNIT III HARMONICS****9**

Harmonic sources from commercial and industrial loads - Locating harmonic sources – Power system response characteristics - Harmonics Vs transients. Effect of harmonics – Harmonic distortion - Voltage and current distortions - Harmonic indices - Inter harmonics – Resonance Harmonic distortion evaluation, IEEE and IEC standards.

**UNIT IV PASSIVE POWER COMPENSATORS****9**

Principle of Operation of Passive Shunt and Series Compensators, Analysis and Design of Passive Shunt Compensators Simulation and Performance of Passive Power Filters-Limitations of Passive Filters Parallel Resonance of Passive Filters with the Supply System

and Its Mitigation. Fundamentals of load compensation – voltage regulation & power factor correction.

**UNIT V POWER QUALITY MONITORING & CUSTOM POWER DEVICES 9**

Monitoring considerations - Monitoring and diagnostic techniques for various power quality problems - Quality measurement equipment - Harmonic / spectrum analyzer - Flicker meters Disturbance analyzer - Applications of expert systems for power quality monitoring. Principle & Working of DSTATCOM – DSTATCOM in Voltage control mode, current control mode, DVR Structure – Rectifier supported DVR – DC Capacitor supported DVR -Unified power quality conditioner.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand various sources, causes and effects of power quality issues, electrical systems and their measures and mitigation.
- Ability to analyze the causes & Mitigation techniques of various PQ events.
- Ability to study about the various Active & Passive power filters.
- Ability to understand the concepts about Voltage and current distortions, harmonics.
- Ability to analyze and design the passive filters.
- Ability to acquire knowledge on compensation techniques.
- Ability to acquire knowledge on DVR.

**TEXT BOOKS:**

1. Roger. C. Dugan, Mark. F. Mc Granagham, Surya Santoso, H.WayneBeaty, “Electrical Power Systems Quality”, McGraw Hill,2003
2. J. Arrillaga, N.R. Watson, S. Chen, “Power System Quality Assessment”, (New York : Wiley),2000.
3. Bhim Singh, Ambrish Chandra, Kamal Al-Haddad,” Power Quality Problems & Mitigation Techniques” Wiley, 2015.

**REFERENCES**

1. G.T. Heydt, “Electric Power Quality”, 2nd Edition. (West Lafayette, IN, Stars in a Circle Publications, 1994.
2. M.H.J Bollen, “Understanding Power Quality Problems: Voltage Sags and Interruptions”, (New York: IEEE Press), 2000.

**EE8007**

**EHVAC TRANSMISSION**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:** To impart knowledge about the following topics:

- EHVAC Transmission lines
- Electrostatic field of AC lines
- Corona in E.H.V. lines

**UNIT I INTRODUCTION 9**

EHVAC Transmission line trends and preliminary aspect - standard transmission voltages – Estimation at line and ground parameters-Bundle conductors: Properties -Inductance and Capacitance of EHV lines – Positive, negative and zero sequence impedance – Line Parameters for Modes of Propagation.

**UNIT II ELECTROSTATIC FIELDS 9**

Electrostatic field and voltage gradients – Calculations of electrostatic field of AC lines – Effect of high electrostatic field on biological organisms and human beings - Surface voltage gradients and Maximum gradients of actual transmission lines – Voltage gradients on sub conductor.

**UNIT III POWER CONTROL 9**

Electrostatic induction in un energized lines – Measurement of field and voltage gradients for three phase single and double circuit lines – Un energized lines. Power Frequency Voltage control and overvoltage in EHV lines: No load voltage – Charging currents at power frequency-Voltage control – Shunt and Series compensation – Static VAR compensation.

**UNIT IV CORONA EFFECTS AND RADIO INTERFERENCE 9**

Corona in EHV lines – Corona loss formulae-Charge voltage diagram- Attenuation of traveling waves due to Corona – Audio noise due to Corona, its generation, characteristic and limits. Measurements of audio noise radio interference due to Corona - properties of radio noise – Frequency spectrum of RI fields – Measurements of RI and RIV.

**UNIT V STEADY STATE AND TRANSIENT LIMITS 9**

Design of EHV lines based on steady state and transient limits - EHV cables and their characteristics-Introduction six phase transmission – UHV.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand the principles and types of EHVAC system.
- Ability to analyze the electrostatic field of AC lines
- Ability to study about the compensation.
- Ability to study about the corona in E.H.V. lines
- Ability to understand the EHV cables.
- Ability to analyze the steady state and transient limits.

**TEXT BOOKS:**

1. Rokosh Das Begamudre, "Extra High Voltage AC Transmission Engineering"– Wiley Eastern LTD., NEW DELHI 1990.
2. S. Rao, "HVAC and HVDC Transmission, Engineering and Practice" Khanna Publisher, Delhi, 1990.

**REFERENCES**

1. Subir Ray, "An Introduction to High Voltage Engineering", Prentice Hall of India Private Limited, 2013.
2. RD Begamudre, "Extra High Voltage AC Transmission Engineering"– New Academic Science Ltd; 4 edition 2011.
3. Edison," EHV Transmission line"- Electric Institution, GEC, 1968.

**OBJECTIVES:**

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To study the various analog and digital modulation techniques
- To study the principles behind information theory and coding
- To study the various digital communication techniques

**UNIT I ANALOG MODULATION****9**

Amplitude Modulation – AM, DSBSC, SSBSC, VSB – PSD, modulators and demodulators – Angle modulation – PM and FM – PSD, modulators and demodulators – Superheterodyne receivers

**UNIT II PULSE MODULATION****9**

Low pass sampling theorem – Quantization – PAM – Line coding – PCM, DPCM, DM, and ADPCM And ADM, Channel Vocoder - Time Division Multiplexing, Frequency Division Multiplexing

**UNIT III DIGITAL MODULATION AND TRANSMISSION****9**

Phase shift keying – BPSK, DPSK, QPSK – Principles of M-ary signaling M-ary PSK & QAM – Comparison, ISI – Pulse shaping – Duo binary encoding – Cosine filters – Eye pattern, equalizers

**UNIT IV INFORMATION THEORY AND CODING****9**

Measure of information – Entropy – Source coding theorem – Shannon–Fano coding, Huffman Coding, LZ Coding – Channel capacity – Shannon-Hartley law – Shannon's limit – Error control codes – Cyclic codes, Syndrome calculation – Convolution Coding, Sequential and Viterbi decoding

**UNIT V SPREAD SPECTRUM AND MULTIPLE ACCESS****9**

PN sequences – properties – m-sequence – DSSS – Processing gain, Jamming – FHSS – Synchronisation and tracking – Multiple Access – FDMA, TDMA, CDMA,

**TOTAL: 45 PERIODS****OUTCOMES:**

**At the end of the course, the student should be able to:**

- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
- Apply analog and digital communication techniques.
- Use data and pulse communication techniques.
- Analyze Source and Error control coding.

**TEXT BOOKS:**

1. H Taub, D L Schilling, G Saha, "Principles of Communication Systems" 3/e, TMH 2007
2. S. Haykin "Digital Communications" John Wiley 2005

**REFERENCES:**

1. B.P.Lathi, "Modern Digital and Analog Communication Systems", 3<sup>rd</sup> edition, Oxford University Press, 2007
2. H P Hsu, Schaum Outline Series – "Analog and Digital Communications" TMH 2006
3. B.Sklar, Digital Communications Fundamentals and Applications" 2/e Pearson Education 2007.

**OBJECTIVES:**

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

**UNIT I INTRODUCTION TO DISASTERS****9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

**UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)****9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

**UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT****9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

**UNIT IV DISASTER RISK MANAGEMENT IN INDIA****9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

**UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS****9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

**TOTAL: 45 PERIODS****OUTCOMES:**

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.

- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management.

**TEXTBOOKS:**

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerability India: A Geographical Study of Disasters, IAS and Sage Publishers, New Delhi, 2010.

**REFERENCES**

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

**GE8074**

**HUMAN RIGHTS**

**LT P C  
3 0 0 3**

**OBJECTIVES :**

- To sensitize the Engineering students to various aspects of Human Rights.

**UNIT I**

**9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

**UNIT II**

**9**

Evolution of the concept of Human Rights Magna carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

**UNIT III**

**9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

**UNIT IV**

**9**

Human Rights in India – Constitutional Provisions / Guarantees.

**UNIT V**

**9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disability persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

**TOTAL : 45 PERIODS**

**OUTCOME :**

- Engineering students will acquire the basic knowledge of human rights.

**REFERENCES:**

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

**MG8491****OPERATIONS RESEARCH**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

**UNIT I          LINEAR MODELS****15**

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

**UNIT II          TRANSPORTATION MODELS AND NETWORK MODELS****8**

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

**UNIT III          INVENTORY MODELS****6**

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

**UNIT IV          QUEUEING MODELS****6**

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

**UNIT V          DECISION MODELS****10**

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variability search technique – Dynamic Programming – Simple Problem.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students can ability to use the optimization techniques for use engineering and Business problems

**TEXT BOOK:**

1. Hillier and Libeberman, "Operations Research", Holden Day, 2005
2. Taha H.A., "Operations Research", Sixth Edition, Prentice Hall of India, 2003.

**REFERENCES:**

1. Bazara M.J., Jarvis and Sherali H., "Linear Programming and Network Flows", John Wiley, 2009.

2. Budnick F.S., "Principles of Operations Research for Management", Richard D Irwin, 1990.
3. Philip D.T. and Ravindran A., "Operations Research", John Wiley, 1992.
4. Shennoy G.V. and Srivastava U.K., "Operation Research for Management", Wiley Eastern, 1994.
5. Tulsian and Pasdey V., "Quantitative Techniques", Pearson Asia, 2002.

**MA8391**

**PROBABILITY AND STATISTICS**

**L T P C**  
**4 0 0 4**

**OBJECTIVES :**

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

**UNIT I PROBABILITY AND RANDOM VARIABLES 12**

Probability – The axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

**UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 12**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

**UNIT III TESTING OF HYPOTHESIS 12**

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

**UNIT IV DESIGN OF EXPERIMENTS 12**

One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design -  $2^2$  factorial design.

**UNIT V STATISTICAL QUALITY CONTROL 12**

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

**TOTAL : 60 PERIODS**

**OUTCOMES :**

Upon successful completion of the course, students will be able to:

- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

#### **TEXT BOOKS :**

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8<sup>th</sup> Edition, 2015.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4<sup>th</sup> Edition, 2007.

#### **REFERENCES :**

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8<sup>th</sup> Edition, 2014.
2. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4<sup>th</sup> Edition, New Delhi, 2010.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3<sup>rd</sup> Edition, Elsevier, 2004.
4. Spiegel. M.R., Schiller. J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8<sup>th</sup> Edition, 2007.

**EI8075**

**FIBRE OPTICS AND LASER INSTRUMENTS**

**LT P C  
3 0 0 3**

#### **AIM:**

To contribute to the knowledge of Fibre optics and Laser Instrumentation and its Industrial and Medical Application.

#### **COURSE OBJECTIVES**

- To expose the students to the basic concepts of optical fibres and their properties.
- To provide adequate knowledge about the Industrial applications of optical fibres.
- To expose the students to the Laser fundamentals.
- To provide adequate knowledge about Industrial application of lasers.
- To provide adequate knowledge about holography and Medical applications of Lasers.

#### **UNIT I OPTICAL FIBRES AND THEIR PROPERTIES**

**9**

Construction of optical fiber cable: Guiding mechanism in optical fiber and Basic component of optical fiber communication, –Principles of light propagation through a fibre: Total internal reflection, Acceptance angle ( $\theta_a$ ), Numerical aperture and Skew mode, –Different types of fibres and their properties: Single and multimode fibers and Step index and graded index fibers,– fibre characteristics: Mechanical characteristics and Transmission characteristics, – Absorption losses – Scattering losses – Dispersion – Connectors and splicers –Fibre termination – Optical sources: Light Emitting Diode (LED), – Optical detectors: PIN Diode.

## **UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBRES 9**

Fibre optic sensors: Types of fiber optics sensor, Intrinsic sensor- Temperature/ Pressure sensor, Extrinsic sensors, Phase Modulated Fibre Optic Sensor and Displacementsensor (Extrinsic Sensor) – Fibre optic instrumentation system: Measurement of attenuation (by cut back method), Optical domain reflectometers, Fiber Scattering loss Measurement, Fiber Absorption Measurement, Fiber dispersion measurements, End reflection method and Near field scanning techniques – Different types of modulators: Electro-optic modulator (EOM) –Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

## **UNIT III LASER FUNDAMENTALS 9**

Fundamental characteristics of lasers – Level Lasers: Two-Level Laser, Three Level Laser, Quasi Three and four level lasers – Properties of laser: Monochromaticity, Coherence, Divergence and Directionality and Brightness –Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers; – Gas lasers, solid lasers, liquid lasers and semiconductor lasers.

## **UNIT IV INDUSTRIAL APPLICATION OF LASERS 9**

Laser for measurement of distance, Laser for measurement of length, Laser for measurement of velocity, Laser for measurement of acceleration, Laser for measurement of current, voltage and Laser for measurement of Atmospheric Effect: Types of LIDAR, Construction And Working, and LIDAR Applications – Material processing: Laser instrumentation for material processing, Powder Feeder, Laser Heating, Laser Welding, Laser Melting, Conduction Limited Melting and Key Hole Melting – Laser trimming of material: Process Of Laser Trimming, Types Of Trim, Construction And Working Advantages – Material Removal and vaporization: Process Of Material Removal.

## **UNIT V HOLOGRAM AND MEDICAL APPLICATIONS 9**

Holography: Basic Principle, Holography vs. photography, Principle Of Hologram Recording, Condition For Recording A Hologram, Reconstructing and viewing the holographic image– Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser-Tissue Interactions Photochemical reactions, Thermalisation, collisional relaxation, Types of Interactions and Selecting an Interaction Mechanism – Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.

**TOTAL : 45 PERIODS**

### **COURSE OUTCOMES (COs):**

1. Understand the principle, transmission, dispersion and attenuation characteristics of optical fibers
2. Apply the gained knowledge on optical fibers for its use as communication medium and as sensor as well which have important applications in production, manufacturing industrial and biomedical applications.
3. Understand laser theory and laser generation system.
4. Students will gain ability to apply laser theory for the selection of lasers for a specific Industrial and medical application.

### **TEXT BOOKS:**

1. J.M. Senior, 'Optical Fibre Communication – Principles and Practice', Prentice Hall of India, 1985.
2. J. Wilson and J.F.B. Hawkes, 'Introduction to Opto Electronics', Prentice Hall of India, 2001.
3. Eric Udd, William B., and Spillman, Jr., "Fiber Optic Sensors: An Introduction for Engineers and Scientists ", John Wiley & Sons, 2011.

### **REFERENCES:**

1. G. Keiser, 'Optical Fibre Communication', McGraw Hill, 1995.
2. M. Arumugam, 'Optical Fibre Communication and Sensors', Anuradha Agencies, 2002.
3. John F. Ready, "Industrial Applications of Lasers", Academic Press, Digitized in 2008.

4. Monte Ross, 'Laser Applications', McGraw Hill, 1968.
5. John and Harry, "Industrial lasers and their application", McGraw-Hill, 2002.
6. Keiser, G., "Optical Fiber Communication", McGraw-Hill, 3rd Edition, 2000.  
<http://nptel.ac.in/courses/117101002/>

<b>GE8072</b>	<b>FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT</b>	<b>L T P C</b> <b>3 0 0 3</b>
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**OBJECTIVES:**

- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

**UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT 9**

**Global Trends Analysis and Product decision** - Social Trends - Technical Trends- Economical Trends - Environmental Trends - Political/Policy Trends - **Introduction to Product Development Methodologies and Management** - Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle – Product Development Planning and Management.

**UNIT II REQUIREMENTS AND SYSTEM DESIGN 9**

**Requirement Engineering** - Types of Requirements - Requirement Engineering - traceability Matrix and Analysis - Requirement Management - **System Design & Modeling** - Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design.

**UNIT III DESIGN AND TESTING 9**

**Conceptualization** - Industrial Design and User Interface Design - Introduction to Concept generation Techniques – **Challenges in Integration of Engineering Disciplines** - Concept Screening & Evaluation - **Detailed Design** - Component Design and Verification – **Mechanical, Electronics and Software Subsystems** - High Level Design/Low Level Design of S/W Program - Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing – **Prototyping** - Introduction to Rapid Prototyping and Rapid Manufacturing - **System Integration, Testing, Certification and Documentation**

**UNIT IV        SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT        9**

Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation - **Sustenance** -Maintenance and Repair – Enhancements - **Product EoL** - Obsolescence Management – Configuration Management - EoL Disposal

**UNIT V        BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY        9**

**The Industry** - Engineering Services Industry - Product Development in Industry versus Academia –**The IPD Essentials** - Introduction to Vertical Specific Product Development processes -Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and Software Systems – Product Development Trade-offs - Intellectual Property Rights and Confidentiality – Security and Configuration Management.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

**TEXTBOOKS:**

1. Book specially prepared by NASSCOM as per the MoU.
2. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2011.
3. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, 2005.

**REFERENCES:**

1. Hiriappa B, "Corporate Strategy – Managing the Business", Author House, 2013.
2. Peter F Drucker, "People and Performance", Butterworth – Heinemann [Elsevier], Oxford, 2004.
3. Vinod Kumar Garg and Venkita Krishnan N K, "Enterprise Resource Planning – Concepts", Second Edition, Prentice Hall, 2003.
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2013

<b>EE8008</b>	<b>SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:** To impart knowledge about the following topics:

- The concept of system identification and adaptive control
- Black-box approach based system identification
- Batch and recursive identification
- Computer Controlled Systems
- Design concept for adaptive control schemes

**UNIT I NON-PARAMETRIC METHODS 9**

Non-parametric methods - Transient analysis - frequency analysis - Correlation analysis - Spectral analysis - Input signal design for identification

**UNIT II PARAMETRIC METHODS 9**

Least squares estimation – Analysis of the least squares estimate - Best linear unbiased estimate – Model parameterizations - Prediction error methods.

**UNIT III RECURSIVE IDENTIFICATION METHODS 9**

The recursive least square method - Model validation –Model structure determination - Introduction to closed loop system identification.

**UNIT IV ADAPTIVE CONTROL SCHEMES 9**

Introduction – Auto-tuning of PID controller using relay feedback approach – Types of adaptive control, Gain scheduling, Model reference adaptive control, Self-tuning controller – Design of gain scheduled adaptive controller – Applications of gain scheduling.

**UNIT V MODEL-REFERENCE ADAPTIVE SYSTEM (MRAS) and SELF-TUNING REGULATOR (STR) 9**

STR – Pole placement design – Indirect STR and direct STR – MRAC - MIT rule – Lyapunov theory – Relationship between MRAC and STR.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand various system identification techniques and features of adaptive control like STR and MRAC.
- Ability to understand the concept of system identification and adaptive control
- Ability to understand about Black-box approach based system identification
- Ability to get knowledge about batch and recursive identification
- Ability to study about computer controlled systems
- Ability to design concept for adaptive control schemes

**TEXT BOOKS:**

1. T. Soderstrom and PetreStoica, System Identification, Prentice Hall International (UK) Ltd. 1989
2. Karl J. Astrom and Bjorn Witten mark, Adaptive Control, Pearson Education, Second edition, Fifth impression, 2009.

**REFERENCES**

- 1 L. Ljung, System Identification - Theory for the User, 2nd edition, PTR Prentice Hall,

- Upper Saddle River, N.J., 1999.
- 2 K. S. Narendra and A. M. Annaswamy, Stability Adaptive Systems, Prentice-Hall, 1989.
  - 3 H. K. Khalil, Nonlinear Systems, Prentice Hall, 3<sup>rd</sup> edition, 2002.
  - 4 William S. Levine, "Control Systems Advanced Methods, the Control Handbook, CRC Press 2011.
  - 5 S. Sastry and M. Bodson, Adaptive Control, Prentice-Hall, 1989

**CS8491**

**COMPUTER ARCHITECTURE**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To learn the basic structure and operations of a computer.
- To learn the arithmetic and logic unit and implementation of fixed-point and floating point arithmetic unit.
- To learn the basics of pipelined execution.
- To understand parallelism and multi-core processors.
- To understand the memory hierarchies, cache memories and virtual memories.
- To learn the different ways of communication with I/O devices.

**UNIT I BASIC STRUCTURE OF A COMPUTER SYSTEM 9**

Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing.

**UNIT II ARITHMETIC FOR COMPUTERS 9**

Addition and Subtraction – Multiplication – Division – Floating Point Representation – Floating Point Operations – Subword Parallelism

**UNIT III PROCESSOR AND CONTROL UNIT 9**

A Basic MIPS implementation – Building a Datapath – Control Implementation Scheme – Pipelining – Pipelined datapath and control – Handling Data Hazards & Control Hazards – Exceptions.

**UNIT IV PARALLELISIM 9**

Parallel processing challenges – Flynn’s classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures - Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.

**UNIT V MEMORY & I/O SYSTEMS 9**

Memory Hierarchy - memory technologies – cache memory – measuring and improving cache performance – virtual memory, TLB’s – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure – Bus operation – Arbitration – Interface circuits - USB.

**TOTAL : 45 PERIODS**

## OUTCOMES:

On Completion of the course, the students should be able to:

- Understand the basics structure of computers, operations and instructions.
- Design arithmetic and logic unit.
- Understand pipelined execution and design control unit.
- Understand parallel processing architectures.
- Understand the various memory systems and I/O communication.

## TEXT BOOKS:

1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012.

## REFERENCES

1. William Stallings, Computer Organization and Architecture – Designing for Performance, Eighth Edition, Pearson Education, 2010.
2. John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012.
3. John L. Hennessey and David A. Patterson, Computer Architecture – A Quantitative ApproachII, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.

**EE8009**

**CONTROL OF ELECTRICAL DRIVES**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:** To impart knowledge about the following topics:

- To understand the DC drive control.
- To study and analyze the Induction motor drive control.
- To study and understand the Synchronous motor drive control.
- To study and analyze the SRM and BLDC motor drive control.
- To analyze and design the Digital control for drives.

### **UNIT I CONTROL OF DC DRIVES**

**9**

Losses in electrical drive system, Energy efficient operation of drives, block diagram/ transfer function of self, separately excited DC motors --closed loop control-speed control-current control - constant torque/power operation - P, PI and PID controllers--response comparison.

### **UNIT II CONTROL OF INDUCTION MOTOR DRIVE**

**9**

VSI and CSI fed induction motor drives-principles of V/f control-closed loop variable frequency PWM inverter with dynamic braking- static Scherbius drives- power factor considerations-- modified Kramer drives-principle of vector control- implementation-block diagram, Design of closed loop operation of V/f control of Induction motor drive systems.

### **UNIT III CONTROL OF SYNCHRONOUS MOTOR DRIVES**

**9**

Open loop VSI fed drive and its characteristics--Self control--Torque control --Torque angle

control –Power factor control–Brushless excitation systems—Field oriented control – Design of closed loop operation of Self control of Synchronous motor drive systems.

**UNIT IV CONTROL OF SRM AND BLDC MOTOR DRIVES 9**

SRM construction - Principle of operation - SRM drive design factors-Torque controlled SRM- Block diagram of Instantaneous Torque control using current controllers and flux controllers. Construction and Principle of operation of BLDC Machine -Sensing and logic switching scheme,-Sinusoidal and trapezoidal type of Brushless dc motors – Block diagram of current controlled Brushless dc motor drive.

**UNIT V DIGITAL CONTROL OF DC DRIVE 9**

Phase Locked Loop and micro-computer control of DC drives–Program flow chart for constant constant torque and constant horse power operations Speed detection and current sensing circuits and feedback elements.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand various control strategies and controllers for AC and DC Motor Drive systems.

**TEXT BOOKS:**

1. Dubey, G.K, Power semiconductor controlled devices, Prentice Hall International New jersey, 1989.
2. R.Krishnan,, Electric Motor Drives - Modeling, Analysis and ControlPrentice- Hall of India Pvt. Ltd., New Delhi, 2003.
3. Murphy, J.M.D, Turnbull F.G, Thyristor control of AC motors,, Pergamon press, Oxford, 1988.

**REFERENCES**

1. Bin Wu, High-Power Converters and AC Drives, Wiley-IEEE Press
2. Buxbaum, A.Schierau, and K.Staugen, A design of control systems for DC drives, Springer-Verlag, Berlin, 1990.
3. Bimal K. Bose, Modern Power Electronics and AC Drives, Pearson Education (Singapore) Pte. Ltd., New Delhi, 2003.
4. R. Krishnan, Switched Reluctance Motor Drives: Modeling, Simulation, Analysis, Design, and Applications, CRC press, 2001.
5. Werner Leonhard, Control of Electrical Drives, 3rd Edition, Springer, Sept., 2001.
6. R. Krishnan, Permanent Magnet Synchronous and Brushless DC Motor Drives, CRC press, 2001.

**EC8095**

**VLSI DESIGN**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- Study the fundamentals of CMOS circuits and its characteristics.
- Learn the design and realization of combinational & sequential digital circuits.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed
- Learn the different FPGA architectures and testability of VLSI circuits.

**UNIT I INTRODUCTION TO MOS TRANSISTOR 9**

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V Characteristics, C-V Characteristics, Nonideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

**UNIT II COMBINATIONAL MOS LOGIC CIRCUITS 9**

**Circuit Families:** Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls.

**Power:** Dynamic Power, Static Power, Low Power Architecture.

**UNIT III SEQUENTIAL CIRCUIT DESIGN 9**

Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostability Sequential Circuits, Astability Sequential Circuits.

**Timing Issues :** Timing Classification Of Digital System, Synchronous Design.

**UNIT IV DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM 9**

**Arithmetic Building Blocks:** Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.

**Designing Memory and Array structures:** Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.

**UNIT V IMPLEMENTATION STRATEGIES AND TESTING 9**

FPGA Building Block Architectures, FPGA Interconnect Routing Procedures.

Design for Testability: *Ad Hoc* Testing, Scan Design, BIST, IDDQ Testing, Design for Manufacturability, Boundary Scan.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**UPON COMPLETION OF THE COURSE, STUDENTS SHOULD ABILITY TO**

- Realize the concepts of digital building blocks using MOS transistor.
- Design combinational MOS circuits and power strategies.
- Design and construct Sequential Circuits and Timing systems.
- Design arithmetic building blocks and memory subsystems.
- Apply and implement FPGA design flow and testing.

**TEXT BOOKS:**

1. Neil H.E. Weste, David Money Harris "CMOS VLSI Design: A Circuits and Systems Perspective", 4<sup>th</sup> Edition, Pearson , 2017.(UNIT I,II,V)
2. Jan M. Rabaey ,Anantha Chandrakasan, Borivoje. Nikolic, "Digital Integrated Circuits:A Design perspective", Second Edition , Pearson , 2016.(UNIT III,IV)

**REFERENCES**

1. M.J. Smith, "Application Specific Integrated Circuits", Addison Wesley, 1997

2. Sung-Mo kang, Yusuf leblebici, Chulwoo Kim “CMOS Digital Integrated Circuits:Analysis & Design”,4<sup>th</sup> edition McGraw Hill Education,2013
3. Wayne Wolf, “Modern VLSI Design: System On Chip”, Pearson Education, 2007
4. R.Jacob Baker, Harry W.LI., David E.Boyee, “CMOS Circuit Design, Layout and Simulation”, Prentice Hall of India 2005.

**EE8010**

**POWER SYSTEMS TRANSIENTS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:** To impart knowledge about the following topics:

- Generation of switching transients and their control using circuit – theoretical concept.
- Mechanism of lighting strokes and the production of lighting surges.
- Propagation, reflection and refraction of travelling waves.
- Voltage transients caused by faults, circuit breaker action, load rejection on integrated power system.

**UNIT I INTRODUCTION AND SURVEY 9**

Review and importance of the study of transients - causes for transients. RL circuit transient with sine wave excitation - double frequency transients - basic transforms of the RLC circuit transients. Different types of power system transients - effect of transients on power systems – role of the study of transients in system planning.

**UNIT II SWITCHING TRANSIENTS 9**

Over voltages due to switching transients - resistance switching and the equivalent circuit for interrupting the resistor current - load switching and equivalent circuit - waveforms for transient voltage across the load and the switch - normal and abnormal switching transients. Current suppression - current chopping - effective equivalent circuit. Capacitance switching - effect of source regulation - capacitance switching with a restrike, with multiple restrikes. Illustration for multiple restriking transients - ferro resonance.

**UNIT III LIGHTNING TRANSIENTS 9**

Review of the theories in the formation of clouds and charge formation - rate of charging of thunder clouds – mechanism of lightning discharges and characteristics of lightning strokes – model for lightning stroke - factors contributing to good line design - protection using ground wires - tower footing resistance - Interaction between lightning and power system.

**UNIT IV TRAVELING WAVES ON TRANSMISSION LINE COMPUTATION OF TRANSIENTS 9**

Computation of transients - transient response of systems with series and shunt lumped parameters and distributed lines. Traveling wave concept - step response - Bewely’s lattice diagram - standing waves and natural frequencies - reflection and refraction of travelling waves.

**UNIT V TRANSIENTS IN INTEGRATED POWER SYSTEM 9**

The short line and kilometric fault - distribution of voltages in a power system - Line dropping and load rejection - voltage transients on closing and reclosing lines - over

voltage induced by faults -switching surges on integrated system Qualitative application of EMTP for transient computation.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand and analyze switching and lightning transients.
- Ability to acquire knowledge on generation of switching transients and their control.
- Ability to analyze the mechanism of lightning strokes.
- Ability to understand the importance of propagation, reflection and refraction of travelling waves.
- Ability to find the voltage transients caused by faults.
- Ability to understand the concept of circuit breaker action, load rejection on integrated power system.

**TEXT BOOKS:**

1. Allan Greenwood, 'Electrical Transients in Power Systems', Wiley Inter Science, New York, 2<sup>nd</sup> Edition, 1991.
2. Pritindra Chowdhari, "Electromagnetic transients in Power System", John Wiley and Sons Inc., Second Edition, 2009.
3. C.S. Indulkar, D.P.Kothari, K. Ramalingam, 'Power System Transients – A statistical approach', PHI Learning Private Limited, Second Edition, 2010.

**REFERENCES**

1. M.S.Naidu and V.Kamaraju, 'High Voltage Engineering', McGraw Hill, Fifth Edition, 2013.
2. R.D. Begamudre, 'Extra High Voltage AC Transmission Engineering', Wiley Eastern Limited, 1986.
3. Y.Hase, Handbook of Power System Engineering," Wiley India, 2012.
4. J.L.Kirtley, "Electric Power Principles, Sources, Conversion, Distribution and use," Wiley, 2012.
5. Akihiro ametani," Power System Transient theory and applications", CRC press, 2013.

**GE8077**

**TOTAL QUALITY MANAGEMENT**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

- To facilitate the understanding of Quality Management principles and process.

**UNIT I INTRODUCTION**

**9**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

**UNIT II TQM PRINCIPLES**

**9**

Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

**UNIT III TQM TOOLS AND TECHNIQUES I 9**  
 The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

**UNIT IV TQM TOOLS AND TECHNIQUES II 9**  
 Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

**UNIT V QUALITY MANAGEMENT SYSTEM 9**  
 Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--**ENVIRONMENTAL MANAGEMENT SYSTEM:** Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

**TEXT BOOK:**

1. Dale H.Besterfield, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

**REFERENCES:**

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8<sup>th</sup> Edition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. ISO9001-2015 standards

<b>EE8011</b>	<b>FLEXIBLE AC TRANSMISSION SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:** To impart knowledge about the following topics:

- The start-of-art of the power system
- Performance of power systems with FACTS controllers.
- FACTS controllers for load flow and dynamic analysis

**UNIT I INTRODUCTION 9**  
 Real and reactive power control in electrical power transmission lines—loads & system compensation-Uncompensated transmission line—shunt and series compensation.

**UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS 9**  
 Voltage control by SVC—Advantages of slope in dynamic characteristics—Influence of SVC on system voltage—Design of SVC voltage regulator—TCR-FC-TCR-Modeling of SVC for power flow and fast transient stability— Applications: Enhancement of transient stability –

Steady state power transfer –Enhancement of power system damping.

**UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS 9**

Operation of the TCSC–Different modes of operation–Modelling of TCSC, Variability reactance model– Modelling for Power Flow and stability studies. Applications: Improvement of the system stability limit–Enhancement of system damping.

**UNIT IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS 9**

Static Synchronous Compensator (STATCOM)–Principle of operation–V-I Characteristics. Applications: Steady state power transfer-enhancement of transient stability-prevention of voltage instability. SSSC-operation of SSSC and the control of power flow–modelling of SSSC in load flow and transient stability studies- Dynamic voltage restorer(DVR).

**UNIT V ADVANCED FACTS CONTROLLERS 9**

Interline DVR(IDVR) - Unified Power flow controller (UPFC) - Interline power flow controller (IPFC) - Unified Power quality conditioner (UPQC).

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand, analyze and develop analytical model of FACTS controller for power system application.
- Ability to understand the concepts about load compensation techniques.
- Ability to acquire knowledge on facts devices.
- Ability to understand the start-of-art of the power system
- Ability to analyze the performance of steady state and transients of facts controllers.
- Ability to study about advanced FACTS controllers.

**TEXT BOOKS:**

1. R.Mohan Mathur, Rajiv K.Varma,“Thyristor–Based Facts Controllers for Electrical Transmission Systems”, IEEE press and JohnWiley&Sons,Inc,2002.
2. NarainG. Hingorani, “Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems”, Standard Publishers Distributors,Delhi-110006,2011.
3. T.J.E Miller, Power Electronics in power systems, John Wiley and sons.

**REFERENCES**

1. K.R. Padiyar, ”FACTS Controllers in Power Transmission and Distribution”, New Age International (P) Limited, Publishers, New Delhi, 2008
2. A.T.John,“FlexibleA.C.TransmissionSystems”,InstitutionofElectricalandElectronic Engineers(IEEE), 1999.
3. V.K.Sood, HVDC and FACTS controllers–Applications of Static Converters in Power System, APRIL2004,KluwerAcademic Publishers,2004.



- Cliffs, N.J., 1992
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill Inc., 2000.

## REFERENCES

1. Goldberg, "Genetic Algorithm in Search, Optimization and Machine learning", Addison Wesley Publishing Company Inc. 1989
2. Millon W.T., Sutton R.S. and Webrose P.J., "Neural Networks for Control", MIT press, 1992
3. Ethem Alpaydin, "Introduction to Machine learning (Adaptive Computation and Machine Learning series)", MIT Press, Second Edition, 2010.
4. Zhang Huaguang and Liu Derong, "Fuzzy Modeling and Fuzzy Control Series: Control Engineering", 2006

**EE8013**

**POWER SYSTEMS DYNAMICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:** To impart knowledge about the following topics:

- Basics of dynamics and stability problems
- Modeling of synchronous machines
- Excitation system and speed-governing controllers.
- Small signal stability of a single-machine infinite bus system with excitation system and power system stabilizer.
- Transient stability simulation of multi machine power system.

### **UNIT I INTRODUCTION**

**9**

Basics of system dynamics – numerical techniques – introduction to software packages to study the responses. Concept and importance of power system stability in the operation and design - distinction between transient and dynamic stability - complexity of stability problem in large system – necessity for reduced models - stability of interconnected systems.

### **UNIT II SYNCHRONOUS MACHINE MODELLING**

**9**

Synchronous machine - flux linkage equations - Park's transformation - per unit conversion - normalizing the equations - equivalent circuit - current space model - flux linkage state space model. Sub-transient and transient inductances - time constants. Simplified models (one axis and constant flux linkage) - steady state equations and phasor diagrams.

### **UNIT III MACHINE CONTROLLERS**

**9**

Exciter and voltage regulators - function and types of excitation systems - typical excitation system configuration - block diagram and state space representation of IEEE type 1 excitation system - saturation function - stabilizing circuit. Function of speed governing systems - block diagram and state space representation of IEEE mechanical hydraulic governor and electrical hydraulic governors for hydro turbines and steam turbines.

**UNIT IV      TRANSIENT STABILITY****9**

State equation for multi machine system with one axis model and simulation – modelling of multi machine power system with one axis machine model including excitation system and speed governing system and simulation using R-K method of fourth order (Gill's technique) for transient stability analysis - power system stabilizer. For all simulations, the algorithm and flow chart have to be discussed.

**UNIT V      DYNAMIC STABILITY****9**

System response to small disturbances - linear model of the unregulated synchronous machine and its modes of oscillation - regulated synchronous machine - distribution of power impact - linearization of the load equation for the one machine problem – simplified linear model - effect of excitation on dynamic stability - approximate system representation - supplementary stabilizing signals - dynamic performance measure - small signal performance measures.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Ability to understand and analyze power system operation, stability, control and protection.
- Ability to get knowledge on the basics of dynamics and stability problems
- Ability to design and modelling of synchronous machines
- Ability to study about excitation system and speed-governing controllers.
- Ability to understand the concept of small signal stability of a single-machine infinite bus system with excitation system.
- Ability to analyze the transient stability simulation.

**TEXT BOOKS:**

1. P.M. Anderson and A.A.Fouad, 'Power System Control and Stability', Galgotia Publications, New Delhi, 2003.
2. P. Kundur, 'Power System Stability and Control', McGraw Hill Inc., USA, 1994.
3. R.Ramanujam, "Power System Dynamics – Analysis and Simulation", PHI, 2009.

**REFERENCES**

1. M.A.Pai and W.Sauer, 'Power System Dynamics and Stability', Pearson Education Asia, India, 2002.
2. James A.Momoh, Mohamed. E. El-Hawary. " Electric Systems, Dynamics and Stability with Artificial Intelligence applications", Marcel Dekker, USA First Edition, 2000.
3. C.A.Gross, "Power System Analysis," Wiley India, 2011.
4. B.M.Weedy, B.J.Lory, N.Jenkins, J.B.Ekanayake and G.Strbac," Electric Power Systems", Wiley India, 2013.
5. K.Umarao, "Computer Techniques and Models in Power System," I.K. International, 2007.

**OBJECTIVES:** To impart knowledge about the following topics:

- Modern power electronic converters and its applications in electric power utility.
- Resonant converters and UPS

**UNIT I DC-DC CONVERTERS 9**

Principles of step down and step up converters – Analysis and state space modeling of Buck, Boost, Buck- Boost and Cuk converters.

**UNIT II SWITCHED MODE POWER CONVERTERS 9**

Analysis and state space modeling of fly back, Forward, Push pull, Luo, Half bridge and full bridge converters- control circuits and PWM techniques.

**UNIT III RESONANT CONVERTERS 9**

Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS , Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control.

**UNIT IV DC-AC CONVERTERS 9**

Single phase and three phase inverters, control using various (sine PWM, SVPWM and PSPWM) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.

**UNIT V POWER CONDITIONERS, UPS & FILTERS 9**

Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to analyze the state space model for DC – DC converters
- Ability to acquire knowledge on switched mode power converters.
- Ability to understand the importance of Resonant Converters.
- Ability to analyze the PWM techniques for DC-AC converters
- Ability to acquire knowledge on modern power electronic converters and its applications in electric power utility.
- Ability to acquire knowledge on filters and UPS

**TEXT BOOKS:**

1. Simon Ang, Alejandro Oliva, " Power-Switching Converters", Third Edition, CRC Press, 2010.
2. KjeldThorborg, "Power Electronics – In theory and Practice", Overseas Press, First Indian Edition 2005.
3. M.H. Rashid – Power Electronics handbook, Elsevier Publication, 2001.

**REFERENCES**

1. Philip T Krein, " Elements of Power Electronics", Oxford University Press
2. Ned Mohan, Tore.M.Undeland, William.P.Robbins, Power Electronics converters, Applications and design- Third Edition- John Wiley and Sons- 2006

3. M.H. Rashid – Power Electronics circuits, devices and applications- third edition Prentice Hall of India New Delhi, 2007.
4. Erickson, Robert W, “Fundamentals of Power Electronics”, Springer, second edition, 2010.

<b>EE8015</b>	<b>ELECTRIC ENERGY GENERATION, UTILIZATION AND CONSERVATION</b>	<b>L</b> <b>3</b>	<b>T</b> <b>0</b>	<b>P</b> <b>0</b>	<b>C</b> <b>3</b>
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**OBJECTIVES:**

To impart knowledge on the following Topics

- To study the generation, conservation of electrical power and energy efficient equipments.
- To understand the principle, design of illumination systems and energy efficiency lamps.
- To study the methods of industrial heating and welding.
- To understand the electric traction systems and their performance.

**UNIT I ILLUMINATION 9**

Importance of lighting – properties of good lighting scheme – laws of illumination – photometry - types of lamps – lighting calculations – basic design of illumination schemes for residential, commercial, street lighting, factory lighting and flood lighting – LED lighting and energy efficient lamps.

**UNIT II REFRIGERATION AND AIR CONDITIONING 9**

Refrigeration-Domestic refrigerator and water coolers - Air-Conditioning-Variou types of air-conditioning system and their applications, smart air conditioning units - Energy Efficient motors: Standard motor efficiency, need for efficient motors, Motor life cycle, Direct Savings and payback analysis, efficiency evaluation factor.

**UNIT III HEATING AND WELDING 9**

Role of electric heating for industrial applications – resistance heating – induction heating – dielectric heating - electric arc furnaces. Brief introduction to electric welding – welding generator, welding transformer and the characteristics.

**UNIT IV TRACTION 9**

Merits of electric traction – requirements of electric traction system – supply systems – mechanics of train movement – traction motors and control – braking – recent trends in electric traction.

**UNIT V DOMESTIC UTILIZATION OF ELECTRICAL ENERGY 9**

Domestic utilization of electrical energy – House wiring. Induction based appliances, Online and OFF line UPS, Batteries - Power quality aspects – nonlinear and domestic loads – Earthing – Domestic, Industrial and Substation.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- To understand the main aspects of generation, utilization and conservation.
- To identify an appropriate method of heating for any particular industrial application.
- To evaluate domestic wiring connection and debug any faults occurred.
- To construct an electric connection for any domestic appliance like refrigerator as well as to design a battery charging circuit for a specific household application.
- To realize the appropriate type of electric supply system as well as to evaluate the

performance of a traction unit.

- To understand the main aspects of Traction.

#### **TEXT BOOKS:**

1. Wadhwa, C.L. "Generation, Distribution and Utilization of Electrical Energy", New Age International Pvt. Ltd, 2003.
2. Dr. Uppal S.L. and Prof. S. Rao, 'Electrical Power Systems', Khanna Publishers, New Delhi, 15th Edition, 2014.
3. Energy Efficiency in Electric Utilities, BEE Guide Book, 2010

#### **REFERENCES**

1. Partab.H, "Art and Science of Utilisation of Electrical Energy", Dhanpat Rai and Co, New Delhi, 2004.
2. Openshaw Taylor.E, "Utilization of Electrical Energy in SI Units", Orient Longman Pvt. Ltd, 2003.
3. Gupta.J.B, "Utilization of Electric Power and Electric Traction", S.K.Kataria and Sons, 2002.
4. Cleaner Production – Energy Efficiency Manual for GERIAP, UNEP, Bangkok prepared by National Productivity Council.

**GE8076**

### **PROFESSIONAL ETHICS IN ENGINEERING**

**LT P C  
3 0 0 3**

#### **OBJECTIVES:**

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

#### **UNIT I HUMAN VALUES**

**10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

#### **UNIT II ENGINEERING ETHICS**

**9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

#### **UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION**

**9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

#### **UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS**

**9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

**UNIT V GLOBAL ISSUES****8**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

**TEXT BOOKS:**

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

**REFERENCES:**

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd., New Delhi, 2013.
6. World Community Service Centre, ' Value Education', Vethathiri publications, Erode, 2011.

**Web sources:**

1. [www.onlineethics.org](http://www.onlineethics.org)
2. [www.nspe.org](http://www.nspe.org)
3. [www.globalethics.org](http://www.globalethics.org)
4. [www.ethics.org](http://www.ethics.org)

**MG8591****PRINCIPLES OF MANAGEMENT****L T P C  
3 0 0 3****OBJECTIVES:**

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.

**UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS****9**

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

**UNIT II PLANNING****9**

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

**UNIT III ORGANISING****9**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

**UNIT IV DIRECTING****9**

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

**UNIT V CONTROLLING****9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have some basic knowledge on international aspect of management

**TEXT BOOKS:**

1. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, 6th Edition, Pearson Education, 2004.
2. Stephen P. Robbins & Mary Coulter, “Management”, Prentice Hall (India) Pvt. Ltd., 10<sup>th</sup> Edition, 2009.

**REFERENCES:**

1. Harold Koontz & Heinz Weihrich, “Essentials of Management”, Tata McGraw Hill, 1998.
2. Robert Kreitner & Mamata Mohapatra, “Management”, Biztantra, 2008.
3. Stephen A. Robbins & David A. Decenzo & Mary Coulter, “Fundamentals of Management”, 7<sup>th</sup> Edition, Pearson Education, 2011.
4. Tripathy PC & Reddy PN, “Principles of Management”, Tata McGraw Hill, 1999

**EE8016**

**ENERGY MANAGEMENT AND AUDITING**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:** To impart knowledge about the following topics:

- To impart concepts behind economic analysis and Load management.
- Energy management on various electrical equipments and metering.
- Concept of lighting systems and cogeneration.

**UNIT I INTRODUCTION 9**

Basics of Energy – Need for energy management – Energy accounting - Energy monitoring, targeting and reporting - Energy audit process.

**UNIT II ENERGY MANAGEMENT FOR MOTORS AND COGENERATION 9**

Energy management for electric motors – Transformer and reactors - Capacitors and synchronous machines, energy management by cogeneration – Forms of cogeneration – Feasibility of cogeneration – Electrical interconnection.

**UNIT III LIGHTING SYSTEMS 9**

Energy management in lighting systems – Task and the working space - Light sources – Ballasts – Lighting controls – Optimizing lighting energy – Power factor and effect of harmonics, lighting and energy standards.

**UNIT IV METERING FOR ENERGY MANAGEMENT 9**

Metering for energy management – Units of measure - Utility meters – Demand meters – Paralleling of current transformers – Instrument transformer burdens – Multi tasking solid state meters, metering location vs requirements, metering techniques and practical examples.

**UNIT V ECONOMIC ANALYSIS AND MODELS 9**

Economic analysis – Economic models - Time value of money - Utility rate structures – Cost of electricity – Loss evaluation, load management – Demand control techniques – Utility monitoring and control system – HVAC and energy management – Economic justification.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand the basics of Energy audit process.
- Ability to understand the basics of energy management by cogeneration
- Ability to acquire knowledge on Energy management in lighting systems
- Ability to impart concepts behind economic analysis and Load management.
- Ability to understand the importance of Energy management on various electrical equipment and metering.
- Ability to acquire knowledge on HVAC.

**TEXT BOOKS:**

1. Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, Guide to Energy Management, Fifth Edition, The Fairmont Press, Inc., 2006
2. Eastop T.D & Croft D.R, Energy Efficiency for Engineers and Technologists,.Logman Scientific & Technical, ISBN-0-582-03184 , 1990.

## REFERENCES

1. Reay D.A, Industrial Energy Conservation, 1<sup>st</sup> edition, Pergamon Press, 1977.
2. IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities, IEEE, 196.
3. Amit K. Tyagi, Handbook on Energy Audits and Management, TERI, 2003.
4. Electricity in buildings good practice guide, McGraw-Hill Education, 2016.
5. National Productivity Council Guide Books

**CS8391**

**DATA STRUCTURES**

**LT P C  
3 0 0 3**

### OBJECTIVES:

- To understand the concepts of ADTs
- To Learn linear data structures – lists, stacks, and queues
- To understand sorting, searching and hashing algorithms
- To apply Tree and Graph structures

### UNIT I      **LINEAR DATA STRUCTURES – LIST**

**9**

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation – singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

### UNIT II      **LINEAR DATA STRUCTURES – STACKS, QUEUES**

**9**

Stack ADT – Operations - Applications - Evaluating arithmetic expressions- Conversion of Infix to postfix expression - Queue ADT – Operations - Circular Queue – Priority Queue - deQueue – applications of queues.

### UNIT III      **NON LINEAR DATA STRUCTURES – TREES**

**9**

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree - B+ Tree - Heap – Applications of heap.

### UNIT IV      **NON LINEAR DATA STRUCTURES - GRAPHS**

**9**

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Applications of graphs.

### UNIT V      **SEARCHING, SORTING AND HASHING TECHNIQUES**

**9**

Searching- Linear Search - Binary Search. Sorting - Bubble sort - Selection sort - Insertion sort - Shell sort – Radix sort. Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

**TOTAL: 45 PERIODS**

### OUTCOMES:

**At the end of the course, the student should be able to:**

- Implement abstract data types for linear data structures.
- Apply the different linear and non-linear data structures to problem solutions.
- Critically analyze the various sorting algorithms.

**TEXT BOOKS:**

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 1997.
2. Reema Thareja, "Data Structures Using C", Second Edition, Oxford University Press, 2011

**REFERENCES:**

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, McGraw Hill, 2002.
2. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education, 1983.
3. Stephen G. Kochan, "Programming in C", 3rd edition, Pearson Education.
4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008

<b>EE8017</b>	<b>HIGH VOLTAGE DIRECT CURRENT TRANSMISSION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:** To impart knowledge about the following topics:

- Planning of DC power transmission and comparison with AC power transmission.
- HVDC converters.
- HVDC system control.
- Harmonics and design of filters.
- Power flow in HVDC system under steady state.

**UNIT I INTRODUCTION 9**

DC Power transmission technology–Comparison of AC and DC transmission–Application of DC transmission–Description of DC transmission system–Planning for HVDC transmission–Modern trends in HVDC technology–DC breakers–Operating problems–HVDC transmission based on VSC –Types and applications of MTDC systems.

**UNIT II ANALYSIS OF HVDC CONVERTERS 9**

Line commutated converter -Analysis of Graetz circuit with and without overlap -Pulse number– Choice of converter configuration – Converter bridge characteristics– Analysis of a 12 pulse converters– Analysis of VSC topologies and firing schemes.

**UNIT III CONVERTER AND HVDC SYSTEM CONTROL 9**

Principles of DC link control–Converter control characteristics–System control hierarchy–Firing angle control– Current and extinction angle control–Starting and stopping of DC link –Power control –Higher level controllers –Control of VSC based HVDC link.

**UNIT IV REACTIVE POWER AND HARMONICS CONTROL 9**

Reactive power requirements in steady state–Sources of reactive power–SVC and STATCOM– Generation of harmonics –Design of AC and DC filters– Active filters.

**UNIT V POWER FLOW ANALYSIS IN AC/DC SYSTEMS 9**

Per unit system for DC quantities–DC system model –Inclusion of constraints –Power flow analysis –case study

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand the principles and types of HVDC system.
- Ability to analyze and understand the concepts of HVDC converters.
- Ability to acquire knowledge on DC link control.
- Ability to understand the concepts of reactive power management, harmonics and power flow analysis.
- Ability to get knowledge about Planning of DC power transmission and comparison with AC power transmission.
- Ability to understand the importance of power flow in HVDC system under steady state.

**TEXT BOOKS:**

1. Padiyar,K.R.,“HVDC power transmission system”, New Age International(P)Ltd. NewDelhi, Second Edition,2010.
2. Arrillaga,J.,“High Voltage Direct Current Transmission”, Peter Pregrinus, London,1983.

**REFERENCES**

1. Kundur P.,“ Power System Stability and Control”, McGraw-Hill,1993.
2. Colin Adamson and Hingorani NG,“ High Voltage Direct Current Power Transmission”, Garraway Limited, London, 1960.
3. Edward Wilson Kimbark,“ Direct Current Transmission”, Vol.I, Wiley inter science, New York, London, Sydney,1971.

<b>EE8018</b>	<b>MICROCONTROLLER BASED SYSTEM DESIGN</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:** To impart knowledge about the following topics:

- Architecture of PIC microcontroller
- Interrupts and timers
- Peripheral devices for data communication and transfer
- Functional blocks of ARM processor
- Architecture of ARM processors

**UNIT I INTRODUCTION TO PIC MICROCONTROLLER 9**

Introduction to PIC Microcontroller–PIC 16C6x and PIC16C7x Architecture–IC16cxx– Pipelining - Program Memory considerations – Register File Structure - Instruction Set - Addressing modes – Simple Operations.

**UNIT II INTERRUPTS AND TIMER 9**

PIC micro controller Interrupts- External Interrupts-Interrupt Programming–Loop time subroutine Timers-Timer Programming– Front panel I/O-Soft Keys– State machines and key switches– Display of Constant and Variability strings.

**UNIT III PERIPHERALS AND INTERFACING 9**

I<sup>2</sup>C Bus for Peripherals Chip Access– Bus operation-Bus subroutines– Serial EEPROM– Analog to Digital Converter–UART-Baud rate selection–Data handling circuit–Initialization -

LCD and keyboard Interfacing -ADC, DAC, and Sensor Interfacing.

**UNIT IV INTRODUCTION TO ARM PROCESSOR 9**

Architecture –ARM programmer’s model –ARM Development tools- Memory Hierarchy – ARM Assembly Language Programming–Simple Examples–Architectural Support for Operating systems.

**UNIT V ARM ORGANIZATION 9**

3-Stage Pipeline ARM Organization– 5-Stage Pipeline ARM Organization–ARM Instruction Execution- ARM Implementation– ARM Instruction Set– ARM coprocessor interface– Architectural support for High Level Languages – Embedded ARM Applications.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand and apply computing platform and software for engineering problems.
- Ability to understand the concepts of Architecture of PIC microcontroller
- Ability to acquire knowledge on Interrupts and timers.
- Ability to understand the importance of Peripheral devices for data communication.
- Ability to understand the basics of sensor interfacing
- Ability to acquire knowledge in Architecture of ARM processors

**TEXT BOOKS:**

1. Peatman,J.B., “Design with PIC Micro Controllers”PearsonEducation,3<sup>rd</sup>Edition, 2004.
2. Furber,S., “ARM System on Chip Architecture” Addison Wesley trade Computer Publication, 2000.

**REFERENCES**

1. Mazidi, M.A.,“PIC Microcontroller” Rollin Mckinlay, Danny causey ,Prentice Hall of India, 2007.

**EE8019**

**SMART GRID**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:** To impart knowledge about the following topics:

- Smart Grid technologies, different smart meters and advanced metering infrastructure.
- The power quality management issues in Smart Grid.
- The high performance computing for Smart Grid applications

**UNIT I INTRODUCTION TO SMART GRID 9**

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid.

**UNIT II SMART GRID TECHNOLOGIES 9**

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plugin Hybrid Electric Vehicles(PHEV).

**UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE 9**

Introduction to Smart Meters, Advanced Metering Infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit (PMU), Intelligent Electronic Devices (IED) & their application for monitoring & protection.

**UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID 9**

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

**UNIT V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS 9**

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broad band over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Learners will develop more understanding on the concepts of Smart Grid and its present developments.
- Learners will study about different Smart Grid technologies.
- Learners will acquire knowledge about different smart meters and advanced metering infrastructure.
- Learners will have knowledge on power quality management in Smart Grids
- Learners will develop more understanding on LAN, WAN and Cloud Computing for Smart Grid applications.

**TEXT BOOKS:**

1. Stuart Borlase "Smart Grid: Infrastructure, Technology and Solutions", CRC Press 2012.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley 2012.

**REFERENCES**

- Vehbi C. Gungör, Dilan Sahin, Taskin Kocak, Salih Ergüt, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke, "Smart Grid Technologies: Communication Technologies and Standards" IEEE Transactions On Industrial Informatics, Vol.7, No.4, November 2011.
- Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang "Smart Grid – The New and Improved Power Grid: A Survey", IEEE Transaction on Smart Grids, vol.14, 2012.
- James Momohe "Smart Grid: Fundamentals of Design and Analysis", Wiley-IEEE Press, 2012.

**OBJECTIVES:**

- To Introduce Fundamentals of Biomedical Engineering
- To study the communication mechanics in a biomedical system with few examples
- To study measurement of certain important electrical and non-electrical parameters
- To understand the basic principles in imaging techniques
- To have a basic knowledge in life assisting and therapeutic devices

**UNIT I                    FUNDAMENTALS OF BIOMEDICAL ENGINEERING                    9**

Cell and its structure – Resting and Action Potential – Nervous system and its fundamentals - Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow - Biomechanics of bone - Biomechanics of soft tissues -Physiological signals and transducers - Transducers – selection criteria – Piezo electric, ultrasonic transducers - Temperature measurements - Fibre optic temperature sensors

**UNIT II                    NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC                    9**  
**PROCEDURES**

Measurement of blood pressure - Cardiac output - Heart rate - Heart sound - Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers, pH of blood –measurement of blood pCO<sub>2</sub>, pO<sub>2</sub>, finger-tip oxymeter - ESR, GSR measurements.

**UNIT III                    ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS                    9**

Electrodes – Limb electrodes –floating electrodes – pregelled disposable electrodes - Micro, needle and surface electrodes – Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier - ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipment.

**UNIT IV                    IMAGING MODALITIES AND ANALYSIS                    9**

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography –Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems.

**UNIT V                    LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES                    9**

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy - ICCU patient monitoring system - Nano Robots - Robotic surgery –Orthopedic prostheses fixation.

**TOTAL :    45    PERIODS****OUTCOMES: At the end of the course students will have the**

- Ability to understand the philosophy of the heart, lung, blood circulation and respiration system.
- Ability to provide latest ideas on devices of non-electrical devices.
- Ability to gain knowledge on various sensing and measurement devices of electrical origin.
- Ability to understand the analysis systems of various organ types.
- Ability to bring out the important and modern methods of imaging techniques and their

analysis.

- Ability to explain the medical assistance/techniques, robotic and therapeutic equipments.

#### **TEXT BOOKS:**

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007.
2. Khandpur R.S, Handbook of Biomedical Instrumentation, Tata McGraw-Hill, New Delhi, 2<sup>nd</sup> edition, 2003
3. Joseph J Carr and John M. Brown, Introduction to Biomedical Equipment Technology, John Wiley and sons, New York, 4<sup>th</sup> edition, 2012

#### **REFERENCES**

1. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, New York, 1998.
2. Duane Knudson, Fundamentals of Biomechanics, Springer, 2nd Edition, 2007.
3. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.
4. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.
5. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.

**GE8073**

**FUNDAMENTALS OF NANOSCIENCE**

**L T P C**  
**3 0 0 3**

#### **OBJECTIVES:**

To learn about basis of nanomaterial science, preparation method, types and application

#### **UNIT I INTRODUCTION**

**8**

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering- Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

#### **UNIT II GENERAL METHODS OF PREPARATION**

**9**

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

#### **UNIT III NANOMATERIALS**

**12**

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO<sub>2</sub>, MgO, ZrO<sub>2</sub>, NiO, nanoalumina, CaO, AgTiO<sub>2</sub>, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

**UNIT IV CHARACTERIZATION TECHNIQUES****9**

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

**UNIT V APPLICATIONS****7**

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

**TOTAL : 45 PERIODS****OUTCOMES:**

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

**TEXT BOOKS :**

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale Charecterisation of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

**REFERENCES:**

1. G Timp, "Nanotechnology", AIP press/Springer, 1999.
2. Akhlesh Lakhtakia, "The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

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**REGULATIONS – 2017**  
**CHOICE BASED CREDIT SYSTEM**

**PROGRAMME EDUCATIONAL OBJECTIVES:**

Bachelor of Mechanical Engineering curriculum is designed to impart Knowledge, Skill and Attitude on the graduates to

1. Have a successful career in Mechanical Engineering and allied industries.
2. Have expertise in the areas of Design, Thermal, Materials and Manufacturing.
3. Contribute towards technological development through academic research and industrial practices.
4. Practice their profession with good communication, leadership, ethics and social responsibility.
5. Graduates will adapt to evolving technologies through life-long learning.

**PROGRAMME OUTCOMES**

1. An ability to apply knowledge of mathematics and engineering sciences to develop mathematical models for industrial problems.
2. An ability to identify, formulates, and solve complex engineering problems. with high degree of competence.
3. An ability to design and conduct experiments, as well as to analyze and interpret data obtained through those experiments.
4. An ability to design mechanical systems, component, or a process to meet desired needs within the realistic constraints such as environmental, social, political and economic sustainability.
5. An ability to use modern tools, software and equipment to analyze multidisciplinary problems.
6. An ability to demonstrate on professional and ethical responsibilities.
7. An ability to communicate, write reports and express research findings in a scientific community.
8. An ability to adapt quickly to the global changes and contemporary practices.
9. An ability to engage in life-long learning.

**PEO / PO Mapping**

<b>Programme Educational Objectives</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>
<b>I</b>	✓	✓	✓	✓	✓	✓	✓	✓	✓
<b>II</b>	✓	✓	✓		✓			✓	
<b>III</b>		✓		✓	✓	✓		✓	
<b>IV</b>					✓	✓	✓		✓
<b>V</b>		✓	✓	✓	✓				✓

		<b>COURSE TITLE</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	
<b>YEAR 1</b>	<b>SEM 1</b>	Communicative English							✓			
		Engineering Mathematics I	✓	✓	✓						✓	
		Engineering Physics	✓	✓	✓							✓
		Engineering Chemistry				✓						
		Problem Solving and Python Programming					✓					
		Engineering Graphics		✓	✓					✓		
		Problem Solving and Python Programming Laboratory			✓		✓					
		Physics and Chemistry Laboratory			✓							
			<b>COURSE TITLE</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>
	<b>SEM 2</b>	Technical English								✓		
		Engineering Mathematics II	✓	✓	✓					✓		✓
		Materials Science				✓					✓	
		Basic Electrical, Electronics and Instrumentation Engineering				✓					✓	
		Environmental Science and Engineering				✓						
		Engineering Mechanics	✓	✓						✓	✓	✓
Engineering Practices Laboratory				✓								
Basic Electrical, Electronics and Instrumentation Engineering				✓								
		<b>COURSE TITLE</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	
<b>YEAR 2</b>	<b>SEM 3</b>	Transforms and Partial Differential Equations	✓	✓	✓					✓	✓	
		Engineering Thermodynamics	✓	✓	✓					✓	✓	
		Fluid Mechanics and Machinery	✓	✓	✓							
		Manufacturing Technology - I			✓	✓	✓	✓			✓	✓
		Electrical Drives and Controls										
		Manufacturing Technology Laboratory - I			✓	✓	✓	✓			✓	✓
		Computer Aided Machine Drawing			✓	✓	✓	✓			✓	✓
		Electrical Engineering Laboratory			✓							
		Interpersonal Skills / Listening & Speaking			✓							
			<b>COURSE TITLE</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>
	<b>SEM 4</b>	Statistics and Numerical Methods	✓	✓								
		Kinematics of Machinery	✓	✓	✓		✓					
		Manufacturing Technology– II	✓		✓	✓	✓				✓	✓
		Engineering Metallurgy								✓		

		Strength of Materials for Mechanical Engineers	✓	✓	✓	✓						
		Thermal Engineering- I	✓	✓			✓					
		Manufacturing Technology Laboratory–II			✓							
		Strength of Materials and Fluid Mechanics Machinery Laboratory			✓							
		Advanced Reading and Writing						✓			✓	
		<b>COURSE TITLE</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	
YEAR 3	SEM 5	Thermal Engineering- II	✓	✓			✓			✓		
		Design of Machine Elements		✓		✓			✓	✓	✓	
		Metrology and Measurements	✓		✓	✓				✓	✓	
		Dynamics of Machines	✓	✓	✓		✓			✓	✓	
		Kinematics and Dynamics Laboratory	✓	✓	✓	✓						
		Thermal Engineering Laboratory	✓	✓	✓							
	Metrology and Measurements Laboratory	✓	✓	✓	✓				✓			
			<b>COURSE TITLE</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>
	SEM 6	Design of Transmission Systems		✓		✓				✓		✓
		Computer Aided Design and Manufacturing		✓	✓		✓					
		Heat and Mass Transfer	✓	✓	✓	✓					✓	✓
		Finite Element Analysis	✓	✓		✓						✓
		Hydraulics and Pneumatics	✓	✓		✓					✓	
		C.A.D. / C.A.M. Laboratory		✓	✓				✓			
Design and Fabrication Project								✓	✓		✓	
Professional Communication						✓	✓	✓	✓		✓	
		<b>COURSE TITLE</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	
YEAR 4	SEM 7	Power Plant Engineering	✓	✓	✓	✓				✓		
		Mechatronics	✓	✓	✓		✓				✓	✓
		Process Planning and Cost Estimation		✓		✓						
		Simulation and Analysis Laboratory	✓				✓			✓		
		Mechatronics Laboratory	✓	✓	✓		✓				✓	✓
	Technical Seminar							✓				
	SEM 8	Project Work	✓	✓	✓				✓	✓		
		Principles of Management							✓			✓

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**I TO VIII SEMESTERS CURRICULA AND SYLLABI**

**SEMESTER I**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	HS8151	Communicative English	HS	4	4	0	0	4
2.	MA8151	Engineering Mathematics - I	BS	4	4	0	0	4
3.	PH8151	Engineering Physics	BS	3	3	0	0	3
4.	CY8151	Engineering Chemistry	BS	3	3	0	0	3
5.	GE8151	Problem Solving and Python Programming	ES	3	3	0	0	3
6.	GE8152	Engineering Graphics	ES	6	2	0	4	4
<b>PRACTICALS</b>								
7.	GE8161	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
8.	BS8161	Physics and Chemistry Laboratory	BS	4	0	0	4	2
<b>TOTAL</b>				<b>31</b>	<b>19</b>	<b>0</b>	<b>12</b>	<b>25</b>

**SEMESTER II**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	HS8251	Technical English	HS	4	4	0	0	4
2.	MA8251	Engineering Mathematics - II	BS	4	4	0	0	4
3.	PH8251	Materials Science	BS	3	3	0	0	3
4.	BE8253	Basic Electrical, Electronics and Instrumentation Engineering	ES	3	3	0	0	3
5.	GE8291	Environmental Science and Engineering	HS	3	3	0	0	3
6.	GE8292	Engineering Mechanics	ES	5	3	2	0	4
<b>PRACTICALS</b>								
7.	GE8261	Engineering Practices Laboratory	ES	4	0	0	4	2
8.	BE8261	Basic Electrical, Electronics and Instrumentation Engineering Laboratory	ES	4	0	0	4	2
<b>TOTAL</b>				<b>30</b>	<b>20</b>	<b>2</b>	<b>8</b>	<b>25</b>

### SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MA8353	Transforms and Partial Differential Equations	BS	4	4	0	0	4
2.	ME8391	Engineering Thermodynamics	PC	5	3	2	0	4
3.	CE8394	Fluid Mechanics and Machinery	ES	4	4	0	0	4
4.	ME8351	Manufacturing Technology - I	PC	3	3	0	0	3
5.	EE8353	Electrical Drives and Controls	ES	3	3	0	0	3
<b>PRACTICAL</b>								
6.	ME8361	Manufacturing Technology Laboratory - I	PC	4	0	0	4	2
7.	ME8381	Computer Aided Machine Drawing	PC	4	0	0	4	2
8.	EE8361	Electrical Engineering Laboratory	ES	4	0	0	4	2
9.	HS8381	Interpersonal Skills / Listening & Speaking	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>33</b>	<b>17</b>	<b>2</b>	<b>14</b>	<b>25</b>

### SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MA8452	Statistics and Numerical Methods	BS	4	4	0	0	4
2.	ME8492	Kinematics of Machinery	PC	3	3	0	0	3
3.	ME8451	Manufacturing Technology – II	PC	3	3	0	0	3
4.	ME8491	Engineering Metallurgy	PC	3	3	0	0	3
5.	CE8395	Strength of Materials for Mechanical Engineers	ES	3	3	0	0	3
6.	ME8493	Thermal Engineering- I	PC	3	3	0	0	3
<b>PRACTICAL</b>								
7.	ME8462	Manufacturing Technology Laboratory – II	PC	4	0	0	4	2
8.	CE8381	Strength of Materials and Fluid Mechanics and Machinery Laboratory	ES	4	0	0	4	2
9.	HS8461	Advanced Reading and Writing	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>29</b>	<b>19</b>	<b>0</b>	<b>10</b>	<b>24</b>

### SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	ME8595	Thermal Engineering- II	PC	3	3	0	0	3
2.	ME8593	Design of Machine Elements	PC	3	3	0	0	3
3.	ME8501	Metrology and Measurements	PC	3	3	0	0	3
4.	ME8594	Dynamics of Machines	PC	4	4	0	0	4
5.		Open Elective I	OE	3	3	0	0	3
<b>PRACTICAL</b>								
6.	ME8511	Kinematics and Dynamics Laboratory	PC	4	0	0	4	2
7.	ME8512	Thermal Engineering Laboratory	PC	4	0	0	4	2
8.	ME8513	Metrology and Measurements Laboratory	PC	4	0	0	4	2
<b>TOTAL</b>				<b>28</b>	<b>16</b>	<b>0</b>	<b>12</b>	<b>22</b>

### SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	ME8651	Design of Transmission Systems	PC	3	3	0	0	3
2.	ME8691	Computer Aided Design and Manufacturing	PC	3	3	0	0	3
3.	ME8693	Heat and Mass Transfer	PC	5	3	2	0	4
4.	ME8692	Finite Element Analysis	PC	3	3	0	0	3
5.	ME8694	Hydraulics and Pneumatics	PC	3	3	0	0	3
6.		Professional Elective - I	PE	3	3	0	0	3
<b>PRACTICAL</b>								
7.	ME8681	CAD / CAM Laboratory	PC	4	0	0	4	2
8.	ME8682	Design and Fabrication Project	EEC	4	0	0	4	2
9.	HS8581	Professional Communication	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>30</b>	<b>18</b>	<b>2</b>	<b>10</b>	<b>24</b>

### SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	ME8792	Power Plant Engineering	PC	3	3	0	0	3
2.	ME8793	Process Planning and Cost Estimation	PC	3	3	0	0	3
3.	ME8791	Mechatronics	PC	3	3	0	0	3
4.		Open Elective - II	OE	3	3	0	0	3
5.		Professional Elective – II	PE	3	3	0	0	3
6.		Professional Elective – III	PE	3	3	0	0	3
<b>PRACTICAL</b>								
7.	ME8711	Simulation and Analysis Laboratory	PC	4	0	0	4	2
8.	ME8781	Mechatronics Laboratory	PC	4	0	0	4	2
9.	ME8712	Technical Seminar	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>28</b>	<b>18</b>	<b>0</b>	<b>10</b>	<b>23</b>

### SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MG8591	Principles of Management	HS	3	3	0	0	3
2.		Professional Elective– IV	PE	3	3	0	0	3
<b>PRACTICAL</b>								
3.	ME8811	Project Work	EEC	20	0	0	20	10
<b>TOTAL</b>				<b>29</b>	<b>9</b>	<b>0</b>	<b>20</b>	<b>16</b>

**TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 184**

### HUMANITIES AND SOCIAL SCIENCES (HS)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	HS8151	Communicative English	HS	4	4	0	0	4
2.	HS8251	Technical English	HS	4	4	0	0	4
3.	GE8291	Environmental Science and Engineering	HS	3	3	0	0	3
4.	MG8591	Principles of Management	HS	3	3	0	0	3

### BASIC SCIENCE (BS)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MA8151	Engineering Mathematics - I	BS	5	3	2	0	4
2.	PH8151	Engineering Physics	BS	3	3	0	0	3
3.	CY8151	Engineering Chemistry	BS	3	3	0	0	3
4.	BS8161	Physics and Chemistry Laboratory	BS	4	0	0	4	2
5.	MA8251	Engineering Mathematics II	BS	4	4	0	0	4
6.	PH8251	Materials Science	BS	3	3	0	0	3
7.	MA8353	Transforms and Partial Differential Equations	BS	4	4	0	0	4
8.	MA8452	Statistics and Numerical Methods	BS	4	4	0	0	4

### ENGINEERING SCIENCES (ES)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	GE8151	Problem Solving and Python Programming	ES	3	3	0	0	3
2.	GE8152	Engineering Graphics	ES	6	2	0	4	4
3.	GE8161	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
4.	BE8253	Basic Electrical, Electronics and Instrumentation Engineering	ES	3	3	0	0	3
5.	GE8292	Engineering Mechanics	ES	5	3	2	0	4
6.	GE8261	Engineering Practices Laboratory	ES	4	0	0	4	2
7.	BE8261	Basic Electrical, Electronics and Instrumentation Engineering Laboratory	ES	4	0	0	4	2
8.	CE8394	Fluid Mechanics and Machinery	ES	5	3	2	0	4
9.	EE8353	Electrical Drives and Controls	ES	3	3	0	0	3
10.	EE8361	Electrical Engineering Laboratory	ES	4	0	0	4	2
11.	CE8395	Strength of Materials for Mechanical Engineers	ES	3	3	0	0	3
12.	CE8381	Strength of Materials and Fluid Mechanics and Machinery Laboratory	ES	4	0	0	4	2

**PROFESSIONAL CORE (PC)**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	ME8391	Engineering Thermodynamics	PC	5	3	2	0	4
2.	ME8351	Manufacturing Technology - I	PC	3	3	0	0	3
3.	ME8361	Manufacturing Technology Laboratory - I	PC	4	0	0	4	2
4.	ME8381	Computer Aided Machine Drawing	PC	4	0	0	4	2
5.	ME8492	Kinematics of Machinery	PC	3	3	0	0	3
6.	ME8451	Manufacturing Technology– II	PC	3	3	0	0	3
7.	ME8491	Engineering Metallurgy	PC	3	3	0	0	3
8.	ME8493	Thermal Engineering- I	PC	3	3	0	0	3
9.	ME8462	Manufacturing Technology Laboratory–II	PC	4	0	0	4	2
10.	ME8595	Thermal Engineering- II	PC	3	3	0	0	3
11.	ME8593	Design of Machine Elements	PC	3	3	0	0	3
12.	ME8501	Metrology and Measurements	PC	3	3	0	0	3
13.	ME8594	Dynamics of Machines	PC	4	4	0	0	4
14.	ME8511	Kinematics and Dynamics Laboratory	PC	4	0	0	4	2
15.	ME8512	Thermal Engineering Laboratory	PC	4	0	0	4	2
16.	ME8513	Metrology and Measurements Laboratory	PC	4	0	0	4	2
17.	ME8651	Design of Transmission Systems	PC	3	3	0	0	3
18.	ME8691	Computer Aided Design and Manufacturing	PC	3	3	0	0	3
19.	ME8693	Heat and Mass Transfer	PC	5	3	2	0	4
20.	ME8692	Finite Element Analysis	PC	3	3	0	0	3
21.	ME8694	Hydraulics and Pneumatics	PC	3	3	0	0	3
22.	ME8681	C.A.D. / C.A.M. Laboratory	PC	4	0	0	4	2
23.	ME8682	Design and Fabrication Project	PC	4	0	0	4	2
24.	ME8792	Power Plant Engineering	PC	3	3	0	0	3
25.	ME8791	Mechatronics	PC	3	3	0	0	3
26.	ME8793	Process Planning and Cost Estimation	PC	3	3	0	0	3
27.	ME8711	Simulation and Analysis Laboratory	PC	4	0	0	4	2
28.	ME8781	Mechatronics Laboratory	PC	4	0	0	4	2

**PROFESSIONAL ELECTIVES FOR B.E. MECHANICAL ENGINEERING****SEMESTER VI, ELECTIVE I**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	ME8091	Automobile Engineering	PE	3	3	0	0	3
2.	PR8592	Welding Technology	PE	3	3	0	0	3
3.	ME8096	Gas Dynamics and Jet Propulsion	PE	3	3	0	0	3
4.	GE8075	Intellectual Property Rights	PE	3	3	0	0	3
5.	GE8073	Fundamentals of Nanoscience	PE	3	3	0	0	3

**SEMESTER VII, ELECTIVE II**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	ME8071	Refrigeration and Air conditioning	PE	3	3	0	0	3
2.	ME8072	Renewable Sources of Energy	PE	3	3	0	0	3
3.	ME8098	Quality Control and Reliability Engineering	PE	3	3	0	0	3
4.	ME8073	Unconventional Machining Processes	PE	3	3	0	0	3
5.	MG8491	Operations Research	PE	3	3	0	0	3
6.	MF8071	Additive Manufacturing	PE	3	3	0	0	3
7.	GE8077	Total Quality Management	PE	3	3	0	0	3

**SEMESTER VII, ELECTIVE III**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	ME8099	Robotics	PE	3	3	0	0	3
2.	ME8095	Design of Jigs, Fixtures and Press Tools	PE	3	3	0	0	3
3.	ME8093	Computational Fluid Dynamics	PE	3	3	0	0	3
4.	ME8097	Non Destructive Testing and Evaluation	PE	3	3	0	0	3
5.	ME8092	Composite Materials and Mechanics	PE	3	3	0	0	3
6.	GE8072	Foundation Skills in Integrated Product Development	PE	3	3	0	0	3
7.	GE8074	Human Rights	PE	3	3	0	0	3
8.	GE8071	Disaster Management	PE	3	3	0	0	3

**SEMESTER VIII, ELECTIVE IV**

<b>SL. NO.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>CONTACT PERIODS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1.	IE8693	Production Planning and Control	PE	3	3	0	0	3
2.	MG8091	Entrepreneurship Development	PE	3	3	0	0	3
3.	ME8094	Computer Integrated Manufacturing Systems	PE	3	3	0	0	3
4.	ME8074	Vibration and Noise Control	PE	3	3	0	0	3
5.	EE8091	Micro Electro Mechanical Systems	PE	3	3	0	0	3
6.	GE8076	Professional Ethics in Engineering	PE	3	3	0	0	3

**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

<b>SL. NO.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>CONTACT PERIODS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1.	HS8381	Interpersonal Skills/Listening &	EEC	4	0	0	4	2
2.	ME8712	Technical Seminar	EEC	2	0	0	2	1
3.	ME8811	Project Work	EEC	20	0	0	20	12
4.	HS8461	Advanced Reading and Writing	EEC	2	0	0	2	1
5.	ME8682	Design and Fabrication Project	EEC	4	0	0	4	2
6.	HS8581	Professional Communication	EEC	2	0	0	2	1

### SUMMARY

SL. NO.	SUBJECT AREA	CREDITS PER SEMESTER								CREDITS TOTAL	Percentage %
		I	II	III	IV	V	VI	VII	VIII		
1.	HS	4	7	-	-	-		-	3	14	7.61%
2.	BS	12	7	4	4	-	-	-	-	27	14.67%
3.	ES	9	11	9	5	-	-	-	-	33	17.80%
4.	PC	-	-	11	14	19	18	13	-	74	40.22%
5.	PE	-	-	-	-	-	3	6	3	15	8.15%
6.	OE	-	-	-	-	3	-	3		6	3.26%
7.	EEC	-	-	1	1	-	3	1	10	16	7.6%
	<b>Total</b>	<b>25</b>	<b>25</b>	<b>25</b>	<b>24</b>	<b>22</b>	<b>24</b>	<b>23</b>	<b>16</b>	<b>184</b>	
8.	<b>Non Credit / Mandatory</b>										

HS8151

COMMUNICATIVE ENGLISH

L	T	P	C
4	0	0	4

**OBJECTIVES:**

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

**UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY & FRIENDS 12**

Reading- short comprehension passages, practice in skimming-scanning and predicting- Writing- completing sentences- - developing hints. Listening- short texts- short formal and informal conversations. Speaking- introducing oneself - exchanging personal information- Language development- Wh- Questions- asking and answering-yes or no questions- parts of speech. Vocabulary development-- prefixes- suffixes- articles.- count/ uncount nouns.

**UNIT II GENERAL READING AND FREE WRITING 12**

Reading - comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- Writing – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –Listening- telephonic conversations. Speaking – sharing information of a personal kind—greeting – taking leave- Language development – prepositions, conjunctions Vocabulary development- guessing meanings of words in context.

**UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12**

Reading- short texts and longer passages (close reading) Writing- understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences Listening – listening to longer texts and filling up the table- product description- narratives from different sources. Speaking- asking about routine actions and expressing opinions. Language development- degrees of comparison- pronouns- direct vs indirect questions- Vocabulary development – single word substitutes- adverbs.

**UNIT IV READING AND LANGUAGE DEVELOPMENT 12**

Reading- comprehension-reading longer texts- reading different types of texts- magazines Writing- letter writing, informal or personal letters-e-mails-conventions of personal email- Listening- listening to dialogues or conversations and completing exercises based on them. Speaking- speaking about oneself- speaking about one's friend- Language development- Tenses- simple present-simple past-present continuous and past continuous- Vocabulary development- synonyms-antonyms- phrasal verbs

**UNIT V EXTENDED WRITING 12**

Reading- longer texts- close reading –Writing- brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing-Listening – listening to talks-conversations- Speaking – participating in conversations- short group conversations-Language development-modal verbs- present/ past perfect tense - Vocabulary development-collocations- fixed and semi-fixed expressions

**TOTAL: 60 PERIODS**

## OUTCOMES:

At the end of the course, learners will be able to:

- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English.

## TEXT BOOKS:

1. Board of Editors. Using English A Course book for Undergraduate Engineers and Technologists. Orient BlackSwan Limited, Hyderabad: 2015
2. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.

## REFERENCES

- 1 Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge,2011.
- 2 Means,L. Thomas and Elaine Langlois. English & Communication For Colleges. CengageLearning ,USA: 2007
- 3 Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student's Book& Workbook) Cambridge University Press, New Delhi: 2005
- 4 Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011
- 5 Dutt P. Kiranmai and Rajeevan Geeta. Basic Communication Skills, Foundation Books: 2013

MA8151

ENGINEERING MATHEMATICS – I

L	T	P	C
4	0	0	4

## OBJECTIVES :

The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

### UNIT I DIFFERENTIAL CALCULUS

12

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

### UNIT II FUNCTIONS OF SEVERAL VARIABLES

12

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

### UNIT III INTEGRAL CALCULUS

12

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

**UNIT IV          MULTIPLE INTEGRALS****12**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

**UNIT V          DIFFERENTIAL EQUATIONS****12**

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

**TOTAL : 60 PERIODS****OUTCOMES :**

After completing this course, students should demonstrate competency in the following skills:

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.

**TEXT BOOKS :**

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43<sup>rd</sup> Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7<sup>th</sup> Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

**REFERENCES :**

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10<sup>th</sup> Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3<sup>rd</sup> Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
5. Weir, M.D and Joel Hass, "Thomas Calculus", 12<sup>th</sup> Edition, Pearson India, 2016.

**OBJECTIVES:**

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

**UNIT I                      PROPERTIES OF MATTER                      9**

Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.

**UNIT II                      WAVES AND FIBER OPTICS                      9**

Oscillatory motion – forced and damped oscillations: differential equation and its solution – plane progressive waves – wave equation. Lasers : population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) – losses associated with optical fibers - fibre optic sensors: pressure and displacement.

**UNIT III                      THERMAL PHYSICS                      9**

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conduction in solids – thermal conductivity - Forbe's and Lee's disc method: theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.

**UNIT IV                      QUANTUM PHYSICS                      9**

Black body radiation – Planck's theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – tunnelling (qualitative) - scanning tunnelling microscope.

**UNIT V                      CRYSTAL PHYSICS                      9**

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

**TOTAL :    45            PERIODS**

**OUTCOMES:**

Upon completion of this course,

- the students will gain knowledge on the basics of properties of matter and its applications,
- the students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
- the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
- the students will get knowledge on advanced physics concepts of quantum theory and its

- applications in tunneling microscopes, and
- the students will understand the basics of crystals, their structures and different crystal growth techniques.

#### TEXT BOOKS:

1. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. "Engineering Physics". Cengage Learning India, 2012.

#### REFERENCES:

1. Halliday, D., Resnick, R. & Walker, J. "Principles of Physics". Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. "Physics for Scientists and Engineers". Cengage Learning, 2010.
3. Tipler, P.A. & Mosca, G. "Physics for Scientists and Engineers with Modern Physics". W.H. Freeman, 2007.

CY8151

ENGINEERING CHEMISTRY

L T P C  
3 0 0 3

#### OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

#### UNIT I WATER AND ITS TREATMENT

9

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

#### UNIT II SURFACE CHEMISTRY AND CATALYSIS

9

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions – adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – kinetics of surface reactions, unimolecular reactions, Langmuir - applications of adsorption on pollution abatement.

Catalysis: Catalyst – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis– Michaelis – Menten equation.

#### UNIT III ALLOYS AND PHASE RULE

9

Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

**UNIT IV FUELS AND COMBUSTION****9**

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel. Combustion of fuels: Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

**UNIT V ENERGY SOURCES AND STORAGE DEVICES****9**

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H<sub>2</sub>-O<sub>2</sub> fuel cell.

**TOTAL: 45 PERIODS****OUTCOMES:**

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

**TEXT BOOKS:**

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

**REFERENCES:**

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

**GE8151****PROBLEM SOLVING AND PYTHON PROGRAMMING****L T P C  
3 0 0 3****OBJECTIVES:**

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures -- lists, tuples, dictionaries.
- To do input/output with files in Python.

**UNIT I ALGORITHMIC PROBLEM SOLVING****9**

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

## **UNIT II DATA, EXPRESSIONS, STATEMENTS 9**

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

## **UNIT III CONTROL FLOW, FUNCTIONS 9**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

## **UNIT IV LISTS, TUPLES, DICTIONARIES 9**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

## **UNIT V FILES, MODULES, PACKAGES 9**

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

### **OUTCOMES:**

**Upon completion of the course, students will be able to**

- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.

**TOTAL : 45 PERIODS**

### **TEXT BOOKS:**

1. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, 2<sup>nd</sup> edition, Updated for Python 3, Shroff/O’Reilly Publishers, 2016 [\\_\(http://greenteapress.com/wp/think-python/\)](http://greenteapress.com/wp/think-python/)
2. Guido van Rossum and Fred L. Drake Jr, “An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

### **REFERENCES:**

1. John V Guttag, “Introduction to Computation and Programming Using Python”, Revised and expanded Edition, MIT Press , 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd., 2015.
4. Kenneth A. Lambert, “Fundamentals of Python: First Programs”, CENGAGE Learning, 2012.
5. Charles Dierbach, “Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, “Practical Programming: An Introduction to Computer Science using Python 3”, Second edition, Pragmatic Programmers, LLC, 2013.

**OBJECTIVES:**

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

**CONCEPTS AND CONVENTIONS (Not for Examination)****1**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

**UNIT I PLANE CURVES AND FREEHAND SKETCHING****7+12**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

**UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE****6+12**

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

**UNIT III PROJECTION OF SOLIDS****5+12**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

**UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES****5+12**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

**UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS****6+12**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

**TOTAL: 90 PERIODS****OUTCOMES:**

On successful completion of this course, the student will be able to

- familiarize with the fundamentals and standards of Engineering graphics
- perform freehand sketching of basic geometrical constructions and multiple views of objects.
- project orthographic projections of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- visualize and to project isometric and perspective sections of simple solids.

**TEXT BOOK:**

1. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

**REFERENCES:**

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50<sup>th</sup> Edition, 2010.
2. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. and Duff, John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2<sup>nd</sup> Edition, 2009.

**Publication of Bureau of Indian Standards:**

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

**Special points applicable to University Examinations on Engineering Graphics:**

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

**GE8161****PROBLEM SOLVING AND PYTHON PROGRAMMING  
LABORATORY****L T P C  
0 0 4 2****OBJECTIVES:**

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

**LIST OF PROGRAMS**

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort

7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

**PLATFORM NEEDED**

Python 3 interpreter for Windows/Linux

**OUTCOMES:**

**Upon completion of the course, students will be able to**

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

**TOTAL :60 PERIODS**

**BS8161**

**PHYSICS AND CHEMISTRY LABORATORY**  
**(Common to all branches of B.E. / B.Tech Programmes)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**OBJECTIVES:**

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

**LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)**

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser  
 (b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

**TOTAL: 30 PERIODS**

**OUTCOMES:**

Upon completion of the course, the students will be able to

- apply principles of elasticity, optics and thermal properties for engineering applications.

## CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

### OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
  - To acquaint the students with the determination of molecular weight of a polymer by viscometry.
1. Estimation of HCl using  $\text{Na}_2\text{CO}_3$  as primary standard and Determination of alkalinity in water sample.
  2. Determination of total, temporary & permanent hardness of water by EDTA method.
  3. Determination of DO content of water sample by Winkler's method.
  4. Determination of chloride content of water sample by argentometric method.
  5. Estimation of copper content of the given solution by Iodometry.
  6. Determination of strength of given hydrochloric acid using pH meter.
  7. Determination of strength of acids in a mixture of acids using conductivity meter.
  8. Estimation of iron content of the given solution using potentiometer.
  9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
  10. Estimation of sodium and potassium present in water using flame photometer.
  11. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
  12. Pseudo first order kinetics-ester hydrolysis.
  13. Corrosion experiment-weight loss method.
  14. Determination of CMC.
  15. Phase change in a solid.
  16. Conductometric titration of strong acid vs strong base.

### OUTCOMES:

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

**TOTAL: 30 PERIODS**

### TEXTBOOKS:

1. Vogel's Textbook of Quantitative Chemical Analysis (8<sup>TH</sup> edition, 2014)

**HS8251**

**TECHNICAL ENGLISH**

L	T	P	C
4	0	0	4

### OBJECTIVES:

The Course prepares second semester engineering and Technology students to:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

### UNIT I INTRODUCTION TECHNICAL ENGLISH

**12**

Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- Speaking –Asking for and giving directions- Reading – reading short technical texts from journals- newspapers- Writing- purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-Vocabulary Development- technical vocabulary Language Development –subject verb agreement - compound words.

**UNIT II READING AND STUDY SKILLS 12**  
 Listening- Listening to longer technical talks and completing exercises based on them-Speaking – describing a process-Reading – reading longer technical texts- identifying the various transitions in a text- paragraphing- Writing- interpreting charts, graphs- Vocabulary Development-vocabulary used in formal letters/emails and reports Language Development- impersonal passive voice, numerical adjectives.

**UNIT III TECHNICAL WRITING AND GRAMMAR 12**  
 Listening- Listening to classroom lectures/ talks on engineering/technology -Speaking – introduction to technical presentations- Reading – longer texts both general and technical, practice in speed reading; Writing-Describing a process, use of sequence words- Vocabulary Development- sequence words- Misspelled words. Language Development- embedded sentences

**UNIT IV REPORT WRITING 12**  
 Listening- Listening to documentaries and making notes. Speaking – mechanics of presentations- Reading – reading for detailed comprehension- Writing- email etiquette- job application – cover letter –Résumé preparation( via email and hard copy)- analytical essays and issue based essays-- Vocabulary Development- finding suitable synonyms-paraphrasing-. Language Development- clauses- if conditionals.

**UNIT V GROUP DISCUSSION AND JOB APPLICATIONS 12**  
 Listening- TED/Ink talks; Speaking –participating in a group discussion -Reading– reading and understanding technical articles Writing– Writing reports- minutes of a meeting- accident and survey- Vocabulary Development- verbal analogies Language Development- reported speech

**TOTAL : 60 PERIODS**

**OUTCOMES:**

At the end of the course learners will be able to:

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

**TEXT BOOKS:**

1. Board of editors. Fluency in English A Course book for Engineering and Technology. Orient Black swan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.

**REFERENCES**

1. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice.Oxford University Press: New Delhi,2014.
2. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
3. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
4. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007
5. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007

**Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.**

**OBJECTIVES :**

This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

**UNIT I            MATRICES****12**

Eigen values and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigen values and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

**UNIT II            VECTOR CALCULUS****12**

Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

**UNIT III           ANALYTIC FUNCTIONS****12**

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions  $w = z + c, cz, \frac{1}{z}, z^2$  - Bilinear transformation.

**UNIT IV            COMPLEX INTEGRATION****12**

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour.

**UNIT V            LAPLACE TRANSFORMS****12**

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

**TOTAL: 60 PERIODS****OUTCOMES :**

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Eigen values and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

**TEXT BOOKS :**

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43<sup>rd</sup> Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10<sup>th</sup> Edition, New Delhi, 2016.

**REFERENCES :**

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7<sup>th</sup> Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., " Advanced Engineering Mathematics ", Narosa Publications, New Delhi , 3<sup>rd</sup> Edition, 2007.
3. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.
4. Sastry, S.S, "Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4<sup>th</sup> Edition, New Delhi, 2014.
5. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

		<b>MATERIALS SCIENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PH8251</b>	(Common to courses offered in Faculty of Mechanical Engineering					
	Except B.E. Materials Science and Engineering )	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	

**OBJECTIVES:**

- To introduce the essential principles of materials science for mechanical and related engineering applications.

**UNIT I PHASE DIAGRAMS 9**

Solid solutions - Hume Rothery's rules – the phase rule - single component system - one-component system of iron - binary phase diagrams - isomorphous systems - the tie-line rule - the lever rule - application to isomorphous system - eutectic phase diagram - peritectic phase diagram - other invariant reactions – free energy composition curves for binary systems - microstructural change during cooling.

**UNIT II FERROUS ALLOYS 9**

The iron-carbon equilibrium diagram - phases, invariant reactions - microstructure of slowly cooled steels - eutectoid steel, hypo and hypereutectoid steels - effect of alloying elements on the Fe-C system - diffusion in solids - Fick's laws - phase transformations - T-T-T-diagram for eutectoid steel – pearlitic, bainitic and martensitic transformations - tempering of martensite – steels – stainless steels – cast irons.

**UNIT III MECHANICAL PROPERTIES 9**

Tensile test - plastic deformation mechanisms - slip and twinning - role of dislocations in slip - strengthening methods - strain hardening - refinement of the grain size - solid solution strengthening - precipitation hardening - creep resistance - creep curves - mechanisms of creep - creep-resistant materials - fracture - the Griffith criterion - critical stress intensity factor and its determination - fatigue failure - fatigue tests - methods of increasing fatigue life - hardness - Rockwell and Brinell hardness - Knoop and Vickers microhardness.



**UNIT II AC CIRCUITS 9**  
Introduction to AC circuits – waveforms and RMS value – power and power factor, single phase and three-phase balanced circuits – Three phase loads - housing wiring, industrial wiring, materials of wiring

**UNIT III ELECTRICAL MACHINES 9**  
Principles of operation and characteristics of ; DC machines, Transformers (single and three phase ) ,Synchronous machines , three phase and single phase induction motors.

**UNIT IV ELECTRONIC DEVICES & CIRCUITS 9**  
Types of Materials – Silicon & Germanium- N type and P type materials – PN Junction –Forward and Reverse Bias –Semiconductor Diodes –Bipolar Junction Transistor – Characteristics –Field Effect Transistors – Transistor Biasing –Introduction to operational Amplifier –Inverting Amplifier –Non Inverting Amplifier –DAC – ADC .

**UNIT V MEASUREMENTS & INSTRUMENTATION 9**  
Introduction to transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect and Mechanical - ,Classification of instruments - Types of indicating Instruments - multimeters –Oscilloscopes- – three-phase power measurements – instrument transformers (CT and PT )

**TOTAL : 45 PERIODS**

**OUTCOMES:**

Ability to

- Understand electric circuits and working principles of electrical machines
- Understand the concepts of various electronic devices
- Choose appropriate instruments for electrical measurement for a specific application

**TEXT BOOKS**

1. Leonard S Bobrow, “Foundations of Electrical Engineering”, Oxford University Press, 2013
2. D P Kothari and I.J Nagarath, ”Electrical Machines “Basic Electrical and Electronics Engineering”, McGraw Hill Education(India) Private Limited, Third Reprint ,2016
3. Thereja .B.L., “Fundamentals of Electrical Engineering and Electronics”, S. Chand & Co. Ltd., 2008

**REFERENCES**

1. Del Toro, “Electrical Engineering Fundamentals”, Pearson Education, New Delhi, 2007
2. John Bird, “Electrical Circuit Theory and Technology”, Elsevier, First Indian Edition, 2006
3. Allan S Moris, “Measurement and Instrumentation Principles”, Elseveir, First Indian Edition, 2006
4. Rajendra Prasad, “Fundamentals of Electrical Engineering”, Prentice Hall of India, 2006
5. A.E.Fitzgerald, David E Higginbotham and Arvin Gabel, “Basic Electrical Engineering”, McGraw Hill Education(India) Private Limited, 2009
6. N K De, Dipu Sarkar, “Basic Electrical Engineering”, Universities Press (India)Private Limited 2016

**OBJECTIVES:**

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14**

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

**UNIT II ENVIRONMENTAL POLLUTION 8**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

**UNIT III NATURAL RESOURCES 10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

#### **UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT**

**7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

#### **UNIT V HUMAN POPULATION AND THE ENVIRONMENT**

**6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

#### **TEXTBOOKS:**

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2<sup>nd</sup> edition, Pearson Education, 2004.

#### **REFERENCES :**

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hydrabad, 2015.
3. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.
4. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.

**GE8292**

**ENGINEERING MECHANICS**

**L T P C  
3 2 0 4**

#### **OBJECTIVES:**

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

#### **UNIT I STATICS OF PARTICLES**

**9+6**

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vectorial representation of forces – Vector operations of forces -additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

**UNIT II EQUILIBRIUM OF RIGID BODIES****9+6**

Free body diagram – Types of supports – Action and reaction forces – stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

**UNIT III PROPERTIES OF SURFACES AND SOLIDS****9+6**

Centroids and centre of mass – Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula – Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

**UNIT IV DYNAMICS OF PARTICLES****9+6**

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton's laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

**UNIT V FRICTION AND RIGID BODY DYNAMICS****9+6**

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

**TOTAL : 45+30=75 PERIODS****OUTCOMES:**

On successful completion of this course, the student will be able to

- illustrate the vectorial and scalar representation of forces and moments
- analyse the rigid body in equilibrium
- evaluate the properties of surfaces and solids
- calculate dynamic forces exerted in rigid body
- determine the friction and the effects by the laws of friction

**TEXT BOOKS:**

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8<sup>th</sup> Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

**REFERENCES:**

1. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 1998.
2. Hibbeler, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11<sup>th</sup> Edition, Pearson Education 2010.
3. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4<sup>th</sup> Edition, Pearson Education 2006.
4. Meriam J.L. and Kraige L.G., " Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", Third Edition, John Wiley & Sons,1993.
5. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3<sup>rd</sup> Edition, Vikas Publishing House Pvt. Ltd., 2005.

**OBJECTIVES:**

To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

**GROUP A (CIVIL & MECHANICAL)****I CIVIL ENGINEERING PRACTICE****13****Buildings:**

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

**Plumbing Works:**

- (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- (b) Study of pipe connections requirements for pumps and turbines.
- (c) Preparation of plumbing line sketches for water supply and sewage works.
- (d) Hands-on-exercise:  
Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
- (e) Demonstration of plumbing requirements of high-rise buildings.

**Carpentry using Power Tools only:**

- (a) Study of the joints in roofs, doors, windows and furniture.
- (b) Hands-on-exercise:  
Wood work, joints by sawing, planing and cutting.

**II MECHANICAL ENGINEERING PRACTICE****18****Welding:**

- (a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
- (b) Gas welding practice

**Basic Machining:**

- (a) Simple Turning and Taper turning
- (b) Drilling Practice

**Sheet Metal Work:**

- (a) Forming & Bending:
- (b) Model making – Trays and funnels.
- (c) Different type of joints.

**Machine assembly practice:**

- (a) Study of centrifugal pump
- (b) Study of air conditioner

**Demonstration on:**

- (a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
- (b) Foundry operations like mould preparation for gear and step cone pulley.
- (c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

## GROUP B (ELECTRICAL & ELECTRONICS)

- III ELECTRICAL ENGINEERING PRACTICE** **13**
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
  2. Fluorescent lamp wiring.
  3. Stair case wiring
  4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
  5. Measurement of energy using single phase energy meter.
  6. Measurement of resistance to earth of an electrical equipment.
- IV ELECTRONICS ENGINEERING PRACTICE** **16**
1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
  2. Study of logic gates AND, OR, EX-OR and NOT.
  3. Generation of Clock Signal.
  4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
  5. Measurement of ripple factor of HWR and FWR.

**TOTAL: 60 PERIODS**

### **OUTCOMES:**

On successful completion of this course, the student will be able to

- fabricate carpentry components and pipe connections including plumbing works.
- use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

### **LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

#### **1. CIVIL**

- |   |          |
|---|----------|
| 1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. | 15 Sets. |
| 2. Carpentry vice (fitted to work bench)  | 15 Nos.  |
| 3. Standard woodworking tools   | 15 Sets. |
| 4. Models of industrial trusses, door joints, furniture joints  | 5 each   |
| 5. Power Tools: (a) Rotary Hammer   | 2 Nos    |
| (b) Demolition Hammer   | 2 Nos    |
| (c) Circular Saw  | 2 Nos    |
| (d) Planer  | 2 Nos    |
| (e) Hand Drilling Machine   | 2 Nos    |
| (f) Jigsaw  | 2 Nos    |

#### **MECHANICAL**

- |   |         |
|---|---------|
| 1. Arc welding transformer with cables and holders                            | 5 Nos.  |
| 2. Welding booth with exhaust facility  | 5 Nos.  |
| 3. Welding accessories like welding shield, chipping hammer, wire brush, etc. | 5 Sets. |
| 4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.    | 2 Nos.  |



**OUTCOMES:**

- Ability to determine the speed characteristic of different electrical machines
- Ability to design simple circuits involving diodes and transistors
- Ability to use operational amplifiers

**1. LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

<b>S.No.</b>	<b>NAME OF THE EQUIPMENT</b>	<b>Qty.</b>
1	D. C. Motor Generator Set	2
2	D.C. Shunt Motor	2
3	Single Phase Transformer	2
4	Single Phase Induction Motor	2
5	Ammeter A.C and D.C	20
6	Voltmeters A.C and D.C	20
7.	Watt meters LPF and UPF	4
8.	Resistors & Breadboards	-
9.	Cathode Ray Oscilloscopes	4
10.	Dual Regulated power supplies	6
11.	A.C. Signal Generators	4
12.	Transistors (BJT, JFET)	-

**MA8353****TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**OBJECTIVES:**

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

**UNIT I PARTIAL DIFFERENTIAL EQUATIONS****12**

Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

**UNIT II FOURIER SERIES****12**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

**UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS****12**

Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

**UNIT IV      FOURIER TRANSFORMS****12**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

**UNIT V      Z - TRANSFORMS AND DIFFERENCE EQUATIONS****12**

Z-transforms - Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems - Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

**TOTAL : 60 PERIODS****OUTCOMES :**

Upon successful completion of the course, students should be able to:

- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

**TEXT BOOKS :**

1. Grewal B.S., "Higher Engineering Mathematics", 43<sup>rd</sup> Edition, Khanna Publishers, New Delhi, 2014.
2. Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

**REFERENCES :**

1. B.V Ramana.., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2. Erwin Kreyszig, "Advanced Engineering Mathematics ", 10<sup>th</sup> Edition, John Wiley, India, 2016.
3. G. James, "Advanced Modern Engineering Mathematics", 3<sup>rd</sup> Edition, Pearson Education, 2007.
4. L.C Andrews, L.C and Shivamoggi, B, "Integral Transforms for Engineers" SPIE Press, 1999.
5. N.P. Bali. and Manish Goyal, "A Textbook of Engineering Mathematics", 9<sup>th</sup> Edition, Laxmi Publications Pvt. Ltd, 2014.
6. R.C. Wylie, and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

**ME8391****ENGINEERING THERMODYNAMICS****L T P C  
3 2 0 4****OBJECTIVE:**

- To familiarize the students to understand the fundamentals of thermodynamics and to perform thermal analysis on their behavior and performance.

(Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychrometric Chart permitted)

**UNIT I BASIC CONCEPTS AND FIRST LAW 9+6**

Basic concepts - concept of continuum, comparison of microscopic and macroscopic approach. Path and point functions. Intensive and extensive, total and specific quantities. System and their types. Thermodynamic Equilibrium State, path and process. Quasi-static, reversible and irreversible processes. Heat and work transfer, definition and comparison, sign convention. Displacement work and other modes of work .P-V diagram. Zeroth law of thermodynamics – concept of temperature and thermal equilibrium– relationship between temperature scales –new temperature scales. First law of thermodynamics –application to closed and open systems – steady and unsteady flow processes.

**UNIT II SECOND LAW AND AVAILABILITY ANALYSIS 9+6**

Heat Reservoir, source and sink. Heat Engine, Refrigerator, Heat pump. Statements of second law and its corollaries. Carnot cycle Reversed Carnot cycle, Performance. Clausius inequality. Concept of entropy, T-s diagram, Tds Equations, entropy change for - pure substance, ideal gases - different processes, principle of increase in entropy. Applications of II Law. High and low grade energy. Available and non-available energy of a source and finite body. Energy and irreversibility. Expressions for the energy of a closed system and open systems. Energy balance and entropy generation. Irreversibility. I and II law Efficiency.

**UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE 9+6**

Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface. Use of Steam Table and Mollier Chart. Determination of dryness fraction. Application of I and II law for pure substances. Ideal and actual Rankine cycles, Cycle Improvement Methods - Reheat and Regenerative cycles, Economiser, preheater, Binary and Combined cycles.

**UNIT IV IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS 9+6**

Properties of Ideal gas- Ideal and real gas comparison- Equations of state for ideal and real gases- Reduced properties. Compressibility factor-Principle of Corresponding states. -Generalised Compressibility Chart and its use-. Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Energy equation, Joule-Thomson Coefficient, Clausius Clapeyron equation, Phase Change Processes. Simple Calculations.

**UNIT V GAS MIXTURES AND PSYCHROMETRY 9+6**

Mole and Mass fraction, Dalton's and Amagat's Law. Properties of gas mixture – Molar mass, gas constant, density, change in internal energy, enthalpy, entropy and Gibbs function. Psychrometric properties, Psychrometric charts. Property calculations of air vapour mixtures by using chart and expressions. Psychrometric process – adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing. Simple Applications

**TOTAL : 75 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Apply the first law of thermodynamics for simple open and closed systems under steady and unsteady conditions.
- CO2 Apply second law of thermodynamics to open and closed systems and calculate entropy and availability.
- CO3 Apply Rankine cycle to steam power plant and compare few cycle improvement methods
- CO4 Derive simple thermodynamic relations of ideal and real gases
- CO5 Calculate the properties of gas mixtures and moist air and its use in psychrometric processes

**TEXT BOOKS :**

1. R.K.Rajput, "A Text Book Of Engineering Thermodynamics ",Fifth Edition,2017.
2. Yunus a. Cengel & michael a. Boles, "Thermodynamics", 8th edition 2015.

**REFERENCES:**

1. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
2. Borgnakke & Sonntag, "Fundamental of Thermodynamics", 8th Edition , 2016.
3. Chattopadhyay, P, "Engineering Thermodynamics", Oxford University Press, 2016.
4. Michael J. Moran, Howard N. Shapiro, "Fundamentals of Engineering Thermodynamics", 8th Edition.
5. Nag.P.K., "Engineering Thermodynamics", 5<sup>th</sup> Edition, Tata McGraw-Hill, New Delhi, 2013.

**CE8394****FLUID MECHANICS AND MACHINERY****L T P C  
4 0 0 4****OBJECTIVES**

- The properties of fluids and concept of control volume are studied
- The applications of the conservation laws to flow through pipes are studied.
- To understand the importance of dimensional analysis
- To understand the importance of various types of flow in pumps.
- To understand the importance of various types of flow in turbines.

**UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 12**

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

**UNIT II FLOW THROUGH CIRCULAR CONDUITS 12**

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli- Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

**UNIT III DIMENSIONAL ANALYSIS 12**

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

**UNIT IV PUMPS 12**

Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps –classification.

**UNIT V TURBINES 12**

Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

Upon completion of this course, the students will be able to

- Apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Can analyse and calculate major and minor losses associated with pipe flow in piping networks.
- Can mathematically predict the nature of physical quantities
- Can critically analyse the performance of pumps
- Can critically analyse the performance of turbines.

**TEXT BOOK:**

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2013.

**REFERENCES:**

1. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2016
3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", 2011.
4. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010

**ME8351****MANUFACTURING TECHNOLOGY – I****L T P C  
3 0 0 3****OBJECTIVE:**

- To introduce the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and manufacture of plastic components.

**UNIT I METAL CASTING PROCESSES****9**

Sand Casting : Sand Mould – Type of patterns - Pattern Materials – Pattern allowances –Moulding sand Properties and testing – Cores –Types and applications – Moulding machines– Types and applications; Melting furnaces : Blast and Cupola Furnaces; Principle of special casting processes : Shell - investment – Ceramic mould – Pressure die casting - Centrifugal Casting - CO2 process – Stir casting; Defects in Sand casting

**UNIT II JOINING PROCESSES****9**

Operating principle, basic equipment, merits and applications of: Fusion welding processes: Gas welding - Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding - Gas metal arc welding – Submerged arc welding – Electro slag welding; Operating principle and applications of: Resistance welding - Plasma arc welding – Thermit welding – Electron beam welding – Friction welding and Friction Stir Welding; Brazing and soldering; Weld defects: types, causes and cure.

**UNIT III METAL FORMING PROCESSES****9**

Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – forging operations. Rolling of metals– Types of Rolling – Flat strip rolling – shape rolling operations – Defects in rolled parts. Principle of rod and wire drawing – Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion.

**UNIT IV SHEET METAL PROCESSES****9**

Sheet metal characteristics – shearing, bending and drawing operations – Stretch forming operations – Formability of sheet metal – Test methods – special forming processes – Working principle and applications – Hydro forming – Rubber pad forming – Metal spinning – Introduction of Explosive forming, magnetic pulse forming, peen forming, Super plastic forming – Micro forming

**UNIT V MANUFACTURE OF PLASTIC COMPONENTS****9**

Types and characteristics of plastics – Moulding of thermoplastics – working principles and typical applications – injection moulding – Plunger and screw machines – Compression moulding, Transfer Moulding – Typical industrial applications – introduction to blow moulding – Rotational moulding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics.

**TOTAL: 45 PERIODS****OUTCOMES:**

- CO1 Explain different metal casting processes, associated defects, merits and demerits  
 CO2 Compare different metal joining processes.  
 CO3 Summarize various hot working and cold working methods of metals.  
 CO4 Explain various sheet metal making processes.  
 CO5 Distinguish various methods of manufacturing plastic components.

**TEXT BOOKS:**

- Hajra Choudhary S.K and Hajra Choudhury. AK., "Elements of workshop Technology", volume I and II, Media promoters and Publishers Private Limited, Mumbai, 2008
- Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India Edition, 2013

**REFERENCES:**

- Gowri P. Hariharan, A.Suresh Babu, "Manufacturing Technology I", Pearson Education, 2008
- Paul Degarma E, Black J.T and Ronald A. Kosher, "Materials and Processes, in Manufacturing" Eight Edition, Prentice – Hall of India, 1997.
- Rao, P.N. "Manufacturing Technology Foundry, Forming and Welding", 4<sup>th</sup> Edition, TMH-2013
- Roy. A. Lindberg, "Processes and Materials of Manufacture", PHI / Pearson education, 2006
- Sharma, P.C., "A Text book of production Technology", S.Chand and Co. Ltd., 2014.

**EE8353****ELECTRICAL DRIVES AND CONTROLS****L T P C  
3 0 0 3****OBJECTIVES:**

- To understand the basic concepts of different types of electrical machines and their performance.
- To study the different methods of starting D.C motors and induction motors.
- To study the conventional and solid-state drives

**UNIT I INTRODUCTION****8**

Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors

**UNIT II DRIVE MOTOR CHARACTERISTICS 9**  
Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors: Shunt, series and compound - single phase and three phase induction motors.

**UNIT III STARTING METHODS 8**  
Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors.

**UNIT IV CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES 10**  
Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system - Using controlled rectifiers and DC choppers –applications.

**UNIT V CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C. DRIVES 10**  
Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- Upon Completion of this subject, the students can able to explain different types of electrical machines and their performance

**TEXT BOOKS:**

1. Nagrath .I.J. & Kothari .D.P, “Electrical Machines”, Tata McGraw-Hill, 2006
2. Vedam Subrahmaniam, “Electric Drives (Concepts and Applications)”, Tata McGraw-Hill, 2010

**REFERENCES:**

1. Partab. H., “Art and Science and Utilisation of Electrical Energy”, Dhanpat Rai and Sons, 2017
2. Pillai.S.K “A First Course on Electric Drives”, Wiley Eastern Limited, 2012
3. Singh. M.D., K.B.Khanchandani, “Power Electronics”, Tata McGraw-Hill, 2006.

**ME8361 MANUFACTURING TECHNOLOGY LABORATORY – I L T P C**  
**0 0 4 2**

**OBJECTIVE:**

- To Study and practice the various operations that can be performed in lathe, shaper, drilling, milling machines etc. and to equip with the practical knowledge required in the core industries.

**LIST OF EXPERIMENTS**

Machining and Machining time estimations for:

1. Taper Turning
2. External Thread cutting
3. Internal Thread Cutting
4. Eccentric Turning
5. Knurling
6. Square Head Shaping
7. Hexagonal Head Shaping
8. Fabrication of simple structural shapes using Gas Metal Arc Welding
9. Joining of plates and pipes using Gas Metal Arc Welding/ Arc Welding /Submerged arc welding
10. Preparation of green sand moulds
- 11 Manufacturing of simple sheet metal components using shearing and bending operations.
12. Manufacturing of sheet metal components using metal spinning on a lathe

**TOTAL: 60 PERIODS**

## OUTCOMES:

Upon the completion of this course the students will be able to

- CO1 Demonstrate the safety precautions exercised in the mechanical workshop.
- CO2 Make the workpiece as per given shape and size using Lathe.
- CO3 Join two metals using arc welding.
- CO4 Use sheet metal fabrication tools and make simple tray and funnel.
- CO5 Use different moulding tools, patterns and prepare sand moulds.

## LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. NO.	NAME OF THE EQUIPMENT	Qty.
1	Centre Lathes	7 Nos.
2	Horizontal Milling Machine	1 No
3	Vertical Milling Machine	1 No
4	Shaper	1 No.
5	Arc welding transformer with cables and holders	2 Nos
6	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit	1 No
7	Moulding table, Moulding equipments	2 Nos
8	Sheet metal forming tools and equipments	2 Nos.

**OBJECTIVES:**

- To make the students understand and interpret drawings of machine components
- To prepare assembly drawings both manually and using standard CAD packages
- To familiarize the students with Indian Standards on drawing practices and standard components
- To gain practical experience in handling 2D drafting and 3D modeling software systems.

**UNIT I DRAWING STANDARDS & FITS AND TOLERANCES 12**

Code of practice for Engineering Drawing, BIS specifications – Welding symbols, riveted joints, keys, fasteners – Reference to hand book for the selection of standard components like bolts, nuts, screws, keys etc. - Limits, Fits – Tolerancing of individual dimensions – Specification of Fits – Preparation of production drawings and reading of part and assembly drawings, basic principles of geometric dimensioning & tolerancing.

**UNIT II INTRODUCTION TO 2D DRAFTING 16**

- Drawing, Editing, Dimensioning, Layering, Hatching, Block, Array, Detailing, Detailed drawing.
- Bearings - Bush bearing, Plummer block
- Valves – Safety and non-return valves.

**UNIT III 3D GEOMETRIC MODELING AND ASSEMBLY 32**

Sketcher - Datum planes – Protrusion – Holes - Part modeling – Extrusion – Revolve – Sweep – Loft – Blend – Fillet - Pattern – Chamfer - Round - Mirror – Section - Assembly

- Couplings – Flange, Universal, Oldham's, Muff, Gear couplings
- Joints – Knuckle, Gib & cotter, strap, sleeve & cotter joints
- Engine parts – Piston, connecting rod, cross-head (vertical and horizontal), stuffing box, multi-plate clutch
- Miscellaneous machine components – Screw jack, machine vice, tail stock, chuck, vane and gear pump

**TOTAL:60 PERIODS**

**Note:** 25% of assembly drawings must be done manually and remaining 75% of assembly drawings must be done by using any CAD software. The above tasks can be performed manually and using standard commercial 2D / 3D CAD software

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

CO1 Follow the drawing standards, Fits and Tolerances

CO2 Re-create part drawings, sectional views and assembly drawings as per standards

**TEXT BOOK:**

1. Gopalakrishna K.R., "Machine Drawing", 22nd Edition, Subhas Stores Books Corner, Bangalore, 2013

**REFERENCES:**

1. N. D. Bhatt and V.M. Panchal, "Machine Drawing", 48th Edition, Charotar Publishers, 2013
2. Junnarkar, N.D., "Machine Drawing", 1st Edition, Pearson Education, 2004
3. N. Siddeshwar, P. Kanniah, V.V.S. Sastri, "Machine Drawing", published by Tata Mc GrawHill, 2006
4. S. Trymbaka Murthy, "A Text Book of Computer Aided Machine Drawing", CBS Publishers, New Delhi, 2007

**EE8361****ELECTRICAL ENGINEERING LABORATORY****L T P C**  
**0 0 4 2****OBJECTIVE:**

- To validate the principles studied in theory by performing experiments in the laboratory

**LIST OF EXPERIMENTS**

1. Load test on DC Shunt & DC Series motor
2. O.C.C & Load characteristics of DC Shunt and DC Series generator
3. Speed control of DC shunt motor (Armature, Field control)
4. Load test on single phase transformer
5. O.C & S.C Test on a single phase transformer
6. Regulation of an alternator by EMF & MMF methods.
7. V curves and inverted V curves of synchronous Motor
8. Load test on three phase squirrel cage Induction motor
9. Speed control of three phase slip ring Induction Motor
10. Study of DC & AC Starters

**TOTAL: 60 PERIODS****OUTCOME:**

- Ability to perform speed characteristic of different electrical machine

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

<b>S.No.</b>	<b>NAME OF THE EQUIPMENT</b>	<b>Qty.</b>
1	DC Shunt motor	2
2	DC Series motor	1
3	DC shunt motor-DC Shunt Generator set	1
4	DC Shunt motor-DC Series Generator set	1
5	Single phase transformer	2
6	Three phase alternator	2
7	Three phase synchronous motor	1
8	Three phase Squirrel cage Induction motor	1
9	Three phase Slip ring Induction motor	1

**HS8381****INTERPERSONAL SKILLS/LISTENING & SPEAKING****L T P C**  
**0 0 2 1****OBJECTIVES: The Course will enable learners to:**

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- improve general and academic listening skills
- Make effective presentations.

## UNIT I

Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

## UNIT II

Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

## UNIT III

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail

## UNIT IV

Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

## UNIT V

Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

**TOTAL : 30 PERIODS**

### **OUTCOMES: At the end of the course Learners will be able to:**

- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal

### **TEXT BOOKS:**

1. Brooks, Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.
2. Richards, C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

### **REFERENCES**

1. Bhatnagar, Nitin and Mamta Bhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.
2. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
3. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014
4. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
5. Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013.

**OBJECTIVES:**

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

**UNIT I TESTING OF HYPOTHESIS****12**

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means - Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

**UNIT II DESIGN OF EXPERIMENTS****12**

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design -  $2^2$  factorial design.

**UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS****12**

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

**UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION****12**

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

**UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS****12**

Single step methods : Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods : Milne's and Adams - Bash forth predictor corrector methods for solving first order equations.

**TOTAL : 60 PERIODS****OUTCOMES :**

Upon successful completion of the course, students will be able to:

- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture.
- Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications

**TEXT BOOKS :**

1. Grewal. B.S. and Grewal. J.S., "Numerical Methods in Engineering and Science ", 10<sup>th</sup> Edition, Khanna Publishers, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8<sup>th</sup> Edition, 2015.

**REFERENCES :**

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9<sup>th</sup> Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8<sup>th</sup> Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 2006.
4. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 2004.
5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 8<sup>th</sup> Edition, Pearson Education, Asia, 2007.

**ME8492****KINEMATICS OF MACHINERY**

L	T	P	C
3	0	0	3

**OBJECTIVES:**

- To understand the basic components and layout of linkages in the assembly of a system machine.
- To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.

**UNIT I           BASICS OF MECHANISMS****9**

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler's criterion – Grashof's Law – Kinematic inversions of four-bar chain and slider crank chains – Limit positions – Mechanical advantage – Transmission Angle – Description of some common mechanisms – Quick return mechanisms, Straight line generators, Universal Joint – rocker mechanisms.

**UNIT II           KINEMATICS OF LINKAGE MECHANISMS****9**

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration polygons – Velocity analysis using instantaneous centres – kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration – Introduction to linkage synthesis problem.

**UNIT III           KINEMATICS OF CAM MECHANISMS****9**

Classification of cams and followers – Terminology and definitions – Displacement diagrams – Uniform velocity, parabolic, simple harmonic and cycloidal motions – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams.

**UNIT IV GEARS AND GEAR TRAINS****9**

Law of toothed gearing – Involute and cycloidal tooth profiles – Spur Gear terminology and definitions – Gear tooth action – contact ratio – Interference and undercutting. Helical, Bevel, Worm, Rack and Pinion gears [Basics only]. Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains.

**UNIT V FRICTION IN MACHINE ELEMENTS****9**

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt and rope drives – Friction in brakes- Band and Block brakes.

**TOTAL: 45 PERIODS****OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Discuss the basics of mechanism
- CO2 Calculate velocity and acceleration in simple mechanisms
- CO3 Develop CAM profiles
- CO4 Solve problems on gears and gear trains
- CO5 Examine friction in machine elements

**TEXT BOOKS:**

1. F.B. Sayyad, "Kinematics of Machinery", MacMillan Publishers Pvt Ltd., Tech-max Educational resources, 2011.
2. Rattan, S.S, "Theory of Machines", 4<sup>th</sup> Edition, Tata McGraw-Hill, 2014.
3. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 4<sup>th</sup> Edition, Oxford University Press, 2014.

**REFERENCES:**

1. Allen S. Hall Jr., "Kinematics and Linkage Design", Prentice Hall, 1961
2. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2014
3. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", 3<sup>rd</sup> Edition Affiliated East-West Pvt. Ltd., New Delhi, 2006.
4. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
5. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.

**ME8451****MANUFACTURING TECHNOLOGY – II**

L	T	P	C
3	0	0	3

**OBJECTIVES:**

- To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching.
- To understand the basic concepts of Computer Numerical Control (CNC) of machine tools and CNC Programming

**UNIT I THEORY OF METAL CUTTING****9**

Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools– nomenclature, orthogonal metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.



**OBJECTIVE:**

- To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

**UNIT I ALLOYS AND PHASE DIAGRAMS 9**

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron – carbon equilibrium diagram. Classification of steel and cast Iron microstructure, properties and application.

**UNIT II HEAT TREATMENT 9**

Definition – Full annealing, stress relief, recrystallisation and spheroidising – normalising, hardening and Tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram CCR – Hardenability, Jominy end quench test - Austempering, martempering – case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening. .

**UNIT III FERROUS AND NON-FERROUS METALS 9**

Effect of alloying additions on steel- and stabilisers– stainless and tool steels – HSLA, Maraging steels – Cast Iron - Grey, white, malleable, spheroidal – alloy cast irons, Copper and copper alloys – Brass, Bronze and Cupronickel – Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys, Mg-alloys, Ni-based super alloys and Titanium alloys.

**UNIT IV NON-METALLIC MATERIALS 9**

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes)- Engineering Ceramics – Properties and applications of Al<sub>2</sub>O<sub>3</sub>, SiC, Si<sub>3</sub>N<sub>4</sub>, PSZ and SIALON –Composites- Classifications- Metal Matrix and FRP - Applications of Composites.

**UNIT V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS 9**

Mechanisms of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), hardness tests, Impact test Izod and charpy, fatigue and creep failure mechanisms.

**TOTAL: 45 PERIODS****OUTCOMES**

**Upon the completion of this course the students will be able to**

- CO1 Explain alloys and phase diagram, Iron-Iron carbon diagram and steel classification.
- CO2 Explain isothermal transformation, continuous cooling diagrams and different heat treatment processes.
- CO3 Clarify the effect of alloying elements on ferrous and non-ferrous metals
- CO4 Summarize the properties and applications of non metallic materials.
- CO5 Explain the testing of mechanical properties. .

**TEXT BOOKS:**

- Avner, S.H., "Introduction to Physical Metallurgy", McGraw Hill Book Company, 1997.
- Williams D Callister, "Material Science and Engineering" Wiley India Pvt Ltd, Revised Indian Edition 2014

**REFERENCES:**

1. Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 2010.
2. Raghavan.V, "Materials Science and Engineering", Prentice Hall of India Pvt. Ltd., 2015.
3. U.C. Jindal : Material Science and Metallurgy, "Engineering Materials and Metallurgy", First Edition, Dorling Kindersley, 2012
4. Upadhyay. G.S. and Anish Upadhyay, "Materials Science and Engineering", Viva Books Pvt. Ltd., New Delhi, 2006.

<b>CE8395</b>	<b>STRENGTH OF MATERIALS FOR MECHANICAL ENGINEERS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To determine stresses and deformation in circular shafts and helical spring due to torsion.
- To compute slopes and deflections in determinate beams by various methods.
- To study the stresses and deformations induced in thin and thick shells.

**UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9**

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains – Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress.

**UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9**

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending – bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

**UNIT III TORSION 9**

Torsion formulation stresses and deformation in circular and hollow shafts – Stepped shafts – Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

**UNIT IV DEFLECTION OF BEAMS 9**

Double Integration method – Macaulay's method – Area moment method for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell's reciprocal theorems.

**UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS 9**

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lamé's theorem.

**TOTAL: 45 PERIODS**

## OUTCOMES

Students will be able to

- Understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.
- Understand the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.
- Apply basic equation of simple torsion in designing of shafts and helical spring
- Calculate the slope and deflection in beams using different methods.
- Analyze and design thin and thick shells for the applied internal and external pressures.

## TEXT BOOKS:

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2016
2. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2009

## REFERENCES:

1. Egor. P. Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2002
2. Ferdinand P. Beer, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing 'co. Ltd., New Delhi, 2005.
3. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2013
4. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2010.

**ME8493**

**THERMAL ENGINEERING - I**

L	T	P	C
3	0	0	3

## OBJECTIVES:

- To integrate the concepts, laws and methodologies from the first course in thermodynamics into analysis of cyclic processes
- To apply the thermodynamic concepts into various thermal application like IC engines, Steam.
- Turbines, Compressors and Refrigeration and Air conditioning systems

(Use of standard refrigerant property data book, Steam Tables, Mollier diagram and Psychrometric chart permitted)

## UNIT I GAS AND STEAM POWER CYCLES

**9**

Air Standard Cycles - Otto, Diesel, Dual, Brayton – Cycle Analysis, Performance and Comparison – Rankine, reheat and regenerative cycle.

## UNIT II RECIPROCATING AIR COMPRESSOR

**9**

Classification and comparison, working principle, work of compression - with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency. Multistage air compressor with Intercooling. Working principle and comparison of Rotary compressors with reciprocating air compressors.

## UNIT III INTERNAL COMBUSTION ENGINES AND COMBUSTION

**9**

IC engine – Classification, working, components and their functions. Ideal and actual : Valve and port timing diagrams, p-v diagrams- two stroke & four stroke, and SI & CI engines – comparison. Geometric, operating, and performance comparison of SI and CI engines. Desirable properties and qualities of fuels. Air-fuel ratio calculation – lean and rich mixtures. Combustion in SI & CI Engines – Knocking – phenomena and control.

**UNIT IV INTERNAL COMBUSTION ENGINE PERFORMANCE AND SYSTEMS 9**

Performance parameters and calculations. Morse and Heat Balance tests. Multipoint Fuel Injection system and Common Rail Direct Injection systems. Ignition systems – Magneto, Battery and Electronic. Lubrication and Cooling systems. Concepts of Supercharging and Turbocharging – Emission Norms.

**UNIT V GAS TURBINES 9**

Gas turbine cycle analysis – open and closed cycle. Performance and its improvement - Regenerative, Intercooled, Reheated cycles and their combinations. Materials for Turbines.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Apply thermodynamic concepts to different air standard cycles and solve problems.
- CO2 Solve problems in single stage and multistage air compressors
- CO3 Explain the functioning and features of IC engines, components and auxiliaries.
- CO4 Calculate performance parameters of IC Engines.
- CO5 Explain the flow in Gas turbines and solve problems.

**TEXT BOOKS:**

1. Kothandaraman.C.P., Domkundwar. S,Domkundwar. A.V., "A course in thermal Engineering", Fifth Edition, "Dhanpat Rai & sons , 2016
2. Rajput. R. K., "Thermal Engineering" S.Chand Publishers, 2017

**REFERENCES:**

1. Arora.C.P, "Refrigeration and Air Conditioning ," Tata McGraw-Hill Publishers 2008
2. Ganesan V.." Internal Combustion Engines" , Third Edition, Tata Mcgraw-Hill 2012
3. Ramalingam. K.K., "Thermal Engineering", SCITECH Publications (India) Pvt. Ltd., 2009.
4. Rudramoorthy, R, "Thermal Engineering ",Tata McGraw-Hill, New Delhi,2003
5. Sarkar, B.K,"Thermal Engineering" Tata McGraw-Hill Publishers, 2007

<b>ME8462</b>	<b>MANUFACTURING TECHNOLOGY LABORATORY – II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**OBJECTIVE:**

- To Study and acquire knowledge on various basic machining operations in special purpose machines and its applications in real life manufacture of components in the industry

**LIST OF EXPERIMENTS:**

1. Contour milling using vertical milling machine
2. Spur gear cutting in milling machine
3. Helical Gear Cutting in milling machine
4. Gear generation in hobbing machine
5. Gear generation in gear shaping machine
6. Plain Surface grinding
7. Cylindrical grinding
8. Tool angle grinding with tool and Cutter Grinder
9. Measurement of cutting forces in Milling / Turning Process
10. CNC Part Programming

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 use different machine tools to manufacturing gears
- CO2 Ability to use different machine tools to manufacturing gears.
- CO3 Ability to use different machine tools for finishing operations
- CO4 Ability to manufacture tools using cutter grinder
- CO5 Develop CNC part programming

**TOTAL: 60 PERIODS**

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

<b>S.No.</b>	<b>NAME OF THE EQUIPMENT</b>	<b>Qty.</b>
1	Turret and Capstan Lathes	1 No each
2	Horizontal Milling Machine	2 No
3	Vertical Milling Machine	1 No
4	Surface Grinding Machine	1 No.
5	Cylindrical Grinding Machine	1 No.
6	Radial Drilling Machine	1 No.
7	lathe Tool Dynamometer	1 No
8	Milling Tool Dynamometer	1 No
9	Gear Hobbing Machine	1 No
10	Tool Makers Microscope	1 No
11	CNC Lathe	1 No
12	CNC Milling machine	1 No
13	Gear Shaping machine	1 No
14	Centerless grinding machine	1 No
15	Tool and cutter grinder	1 No

**CE8381**

**STRENGTH OF MATERIALS AND FLUID MECHANICS  
AND MACHINERY LABORATORY**

**L T P C  
0 0 4 2**

**OBJECTIVES:**

- To study the mechanical properties of materials when subjected to different types of loading.
- To verify the principles studied in Fluid Mechanics theory by performing experiments in lab.

**STRENGTH OF MATERIALS**

**30**

**LIST OF EXPERIMENTS**

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison

- (i) Unhardened specimen
  - (ii) Quenched Specimen and
  - (iii) Quenched and tempered specimen.
11. Microscopic Examination of
- (i) Hardened samples and
  - (ii) Hardened and tempered samples.

**OUTCOME:**

- Ability to perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.

**LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS**

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity	1
2	Torsion Testing Machine (60 NM Capacity)	1
3	Impact Testing Machine (300 J Capacity)	1
4	Brinell Hardness Testing Machine	1
5	Rockwell Hardness Testing Machine	1
6	Spring Testing Machine for tensile and compressive loads (2500 N)	1
7	Metallurgical Microscopes	3
8	Muffle Furnace (800 C)	1

**FLUID MECHANICS AND MACHINES LABORATORY**

**30**

**LIST OF EXPERIMENTS**

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

Upon completion of this course, the students will be able to:

- Perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.
- Use the measurement equipments for flow measurement.
- Perform test on different fluid machinery.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S. NO.	NAME OF THE EQUIPMENT	Qty.
1	Orifice meter setup	1
2	Venturi meter setup	1
3	Rotameter setup	1
4	Pipe Flow analysis setup	1
5	Centrifugal pump/submergible pump setup	1
6	Reciprocating pump setup	1

7	Gear pump setup	1
8	Pelton wheel setup	1
9	Francis turbine setup	1
10	Kaplan turbine setup	1

**HS8461**

**ADVANCED READING AND WRITING**

**L T P C**  
**0 0 2 1**

**OBJECTIVES:**

- Strengthen the reading skills of students of engineering.
- Enhance their writing skills with specific reference to technical writing.
- Develop students' critical thinking skills.
- Provide more opportunities to develop their project and proposal writing skills.

**UNIT I**

Reading - Strategies for effective reading-Use glosses and footnotes to aid reading comprehension-Read and recognize different text types-Predicting content using photos and title Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence –Write a descriptive paragraph

**UNIT II**

Reading-Read for details-Use of graphic organizers to review and aid comprehension Writing-State reasons and examples to support ideas in writing- Write a paragraph with reasons and examples-Write an opinion paragraph

**UNIT III**

Reading- Understanding pronoun reference and use of connectors in a passage- speed reading techniques-Writing- Elements of a good essay-Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

**UNIT IV**

Reading- Genre and Organization of Ideas- Writing- Email writing- resumes – Job application- project writing-writing convincing proposals.

**UNIT V**

Reading- Critical reading and thinking- understanding how the text positions the reader- identify Writing- Statement of Purpose- letter of recommendation- Vision statement

**TOTAL: 30 PERIODS**

**OUTCOMES: At the end of the course Learners will be able to:**

- Write different types of essays.
- Write winning job applications.
- Read and evaluate texts critically.
- Display critical thinking in various professional contexts.

**TEXT BOOKS:**

1. Debra Daise, CharlNorloff, and Paul Carne Reading and Writing (Level 4) Oxford University Press: Oxford, 2011
2. Gramer F. Margot and Colin S. Ward Reading and Writing (Level 3) Oxford University Press: Oxford, 2011

## REFERENCES

1. Davis, Jason and Rhonda Liss. Effective Academic Writing (Level 3) Oxford University Press: Oxford, 2006
2. E. Suresh Kumar and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Black swan: Hyderabad, 2012
3. Withrow, Jeans and et al. Inspired to Write. Readings and Tasks to develop writing skills. Cambridge University Press: Cambridge, 2004
4. Goatly, Andrew. Critical Reading and Writing. Routledge: United States of America, 2000
5. Petelin, Roslyn and Marsh Durham. The Professional Writing Guide: Knowing Well and Knowing Why. Business & Professional Publishing: Australia, 2004

**ME8595**

**THERMAL ENGINEERING – II**

**L T P C**  
**3 0 0 3**

### OBJECTIVES:

- To apply the thermodynamic concepts for Nozzles, Boilers, Turbines, and Refrigeration & Air Conditioning Systems.
- To understand the concept of utilising residual heat in thermal systems.

### UNIT I STEAM NOZZLE

**9**

Types and Shapes of nozzles, Flow of steam through nozzles, Critical pressure ratio, Variation of mass flow rate with pressure ratio. Effect of friction. Metastable flow.

### UNIT II BOILERS

**9**

Types and comparison. Mountings and Accessories. Fuels - Solid, Liquid and Gas. Performance calculations, Boiler trial.

### UNIT III STEAM TURBINES

**9**

Types, Impulse and reaction principles, Velocity diagrams, Work done and efficiency – optimal operating conditions. Multi-staging, compounding and governing.

### UNIT IV COGENERATION AND RESIDUAL HEAT RECOVERY

**9**

Cogeneration Principles, Cycle Analysis, Applications, Source and utilisation of residual heat. Heat pipes, Heat pumps, Recuperative and Regenerative heat exchangers. Economic Aspects.

### UNIT V REFRIGERATION AND AIR – CONDITIONING

**9**

Vapour compression refrigeration cycle, Effect of Superheat and Sub-cooling, Performance calculations, Working principle of air cycle, vapour absorption system, and Thermoelectric refrigeration. Air conditioning systems, concept of RSHF, GSHF and ESHF, Cooling load calculations. Cooling towers – concept and types.

**TOTAL:45 PERIODS**

### OUTCOMES:

**Upon the completion of this course the students will be able to**

- CO1 Solve problems in Steam Nozzle
- CO2 Explain the functioning and features of different types of Boilers and auxiliaries and calculate performance parameters.
- CO3 Explain the flow in steam turbines, draw velocity diagrams for steam turbines and solve problems.
- CO4 Summarize the concept of Cogeneration, Working features of Heat pumps and Heat exchangers
- CO5 Solve problems using refrigerant table / charts and psychrometric charts

**TEXT BOOKS:**

1. Kothandaraman, C.P., Domkundwar .S and Domkundwar A.V.,"A course in Thermal Engineering", Dhanpat Rai & Sons, 2016.
2. Mahesh. M. Rathore, "Thermal Engineering", 1<sup>st</sup> Edition, Tata Mc Graw Hill Publications, 2010.

**REFERENCES:**

1. Arora .C.P., "Refrigeration and Air Conditioning", Tata Mc Graw Hill, 2008
2. Ballaney. P.L ." Thermal Engineering", Khanna publishers, 24th Edition 2012
3. Charles H Butler : Cogeneration" McGraw Hill, 1984.
4. Donald Q. Kern, " Process Heat Transfer", Tata Mc Graw Hill, 2001.
5. Sydney Reiter "Industrial and Commercial Heat Recovery Systems" Van Nostrand Reinholds, 1985.

**ME8593****DESIGN OF MACHINE ELEMENTS**

L	T	P	C
3	0	0	3

**OBJECTIVES**

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components
- (Use of P S G Design Data Book is permitted)

**UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 9**

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – curved beams – crane hook and ‘C’ frame- Factor of safety - theories of failure – Design based on strength and stiffness – stress concentration – Design for variable loading.

**UNIT II SHAFTS AND COUPLINGS 9**

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines - Rigid and flexible couplings.

**UNIT III TEMPORARY AND PERMANENT JOINTS 9**

Threaded fasteners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints, riveted joints for structures - theory of bonded joints.

**UNIT IV ENERGY STORING ELEMENTS AND ENGINE COMPONENTS 9**

Various types of springs, optimization of helical springs - rubber springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

**UNIT V BEARINGS 9**

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs, -- Selection of Rolling Contact bearings.

**TOTAL: 45 PERIODS**

**OUTCOMES:****Upon the completion of this course the students will be able to**

- CO1 Explain the influence of steady and variable stresses in machine component design.
- CO2 Apply the concepts of design to shafts, keys and couplings.
- CO3 Apply the concepts of design to temporary and permanent joints.
- CO4 Apply the concepts of design to energy absorbing members, connecting rod and crank shaft.
- CO5 Apply the concepts of design to bearings.

**TEXT BOOKS:**

1. Bhandari V, "Design of Machine Elements", 4<sup>th</sup> Edition, Tata McGraw-Hill Book Co, 2016.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 9th Edition, Tata McGraw-Hill, 2011.

**REFERENCES:**

1. Alfred Hall, Halowenko, A and Laughlin, H., "Machine Design", Tata McGraw-Hill BookCo.(Schaum's Outline), 2010
2. Ansel Ugural, "Mechanical Design – An Integral Approach", 1<sup>st</sup> Edition, Tata McGraw-Hill Book Co, 2003.
3. P.C. Gope, "Machine Design – Fundamental and Application", PHI learning private ltd, New Delhi, 2012.
4. R.B. Patel, "Design of Machine Elements", MacMillan Publishers India P Ltd., Tech-Max Educational resources, 2011.
5. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design", 4<sup>th</sup> Edition, Wiley, 2005
6. Sundararajamoorthy T. V. Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2015.

**ME8501****METROLOGY AND MEASUREMENTS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To provide knowledge on various Metrological equipments available to measure the dimension of the components.
- To provide knowledge on the correct procedure to be adopted to measure the dimension of the components.

**UNIT I BASICS OF METROLOGY****9**

Introduction to Metrology – Need – Elements – Work piece, Instruments – Persons – Environment – their effect on Precision and Accuracy – Errors – Errors in Measurements – Types – Control – Types of standards.

**UNIT II LINEAR AND ANGULAR MEASUREMENTS****9**

Linear Measuring Instruments – Evolution – Types – Classification – Limit gauges – gauge design – terminology – procedure – concepts of interchange ability and selective assembly – Angular measuring instruments – Types – Bevel protractor clinometers angle gauges, spirit levels sine bar – Angle alignment telescope – Autocollimator – Applications.





**OBJECTIVES:**

- To supplement the principles learnt in kinematics and Dynamics of Machinery.
- To understand how certain measuring devices are used for dynamic testing.

**LIST OF EXPERIMENTS**

- a) Study of gear parameters.  
b) Experimental study of velocity ratios of simple, compound, Epicyclic and differential gear trains.
- a) Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinder Mechanisms.  
b) Kinematics of single and double universal joints.
- a) Determination of Mass moment of inertia of Fly wheel and Axle system.  
b) Determination of Mass Moment of Inertia of axisymmetric bodies using Turn Table apparatus. c) Determination of Mass Moment of Inertia using bifilar suspension and compound pendulum.
- Motorized gyroscope – Study of gyroscopic effect and couple.
- Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.
- Cams – Cam profile drawing, Motion curves and study of jump phenomenon
- a) Single degree of freedom Spring Mass System – Determination of natural Frequency and verification of Laws of springs – Damping coefficient determination. b) Multi degree freedom suspension system – Determination of influence coefficient.
- a) Determination of torsional natural frequency of single and Double Rotor systems.- Undamped and Damped Natural frequencies.  
b) Vibration Absorber – Tuned vibration absorber.
- Vibration of Equivalent Spring mass system – undamped and damped vibration.
- Whirling of shafts – Determination of critical speeds of shafts with concentrated loads.
- a) Balancing of rotating masses. (b) Balancing of reciprocating masses.
- a) Transverse vibration of Free-Free beam – with and without concentrated masses. b) Forced Vibration of Cantilever beam – Mode shapes and natural frequencies.  
c) Determination of transmissibility ratio using vibrating table.

**TOTAL : 60 PERIODS****OUTCOMES****Upon the completion of this course the students will be able to**

- CO1 Explain gear parameters, kinematics of mechanisms, gyroscopic effect and working of lab equipments.
- CO2 Determine mass moment of inertia of mechanical element, governor effort and range sensitivity, natural frequency and damping coefficient, torsional frequency, critical speeds of shafts, balancing mass of rotating and reciprocating masses, and transmissibility ratio.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Cam follower setup.	1 No.
2	Motorised gyroscope.	1 No.
3	Governor apparatus - Watt, Porter, Proell and Hartnell governors.	1 No.
4	Whirling of shaft apparatus.	1 No.
5	Dynamic balancing machine.	1 No.
6	Two rotor vibration setup.	1 No.
7	Spring mass vibration system.	1 No.

8	Torsional Vibration of single rotor system setup.	1 No.
9	Gear Models	1 No.
10	Kinematic Models to study various mechanisms.	1 No.
11	Turn table apparatus.	1 No.
12	Transverse vibration setup of a) cantilever	1 No.

**ME8512**

**THERMAL ENGINEERING LABORATORY**

**L T P C**  
**0 0 4 2**

**OBJECTIVES:**

- To study the value timing-V diagram and performance of IC Engines
- To Study the characteristics of fuels/Lubricates used in IC Engines
- To study the Performance of steam generator/ turbine
- To study the heat transfer phenomena predict the relevant coefficient using implementation
- To study the performance of refrigeration cycle / components

**LIST OF EXPERIMENTS**

**I.C. ENGINE LAB**

1. Valve Timing and Port Timing diagrams.
2. Actual p-v diagrams of IC engines.
3. Performance Test on 4 – stroke Diesel Engine.
4. Heat Balance Test on 4 – stroke Diesel Engine.
5. Morse Test on Multi-cylinder Petrol Engine.
6. Retardation Test on a Diesel Engine.
7. Determination of Flash Point and Fire Point of various fuels / lubricants.

**STEAM LAB**

1. Study on Steam Generators and Turbines.
2. Performance and Energy Balance Test on a Steam Generator.
3. Performance and Energy Balance Test on Steam Turbine.

**HEAT TRANSFER LAB:**

1. Thermal conductivity measurement using guarded plate apparatus.
2. Thermal conductivity measurement of pipe insulation using lagged pipe apparatus.
3. Determination of heat transfer coefficient under natural convection from a vertical cylinder.
4. Determination of heat transfer coefficient under forced convection from a tube.
5. Determination of Thermal conductivity of composite wall.
6. Determination of Thermal conductivity of insulating powder.
7. Heat transfer from pin-fin apparatus (natural & forced convection modes)
8. Determination of Stefan – Boltzmann constant.
9. Determination of emissivity of a grey surface.
10. Effectiveness of Parallel / counter flow heat exchanger.

**REFRIGERATION AND AIR CONDITIONING LAB**

1. Determination of COP of a refrigeration system
2. Experiments on Psychrometric processes
3. Performance test on a reciprocating air compressor
4. Performance test in a HC Refrigeration System
5. Performance test in a fluidized Bed Cooling Tower

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 conduct tests on heat conduction apparatus and evaluate thermal conductivity of materials.
- CO2 conduct tests on natural and forced convective heat transfer apparatus and evaluate heat transfer coefficient.
- CO3 conduct tests on radiative heat transfer apparatus and evaluate Stefan Boltzmann constant and emissivity.
- CO4 conduct tests to evaluate the performance of parallel/counter flow heat exchanger apparatus and reciprocating air compressor.
- CO5 conduct tests to evaluate the performance of refrigeration and airconditioning test rigs.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

	<b>NAME OF THE EQUIPMENT</b>	<b>Qty.</b>
1	I.C Engine – 2 stroke and 4 stroke model	1 set
2	Apparatus for Flash and Fire Point	1 No.
3	4-stroke Diesel Engine with mechanical loading.	1 No
4	4-stroke Diesel Engine with hydraulic loading.	1 No.
5	4-stroke Diesel Engine with electrical loading.	1 No.
6	Multi-cylinder Petrol Engine	1 No.
7	Single cylinder Petrol Engine	1 No.
8	Data Acquisition system with any one of the above engines	1 No.
9	Steam Boiler with turbine setup	1 No.

<b>S.No.</b>	<b>NAME OF THE EQUIPMENT</b>	<b>Qty.</b>
1	Guarded plate apparatus	1 No.
2	Lagged pipe apparatus	1 No.
3	Natural convection-vertical cylinder apparatus	1 No.
4	Forced convection inside tube apparatus	1 No.
5	Composite wall apparatus	1 No.
6	Thermal conductivity of insulating powder apparatus	1 No.
7	Pin-fin apparatus	1 No.
8	Stefan-Boltzmann apparatus	1 No.
9	Emissivity measurement apparatus	1 No.
10	Parallel/counter flow heat exchanger apparatus	1 No.
11	Single/two stage reciprocating air compressor	1 No.
12	Refrigeration test rig	1 No.
13	Air-conditioning test rig	1 No.

**OBJECTIVE:**

- To familiar with different measurement equipments and use of this industry for quality inspection.

**LIST OF EXPERIMENTS**

1. Calibration and use of measuring instruments – Vernier caliper, micrometer, Vernier height gauge – using gauge blocks
2. Calibration and use of measuring instruments – depth micrometer, bore gauge, telescopic gauge
3. Measurement of linear dimensions using Comparators
4. Measurement of angles using bevel protractor and sine bar
5. Measurement of screw thread parameters – Screw thread Micrometers and Three wire method (floating carriage micrometer)
6. Measurement of gear parameters – disc micrometers, gear tooth vernier caliper
7. Measurement of features in a prismatic component using Coordinate Measuring Machine (CMM)
8. Programming of CNC Coordinate Measuring Machines for repeated measurements of identical components
9. Non-contact (Optical) measurement using Toolmaker's microscope / Profile projector and Video measurement system
10. Measurement of Surface finish in components manufactured using various processes (turning, milling, grinding, etc.,) using stylus based instruments.
11. Machine tool metrology – Level tests using precision level; Testing of straightness of a machine tool guide way using Autocollimator, spindle tests.
12. Measurement of force, torque and temperature

**TOTAL: 60 PERIODS****OUTCOMES****Upon the completion of this course the students will be able to**

- CO1 Measure the gear tooth dimensions, angle using sine bar, straightness and flatness, thread parameters, temperature using thermocouple, force, displacement, torque and vibration.
- CO2 Calibrate the vernier, micrometer and slip gauges and setting up the comparator for the inspection.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Micrometer	5
2	Vernier Caliper	5
3	Vernier Height Gauge	2
4	Vernier depth Gauge	2
5	Slip Gauge Set	1
6	Gear Tooth Vernier	1
7	Sine Bar	1
8	Floating Carriage Micrometer	1
9	Profile Projector / Tool Makers Microscope	1
10	Parallel / counter flow heat exchanger apparatus	1
11	Mechanical / Electrical / Pneumatic Comparator	1
12	Autocollimator	1
13	Temperature Measuring Setup	1
14	Force Measuring Setup	1
15	Torque Measuring Setup	1

16	Coordinate measuring machine	1
17	Surface finish measuring equipment	1
18	Bore gauge	1
19	Telescope gauge	1

<b>ME8651</b>	<b>DESIGN OF TRANSMISSION SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To gain knowledge on the principles and procedure for the design of Mechanical power Transmission components.
- To understand the standard procedure available for Design of Transmission of Mechanical elements
- To learn to use standard data and catalogues  
(Use of P S G Design Data Book permitted)

**UNIT I DESIGN OF FLEXIBLE ELEMENTS 9**

Design of Flat belts and pulleys - Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.

**UNIT II SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 9**

Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects – Fatigue strength - Factor of safety - Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations – Pressure angle in the normal and transverse plane-Equivalent number of teeth-forces for helical gears.

**UNIT III BEVEL, WORM AND CROSS HELICAL GEARS 9**

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits-terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair. Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

**UNIT IV GEAR BOXES 9**

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box - Design of multi speed gear box for machine tool applications - Constant mesh gear box - Speed reducer unit. – Variable speed gear box, Fluid Couplings, Torque Converters for automotive applications.

**UNIT V CAMS, CLUTCHES AND BRAKES 9**

Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses. Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches-Electromagnetic clutches. Band and Block brakes - external shoe brakes – Internal expanding shoe brake.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 apply the concepts of design to belts, chains and rope drives.  
 CO2 apply the concepts of design to spur, helical gears.  
 CO3 apply the concepts of design to worm and bevel gears.  
 CO4 apply the concepts of design to gear boxes .  
 CO5 apply the concepts of design to cams, brakes and clutches

**TEXT BOOKS:**

1. Bhandari V, "Design of Machine Elements", 4<sup>th</sup> Edition, Tata McGraw-Hill Book Co, 2016.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8<sup>th</sup> Edition, Tata McGraw-Hill, 2008.

**REFERENCES:**

1. Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, "Design of Machine Elements" 8<sup>th</sup> Edition, Printice Hall, 2003.
2. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
3. Prabhu. T.J., "Design of Transmission Elements", Mani Offset, Chennai, 2000.
4. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design", 4<sup>th</sup> Edition, Wiley, 2005
5. Sundararamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.

**ME8691****COMPUTER AIDED DESIGN AND MANUFACTURING****L T P C  
3 0 0 3****OBJECTIVES:**

- To provide an overview of how computers are being used in mechanical component design
- To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

**UNIT I INTRODUCTION****9**

Product cycle- Design process- sequential and concurrent engineering- Computer aided design – CAD system architecture- Computer graphics – co-ordinate systems- 2D and 3D transformations-homogeneous coordinates - Line drawing -Clipping- viewing transformation-Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM –CAD/CAM concepts —Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance

**UNIT II GEOMETRIC MODELING****9**

Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves-Techniques for surface modeling – surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG andB-rep

**UNIT III CAD STANDARDS****9**

Standards for computer graphics- Graphical Kernel System (GKS) - standards for exchange images- Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, CALS etc. - communication standards.

**UNIT IV FUNDAMENTAL OF CNC AND PART PROGRAMING 9**

Introduction to NC systems and CNC - Machine axis and Co-ordinate system- CNC machine tools- Principle of operation CNC- Construction features including structure- Drives and CNC controllers- 2D and 3D machining on CNC- Introduction of Part Programming, types - Detailed Manual part programming on Lathe & Milling machines using G codes and M codes- Cutting Cycles, Loops, Sub program and Macros- Introduction of CAM package.

**UNIT V CELLULAR MANUFACTURING AND FLEXIBLE MANUFACTURING SYSTEM (FMS) 9**

Group Technology(GT),Part Families–Parts Classification and coding–Simple Problems in Opitz Part Coding system–Production flow Analysis–Cellular Manufacturing–Composite part concept–Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control– Quantitative analysis in FMS

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Explain the 2D and 3D transformations, clipping algorithm, Manufacturing models and Metrics
- CO2 Explain the fundamentals of parametric curves, surfaces and Solids
- CO3 Summarize the different types of Standard systems used in CAD
- CO4 Apply NC & CNC programming concepts to develop part programme for Lathe & Milling Machines
- CO5 Summarize the different types of techniques used in Cellular Manufacturing and FMS

**TEXT BOOKS:**

1. Ibrahim Zeid “Mastering CAD CAM” Tata McGraw-Hill PublishingCo.2007
2. Mikell.P.Groover “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India, 2008.
3. Radhakrishnan P, SubramanyanS.andRaju V., “CAD/CAM/CIM”, 2nd Edition, New Age International (P) Ltd, New Delhi,2000.

**REFERENCES:**

1. Chris McMahan and Jimmie Browne “CAD/CAM Principles”, "Practice and Manufacturing management “ Second Edition, Pearson Education, 1999.
2. Donald Hearn and M. Pauline Baker “Computer Graphics”. Prentice Hall, Inc,1992.
3. Foley, Wan Dam, Feiner and Hughes - "Computer graphics principles & practice" Pearson Education -2003
4. William M Neumann and Robert F.Sproul “Principles of Computer Graphics”, McGraw Hill Book Co. Singapore, 1989.

**ME8693**

**HEAT AND MASS TRANSFER**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>2</b>	<b>0</b>	<b>4</b>

**OBJECTIVES:**

- To understand the mechanisms of heat transfer under steady and transient conditions.
  - To understand the concepts of heat transfer through extended surfaces.
  - To learn the thermal analysis and sizing of heat exchangers and to understand the basic concepts of mass transfer.
- (Use of standard HMT data book permitted)

**UNIT I CONDUCTION****9+6**

General Differential equation of Heat Conduction– Cartesian and Polar Coordinates – One Dimensional Steady State Heat Conduction — plane and Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Semi Infinite and Infinite Solids –Use of Heisler's charts.

**UNIT II CONVECTION****9+6**

Free and Forced Convection - Hydrodynamic and Thermal Boundary Layer. Free and Forced Convection during external flow over Plates and Cylinders and Internal flow through tubes .

**UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS****9+6**

Nusselt's theory of condensation - Regimes of Pool boiling and Flow boiling. Correlations in boiling and condensation. Heat Exchanger Types - Overall Heat Transfer Coefficient – Fouling Factors - Analysis – LMTD method - NTU method.

**UNIT IV RADIATION****9+6**

Black Body Radiation – Grey body radiation - Shape Factor – Electrical Analogy – Radiation Shields. Radiation through gases.

**UNIT V MASS TRANSFER****9+6**

Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy – Convective Mass Transfer Correlations.

**TOTAL : 75 PERIODS****OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Apply heat conduction equations to different surface configurations under steady state and transient conditions and solve problems
- CO2 Apply free and forced convective heat transfer correlations to internal and external flows through/over various surface configurations and solve problems
- CO3 Explain the phenomena of boiling and condensation, apply LMTD and NTU methods of thermal analysis to different types of heat exchanger configurations and solve problems
- CO4 Explain basic laws for Radiation and apply these principles to radiative heat transfer between different types of surfaces to solve problems
- CO5 Apply diffusive and convective mass transfer equations and correlations to solve problems for different applications

**TEXT BOOKS:**

1. Holman, J.P., "Heat and Mass Transfer", Tata McGraw Hill, 2000
2. Yunus A. Cengel, "Heat Transfer A Practical Approach", Tata McGraw Hill, 5th Edition 2015

**REFERENCES:**

1. Frank P. Incropera and David P. Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley & Sons, 1998.
2. Kothandaraman, C.P., "Fundamentals of Heat and Mass Transfer", New Age International, New Delhi, 1998.
3. Nag, P.K., "Heat Transfer", Tata McGraw Hill, New Delhi, 2002
4. Ozisik, M.N., "Heat Transfer", McGraw Hill Book Co., 1994.
5. R.C. Sachdeva, "Fundamentals of Engineering Heat & Mass transfer", New Age International Publishers, 2009

**OBJECTIVES:**

- To introduce the concepts of Mathematical Modeling of Engineering Problems.
- To appreciate the use of FEM to a range of Engineering Problems.

**UNIT I INTRODUCTION****9**

Historical Background – Mathematical Modeling of field problems in Engineering – Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

**UNIT II ONE-DIMENSIONAL PROBLEMS****9**

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors- Assembly of Matrices - Solution of problems from solid mechanics and heat transfer. Longitudinal vibration frequencies and mode shapes. Fourth Order Beam Equation – Transverse deflections and Natural frequencies of beams.

**UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS****9**

Second Order 2D Equations involving Scalar Variable Functions – Variational formulation – Finite Element formulation – Triangular elements – Shape functions and element matrices and vectors. Application to Field Problems - Thermal problems – Torsion of Non circular shafts – Quadrilateral elements – Higher Order Elements.

**UNIT IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS****9**

Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements.

**UNIT V ISOPARAMETRIC FORMULATION****9**

Natural co-ordinate systems – Isoparametric elements – Shape functions for iso parametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems - Matrix solution techniques – Solutions Techniques to Dynamic problems – Introduction to Analysis Software.

**TOTAL : 45 PERIODS****OUTCOMES**

- CO1 Summarize the basics of finite element formulation.
- CO2 Apply finite element formulations to solve one dimensional Problems.
- CO3 Apply finite element formulations to solve two dimensional scalar Problems.
- CO4 Apply finite element method to solve two dimensional Vector problems.
- CO5 Apply finite element method to solve problems on iso parametric element and dynamic Problems.

**TEXT BOOKS:**

1. Reddy. J.N., “An Introduction to the Finite Element Method”, 3rd Edition, Tata McGraw-Hill, 2005
2. Seshu, P, “Text Book of Finite Element Analysis”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.

## REFERENCES:

1. Bhatti Asghar M, "Fundamental Finite Element Analysis and Applications", John Wiley & Sons, 2005 (Indian Reprint 2013)\*
2. Chandrupatla & Belagundu, "Introduction to Finite Elements in Engineering", 3rd Edition, Prentice Hall College Div, 1990
3. Logan, D.L., "A first course in Finite Element Method", Thomson Asia Pvt. Ltd., 2002
4. Rao, S.S., "The Finite Element Method in Engineering", 3rd Edition, Butterworth Heinemann, 2004
5. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", 4th Edition, Wiley Student Edition, 2002.

**ME8694**

**HYDRAULICS AND PNEUMATICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

## OBJECTIVES:

- To provide student with knowledge on the application of fluid power in process, construction and manufacturing Industries.
- To provide students with an understanding of the fluids and components utilized in modern industrial fluid power system.
- To develop a measurable degree of competence in the design, construction and operation of fluid power circuits.

## **UNIT I FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS 9**

Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types of fluids - Properties of fluids and selection – Basics of Hydraulics – Pascal's Law – Principles of flow - Friction loss – Work, Power and Torque Problems, Sources of Hydraulic power : Pumping Theory – Pump Classification – Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criteria of Linear and Rotary – Fixed and Variable displacement pumps – Problems.

## **UNIT II HYDRAULIC ACTUATORS AND CONTROL COMPONENTS 9**

Hydraulic Actuators: Cylinders – Types and construction, Application, Hydraulic cushioning – Hydraulic motors - Control Components : Direction Control, Flow control and pressure control valves – Types, Construction and Operation – Servo and Proportional valves – Applications – Accessories : Reservoirs, Pressure Switches – Applications – Fluid Power ANSI Symbols – Problems.

## **UNIT III HYDRAULIC CIRCUITS AND SYSTEMS 9**

Accumulators, Intensifiers, Industrial hydraulic circuits – Regenerative, Pump Unloading, Double-Pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control, Hydrostatic transmission, Electro hydraulic circuits, Mechanical hydraulic servo systems.

## **UNIT IV PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS 9**

Properties of air – Perfect Gas Laws – Compressor – Filters, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit – Cascade method – Electro Pneumatic System – Elements – Ladder diagram – Problems, Introduction to fluidics and pneumatic logic circuits.

## UNIT V TROUBLE SHOOTING AND APPLICATIONS

9

Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems, Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for Pick and Place applications and tool handling in CNC Machine tools – Low cost Automation – Hydraulic and Pneumatic power packs.

**TOTAL:45 PERIODS**

### OUTCOMES:

**Upon the completion of this course the students will be able to**

- CO1 Explain the Fluid power and operation of different types of pumps.
- CO2 Summarize the features and functions of Hydraulic motors, actuators and Flow control valves
- CO3 Explain the different types of Hydraulic circuits and systems
- CO4 Explain the working of different pneumatic circuits and systems
- CO5 Summarize the various trouble shooting methods and applications of hydraulic and pneumatic systems.

### TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education 2005.
2. Majumdar S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGraw-Hill, 2001.

### REFERENCES:

1. Anthony Lal, "Oil hydraulics in the service of industry", Allied publishers, 1982.
2. Dudelyt, A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 1987.
3. Majumdar S.R., "Pneumatic systems – Principles and maintenance", Tata McGraw Hill, 1995
4. Michael J, Prinches and Ashby J. G, "Power Hydraulics", Prentice Hall, 1989.
5. Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co, 2006.

ME8681

CAD / CAM LABORATORY

L	T	P	C
0	0	4	2

### OBJECTIVES:

- To gain practical experience in handling 2D drafting and 3D modelling software systems.
- To study the features of CNC Machine Tool.
- To expose students to modern control systems (Fanuc, Siemens etc.,)
- To know the application of various CNC machines like CNC lathe, CNC Vertical Machining centre, CNC EDM and CNC wire-cut and studying of Rapid prototyping.

### LIST OF EXPERIMENTS

#### 1. 3D GEOMETRIC MODELLING

**30 PERIODS**

##### List of Experiments

1. Introduction of 3D Modelling software

##### Creation of 3D assembly model of following machine elements using 3D Modelling software

2. Flange Coupling
3. Plummer Block
4. Screw Jack
5. Lathe Tailstock
6. Universal Joint
7. Machine Vice
8. Stuffing box
9. Crosshead

10. Safety Valves
11. Non-return valves
12. Connecting rod
13. Piston
14. Crankshaft

\* Students may also be trained in manual drawing of some of the above components

## 2. Manual Part Programming.

**30 PERIODS**

(i) Part Programming - CNC Machining  
Centre a) Linear Cutting.

b) Circular cutting.

c) Cutter Radius

Compensation. d) Canned

Cycle Operations.

(ii) Part Programming - CNC Turning

Centre a) Straight, Taper and Radius

Turning.

b) Thread Cutting.

c) Rough and Finish Turning

Cycle. d) Drilling and Tapping

Cycle.

## 3. Computer Aided Part Programming

e) CL Data and Post process generation using CAM packages.

f) Application of CAPP in Machining and Turning Centre.

**TOTAL: 60 PERIODS**

## OUTCOMES

CO1 Draw 3D and Assembly drawing using CAD software

CO2 Demonstrate manual part programming with G and M codes using CAM

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	Description of Equipment	Qty
<b>HARDWARE</b>		
1.	Computer Server	1
2.	Computer nodes or systems (High end CPU with atleast 1 GB main memory) networked to the server	30
3.	A3 size plotter	1
4.	Laser Printer	1
5.	CNC Lathe	1
6.	CNC milling machine	1
<b>SOFTWARE</b>		
7.	Any High end integrated modeling and manufacturing CAD / CAM software	15 licenses
8.	CAM Software for machining centre and turning centre (CNC Programming and tool path simulation for FANUC / Sinumeric and Heidenhain controller)	15 licenses
9.	Licensed operating system	Adequate
10.	Support for CAPP	Adequate

**ME8682**

**DESIGN AND FABRICATION PROJECT**

**L T P C**  
**0 0 4 2**

**OBJECTIVE:**

- The main objective is to give an opportunity to the student to get hands on training in the fabrication of one or more components of a complete working model, which is designed by them.

**GUIDELINE FOR REVIEW AND EVALUATION**

The students may be grouped into 2 to 4 and work under a project supervisor. The device/system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL : 60 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

CO1 design and Fabricate the machine element or the mechanical product.

CO2 demonstrate the working model of the machine element or the mechanical product.

**HS8581**

**PROFESSIONAL COMMUNICATION**

**L T P C**  
**0 0 2 1**

**OBJECTIVES: The course aims to:**

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

**UNIT I**

Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

**UNIT II**

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

**UNIT III**

Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -- questioning and clarifying –GD strategies- activities to improve GD skills

**UNIT IV**

Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

## UNIT V

Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

**TOTAL : 30 PERIODS**

### OUTCOMES: At the end of the course Learners will be able to:

- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

### Recommended Software

1. Open Source Software
2. Win English

### REFERENCES:

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Interact English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

**ME8792**

**POWER PLANT ENGINEERING**

L	T	P	C
3	0	0	3

### OBJECTIVE:

- Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

### UNIT I COAL BASED THERMAL POWER PLANTS 9

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

### UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 9

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

### UNIT III NUCLEAR POWER PLANTS 9

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : *Boiling Water Reactor (BWR)*, *Pressurized Water Reactor (PWR)*, CANada Deuterium- Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

**UNIT IV POWER FROM RENEWABLE ENERGY 9**  
 Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, *Solar* Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

**UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS 9**  
 Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Explain the layout, construction and working of the components inside a thermal power plant.
- CO2 Explain the layout, construction and working of the components inside a Diesel, Gas and Combined cycle power plants.
- CO3 Explain the layout, construction and working of the components inside nuclear power plants.
- CO4 Explain the layout, construction and working of the components inside Renewable energy power plants.
- CO5 Explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.

**TEXT BOOK:**

1. Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008.

**REFERENCES:**

1. El-Wakil. M.M., "Power Plant Technology", Tata McGraw – Hill Publishing Company Ltd., 2010.
2. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, "Power Plant Engineering", Second Edition, Standard Handbook of McGraw – Hill, 1998.

<b>ME8793</b>	<b>PROCESS PLANNING AND COST ESTIMATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVE:**

- To introduce the process planning concepts to make cost estimation for various products after process planning

**UNIT I INTRODUCTION TO PROCESS PLANNING 9**  
 Introduction- methods of process planning-Drawing interpretation-Material evaluation – steps in process selection-.Production equipment and tooling selection

**UNIT II PROCESS PLANNING ACTIVITIES 9**  
 Process parameters calculation for various production processes-Selection jigs and fixtures election of quality assurance methods - Set of documents for process planning-Economics of process planning- case studies

**UNIT III INTRODUCTION TO COST ESTIMATION 9**  
 Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of over head charges- Calculation of depreciation cost

**UNIT IV PRODUCTION COST ESTIMATION 9**  
 Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop

**UNIT V MACHINING TIME CALCULATION 9**  
 Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations ,Drilling and Boring - Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 select the process, equipment and tools for various industrial products.
- CO2 prepare process planning activity chart.
- CO3 explain the concept of cost estimation.
- CO4 compute the job order cost for different type of shop floor.
- CO5 calculate the machining time for various machining operations.

**TEXT BOOKS:**

1. Peter scalon, “Process planning, Design/Manufacture Interface”, Elsevier science technology Books, Dec 2002.
2. Sinha B.P, “Mechanical Estimating and Costing”, Tata-McGraw Hill publishing co, 1995.

**REFERENCES:**

1. Chitale A.V. and Gupta R.C., “Product Design and Manufacturing”, 2nd Edition, PHI, 2002.
2. Ostwalal P.F. and Munez J., “Manufacturing Processes and systems”, 9<sup>th</sup> Edition, John Wiley, 1998.
3. Russell R.S and Tailor B.W, “Operations Management”, 4th Edition, PHI, 2003.
4. Mikell P. Groover, “Automation, Production, Systems and Computer Integrated Manufacturing”, Pearson Education 2001.
5. K.C. Jain & L.N. Aggarwal, “Production Planning Control and Industrial Management”, Khanna Publishers 1990.

**ME8791**

**MECHATRONICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVE:**

- To impart knowledge about the elements and techniques involved in Mechatronics systems which are very much essential to understand the emerging field of automation.

**UNIT I INTRODUCTION 9**  
 Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers: Static and dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor – Temperature sensors – Light sensors

<b>UNIT II</b>	<b>MICROPROCESSOR AND MICROCONTROLLER</b>	<b>9</b>
Introduction – Architecture of 8085 – Pin Configuration – Addressing Modes –Instruction set, Timing diagram of 8085 – Concepts of 8051 microcontroller – Block diagram,.		
<b>UNIT III</b>	<b>PROGRAMMABLE PERIPHERAL INTERFACE</b>	<b>9</b>
Introduction – Architecture of 8255, Keyboard interfacing, LED display –interfacing, ADC and DAC interface, Temperature Control – Stepper Motor Control – Traffic Control interface.		
<b>UNIT IV</b>	<b>PROGRAMMABLE LOGIC CONTROLLER</b>	<b>9</b>
Introduction – Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters and internal relays – Data handling – Selection of PLC.		
<b>UNIT V</b>	<b>ACTUATORS AND MECHATRONIC SYSTEM DESIGN</b>	<b>9</b>
Types of Stepper and Servo motors – Construction – Working Principle – Advantages and Disadvantages. Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Engine Management system – Automatic car park barrier.		
		<b>TOTAL : 45 PERIODS</b>

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Discuss the interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical, Electronic Systems and sensor technology.
- CO2 Discuss the architecture of Microprocessor and Microcontroller, Pin Diagram, Addressing Modes of Microprocessor and Microcontroller.
- CO3 Discuss Programmable Peripheral Interface, Architecture of 8255 PPI, and various device interfacing
- CO4 Explain the architecture, programming and application of programmable logic controllers to problems and challenges in the areas of Mechatronic engineering.
- CO5 Discuss various Actuators and Mechatronics system using the knowledge and skills acquired through the course and also from the given case studies

**TEXT BOOKS:**

1. Bolton, "Mechatronics", Prentice Hall, 2008
2. Ramesh S Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 5th Edition, Prentice Hall, 2008.

**REFERENCES:**

1. Bradley D.A, Dawson D, Buru N.C and Loader A.J, "Mechatronics", Chapman and Hall, 1993.
2. Clarence W, de Silva, "Mechatronics" CRC Press, First Indian Re-print, 2013
3. Devadas Shetty and Richard A. Kolk, "Mechatronics Systems Design", PWS publishing company, 2007.
4. Krishna Kant, "Microprocessors & Microcontrollers", Prentice Hall of India, 2007.
5. Michael B.Histand and Davis G.Alciatore, "Introduction to Mechatronics and Measurement systems", McGraw Hill International edition, 2007.

**OBJECTIVES:**

- To give exposure to software tools needed to analyze engineering problems.
- To expose the students to different applications of simulation and analysis tools.

**LIST OF EXPERIMENTS A. SIMULATION**

1. MATLAB basics, Dealing with matrices, Graphing-Functions of one variable and two variables
2. Use of Matlab to solve simple problems in vibration
3. Mechanism Simulation using Multibody Dynamic software

**B. ANALYSIS**

1. Force and Stress analysis using link elements in Trusses, cables etc.
2. Stress and deflection analysis in beams with different support conditions.
3. Stress analysis of flat plates and simple shells.
4. Stress analysis of axi – symmetric components.
5. Thermal stress and heat transfer analysis of plates.
6. Thermal stress analysis of cylindrical shells.
7. Vibration analysis of spring-mass systems.
8. Model analysis of Beams.
9. Harmonic, transient and spectrum analysis of simple systems.

**TOTAL: 60 PERIODS****OUTCOMES:****Upon the completion of this course the students will be able to**

- CO1 simulate the working principle of air conditioning system, hydraulic and pneumatic cylinder and cam follower mechanisms using MATLAB.
- CO2 analyze the stresses and strains induced in plates, brackets and beams and heat transfer problems.
- CO3 calculate the natural frequency and mode shape analysis of 2D components and beams.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S. NO.	NAME OF THE EQUIPMENT	Qty.
1	Computer Work Station	15
2	Color Desk Jet Printer	01
3	Multibody Dynamic Software Suitable for Mechanism simulation and analysis	15 licenses
4	C / MATLAB	5 licenses

**ME8781**

**MECHATRONICS LABORATORY**

**L T P C**  
**0 0 4 2**

**OBJECTIVE:**

- To know the method of programming the microprocessor and also the design, modeling & analysis of basic electrical, hydraulic & pneumatic Systems which enable the students to understand the concept of mechatronics.

**LIST OF EXPERIMENTS:**

1. Assembly language programming of 8085 – Addition – Subtraction – Multiplication – Division – Sorting – Code Conversion.
2. Stepper motor interface.
3. Traffic light interface.
4. Speed control of DC motor.
5. Study of various types of transducers.
6. Study of hydraulic, pneumatic and electro-pneumatic circuits.
7. Modelling and analysis of basic hydraulic, pneumatic and electrical circuits using Software.
8. Study of PLC and its applications.
9. Study of image processing technique.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Demonstrate the functioning of mechatronics system with various pneumatic, hydraulic and electrical systems.
- CO2 Demonstrate the functioning of control systems with the help of PLC and microcontrollers.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

<b>Sl. No.</b>	<b>NAME OF THE EQUIPMENT</b>	<b>Qty.</b>
1	Basic Pneumatic Trainer Kit with manual and electrical controls/ PLC Control each	1 No.
2	Basic Hydraulic Trainer Kit	1 No
3	Hydraulics and Pneumatics Systems Simulation Software	10 No
4	8051 - Microcontroller kit with stepper motor and drive circuit sets	2 No
5	Image processing system with hardware & software	1 No.

**ME8712**

**TECHNICAL SEMINAR**

**L T P C**  
**0 0 2 1**

To enrich the communication skills of the student and presentations of technical topics of interest, this course is introduced. In this course, a student has to present three Technical papers or recent advances in engineering/technology that will be evaluated by a Committee constituted by the Head of the Department.

**TOTAL: 30 PERIODS**

**OBJECTIVE:**

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization

**UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9**

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

**UNIT II PLANNING 9**

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

**UNIT III ORGANISING 9**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

**UNIT IV DIRECTING 9**

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

**UNIT V CONTROLLING 9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

**TOTAL: 45 PERIODS****OUTCOME:**

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

**TEXT BOOKS:**

- JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6th Edition, Pearson Education, 2004.
- Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall (India) Pvt. Ltd., 10<sup>th</sup> Edition, 2009.

**REFERENCES:**

- Harold Koontz & Heinz Weihrich, "Essentials of Management", Tata McGraw Hill, 1998.
- Robert Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008.
- Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management", 7<sup>th</sup> Edition, Pearson Education, 2011.
- Tripathy PC & Reddy PN, "Principles of Management", Tata McGraw Hill, 1999

**ME8811**

**PROJECT WORK**

L	T	P	C
0	0	20	10

**OBJECTIVE:**

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL: 300 PERIODS**

**OUTCOME:**

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

**ME8091**

**AUTOMOBILE ENGINEERING**

L	T	P	C
3	0	0	3

**OBJECTIVES:**

- To understand the construction and working principle of various parts of an automobile.
- To have the practice for assembling and dismantling of engine parts and transmission system

**UNIT I VEHICLE STRUCTURE AND ENGINES 9**

Types of automobiles vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines –components-functions and materials, variable valve timing (VVT).

**UNIT II ENGINE AUXILIARY SYSTEMS 9**

Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

**UNIT III TRANSMISSION SYSTEMS 9**

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints, Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

**UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS 9**

Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control.

**UNIT V ALTERNATIVE ENERGY SOURCES****9**

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

**TOTAL: 45 PERIODS****OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 recognize the various parts of the automobile and their functions and materials.
- CO2 discuss the engine auxiliary systems and engine emission control.
- CO3 distinguish the working of different types of transmission systems.
- CO4 explain the Steering, Brakes and Suspension Systems.
- CO5 predict possible alternate sources of energy for IC Engines.

**TEXT BOOKS:**

1. Jain K.K. and Asthana .R.B, “Automobile Engineering” Tata McGraw Hill Publishers, New Delhi, 2002.
2. Kirpal Singh, “Automobile Engineering”, Vol 1 & 2, Seventh Edition, Standard Publishers, New Delhi, 13th Edition 2014..

**REFERENCES:**

1. Ganesan V. “Internal Combustion Engines”, Third Edition, Tata McGraw-Hill, 2012.
2. Heinz Heisler, “Advanced Engine Technology,” SAE International Publications USA, 1998.
3. Joseph Heitner, “Automotive Mechanics,” Second Edition, East-West Press, 1999.
4. Martin W, Stockel and Martin T Stockle , “Automotive Mechanics Fundamentals,” The Good heart - Will Cox Company Inc, USA ,1978.
5. Newton ,Steeds and Garet, “Motor Vehicles”, Butterworth Publishers,1989.

**PR8592****WELDING TECHNOLOGY****L T P C  
3 0 0 3****OBJECTIVE:**

- To understand the basics of welding and to know about the various types of welding processes

**UNIT I GAS AND ARC WELDING PROCESSES:****9**

Fundamental principles – Air Acetylene welding, Oxyacetylene welding, Carbon arc welding, Shielded metal arc welding, Submerged arc welding, TIG & MIG welding, Plasma arc welding and Electroslag welding processes - advantages, limitations and applications.

**UNIT II RESISTANCE WELDING PROCESSES:****9**

Spot welding, Seam welding, Projection welding, Resistance Butt welding, Flash Butt welding, Percussion welding and High frequency resistance welding processes - advantages, limitations and applications.

**UNIT III SOLID STATE WELDING PROCESSES:****9**

Cold welding, Diffusion bonding, Explosive welding, Ultrasonic welding, Friction welding, Forge welding, Roll welding and Hot pressure welding processes - advantages, limitations and applications.

**UNIT IV OTHER WELDING PROCESSES: 9**  
Thermit welding, Atomic hydrogen welding, Electron beam welding, Laser Beam welding, Friction stir welding, Under Water welding, Welding automation in aerospace, nuclear and surface transport vehicles.

**UNIT V DESIGN OF WELD JOINTS, WELDABILITY AND TESTING OF WELDMENTS 9**  
Various weld joint designs – Welding defects – causes and remedies - Weldability of Aluminium, Copper, and Stainless steels. Destructive and non destructive testing of weldments.  
**TOTAL : 45 PERIODS**

**OUTCOMES:**

Upon completion of this course, the students can able

- Understand the construction and working principles of gas and arc welding process.
- Understand the construction and working principles of resistance welding process.
- Understand the construction and working principles of various solid state welding process.
- Understand the construction and working principles of various special welding processes.
- Understand the concepts on weld joint design, weldability and testing of weldments.

**TEXT BOOKS**

1. Little R.L., "Welding and welding Technology", Tata McGraw Hill Publishing Co., Ltd., New Delhi, 34<sup>th</sup> reprint, 2008.
2. Parmer R.S., "Welding Engineering and Technology", 1<sup>st</sup> Edition, Khanna Publishers, New Delhi, 2008.
3. Parmer R.S., "Welding Processes and Technology", Khanna Publishers, New Delhi, 1992.

**REFERENCES**

1. AWS- Welding Hand Book. 8<sup>th</sup> Edition. Vol- 2. "Welding Process"
2. Christopher Davis. "Laser Welding- Practical Guide". Jaico Publishing House.
3. Davis A.C., "The Science and Practice of Welding", Cambridge University Press, Cambridge, 1993
4. Nadkarni S.V. "Modern Arc Welding Technology", Oxford IBH Publishers, 1<sup>st</sup> Edition, 2005.
5. Schwartz M.M. "Metals Joining Manual". McGraw Hill Books, 1979.
6. Tylecote R.F. "The Solid Phase Welding of Metals". Edward Arnold Publishers Ltd. London.

**ME8096 GAS DYNAMICS AND JET PROPULSION L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To understand the basic difference between incompressible and compressible flow.
- To understand the phenomenon of shock waves and its effect on flow. To gain some basic knowledge about jet propulsion and Rocket Propulsion.  
(Use of Standard Gas Tables permitted)

**UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS 9**  
Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers

**UNIT II FLOW THROUGH DUCTS 9**  
Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties.



**UNIT III      AGREEMENTS AND LEGISLATIONS      10**  
International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

**UNIT IV      DIGITAL PRODUCTS AND LAW      9**  
Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

**UNIT V      ENFORCEMENT OF IPRs      7**  
Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

**TOTAL :45 PERIODS**

**OUTCOME:**

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

**TEXT BOOKS**

1. S.V. Satarkar, Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002.
2. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012

**REFERENCES**

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

**GE8073      FUNDAMENTALS OF NANOSCIENCE**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

To learn about basis of nanomaterial science, preparation method, types and application

**UNIT I      INTRODUCTION      8**  
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering- Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms- multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

**UNIT II      GENERAL METHODS OF PREPARATION      9**  
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

**UNIT III      NANOMATERIALS      12**  
Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO<sub>2</sub>, MgO, ZrO<sub>2</sub>, NiO, nanoalumina, CaO, AgTiO<sub>2</sub>, Ferrites, Nanoclays-

functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

#### **UNIT IV CHARACTERIZATION TECHNIQUES**

**9**

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

#### **UNIT V APPLICATIONS**

**7**

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

**TOTAL : 45 PERIODS**

#### **OUTCOMES:**

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

#### **TEXT BOOKS :**

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale Characterization of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

#### **REFERENCES:**

1. G Timp, "Nanotechnology", AIP press/Springer, 1999.
2. Akhlesh Lakhtakia, "The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

**ME8071**

**REFRIGERATION AND AIR CONDITIONING**

L	T	P	C
3	0	0	3

#### **OBJECTIVES:**

- To understand the underlying principles of operations in different Refrigeration & Air conditioning systems and components.
- To provide knowledge on design aspects of Refrigeration & Air conditioning systems

#### **UNIT I INTRODUCTION**

**9**

Introduction to Refrigeration - Unit of Refrigeration and C.O.P.– Ideal cycles- Refrigerants Desirable properties – Classification - Nomenclature - ODP & GWP.

#### **UNIT II VAPOUR COMPRESSION REFRIGERATION SYSTEM**

**9**

Vapor compression cycle : p-h and T-s diagrams - deviations from theoretical cycle – subcooling and super heating- effects of condenser and evaporator pressure on COP- multipressure system - low temperature refrigeration - Cascade systems – problems. Equipments: Type of Compressors, Condensers, Expansion devices, Evaporators.

**UNIT III OTHER REFRIGERATION SYSTEMS 9**  
Working principles of Vapour absorption systems and adsorption cooling systems – Steam jet refrigeration- Ejector refrigeration systems- Thermoelectric refrigeration- Air refrigeration - Magnetic - Vortex and Pulse tube refrigeration systems.

**UNIT IV PSYCHROMETRIC PROPERTIES AND PROCESSES 9**  
Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temperature Thermodynamic wet bulb temperature, Psychrometric chart; Psychrometric of air-conditioning processes, mixing of air streams.

**UNIT V AIR CONDITIONING SYSTEMS AND LOAD ESTIMATION 9**  
Air conditioning loads: Outside and inside design conditions; Heat transfer through structure, Solar radiation, Electrical appliances, Infiltration and ventilation, internal heat load; Apparatus selection; fresh air load, human comfort & IAQ principles, effective temperature & chart, calculation of summer & winter air conditioning load; Classifications, Layout of plants; Air distribution system; Filters; Air Conditioning Systems with Controls: Temperature, Pressure and Humidity sensors, Actuators & Safety controls.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Explain the basic concepts of Refrigeration
- CO2 Explain the Vapor compression Refrigeration systems and to solve problems
- CO3 Discuss the various types of Refrigeration systems
- CO4 Calculate the Psychrometric properties and its use in psychrometric processes
- CO5 Explain the concepts of Air conditioning and to solve problems

**TEXT BOOK:**

1. Arora, C.P., "Refrigeration and Air Conditioning", 3<sup>rd</sup> edition, McGraw Hill, New Delhi, 2010.

**REFERENCES:**

1. ASHRAE Hand book, Fundamentals, 2010
2. Jones W.P., "Air conditioning engineering", 5<sup>th</sup> edition, Elsevier Butterworth-Heinemann, 2007
3. Roy J. Dossat, "Principles of Refrigeration", 4<sup>th</sup> edition, Pearson Education Asia, 2009.
4. Stoecker, W.F. and Jones J. W., "Refrigeration and Air Conditioning", McGraw Hill, New Delhi, 1986.

**ME8072**

**RENEWABLE SOURCES OF ENERGY**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

- At the end of the course, the students are expected to identify the new methodologies / technologies for effective utilization of renewable energy sources.

**UNIT I INTRODUCTION 9**

World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilisation – Renewable Energy Scenario in Tamil nadu, India and around the World – Potentials - Achievements / Applications – Economics of renewable energy systems.

**UNIT II SOLAR ENERGY 9**

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

**UNIT III WIND ENERGY 9**

Wind Data and Energy Estimation – Types of Wind Energy Systems – Performance – Site Selection – Details of Wind Turbine Generator – Safety and Environmental Aspects

**UNIT IV BIO - ENERGY 9**

Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production – Bio diesel – Cogeneration - Biomass Applications

**UNIT V OTHER RENEWABLE ENERGY SOURCES 9**

Tidal energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro-Geothermal Energy – Hydrogen and Storage - Fuel Cell Systems – Hybrid Systems.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Discuss the importance and Economics of renewable Energy
- CO2 Discuss the method of power generation from Solar Energy
- CO3 Discuss the method of power generation from Wind Energy
- CO4 Explain the method of power generation from Bio Energy
- CO5 Explain the Tidal energy, Wave Energy, OTEC, Hydro energy, Geothermal Energy, Fuel Cells and Hybrid Systems.

**TEXT BOOKS:**

1. Rai. G.D., "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 2011.
2. Twidell, J.W. & Weir, A., "Renewable Energy Sources", EFN Spon Ltd., UK, 2006.

**REFERENCES:**

1. Chetan Singh Solanki, Solar Photovoltaics, "Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi, 2015.
2. David M. Mousdale – "Introduction to Biofuels", CRC Press, Taylor & Francis Group, USA 2017
3. Freris. L.L., "Wind Energy Conversion Systems", Prentice Hall, UK, 1990.
4. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 2012.
5. Johnson Gary, L. "Wind Energy Systems", Prentice Hall, New York, 1985

**OBJECTIVES:**

- To introduce the concept of SQC
- To understand process control and acceptance sampling procedure and their application.
- To learn the concept of reliability.

**UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES 9**

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality control: Quality cost-Variation in process causes of variation – Theory of control chart- uses of control chart –X chart, R chart and chart - process capability – process capability studies and simple problems. Six sigma concepts

**UNIT II PROCESS CONTROL FOR ATTRIBUTES 9**

Control chart for attributes –control chart for non conformings– p chart and np chart – control chart for nonconformities– C and U charts, State of control and process out of control identification in charts, pattern study.

**UNIT III ACCEPTANCE SAMPLING 9**

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD- uses of standard sampling plans.

**UNIT IV LIFE TESTING – RELIABILITY 9**

Life testing – Objective – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate – Weibull model, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems. Acceptance sampling based on reliability test – O.C Curves.

**UNIT V QUALITY AND RELIABILITY 9**

Reliability improvements – techniques- use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development–Product life cycles.

**Note:** Use of approved statistical table permitted in the examination.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Summarize the concept of Quality and Process control for variables
- CO2 Apply the process control for attributes
- CO3 Explain the concept of sampling and to solve problems
- CO4 Explain the concept of Life testing
- CO5 Explain the concept Reliability and techniques involved

**TEXT BOOKS:**

1. Douglas.C. Montgomery, "Introduction to Statistical quality control", 7<sup>th</sup> edition, John Wiley 2012.
2. Srinath. L.S., "Reliability Engineering", Affiliated East west press, 2008.

**REFERENCES:**

1. Besterfield D.H., "Quality Control", Prentice Hall, 2013.
2. Connor, P.D.T.O., "Practical Reliability Engineering", John Wiley, 2012
3. Danny Samson, "Manufacturing & Operations Strategy", Prentice Hall, 1991
4. Grant, Eugene .L "Statistical Quality Control", McGraw-Hill, 2017
5. Gupta. R.C, "Statistical Quality control", Khanna Publishers, 2001.

<b>ME8073</b>	<b>UNCONVENTIONAL MACHINING PROCESSES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVE:**

- To learn about various unconventional machining processes, the various process parameters and their influence on performance and their applications

**UNIT I INTRODUCTION AND MECHANICAL ENERGY BASED PROCESSES 9**

Unconventional machining Process – Need – classification – merits, demerits and applications. Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining - Ultrasonic Machining. (AJM, WJM, AWJM and USM). Working Principles – equipment used – Process parameters – MRR- Applications.

**UNIT II THERMAL AND ELECTRICAL ENERGY BASED PROCESSES 9**

Electric Discharge Machining (EDM) – Wire cut EDM – Working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing — Applications. Laser Beam machining and drilling, (LBM), plasma, Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications.

**UNIT III CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES 9**

Chemical machining and Electro-Chemical machining (CHM and ECM)- Etchants – Maskant - techniques of applying maskants - Process Parameters – Surface finish and MRR-Applications. Principles of ECM- equipments-Surface Roughness and MRR Electrical circuit-Process Parameters-ECG and ECH - Applications.

**UNIT IV ADVANCED NANO FINISHING PROCESSES 9**

Abrasive flow machining, chemo-mechanical polishing, magnetic abrasive finishing, magneto rheological finishing, magneto rheological abrasive flow finishing their working principles, equipments, effect of process parameters, applications, advantages and limitations.

**UNIT V RECENT TRENDS IN NON-TRADITIONAL MACHINING PROCESSES 9**

Recent developments in non-traditional machining processes, their working principles, equipments, effect of process parameters, applications, advantages and limitations. Comparison of non-traditional machining processes.

**TOTAL: 45 PERIODS****OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Explain the need for unconventional machining processes and its classification
- CO2 Compare various thermal energy and electrical energy based unconventional machining processes.
- CO3 Summarize various chemical and electro-chemical energy based unconventional machining processes.
- CO4 Explain various nano abrasives based unconventional machining processes.
- CO5 Distinguish various recent trends based unconventional machining processes.

**TEXT BOOKS:**

1. Vijay.K. Jain “Advanced Machining Processes” Allied Publishers Pvt. Ltd., New Delhi, 2007
2. Pandey P.C. and Shan H.S. “Modern Machining Processes” Tata McGraw-Hill, New Delhi, 2007.

**REFERENCES:**

1. Benedict. G.F. “Nontraditional Manufacturing Processes”, Marcel Dekker Inc., New York, 1987.
2. Mc Geough, “Advanced Methods of Machining”, Chapman and Hall, London, 1998.
3. Paul De Garmo, J.T.Black, and Ronald. A.Kohser, “Material and Processes in Manufacturing” Prentice Hall of India Pvt. Ltd., 8thEdition, New Delhi , 2001.

**MG8491****OPERATIONS RESEARCH**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVE:**

- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

**UNIT I      LINEAR MODELS****15**

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

**UNIT II      TRANSPORTATION MODELS AND NETWORK MODELS****8**

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

**UNIT III      INVENTORY MODELS****6**

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

**UNIT IV      QUEUEING MODELS****6**

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

**UNIT V      DECISION MODELS****10**

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

**TOTAL: 45 PERIODS****OUTCOME:**

- Upon completion of this course, the students can able to use the optimization techniques for use engineering and Business problems

**TEXT BOOK:**

1. Hillier and Libebberman, “Operations Research”, Holden Day, 2005
2. Taha H.A., “Operations Research”, Sixth Edition, Prentice Hall of India, 2003.

**REFERENCES:**

1. Bazara M.J., Jarvis and Sherali H., "Linear Programming and Network Flows", John Wiley, 2009.
2. Budnick F.S., "Principles of Operations Research for Management", Richard D Irwin, 1990.
3. Philip D.T. and Ravindran A., "Operations Research", John Wiley, 1992.
4. Shennoy G.V. and Srivastava U.K., "Operation Research for Management", Wiley Eastern, 1994.
5. Tulsian and Pasdey V., "Quantitative Techniques", Pearson Asia, 2002.

**MF8071****ADDITIVE MANUFACTURING****L T P C  
3 0 0 3****OBJECTIVES:**

- To know the principle, methods, possibilities and limitations as well as environmental effects of Additive Manufacturing technologies.
- To be familiar with the characteristics of the different materials those are used in Additive Manufacturing technologies.

**UNIT I INTRODUCTION****9**

Overview – Need - Development of Additive Manufacturing Technology -Principle – AM Process Chain- Classification –Rapid Prototyping- Rapid Tooling – Rapid Manufacturing – Applications- Benefits –Case studies.

**UNIT II DESIGN FOR ADDITIVE MANUFACTURING****9**

Design tools: Data processing - CAD model preparation – Part orientation and support structure generation – Model slicing –Tool path generation- Design for Additive Manufacturing: Concepts and objectives- AM unique capabilities – DFAM for part quality improvement- Customised design and fabrication for medical applications.

**UNIT III PHOTOPOLYMERIZATION AND POWDER BED FUSION PROCESSES****9**

Photo polymerization: SLA-Photo curable materials – Process - Advantages and Applications. Powder Bed Fusion: SLS-Process description – powder fusion mechanism – Process Parameters – Typical Materials and Application. Electron Beam Melting.

**UNIT IV EXTRUSION BASED AND SHEET LAMINATION PROCESSES****9**

Extrusion Based System: FDM-Introduction – Basic Principle – Materials – Applications and Limitations – Bioextrusion. Sheet Lamination Process:LOM- Gluing or Adhesive bonding – Thermal bonding.

**UNIT V PRINTING PROCESSES AND BEAM DEPOSITION PROCESSES****9**

Droplet formation technologies – Continuous mode – Drop on Demand mode – Three Dimensional Printing – Advantages – Bioplotter - Beam Deposition Process:LENS- Process description – Material delivery – Process parameters – Materials – Benefits – Applications.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- On completion of this course, students will learn about a working principle and construction of Additive Manufacturing technologies, their potential to support design and manufacturing, modern development in additive manufacturing process and case studies relevant to mass customized manufacturing.

**TEXT BOOKS:**

- 1 Chua C.K., Leong K.F., and Lim C.S., “Rapid prototyping: Principles and applications”, Third edition, World Scientific Publishers, 2010.
- 2 Ian Gibson, David W.Rosen, Brent Stucker “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing” Springer , 2010.

**REFERENCES:**

- 1 Andreas Gebhardt “Understanding Additive Manufacturing: Rapid Prototyping, Rapid Manufacturing” Hanser Gardner Publication 2011.
- 2 Kamrani A.K. and Nasr E.A., “Rapid Prototyping: Theory and practice”, Springer, 2006.
- 3 Liou L.W. and Liou F.W., “Rapid Prototyping and Engineering applications :A tool box for prototype development”, CRC Press, 2007.
- 4 Tom Page “Design for Additive Manufacturing” LAP Lambert Academic Publishing, 2012.

**GE8077**

**TOTAL QUALITY MANAGEMENT**

**L T P C  
3 0 0 3**

**OBJECTIVE:**

- To facilitate the understanding of Quality Management principles and process.

**UNIT I INTRODUCTION**

**9**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

**UNIT II TQM PRINCIPLES**

**9**

Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

**UNIT III TQM TOOLS AND TECHNIQUES I**

**9**

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

**UNIT IV TQM TOOLS AND TECHNIQUES II**

**9**

Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

**UNIT V QUALITY MANAGEMENT SYSTEM**

**9**

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--**ENVIRONMENTAL MANAGEMENT SYSTEM:**

Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

**TEXT BOOK:**

1. Dale H.Besterfield, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

**REFERENCES:**

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8<sup>th</sup> Edition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. ISO 9001-2015 standards

**ME8099**

**ROBOTICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the functions of the basic components of a Robot.
- To study the use of various types of End of Effectors and Sensors
- To impart knowledge in Robot Kinematics and Programming
- To learn Robot safety issues and economics.

**UNIT I FUNDAMENTALS OF ROBOT**

**9**

Robot - Definition - Robot Anatomy - Co ordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions-Need for Robots-Different Applications.

**UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS**

**9**

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingere and Three Fingere Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

**UNIT III SENSORS AND MACHINE VISION**

**9**

Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data-Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation.

**UNIT IV      ROBOT KINEMATICS AND ROBOT PROGRAMMING      9**

Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

**UNIT V      IMPLEMENTATION AND ROBOT ECONOMICS      9**

RGV, AGV; Implementation of Robots in Industries-Variou Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Explain the concepts of industrial robots, classification, specifications and coordinate systems. Also summarize the need and application of robots in different sectors.
- CO2 Illustrate the different types of robot drive systems as well as robot end effectors.
- CO3 Apply the different sensors and image processing techniques in robotics to improve the ability of robots.
- CO4 Develop robotic programs for different tasks and familiarize with the kinematics motions of robot.
- CO5 Examine the implementation of robots in various industrial sectors and interpolate the economic analysis of robots.

**TEXT BOOKS:**

1. Groover M.P., "Industrial Robotics -Technology Programming and Applications", McGraw Hill, 2012.
2. Klaffer R.D., Chmielewski T.A and Negin M., "Robotic Engineering - An Integrated Approach",Prentice Hall, 2003.

**REFERENCES:**

1. Craig J.J., "Introduction to Robotics Mechanics and Control", Pearson Education, 2008.
2. Deb S.R., "Robotics Technology and Flexible Automation" Tata McGraw Hill Book Co., 2013.
3. Fu.K.S.,Gonzalz R.C. and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw Hill Book Co., 1987.
4. Janakiraman P.A., "Robotics and Image Processing", Tata McGraw Hill, 1995.
5. Koren Y., "Robotics for Engineers", Mc Graw Hill Book Co., 1992.

<b>ME8095</b>	<b>DESIGN OF JIGS, FIXTURES AND PRESS TOOLS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the functions and design principles of Jigs, fixtures and press tools
- To gain proficiency in the development of required views of the final design.

**UNIT I      LOCATING AND CLAMPING PRINCIPLES:      9**

Objectives of tool design- Function and advantages of Jigs and fixtures – Basic elements – principles of location – Locating methods and devices – Redundant Location – Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and Jig buttons – Tolerances and materials used.

**UNIT II JIGS AND FIXTURES****9**

Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

**UNIT III PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES 9**

Press Working Terminologies - operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material Utilization – Shearing action – Clearances – Press Work Materials – Center of pressure- Design of various elements of dies – Die Block – Punch holder, Die set, guide plates – Stops – Strippers – Pilots – Selection of Standard parts – Design and preparation of four standard views of simple blanking, piercing, compound and progressive dies.

**UNIT IV BENDING AND DRAWING DIES 9**

Difference between bending and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back – knockouts – direct and indirect – pressure pads – Ejectors – Variables affecting Metal flow in drawing operations – draw die inserts – draw beads- ironing – Design and development of bending, forming, drawing, reverse redrawing and combination dies – Blank development for axisymmetric, rectangular and elliptic parts – Single and double action dies.

**UNIT V FORMING TECHNIQUES AND EVALUATION 9**

Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction - tooling for numerically controlled machines- setup reduction for work holding – Single minute exchange of dies – Poka Yoke.

**TOTAL: 45 PERIODS**

**Note:** (Use of P S G Design Data Book is permitted in the University examination)

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Summarize the different methods of Locating Jigs and Fixtures and Clamping principles
- CO2 Design and develop jigs and fixtures for given component
- CO3 Discuss the press working terminologies and elements of cutting dies
- CO4 Distinguish between Bending and Drawing dies.
- CO5 Discuss the different types of forming techniques

**TEXT BOOKS:**

1. Joshi, P.H. "Jigs and Fixtures", Second Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2010.
2. Joshi P.H "Press tools - Design and Construction", wheels publishing, 1996

**REFERENCES:**

1. ASTME Fundamentals of Tool Design Prentice Hall of India.
2. Design Data Hand Book, PSG College of Technology, Coimbatore.
3. Donaldson, Lecain and Goold "Tool Design", 5<sup>th</sup> Edition, Tata McGraw Hill, 2017.
4. Hoffman "Jigs and Fixture Design", Thomson Delmar Learning, Singapore, 2004.
5. Kempster, "Jigs and Fixture Design", Third Edition, Hoddes and Stoughton, 1974.
6. Venkataraman. K., "Design of Jigs Fixtures & Press Tools", Tata McGraw Hill, New Delhi, 2005.

**OBJECTIVES:**

- To introduce Governing Equations of viscous fluid flows
- To introduce numerical modeling and its role in the field of fluid flow and heat transfer
- To enable the students to understand the various discretization methods, solution procedures and turbulence modeling.
- To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers.

**UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 9**

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behaviour of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

**UNIT II FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION 9**

Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – Finite volume formulation for steady state One, Two and Three - dimensional diffusion problems –Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations – Use of Finite Difference and Finite Volume methods.

**UNIT III FINITE VOLUME METHOD FOR CONVECTION DIFFUSION 9**

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes properties of discretization schemes – Conservativeness, Boundedness, Transportiveness, Hybrid, Power-law, QUICK Schemes.

**UNIT IV FLOW FIELD ANALYSIS 9**

Finite volume methods -Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants – PISO Algorithms.

**UNIT V TURBULENCE MODELS AND MESH GENERATION 9**

Turbulence models, mixing length model, Two equation (k- ) models – High and low Reynolds number models – Structured Grid generation – Unstructured Grid generation – Mesh refinement – Adaptive mesh – Software tools.

**TOTAL: 45 PERIODS****OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Derive the governing equations and boundary conditions for Fluid dynamics
- CO2 Analyze Finite difference and Finite volume methods for Diffusion
- CO3 Analyze Finite volume method for Convective diffusion
- CO4 Analyze Flow field problems
- CO5 Explain and solve the Turbulence models and Mesh generation techniques

**TEXT BOOKS:**

1. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw Hill Publishing Company Ltd., 2017.
2. Versteeg, H.K., and Malalasekera, W., "An Introduction to Computational Fluid Dynamics: The finite volume Method", Pearson Education Ltd.Second Edition, 2007.

## REFERENCES:

1. Anil W. Date "Introduction to Computational Fluid Dynamics" Cambridge University Press, 2005.
2. Chung, T.J. "Computational Fluid Dynamics", Cambridge University, Press, 2002.
3. Ghoshdastidar P.S., "Heat Transfer", Oxford University Press, 2005
4. Muralidhar, K., and Sundararajan, T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi, 2014.
5. Patankar, S.V. "Numerical Heat Transfer and Fluid Flow", Hemisphere Publishing Corporation, 2004

**ME8097**

**NON DESTRUCTIVE TESTING AND EVALUATION**

L	T	P	C
3	0	0	3

## OBJECTIVE:

- To study and understand the various Non Destructive Evaluation and Testing methods, theory and their industrial applications.

### **UNIT I OVERVIEW OF NDT**

**9**

NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterisation. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT., Visual inspection – Unaided and aided.

### **UNIT II SURFACE NDE METHODS**

**9**

Liquid Penetrant Testing - Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results. Magnetic Particle Testing- Theory of magnetism, inspection materials Magnetisation methods, Interpretation and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism.

### **UNIT III THERMOGRAPHY AND EDDY CURRENT TESTING (ET)**

**9**

Thermography- Principles, Contact and non contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation - infrared radiation and infrared detectors, Instrumentations and methods, applications. Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.

### **UNIT IV ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION (AE)**

**9**

Ultrasonic Testing-Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A/Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight Diffraction. Acoustic Emission Technique – Principle, AE parameters, Applications

### **UNIT V RADIOGRAPHY (RT)**

**9**

Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of films - graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Computed Radiography, Computed Tomography

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Explain the fundamental concepts of NDT
- CO2 Discuss the different methods of NDE
- CO3 Explain the concept of Thermography and Eddy current testing
- CO4 Explain the concept of Ultrasonic Testing and Acoustic Emission
- CO5 Explain the concept of Radiography

**TEXT BOOKS:**

1. Baldev Raj, T.Jayakumar, M.Thavasimuthu "Practical Non-Destructive Testing", Narosa Publishing House, 2014.
2. Ravi Prakash, "Non-Destructive Testing Techniques", 1st revised edition, New Age International Publishers, 2010

**REFERENCES:**

1. ASM Metals Handbook, "Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17.
2. ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NDT Handbook, Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing, Vol. 5, Electromagnetic Testing, Vol. 6, Acoustic Emission Testing, Vol. 7, Ultrasonic Testing
3. Charles, J. Hellier, "Handbook of Nondestructive evaluation", McGraw Hill, New York 2001.
4. Paul E Mix, "Introduction to Non-destructive testing: a training guide", Wiley, 2<sup>nd</sup> Edition New Jersey, 2005

**ME8092****COMPOSITE MATERIALS AND MECHANICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the fundamentals of composite material strength and its mechanical behavior
- Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
- Thermo-mechanical behavior and study of residual stresses in Laminates during processing.
- Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronic chips.

**UNIT I INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS & MANUFACTURING 9**

Definition –Need – General Characteristics, Applications. Fibers – Glass, Carbon, Ceramic and Aramid fibers. Matrices – Polymer, Graphite, Ceramic and Metal Matrices – Characteristics of fibers and matrices. Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix ( $Q_{ij}$ ), Typical Commercial material properties, Rule of Mixtures. Generally Orthotropic Lamina –Transformation Matrix, Transformed Stiffness. Manufacturing: Bag Moulding Compression Moulding – Pultrusion – Filament Winding – Other Manufacturing Processes



<b>GE8072</b>	<b>FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT</b>	<b>L T P C</b> <b>3 0 0 3</b>
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**OBJECTIVES:**

- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

**UNIT I                    FUNDAMENTALS OF PRODUCT DEVELOPMENT                    9**

**Global Trends Analysis and Product decision** - Social Trends - Technical Trends- Economical Trends - Environmental Trends - Political/Policy Trends - **Introduction to Product Development Methodologies and Management** - Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle – Product Development Planning and Management.

**UNIT II                    REQUIREMENTS AND SYSTEM DESIGN                    9**

**Requirement Engineering** - Types of Requirements - Requirement Engineering - traceability Matrix and Analysis - Requirement Management - **System Design & Modeling** - Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design.

**UNIT III                    DESIGN AND TESTING                    9**

**Conceptualization** - Industrial Design and User Interface Design - Introduction to Concept generation Techniques – **Challenges in Integration of Engineering Disciplines** - Concept Screening & Evaluation - **Detailed Design** - Component Design and Verification – **Mechanical, Electronics and Software Subsystems** - High Level Design/Low Level Design of S/W Program - Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing – **Prototyping** - Introduction to Rapid Prototyping and Rapid Manufacturing - **System Integration, Testing, Certification and Documentation**

**UNIT IV                    SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT                    9**

Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation - **Sustenance** -Maintenance and Repair – Enhancements - **Product EoL** - Obsolescence Management – Configuration Management - EoL Disposal

**UNIT V                    BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY                    9**

**The Industry** - Engineering Services Industry - Product Development in Industry versus Academia –**The IPD Essentials** - Introduction to Vertical Specific Product Development processes -Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and Software Systems – Product Development Trade-offs - Intellectual Property Rights and Confidentiality – Security and Configuration Management.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

**TEXTBOOKS:**

1. Book specially prepared by NASSCOM as per the MoU.
2. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2011.
3. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, 2005.

**REFERENCES:**

1. Hiriappa B, "Corporate Strategy – Managing the Business", Author House, 2013.
2. Peter F Drucker, "People and Performance", Butterworth – Heinemann [Elsevier], Oxford, 2004.
3. Vinod Kumar Garg and Venkita Krishnan N K, "Enterprise Resource Planning – Concepts", Second Edition, Prentice Hall, 2003.
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2013

**GE8074****HUMAN RIGHTS****L T P C  
3 0 0 3****OBJECTIVE:**

- To sensitize the Engineering students to various aspects of Human Rights.

**UNIT I****9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

**UNIT II****9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

**UNIT III****9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

**UNIT IV****9**

Human Rights in India – Constitutional Provisions / Guarantees.

**UNIT V****9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

**TOTAL : 45 PERIODS**

**OUTCOME :**

- Engineering students will acquire the basic knowledge of human rights.

**REFERENCES:**

1. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
2. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

**GE8071****DISASTER MANAGEMENT****L T P C**  
**3 0 0 3****OBJECTIVES:**

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

**UNIT I INTRODUCTION TO DISASTERS****9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

**UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)****9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

**UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT****9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

**UNIT IV DISASTER RISK MANAGEMENT IN INDIA****9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

## **UNIT V            DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS**

**9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

**TOTAL: 45 PERIODS**

### **OUTCOMES:**

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management.

### **TEXT BOOKS:**

1. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
2. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IAS and Sage Publishers, New Delhi, 2010.
3. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
4. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]

### **REFERENCES**

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

**IE8693**

## **PRODUCTION PLANNING AND CONTROL**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **OBJECTIVES:**

- To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.
- To know the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

## **UNIT I            INTRODUCTION**

**9**

Objectives and benefits of planning and control-Functions of production control-Types of production- job- batch and continuous-Product development and design-Marketing aspect - Functional aspects- Operational aspect-Durability and dependability aspect aesthetic aspect. Profit consideration- Standardization, Simplification & specialization- Break even analysis-Economics of a new design.

## **UNIT II            WORK STUDY**

**9**

Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

**UNIT III PRODUCT PLANNING AND PROCESS PLANNING****9**

Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning- Steps in process planning-Quantity determination in batch production-Machine capacity, balancing- Analysis of process capabilities in a multi product system.

**UNIT IV PRODUCTION SCHEDULING****9**

Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems - Line of balance – Flow production scheduling- Batch production scheduling-Product sequencing – Production Control systems-Periodic batch control-Material requirement planning kanban – Dispatching-Progress reporting and expediting- Manufacturing lead time-Techniques for aligning completion times and due dates.

**UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC****9**

Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system - Ordering cycle system-Determination of Economic order quantity and economic lot size- ABC analysis - Recorder procedure-Introduction to computer integrated production planning systems- elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of this course, the students can able to prepare production planning and control activities such as work study, product planning, production scheduling, Inventory Control.
- They can plan manufacturing requirements manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

**TEXT BOOKS:**

1. James. B. Dilworth, "Operations management – Design, Planning and Control for manufacturing and services" Mcgraw Hill International edition 1992.
2. Martand Telsang, "Industrial Engineering and Production Management", First edition, S. Chand and Company, 2000.

**REFERENCES:**

1. Chary. S.N., "Theory and Problems in Production & Operations Management", Tata McGraw Hill, 1995.
2. Elwood S.Buffa, and Rakesh K.Sarin, "Modern Production / Operations Management", 8th Edition John Wiley and Sons, 2000.
3. Jain. K.C. & Aggarwal. L.N., "Production Planning Control and Industrial Management", Khanna Publishers, 1990.
4. Kanishka Bedi, "Production and Operations management", 2<sup>nd</sup> Edition, Oxford university press, 2007.
5. Melynk, Denzler, " Operations management – A value driven approach" Irwin Mcgraw hill.
6. Norman Gaither, G. Frazier, "Operations Management" 9<sup>th</sup> Edition, Thomson learning IE, 2007
7. Samson Eilon, "Elements of Production Planning and Control", Universal Book Corpn.1984
8. Upendra Kachru, " Production and Operations Management – Text and cases" 1<sup>st</sup> Edition, Excel books 2007

**MG8091**

**ENTREPRENEURSHIP DEVELOPMENT**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVE:**

- To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

**UNIT I ENTREPRENEURSHIP**

**9**

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

**UNIT II MOTIVATION**

**9**

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

**UNIT III BUSINESS**

**9**

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

**UNIT IV FINANCING AND ACCOUNTING**

**9**

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.

**UNIT V SUPPORT TO ENTREPRENEURS**

**9**

Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures - Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

**TOTAL : 45 PERIODS**

**OUTCOME:**

- Upon completion of the course, students will be able to gain knowledge and skills needed to run a business successfully.

**TEXT BOOKS :**

1. Donald F Kuratko, "Entrepreneurship – Theory, Process and Practice", 9<sup>th</sup> Edition, Cengage Learning, 2014.
2. Khanka. S.S., "Entrepreneurial Development" S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.

**REFERENCES :**

1. EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development", Institute of India, Ahmadabad, 1986.
2. Hisrich R D, Peters M P, "Entrepreneurship" 8<sup>th</sup> Edition, Tata McGraw-Hill, 2013.
3. Mathew J Manimala, "Enterprenuership theory at cross roads: paradigms and praxis" 2<sup>nd</sup> Edition Dream tech, 2005.
4. Rajeev Roy, "Entrepreneurship" 2<sup>nd</sup> Edition, Oxford University Press, 2011.

<b>ME8094</b>	<b>COMPUTER INTEGRATED MANUFACTURING SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVE:**

- To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

**UNIT I INTRODUCTION 9**

Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM – Concurrent Engineering-CIM concepts – Computerised elements of CIM system – Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance – Simple problems – Manufacturing Control – Simple Problems – Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In-Time Production.

**UNIT II PRODUCTION PLANNING AND CONTROL AND COMPUTERISED PROCESS PLANNING 9**

Process planning – Computer Aided Process Planning (CAPP) – Logical steps in Computer Aided Process Planning – Aggregate Production Planning and the Master Production Schedule – Material Requirement planning – Capacity Planning- Control Systems-Shop Floor Control-Inventory Control – Brief on Manufacturing Resource Planning-II (MRP-II) & Enterprise Resource Planning (ERP) - Simple Problems.

**UNIT III CELLULAR MANUFACTURING 9**

Group Technology(GT), Part Families – Parts Classification and coding – Simple Problems in Opitz Part Coding system – Production flow Analysis – Cellular Manufacturing – Composite part concept – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing – Rank Order Clustering Method - Arranging Machines in a GT cell – Hollier Method – Simple Problems.

**UNIT IV FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED GUIDED VEHICLE SYSTEM (AGVS) 9**

Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control – Quantitative analysis in FMS – Simple Problems. Automated Guided Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety.

**UNIT V INDUSTRIAL ROBOTICS 9**

Robot Anatomy and Related Attributes – Classification of Robots- Robot Control systems – End Effectors – Sensors in Robotics – Robot Accuracy and Repeatability - Industrial Robot Applications – Robot Part Programming – Robot Accuracy and Repeatability – Simple Problems.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- CO1 Explain the basic concepts of CAD, CAM and computer integrated manufacturing systems
- CO2 Summarize the production planning and control and computerized process planning
- CO3 Differentiate the different coding systems used in group technology
- CO4 Explain the concepts of flexible manufacturing system (FMS) and automated guided vehicle (AGV) system
- CO5 Classification of robots used in industrial applications



## OUTCOMES:

Upon the completion of this course the students will be able to

- CO1 Summarize the Basics of Vibration
- CO2 Summarize the Basics of Noise
- CO3 Explain the Sources of Automotive Noise
- CO4 Discuss the Control techniques for vibration
- CO5 Describe the sources and control of Noise

## TEXT BOOK:

1. Singiresu S.Rao, "Mechanical Vibrations", 6<sup>th</sup> Edition, Pearson Education, 2016.

## REFERENCES:

1. Balakumar Balachandran and Edward B. Magrab, "Fundamentals of Vibrations", 1<sup>st</sup> Edition, Cengage Learning, 2009
2. Benson H. Tongue, "Principles of Vibrations", 2<sup>nd</sup> Edition, Oxford University, 2007
3. Bernard Challen and Rodica Baranescu - "Diesel Engine Reference Book", Second Edition, SAE International, 1999.
4. David Bies and Colin Hansen, "Engineering Noise Control – Theory and Practice", 4<sup>th</sup> Edition, E and FN Spon, Taylore & Francise e-Library, 2009
5. Grover. G.T., "Mechanical Vibrations", Nem Chand and Bros., 2009

EE8091

MICRO ELECTRO MECHANICAL SYSTEMS

L T P C  
3 0 0 3

## OBJECTIVES

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

## UNIT I INTRODUCTION

9

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

## UNIT II SENSORS AND ACTUATORS-I

9

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys

## UNIT III SENSORS AND ACTUATORS-II

9

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

**UNIT IV MICROMACHINING****9**

Silicon Anisotropic Etching – Anisotropic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

**UNIT V POLYMER AND OPTICAL MEMS****9**

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

**TOTAL : 45 PERIODS****OUTCOMES**

- Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.
- Ability to understand and analyse, linear and digital electronic circuits.

**TEXT BOOKS:**

1. Chang Liu, "Foundations of MEMS", Pearson Education Inc., 2006.
2. Stephen D Senturia, "Microsystem Design", Springer Publication, 2000.
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

**REFERENCES:**

1. James J.Allen, "Micro Electro Mechanical System Design", CRC Press Publisher, 2010
2. Julian w. Gardner, Vijay K. Varadan, Osama O. Awadelkarim, "Micro Sensors MEMS and Smart Devices", John Wiley & Son LTD,2002
3. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2000
4. Nadim Maluf," An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
5. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer 2012.

**OBJECTIVE:**

- To enable the students to create an awareness on Engineering Ethics and Human Values to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

**UNIT I HUMAN VALUES 10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

**UNIT II ENGINEERING ETHICS 9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

**UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

**UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

**UNIT V GLOBAL ISSUES 8**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility.

**TOTAL: 45 PERIODS****OUTCOME:**

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

**TEXT BOOKS:**

- Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
- Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.

**REFERENCES:**

- Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
- Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
- Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
- John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
- Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd., New Delhi, 2013.
- World Community Service Centre, ' Value Education', Vethathiri publications, Erode, 2011.

**Web sources:**

1. [www.onlineethics.org](http://www.onlineethics.org)
2. [www.nspe.org](http://www.nspe.org)
3. [www.globalethics.org](http://www.globalethics.org)
4. [www.ethics.org](http://www.ethics.org)

**ANNA UNIVERSITY, CHENNAI**  
**AFFILIATED INSTITUTIONS**  
**B.E. MECHATRONICS ENGINEERING**  
**REGULATIONS – 2017**  
**CHOICE BASED CREDIT SYSTEM**

**1. PROGRAMME EDUCATIONAL OBJECTIVES:**

Bachelor of Mechatronics curriculum is designed to prepare the graduates having attitude and knowledge to

1. Develop innovative and sustainable products with multidisciplinary Engineering expertise.
2. Solve complex engineering problems by applying mechanical, electrical and computer knowledge and engage in lifelong learning in their profession
3. Work or pursue higher education in multicultural, multilingual and multinational environment with competent oral and written communication.
4. Lead and contribute in a team entrusted with professional, social and ethical responsibilities.

**2. PROGRAMME OUTCOMES:**

- a. Will be able to apply the laws of science and mathematics to provide engineering solutions to solve complex problems.
- b. Will be able to identify and analyze complex problems by modeling with the help of literature survey and validate the solution with experiments.
- c. Will be able to design and develop Mechatronics systems by selecting and integrating, sensors, appropriate materials, mechanics, thermal systems, manufacturing and automation methods.
- d. Will be able to collect, condition monitor and interpret data to provide engineering solutions.
- e. Will be able to create applications, products as well as modernizing the existing systems by using latest tools and technologies.
- f. Will be able to develop solutions for local and global requirements by applying engineering knowledge and professional ethics.
- g. Will have professional values on environmental and energy consumption for sustainability.
- h. Will be able to become a leader and contribute in a team with entrepreneurial qualities.
- i. Will be able to interact effectively in both oral and written format.
- j. Will continuously update their knowledge and skills to meet the ever changing global needs.

**3. PEO / PO Mapping**

PEO / PO	a	b	c	d	e	f	g	h	i	j
1	✓	✓	✓	✓	✓	✓	✓			
2	✓	✓	✓	✓	✓	✓				✓
3									✓	✓
4							✓	✓	✓	

#### 4. SEMESTER COURSE WISE PO MAPPING

		COURSE TITLE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	
YEAR 1	SEMESTER 1	Communicative English							✓			
		Engineering Mathematics I	✓	✓	✓						✓	
		Engineering Physics	✓	✓	✓						✓	
		Engineering Chemistry				✓						
		Problem Solving and Python Programming					✓					
		Engineering Graphics		✓	✓					✓		
		Problem Solving and Python Programming Laboratory			✓		✓					
		Physics and Chemistry Laboratory			✓							
	SEMESTER 2	Technical English								✓		
		Engineering Mathematics II	✓	✓	✓					✓		✓
		Materials Science										
		Basic Electrical, Electronics and Instrumentation Engineering										
		Environmental Science and Engineering					✓					
		Engineering Mechanics	✓	✓						✓	✓	✓
		Engineering Practices Laboratory			✓							
Basic Electrical, Electronics and Instrumentation Engineering Laboratory			✓									

		<b>Course Title</b>	<b>a</b>	<b>b</b>	<b>c</b>	<b>d</b>	<b>e</b>	<b>f</b>	<b>g</b>	<b>h</b>	<b>i</b>	<b>j</b>	
<b>YEAR II</b>	<b>SEMESTER III</b>	Transforms and Partial Differential Equations	✓	✓		✓	✓	✓					
		Strength of Materials for Mechanical Engineers	✓	✓	✓								
		Fluid Mechanics and Machinery	✓	✓	✓								
		Digital Electronics	✓	✓	✓		✓	✓	✓	✓			
		Electrical Machines and Drives	✓	✓	✓		✓	✓	✓				
		Analog Devices and Circuits	✓	✓	✓		✓						
		Strength of Materials and Fluid Mechanics & Machinery Laboratory	✓	✓	✓								
		Electrical Machines and Drives Laboratory	✓	✓	✓		✓	✓	✓				
	Interpersonal Skills/Listening & Speaking											✓	
	<b>SEMESTER IV</b>	Statistics and Numerical Methods	✓	✓	✓		✓						
		Manufacturing Technology	✓	✓		✓		✓	✓			✓	
		Microprocessors and Microcontrollers	✓	✓	✓	✓	✓	✓	✓				✓
		Kinematics of Machinery	✓	✓	✓		✓						
		Thermodynamics and Heat Transfer	✓		✓					✓			
		Microprocessor and Microcontrollers Laboratory	✓	✓	✓	✓	✓	✓	✓				✓
Manufacturing Technology Laboratory		✓	✓		✓		✓	✓			✓		
Computer Aided Machine Drawing				✓		✓							
		Advanced Reading and Writing									✓		
<b>YEAR III</b>	<b>SEMESTER V</b>	Power Electronics	✓	✓	✓		✓	✓				✓	
		Sensors and Instrumentation	✓	✓	✓	✓	✓	✓				✓	✓
		Dynamics of Machines	✓	✓	✓		✓						
		Control System Engineering	✓	✓	✓	✓	✓					✓	✓
		Open Elective - I											
		Power Electronics Laboratory	✓	✓	✓		✓	✓					✓
		Sensors and Instrumentation Laboratory	✓	✓	✓	✓	✓	✓				✓	✓
		Dynamics Laboratory	✓	✓	✓		✓						
		Professional Communication	✓										✓
	<b>SE ME ST</b>	Applied Hydraulics and Pneumatics	✓		✓	✓	✓	✓	✓	✓	✓		
Design of Mechatronics System	✓	✓	✓	✓	✓	✓	✓	✓			✓		



**ANNA UNIVERSITY, CHENNAI**  
**AFFILIATED INSTITUTIONS**  
**B.E. MECHATRONICS ENGINEERING**  
**REGULATIONS – 2017**  
**CHOICE BASED CREDIT SYSTEM**  
**I TO VIII SEMESTERS CURRICULA AND SYLLABI**

**SEMESTER I**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	HS8151	Communicative English	HS	4	4	0	0	4
2.	MA8151	Engineering Mathematics - I	BS	4	4	0	0	4
3.	PH8151	Engineering Physics	BS	3	3	0	0	3
4.	CY8151	Engineering Chemistry	BS	3	3	0	0	3
5.	GE8151	Problem Solving and Python Programming	ES	3	3	0	0	3
6.	GE8152	Engineering Graphics	ES	6	2	0	4	4
<b>PRACTICALS</b>								
7.	GE8161	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
8.	BS8161	Physics and Chemistry Laboratory	BS	4	0	0	4	2
<b>TOTAL</b>				<b>31</b>	<b>19</b>	<b>0</b>	<b>12</b>	<b>25</b>

**SEMESTER II**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	HS8251	Technical English	HS	4	4	0	0	4
2.	MA8251	Engineering Mathematics - II	BS	4	4	0	0	4
3.	PH8251	Materials Science	BS	3	3	0	0	3
4.	BE8253	Basic Electrical, Electronics and Instrumentation Engineering	ES	3	3	0	0	3
5.	GE8291	Environmental Science and Engineering	HS	3	3	0	0	3
6.	GE8292	Engineering Mechanics	ES	5	3	2	0	4
<b>PRACTICALS</b>								
7.	GE8261	Engineering Practices Laboratory	ES	4	0	0	4	2
8.	BE8261	Basic Electrical, Electronics and Instrumentation Engineering Laboratory	ES	4	0	0	4	2
<b>TOTAL</b>				<b>30</b>	<b>20</b>	<b>2</b>	<b>8</b>	<b>25</b>

### SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MA8353	Transforms and Partial Differential Equations	BS	4	4	0	0	4
2.	CE8395	Strength of Materials for Mechanical Engineers	ES	3	3	0	0	3
3.	CE8394	Fluid Mechanics and Machinery	ES	4	4	0	0	4
4.	EC8392	Digital Electronics	ES	3	3	0	0	3
5.	MT8301	Electrical Machines and Drives	ES	3	3	0	0	3
6.	MT8302	Analog Devices and Circuits	PC	3	3	0	0	3
<b>PRACTICALS</b>								
7.	CE8381	Strength of Materials and Fluid Mechanics & Machinery Laboratory	ES	4	0	0	4	2
8.	MT8311	Electrical Machines and Drives Laboratory	ES	4	0	0	4	2
9.	HS8381	Interpersonal Skills/Listening & Speaking	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>30</b>	<b>20</b>	<b>0</b>	<b>10</b>	<b>25</b>

### SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MA8452	Statistics and Numerical Methods	BS	4	4	0	0	4
2.	ME8392	Manufacturing Technology	PC	3	3	0	0	3
3.	MT8491	Microprocessors and Microcontrollers	PC	3	3	0	0	3
4.	ME8492	Kinematics of Machinery	PC	3	3	0	0	3
5.	MT8401	Thermodynamics and Heat Transfer	PC	3	3	0	0	3
<b>PRACTICALS</b>								
6.	MT8411	Microprocessor and Microcontrollers Laboratory	PC	4	0	0	4	2
7.	ME8461	Manufacturing Technology Laboratory	PC	4	0	0	4	2
8.	ME8381	Computer Aided Machine Drawing	PC	4	0	0	4	2
9.	HS8461	Advanced Reading and Writing	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>30</b>	<b>16</b>	<b>0</b>	<b>14</b>	<b>23</b>

**SEMESTER V**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	EE8552	Power Electronics	ES	3	3	0	0	3
2.	MT8591	Sensors and Instrumentation	PC	3	3	0	0	3
3.	ME8594	Dynamics of Machines	PC	4	4	0	0	4
4.	EC8391	Control Systems Engineering	ES	3	3	0	0	3
5.		Open Elective - I	OE	3	3	0	0	3
<b>PRACTICALS</b>								
6.	MT8511	Power Electronics Laboratory	ES	4	0	0	4	2
7.	MT8512	Sensors and Instrumentation Laboratory	PC	4	0	0	4	2
8.	ME8481	Dynamics Laboratory	PC	4	0	0	4	2
9.	HS8581	Professional Communication	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>30</b>	<b>16</b>	<b>0</b>	<b>14</b>	<b>23</b>

**SEMESTER VI**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	ME8591	Applied Hydraulics and Pneumatics	PC	3	3	0	0	3
2.	MT8601	Design of Mechatronics System	PC	3	3	0	0	3
3.	ME8593	Design of Machine Elements	PC	3	3	0	0	3
4.	MT8602	Industrial Automation	PC	3	3	0	0	3
5.	MG8591	Principles of Management	HS	3	3	0	0	3
6.		Professional Elective – I	PE	3	3	0	0	3
<b>PRACTICALS</b>								
7.	MT8611	Applied Hydraulics and Pneumatics Laboratory	PC	4	0	0	4	2
8.	MT8612	Industrial Automation Laboratory	PC	4	0	0	4	2
9.	ME8682	Design and Fabrication Project	EEC	4	0	0	4	2
<b>TOTAL</b>				<b>30</b>	<b>18</b>	<b>0</b>	<b>12</b>	<b>24</b>

**SEMESTER VII**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	ME8691	Computer Aided Design and Manufacturing	PC	3	3	0	0	3
2.	MT8701	Robotics and Machine Vision System	PC	3	3	0	0	3
3.	MT8791	Embedded System Design	PC	4	2	0	2	3
4.		Open Elective - II	OE	3	3	0	0	3
5.		Professional Elective – II	PE	3	3	0	0	3
6.		Professional Elective - III	PE	3	3	0	0	3
<b>PRACTICALS</b>								
7.	MT8711	Computer Aided Design and Manufacturing Laboratory	PC	4	0	0	4	2
8.	MT8781	Robotics Laboratory	PC	4	0	0	4	2
<b>TOTAL</b>				<b>27</b>	<b>17</b>	<b>0</b>	<b>10</b>	<b>22</b>

**SEMESTER VIII**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MT8801	Automotive Electronics	PC	3	3	0	0	3
2.		Professional Elective - IV	PE	3	3	0	0	3
3.		Professional Elective – V	PE	3	3	0	0	3
<b>PRACTICALS</b>								
4.	MT8811	Project Work	EEC	20	0	0	20	10
<b>TOTAL</b>				<b>29</b>	<b>9</b>	<b>0</b>	<b>20</b>	<b>19</b>

**TOTAL NO. OF CREDITS:186**

**HUMANITIES AND SOCIAL SCIENCES (HS)**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	HS8151	Communicative English	HS	4	4	0	0	4
2	HS8251	Technical English	HS	4	4	0	0	4
3	GE8291	Environmental Science and Engineering	HS	3	3	0	0	3
4	MG8591	Principles of Management	HS	3	3	0	0	3

**BASIC SCIENCE (BS)**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	MA8151	Engineering Mathematics I	BS	4	4	0	0	4
2	PH8151	Engineering Physics	BS	3	3	0	0	3
3	CY8151	Engineering Chemistry	BS	3	3	0	0	3
4	BS8161	Physics and Chemistry Laboratory	BS	4	0	0	4	2
5	MA8251	Engineering Mathematics II	BS	4	4	0	0	4
6	PH8251	Materials Science	BS	3	3	0	0	3
7	MA8353	Transforms and Partial Differential Equations	BS	4	4	0	0	4
8	MA8452	Statistics and Numerical Methods	BS	4	4	0	0	4

**ENGINEERING SCIENCES (ES)**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	GE8151	Problem Solving and Python Programming	ES	3	3	0	0	3
2.	GE8152	Engineering Graphics	ES	6	2	0	4	4
3.	GE8161	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
4.	BE8253	Basic Electrical, Electronics and Instrumentation Engineering	ES	3	3	0	0	3
5.	GE8292	Engineering Mechanics	ES	5	3	2	0	4
6.	GE8261	Engineering Practices Laboratory	ES	4	0	0	4	2
7.	BE8261	Basic Electrical, Electronics and Instrumentation Engineering Laboratory	ES	4	0	0	4	2
8.	CE8395	Strength of Materials for Mechanical Engineers	ES	3	3	0	0	3

9.	CE8394	Fluid Mechanics and Machinery	ES	4	4	0	0	4
10.	CE8395	Strength of Materials and Fluid Mechanics & Machinery Laboratory	ES	4	0	0	4	2
11.	EC8392	Digital Electronics	ES	3	3	0	0	3
12.	MT8301	Electrical Machines and Drives	ES	3	3	0	0	3
13.	MT8311	Electrical Machines and Drives Laboratory	ES	4	0	0	4	2
14.	EE8552	Power Electronics	ES	3	3	0	0	3
15.	EC8391	Control Systems Engineering	ES	3	3	0	0	3
16.	MT8511	Power Electronics Laboratory	ES	4	0	0	4	2

### PROFESSIONAL CORE (PC)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	MT8302	Analog Devices and Circuits	PC	3	3	0	0	3
3	ME8392	Manufacturing Technology	PC	3	3	0	0	3
4	MT8491	Microprocessors and Microcontrollers	PC	3	3	0	0	3
5	ME8492	Kinematics of Machinery	PC	3	3	0	0	3
6	MT8401	Thermodynamics and Heat Transfer	PC	3	3	0	0	3
7	MT8411	Microprocessor and Microcontrollers Laboratory	PC	4	0	0	4	2
8	ME8461	Manufacturing Technology Laboratory	PC	4	0	0	4	2
9	ME8381	Computer Aided Machine Drawing	PC	4	0	0	4	2
10	MT8591	Sensors and Instrumentation	PC	3	3	0	0	3
11	ME8594	Dynamics of Machines	PC	4	4	0	0	4
12	MT8511	Sensors and Instrumentation Laboratory	PC	4	0	0	4	2
13	ME8481	Dynamics Laboratory	PC	4	0	0	4	2
14	ME8591	Applied Hydraulics and Pneumatics	PC	3	3	0	0	3
15	MT8601	Design of Mechatronics System	PC	3	3	0	0	3
16	ME8593	Design of Machine Elements	PC	3	3	0	0	3

17	MT8602	Industrial Automation	PC	3	3	0	0	3
18	MT8611	Applied Hydraulics and Pneumatics Laboratory	PC	4	0	0	4	2
19	MT8612	Industrial Automation Laboratory	PC	4	0	0	4	2
20	ME8691	Computer Aided Design and Manufacturing	PC	3	3	0	0	3
21	MT8701	Robotics and Machine Vision System	PC	3	3	0	0	3
22	MT8791	Embedded System Design	PC	4	2	0	2	3
25	MT8711	Computer Aided Design and Manufacturing Laboratory	PC	4	0	0	4	2
26	MT8781	Robotics Laboratory	PC	4	0	0	4	2
27	MT8801	Automotive Electronics	PC	3	3	0	0	3

**PROFESSIONAL ELECTIVES (PE)\*****SEMESTER VI, ELECTIVE I**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	IT8071	Digital Signal Processing	PE	3	3	0	0	3
2.	MT8001	Object Oriented Programming in C++	PE	3	3	0	0	3
3.	ME8091	Automobile Engineering	PE	3	3	0	0	3
4.	GE8075	Intellectual Property Rights	PE	3	3	0	0	3
5.	GE8073	Fundamentals of Nanoscience	PE	3	3	0	0	3

**SEMESTER VII, ELECTIVE II**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	AN8091	Maintenance Engineering	PE	3	3	0	0	3
2.	ME8793	Process Planning and Cost Estimation	PE	3	3	0	0	3
3.	MG8491	Operations Research	PE	3	3	0	0	3
4.	MT8002	Advanced Manufacturing Technology	PE	3	3	0	0	3
5.	AE8751	Avionics	PE	3	3	0	0	3
6.	MF8071	Additive Manufacturing	PE	3	3	0	0	3
7.	GE8077	Total Quality Management	PE	3	3	0	0	3

**SEMESTER VII, ELECTIVE III**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	EC8093	Digital Image Processing	PE	3	3	0	0	3
2.	MT8003	Medical Mechatronics	PE	3	3	0	0	3
3.	MT8071	Virtual Instrumentation	PE	3	3	0	0	3
4.	IT8075	Software Project Management	PE	3	3	0	0	3
5.	GE8072	Foundation skills in Integrated Product Development	PE	3	3	0	0	3
6.	GE8074	Human Rights	PE	3	3	0	0	3
7.	GE8071	Disaster Management	PE	3	3	0	0	3

**SEMESTER VIII, ELECTIVE IV**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CS8691	Artificial Intelligence	PE	3	3	0	0	3
2.	MG8091	Entrepreneurship Development	PE	3	3	0	0	3
3.	RO8791	Modeling and Simulation	PE	3	3	0	0	3
4.	EE8091	Micro Electro Mechanical Systems	PE	3	3	0	0	3



HS8151

**COMMUNICATIVE ENGLISH**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**OBJECTIVES:**

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

**UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS 12**

Reading- short comprehension passages, practice in skimming-scanning and predicting- Writing-completing sentences- - developing hints. Listening- short texts- short formal and informal conversations. Speaking- introducing oneself - exchanging personal information- Language development- Wh- Questions- asking and answering-yes or no questions- parts of speech. Vocabulary development-- prefixes- suffixes- articles.- count/ uncount nouns.

**UNIT II GENERAL READING AND FREE WRITING 12**

Reading - comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- Writing – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –Listening- telephonic conversations. Speaking – sharing information of a personal kind—greeting – taking leave- Language development – prepositions, conjunctions Vocabulary development- guessing meanings of words in context.

**UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12**

Reading- short texts and longer passages (close reading) Writing- understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences Listening – listening to longer texts and filling up the table- product description- narratives from different sources. Speaking- asking about routine actions and expressing opinions. Language development- degrees of comparison-pronouns- direct vs indirect questions- Vocabulary development – single word substitutes- adverbs.

**UNIT IV READING AND LANGUAGE DEVELOPMENT 12**

Reading- comprehension-reading longer texts- reading different types of texts- magazines Writing- letter writing, informal or personal letters-e-mails-conventions of personal email- Listening- listening to dialogues or conversations and completing exercises based on them. Speaking- speaking about oneself- speaking about one's friend- Language development- Tenses- simple present-simple past-present continuous and past continuous- Vocabulary development- synonyms-antonyms- phrasal verbs

**UNIT V EXTENDED WRITING 12**

Reading- longer texts- close reading –Writing- brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing-Listening – listening to talks-conversations- Speaking – participating in conversations- short group conversations-Language development-modal verbs- present/ past perfect tense - Vocabulary development-collocations- fixed and semi-fixed expressions

**TOTAL: 60 PERIODS**

**OUTCOMES: At the end of the course, learners will be able to:**

- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English.

**TEXT BOOKS:**

1. Board of Editors. Using English A Coursebook for Undergraduate Engineers and Technologists. Orient BlackSwan Limited, Hyderabad: 2015
2. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.

**REFERENCES**

- 1 Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge,2011.
- 2 Means,L. Thomas and Elaine Langlois. English & Communication For Colleges. CengageLearning ,USA: 2007
- 3 Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student's Book & Workbook) Cambridge University Press, New Delhi: 2005
- 4 Comfort, Jeremy, et al. Speaking Effectively : Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011
- 5 Dutt P. Kiranmai and Rajeevan Geeta. Basic Communication Skills, Foundation Books: 2013

**MA8151****ENGINEERING MATHEMATICS – I**

L	T	P	C
4	0	0	4

**OBJECTIVES :**

The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

**UNIT I DIFFERENTIAL CALCULUS****12**

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

**UNIT II FUNCTIONS OF SEVERAL VARIABLES****12**

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

**UNIT III INTEGRAL CALCULUS****12**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

**UNIT IV MULTIPLE INTEGRALS****12**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

**UNIT V DIFFERENTIAL EQUATIONS****12**

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

**TOTAL : 60 PERIODS****OUTCOMES :**

After completing this course, students should demonstrate competency in the following skills:

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.

**TEXT BOOKS :**

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43<sup>rd</sup> Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7<sup>th</sup> Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

**REFERENCES :**

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10<sup>th</sup> Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3<sup>rd</sup> Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
5. Weir, M.D and Joel Hass, "Thomas Calculus", 12<sup>th</sup> Edition, Pearson India, 2016.



**TEXT BOOKS:**

1. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. "Engineering Physics". Cengage Learning India, 2012.

**REFERENCES:**

1. Halliday, D., Resnick, R. & Walker, J. "Principles of Physics". Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. "Physics for Scientists and Engineers". Cengage Learning, 2010.
3. Tipler, P.A. & Mosca, G. "Physics for Scientists and Engineers with Modern Physics". W.H. Freeman, 2007.

**CY8151****ENGINEERING CHEMISTRY****L T P C  
3 0 0 3****OBJECTIVES:**

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

**UNIT I WATER AND ITS TREATMENT****9**

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

**UNIT II SURFACE CHEMISTRY AND CATALYSIS****9**

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions – adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – kinetics of surface reactions, unimolecular reactions, Langmuir - applications of adsorption on pollution abatement.

Catalysis: Catalyst – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis– Michaelis – Menten equation.

**UNIT III ALLOYS AND PHASE RULE****9**

Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

**UNIT IV FUELS AND COMBUSTION****9**

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture

of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel. Combustion of fuels: Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

#### **UNIT V ENERGY SOURCES AND STORAGE DEVICES 9**

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H<sub>2</sub>-O<sub>2</sub> fuel cell.

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

#### **TEXT BOOKS:**

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

#### **REFERENCES:**

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

#### **GE8151 PROBLEM SOLVING AND PYTHON PROGRAMMING**

**L T P C**  
**3 0 0 3**

#### **OBJECTIVES:**

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures — lists, tuples, dictionaries.
- To do input/output with files in Python.

#### **UNIT I ALGORITHMIC PROBLEM SOLVING 9**

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

## **UNIT II DATA, EXPRESSIONS, STATEMENTS 9**

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

## **UNIT III CONTROL FLOW, FUNCTIONS 9**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

## **UNIT IV LISTS, TUPLES, DICTIONARIES 9**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

## **UNIT V FILES, MODULES, PACKAGES 9**

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

### **OUTCOMES:**

**Upon completion of the course, students will be able to**

- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.

**TOTAL : 45 PERIODS**

### **TEXT BOOKS:**

1. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, 2<sup>nd</sup> edition, Updated for Python 3, Shroff/O’Reilly Publishers, 2016 (<http://greenteapress.com/wp/think-python/>)
2. Guido van Rossum and Fred L. Drake Jr, “An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

### **REFERENCES:**

1. John V Guttag, “Introduction to Computation and Programming Using Python”, Revised and expanded Edition, MIT Press , 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd.,, 2015.
4. Kenneth A. Lambert, “Fundamentals of Python: First Programs”, CENGAGE Learning, 2012.
5. Charles Dierbach, “Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, “Practical Programming: An Introduction to Computer Science using Python 3”, Second edition, Pragmatic Programmers, LLC, 2013.

**OBJECTIVES:**

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

**CONCEPTS AND CONVENTIONS (Not for Examination)**

1

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

**UNIT I PLANE CURVES AND FREEHAND SKETCHING**

7+12

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

**UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE**

6+12

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

**UNIT III PROJECTION OF SOLIDS**

5+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

**UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES**

5+12

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

**UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS**

6+12

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

**TOTAL: 90 PERIODS****OUTCOMES:**

On successful completion of this course, the student will be able to

- familiarize with the fundamentals and standards of Engineering graphics
- perform freehand sketching of basic geometrical constructions and multiple views of objects.
- project orthographic projections of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- visualize and to project isometric and perspective sections of simple solids.

**TEXT BOOK:**

1. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

**REFERENCES:**

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50<sup>th</sup> Edition, 2010.
2. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. and Duff, John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2<sup>nd</sup> Edition, 2009.

**Publication of Bureau of Indian Standards:**

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

**Special points applicable to University Examinations on Engineering Graphics:**

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

**GE8161          PROBLEM SOLVING AND PYTHON PROGRAMMING  
LABORATORY****L T P C  
0 0 4 2****OBJECTIVES:**

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

**LIST OF PROGRAMS**

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort

7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

**PLATFORM NEEDED**

Python 3 interpreter for Windows/Linux

**COURSE OUTCOMES:**

**Upon completion of the course, students will be able to**

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

**TOTAL :60 PERIODS**

**BS8161**

**PHYSICS AND CHEMISTRY LABORATORY**  
**(Common to all branches of B.E. / B.Tech Programmes)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**OBJECTIVES:**

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

**LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)**

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser  
 (b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

**TOTAL: 30 PERIODS**

**OUTCOMES:**

Upon completion of the course, the students will be able to

- apply principles of elasticity, optics and thermal properties for engineering applications.

## **CHEMISTRY LABORATORY: (Any seven experiments to be conducted)**

### **OBJECTIVES:**

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
  - To acquaint the students with the determination of molecular weight of a polymer by viscometry.
1. Estimation of HCl using  $\text{Na}_2\text{CO}_3$  as primary standard and Determination of alkalinity in water sample.
  2. Determination of total, temporary & permanent hardness of water by EDTA method.
  3. Determination of DO content of water sample by Winkler's method.
  4. Determination of chloride content of water sample by argentometric method.
  5. Estimation of copper content of the given solution by Iodometry.
  6. Determination of strength of given hydrochloric acid using pH meter.
  7. Determination of strength of acids in a mixture of acids using conductivity meter.
  8. Estimation of iron content of the given solution using potentiometer.
  9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
  10. Estimation of sodium and potassium present in water using flame photometer.
  11. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
  12. Pseudo first order kinetics-ester hydrolysis.
  13. Corrosion experiment-weight loss method.
  14. Determination of CMC.
  15. Phase change in a solid.
  16. Conductometric titration of strong acid vs strong base.

### **OUTCOMES:**

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

**TOTAL: 30 PERIODS**

### **TEXTBOOKS:**

1. Vogel's Textbook of Quantitative Chemical Analysis (8<sup>TH</sup> edition, 2014)

HS8251

**TECHNICAL ENGLISH**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**OBJECTIVES:**

The Course prepares second semester Engineering and Technology students to:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

**UNIT I INTRODUCTION TECHNICAL ENGLISH 12**

Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- Speaking –Asking for and giving directions- Reading – reading short technical texts from journals- newspapers- Writing- purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-Vocabulary Development- technical vocabulary Language Development –subject verb agreement - compound words.

**UNIT II READING AND STUDY SKILLS 12**

Listening- Listening to longer technical talks and completing exercises based on them-Speaking – describing a process-Reading – reading longer technical texts- identifying the various transitions in a text- paragraphing- Writing- interpreting charts, graphs- Vocabulary Development-vocabulary used in formal letters/emails and reports Language Development- impersonal passive voice, numerical adjectives.

**UNIT III TECHNICAL WRITING AND GRAMMAR 12**

Listening- Listening to classroom lectures/ talks on engineering/technology -Speaking – introduction to technical presentations- Reading – longer texts both general and technical, practice in speed reading; Writing-Describing a process, use of sequence words- Vocabulary Development- sequence words- Misspelled words. Language Development- embedded sentences

**UNIT IV REPORT WRITING 12**

Listening- Listening to documentaries and making notes. Speaking – mechanics of presentations- Reading – reading for detailed comprehension- Writing- email etiquette- job application – cover letter –Résumé preparation( via email and hard copy)- analytical essays and issue based essays-- Vocabulary Development- finding suitable synonyms-paraphrasing-. Language Development- clauses- if conditionals.

**UNIT V GROUP DISCUSSION AND JOB APPLICATIONS 12**

Listening- TED/Ink talks; Speaking –participating in a group discussion -Reading– reading and understanding technical articles Writing– Writing reports- minutes of a meeting- accident and survey- Vocabulary Development- verbal analogies Language Development- reported speech

**TOTAL : 60 PERIODS**

**OUTCOMES:** At the end of the course learners will be able to:

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

### TEXT BOOKS:

1. Board of editors. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.

### REFERENCES

1. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice.Oxford University Press: New Delhi,2014.
2. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
3. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
4. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007
5. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007

**Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.**

**MA8251**

**ENGINEERING MATHEMATICS – II**

**L T P C**  
**4 0 0 4**

### OBJECTIVES :

This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modeling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

### UNIT I MATRICES

**12**

Eigen values and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigen values and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

### UNIT II VECTOR CALCULUS

**12**

Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

### UNIT III ANALYTIC FUNCTIONS

**12**

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions  $w = z + c, cz, \frac{1}{z}, z^2$  - Bilinear transformation.

### UNIT IV COMPLEX INTEGRATION

**12**

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour.

## UNIT V LAPLACE TRANSFORMS

12

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

**TOTAL: 60 PERIODS**

### OUTCOMES :

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Eigen values and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

### TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43<sup>rd</sup> Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10<sup>th</sup> Edition, New Delhi, 2016.

### REFERENCES :

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7<sup>th</sup> Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., " Advanced Engineering Mathematics ", Narosa Publications, New Delhi , 3<sup>rd</sup> Edition, 2007.
3. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.
4. Sastry, S.S, "Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4<sup>th</sup> Edition, New Delhi, 2014.
5. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

	<b>MATERIALS SCIENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PH8251</b>	(Common to courses offered in Faculty of Mechanical Engineering Except B.E. Materials Science and Engineering )	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### OBJECTIVES:

- To introduce the essential principles of materials science for mechanical and related engineering applications.

## UNIT I PHASE DIAGRAMS

9

Solid solutions - Hume Rothery's rules – the phase rule - single component system - one-component system of iron - binary phase diagrams - isomorphous systems - the tie-line rule - the lever rule - application to isomorphous system - eutectic phase diagram - peritectic phase diagram - other invariant reactions – free energy composition curves for binary systems - microstructural change during cooling.



**OBJECTIVES:**

To impart knowledge on

- Electric circuit laws, single and three phase circuits and wiring
- Working principles of Electrical Machines
- Working principle of Various electronic devices and measuring instruments

**UNIT I ELECTRICAL CIRCUITS****9**

Basic circuit components – Ohms Law - Kirchoff's Law – Instantaneous Power – Inductors - Capacitors – Independent and Dependent Sources - steady state solution of DC circuits - Nodal analysis, Mesh analysis- Thevenin's Theorem, Norton's Theorem, Maximum Power transfer theorem- Linearity and Superposition Theorem.

**UNIT II AC CIRCUITS****9**

Introduction to AC circuits – waveforms and RMS value – power and power factor, single phase and three-phase balanced circuits – Three phase loads - housing wiring, industrial wiring, materials of wiring

**UNIT III ELECTRICAL MACHINES****9**

Principles of operation and characteristics of ; DC machines, Transformers (single and three phase ) , Synchronous machines , three phase and single phase induction motors.

**UNIT IV ELECTRONIC DEVICES & CIRCUITS****9**

Types of Materials – Silicon & Germanium- N type and P type materials – PN Junction –Forward and Reverse Bias –Semiconductor Diodes –Bipolar Junction Transistor – Characteristics —Field Effect Transistors – Transistor Biasing –Introduction to operational Amplifier –Inverting Amplifier –Non Inverting Amplifier –DAC – ADC .

**UNIT V MEASUREMENTS & INSTRUMENTATION****9**

Introduction to transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect and Mechanical - ,Classification of instruments - Types of indicating Instruments - multimeters –Oscilloscopes- – three-phase power measurements– instrument transformers (CT and PT )

**TOTAL : 45 PERIODS****OUTCOMES:**

Ability to

- Understand electric circuits and working principles of electrical machines
- Understand the concepts of various electronic devices
- Choose appropriate instruments for electrical measurement for a specific application

**TEXT BOOKS**

1. Leonard S Bobrow, " Foundations of Electrical Engineering", Oxford University Press, 2013
2. D P Kothari and I.J Nagarath, "Electrical Machines "Basic Electrical and Electronics Engineering", McGraw Hill Education(India) Private Limited, Third Reprint ,2016
3. Thereja .B.L., "Fundamentals of Electrical Engineering and Electronics", S. Chand & Co. Ltd., 2008

## REFERENCES

1. Del Toro, "Electrical Engineering Fundamentals", Pearson Education, New Delhi, 2007
2. John Bird, "Electrical Circuit Theory and Technology", Elsevier, First Indian Edition, 2006
3. Allan S Moris, "Measurement and Instrumentation Principles", Elseveir, First Indian Edition, 2006
4. Rajendra Prasad, "Fundamentals of Electrical Engineering", Prentice Hall of India, 2006
5. A.E.Fitzgerald, David E Higginbotham and Arvin Gabel, "Basic Electrical Engineering", McGraw Hill Education(India) Private Limited, 2009
6. N K De, Dipu Sarkar, "Basic Electrical Engineering", Universities Press (India)Private Limited 2016

**GE8291**

**ENVIRONMENTAL SCIENCE AND ENGINEERING**

**L T P C**  
**3 0 0 3**

### OBJECTIVES:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

### UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

**14**

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

### UNIT II ENVIRONMENTAL POLLUTION

**8**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

### UNIT III NATURAL RESOURCES

**10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case

studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

#### **UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

#### **UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

**TOTAL: 45 PERIODS**

#### **OUTCOMES:**

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

#### **TEXT BOOKS:**

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2<sup>nd</sup> edition, Pearson Education, 2004.

#### **REFERENCES :**

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hyderabad, 2015.
3. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.
4. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.

**OBJECTIVES:**

- To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

**UNIT I STATICS OF PARTICLES****9+6**

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vectorial representation of forces – Vector operations of forces -additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

**UNIT II EQUILIBRIUM OF RIGID BODIES****9+6**

Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

**UNIT III PROPERTIES OF SURFACES AND SOLIDS****9+6**

Centroids and centre of mass – Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula – Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

**UNIT IV DYNAMICS OF PARTICLES****9+6**

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton's laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

**UNIT V FRICTION AND RIGID BODY DYNAMICS****9+6**

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

**TOTAL : 45+30=75 PERIODS****OUTCOMES:**

On successful completion of this course, the student will be able to

- illustrate the vectorial and scalar representation of forces and moments
- analyse the rigid body in equilibrium
- evaluate the properties of surfaces and solids
- calculate dynamic forces exerted in rigid body
- determine the friction and the effects by the laws of friction

**TEXT BOOKS:**

- Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8<sup>th</sup> Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
- Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

## REFERENCES:

1. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 1998.
2. Hibbeler, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11<sup>th</sup> Edition, Pearson Education 2010.
3. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4<sup>th</sup> Edition, Pearson Education 2006.
4. Meriam J.L. and Kraige L.G., " Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", Third Edition, John Wiley & Sons,1993.
5. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3<sup>rd</sup> Edition, Vikas Publishing House Pvt. Ltd., 2005.

GE8261

ENGINEERING PRACTICES LABORATORY

L T P C  
0 0 4 2

## OBJECTIVES:

To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

### GROUP A (CIVIL & MECHANICAL)

#### I CIVIL ENGINEERING PRACTICE

13

#### **Buildings:**

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

#### **Plumbing Works:**

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.

(b) Study of pipe connections requirements for pumps and turbines.

(c) Preparation of plumbing line sketches for water supply and sewage works.

(d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

(e) Demonstration of plumbing requirements of high-rise buildings.

#### **Carpentry using Power Tools only:**

(a) Study of the joints in roofs, doors, windows and furniture.

(b) Hands-on-exercise:

Wood work, joints by sawing, planing and cutting.

#### II MECHANICAL ENGINEERING PRACTICE

18

#### **Welding:**

(a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.

(b) Gas welding practice

#### **Basic Machining:**

(a) Simple Turning and Taper turning

(b) Drilling Practice

#### **Sheet Metal Work:**

(a) Forming & Bending:

- (b) Model making – Trays and funnels.
- (c) Different type of joints.

**Machine assembly practice:**

- (a) Study of centrifugal pump
- (b) Study of air conditioner

**Demonstration on:**

- (a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
- (b) Foundry operations like mould preparation for gear and step cone pulley.
- (c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

**GROUP B (ELECTRICAL & ELECTRONICS)**

**III ELECTRICAL ENGINEERING PRACTICE**

**13**

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
  4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

**IV ELECTRONICS ENGINEERING PRACTICE**

**16**

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

On successful completion of this course, the student will be able to

- fabricate carpentry components and pipe connections including plumbing works.
- use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundry and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

**CIVIL**

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
2. Carpentry vice (fitted to work bench) 15 Nos.
3. Standard woodworking tools 15 Sets.
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools: (a) Rotary Hammer 2 Nos

(b) Demolition Hammer	2 Nos
(c) Circular Saw	2 Nos
(d) Planer	2 Nos
(e) Hand Drilling Machine	2 Nos
(f) Jigsaw	2 Nos

### **MECHANICAL**

1. Arc welding transformer with cables and holders	5 Nos.
2. Welding booth with exhaust facility	5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos.
5. Centre lathe	2 Nos.
6. Hearth furnace, anvil and smithy tools	2 Sets.
7. Moulding table, foundry tools	2 Sets.
8. Power Tool: Angle Grinder	2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner	One each.

### **ELECTRICAL**

1. Assorted electrical components for house wiring	15 Sets
2. Electrical measuring instruments	10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp	1 each
4. Megger (250V/500V)	1 No.
5. Power Tools: (a) Range Finder	2 Nos
(b) Digital Live-wire detector	2 Nos

### **ELECTRONICS**

1. Soldering guns	10 Nos.
2. Assorted electronic components for making circuits	50 Nos.
3. Small PCBs	10 Nos.
4. Multimeters	10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply	

**OBJECTIVE:**

- To train the students in performing various tests on electrical drives, sensors and circuits.

**LIST OF EXPERIMENTS:**

1. Load test on separately excited DC generator
2. Load test on Single phase Transformer
3. Load test on Induction motor
4. Verification of Circuit Laws
5. Verification of Circuit Theorems
6. Measurement of three phase power
7. Load test on DC shunt motor.
8. Diode based application circuits
9. Transistor based application circuits
10. Study of CRO and measurement of AC signals
11. Characteristics of LVDT
12. Calibration of Rotometer
13. RTD and Thermistor

**Minimum of 10 Experiments to be carried out :-**

**TOTAL: 60 PERIODS**

**OUTCOMES:**

- Ability to determine the speed characteristic of different electrical machines
- Ability to design simple circuits involving diodes and transistors
- Ability to use operational amplifiers

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

<b>S.No.</b>	<b>NAME OF THE EQUIPMENT</b>	<b>Qty.</b>
1	D. C. Motor Generator Set	2
2	D.C. Shunt Motor	2
3	Single Phase Transformer	2
4	Single Phase Induction Motor	2
5	Ammeter A.C and D.C	20
6	Voltmeters A.C and D.C	20
7.	Watt meters LPF and UPF	4
8.	Resistors & Breadboards	-
9.	Cathode Ray Oscilloscopes	4
10.	Dual Regulated power supplies	6
11.	A.C. Signal Generators	4
12.	Transistors (BJT, JFET)	-

**OBJECTIVES:**

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

**UNIT I PARTIAL DIFFERENTIAL EQUATIONS****12**

Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

**UNIT II FOURIER SERIES****12**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

**UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS****12**

Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

**UNIT IV FOURIER TRANSFORMS****12**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

**UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS****12**

Z-transforms - Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems - Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

**TOTAL : 60 PERIODS****OUTCOMES :**

Upon successful completion of the course, students should be able to:

- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.



**UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS****9**

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lamé's theorem.

**TOTAL: 45 PERIODS****OUTCOMES:**

Students will be able to

- Understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.
- Understand the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.
- Apply basic equation of simple torsion in designing of shafts and helical spring
- Calculate the slope and deflection in beams using different methods.
- Analyze and design thin and thick shells for the applied internal and external pressures.

**TEXT BOOKS:**

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2016
2. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2009

**REFERENCES:**

1. Egor. P.Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2002
2. Ferdinand P. Beer, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing 'co. Ltd., New Delhi, 2005.
3. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2013
4. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2010.

**CE8394****FLUID MECHANICS AND MACHINERY****L T P C  
4 0 0 4****OBJECTIVES:**

- The properties of fluids and concept of control volume are studied
- The applications of the conservation laws to flow through pipes are studied.
- To understand the importance of dimensional analysis
- To understand the importance of various types of flow in pumps.
- To understand the importance of various types of flow in turbines

**UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS****12**

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

**UNIT II FLOW THROUGH CIRCULAR CONDUITS****12**

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor-Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

**UNIT III DIMENSIONAL ANALYSIS****12**

Need for dimensional analysis – methods of dimensional analysis – Similitude – types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

**UNIT IV PUMPS****12**

Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps – classification.

**UNIT V TURBINES****12**

Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

**TOTAL: 60 PERIODS****OUTCOMES:**

Upon completion of this course, the students will be able to

- Apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Can analyse and calculate major and minor losses associated with pipe flow in piping networks.
- Can mathematically predict the nature of physical quantities
- Can critically analyse the performance of pumps
- Can critically analyse the performance of turbines.

**TEXT BOOK:**

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2013.

**REFERENCES:**

1. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2016
3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", 2011.
4. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010

**EC8392****DIGITAL ELECTRONICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To present the Digital fundamentals, Boolean algebra and its applications in digital systems
- To familiarize with the design of various combinational digital circuits using logic gates
- To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits
- To explain the various semiconductor memories and related technology
- To introduce the electronic circuits involved in the making of logic gates

**UNIT I DIGITAL FUNDAMENTALS****9**

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization and Quine-McCluskey method of minimization.



**OBJECTIVES:**

- To understand the working principle and performance characteristics of DC Generator and DC Motor.
- To understand the working principle of induction motor and synchronous machines.
- To provide knowledge in the area of special electrical machines and drives.

<b>UNIT I</b>	<b>ELECTRICAL CIRCUITS AND TRANSFORMERS</b>	<b>6</b>
D.C. Voltage, current, power – Ohms law – series, parallel circuits – Kirchhoff's laws – mesh analysis – A.C. voltage – sinusoidal waves, – power factor – complex power – basic operation of transformers – simple problems.		
<b>UNIT II</b>	<b>ELECTRICAL MOTORS</b>	<b>12</b>
Constructional details, principle of operation and performance characteristics of D.C. motors, single phase induction motor, three phase induction motor, synchronous motors, universal motors, stepper motors and reluctance motor.		
<b>UNIT III</b>	<b>SPEED CONTROL AND STARTING</b>	<b>9</b>
Speed control of D.C. motors – three phase induction motors – starting methods of D.C. motor and three phase induction motor – electrical braking – simple problems.		
<b>UNIT IV</b>	<b>ELECTRICAL DRIVES</b>	<b>9</b>
Type of Electrical Drives – Selection & factors influencing the selection – heating and cooling curves – loading condition and classes of duty – determination of power rating – simple problems.		
<b>UNIT V</b>	<b>SOLID STATE DRIVES (QUALITATIVE TREATMENT ONLY)</b>	<b>9</b>
Advantages of solid state drives – D.C. motor control using rectifiers and choppers – control of induction motor by V, V/f and slip power recovery scheme using inverters and A.C. power regulators.		
<b>TOTAL</b>		<b>45 PERIODS</b>

**OUTCOMES:**

**After successful completion of this course, the students should be able to**

- CO1: Get the basic knowledge about the Electric circuits and transformers.  
 CO2: Understand the various types of electrical motors.  
 CO3: Know about speed control and starting methods DC and induction motors  
 CO4: Understand about various types of electrical drives  
 CO5: Get exposure with solid state drives

**TEXT BOOKS:**

1. De. N.K., & Sen. P.K "Electric Drives", Prentice Hall India Pvt Limited 2002.
2. Vedam Subramaniam. "Electric Drives", Tata McGraw Hill , New Delhi , 2007.
3. Vukosavic, "Digital Control of Electrical Drives", Springer, Indian Reprint, 2010.

**REFERENCES:**

1. Bhattacharya S.K. & Brinjinder Singh , "Control of Electrical Machines", New Age International Publishers, 2002.
2. Crowder, "Electric Drives and Electromechanical Systems", Elsevier, Indian Reprint,2009.
3. Dubey.G.K. "Fundamental Electrical Drives" 2<sup>nd</sup> Edition, Narosa Publications, 2002
4. Metha. V.K. & Rohit Metha, "Principle of Electrical Engineering", S.Chand & Co .2006.

MT8302

**ANALOG DEVICES AND CIRCUITS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To understand the basic principle of switching devices
- To study various types of amplifiers.
- To understand the various functionalities of ICs and Waveform generators.
- To study the characteristics of various electronic devices.

**UNIT I ANALOG ELECTRONICS**

**9**

Switching Devices: SCR, TRIAC, JFET, MOSFET - Rectifiers and Filters - Regulated Power Supply – Switching Power Supplies, Thermal Considerations - Feedback and power amplifiers - Oscillators: Colpitts oscillator, Hartley oscillator and Wien bridge oscillator

**UNIT II OPERATIONAL AMPLIFIERS AND APPLICATIONS**

**9**

Operational amplifiers – Principles, Specifications, characteristics and applications-. Arithmetic Operations, Integrator, Differentiator, Comparator, Schmitt Trigger, Instrumentation Amplifier, A/D & D/A converters

**UNIT III WAVEFORM GENERATORS AND ICs**

**9**

Triangular, Saw tooth and Sine wave generators - Multivibrators - Function generator ICs – Timer ICs – Voltage regulator ICs: fixed, Adjustable and General purpose - V/F and F/V convertors – Optocouplers

**UNIT IV TEST AND MEASURING INSTRUMENTS**

**9**

Measurement of voltage, current, frequency and power using Multi meters, oscilloscopes, recorders, data loggers, signal sources, counters, analyzers and printers.

**UNIT V DISPLAY DEVICES**

**9**

Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Displays, Numeric Displays, Photo transistor, Solar cell, CCD

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon Completion of the course, the students will be able to:**

- CO1: Apply the various switching devices in electronic circuits.  
CO2: Work with various applications of amplifiers  
CO3: Design various circuits using ICs.  
CO4: Test and measure different parameters available in electronic circuits.  
CO5: Explain the principles of various display devices.

**TEXT BOOKS:**

1. Donald A Neaman, "Semiconductor Physics and Devices", Fourth Edition, Tata Mc Graw Hill Inc. 2012.
2. Roy Chowdhury D. and Jain Shail B., Linear Integrated Circuits, New Age Int. Pub., 5<sup>th</sup> edition, 2018.
3. Salivahanan S., Suresh kumar N. and Vallavaraj A., Electronic Devices and Circuits, Tata Mc Graw Hill publishing company, New Delhi, 3<sup>rd</sup> edition, 2012

**REFERENCES**

1. Albert Malvino and Bates J., Electronic Principles, Tata McGraw- Hill Pub. Company Ltd., 7<sup>th</sup> edition, 2013.
2. Millman J., Halkias C.C. and Satyabrata Jit, Electronic Devices and Circuits, Tata McGraw Hill, New Delhi, 3<sup>rd</sup> edition, 2010.
3. Thomas L. Floyd, Electronic Devices, Pearson Education Asia, 9<sup>th</sup> edition, 2010.

**OBJECTIVES:**

- To study the mechanical properties of materials when subjected to different types of loading.
- To verify the principles studied in Fluid Mechanics theory by performing experiments in lab.

**STRENGTH OF MATERIALS****30****LIST OF EXPERIMENTS**

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
  - (i) Unhardened specimen
  - (ii) Quenched Specimen and
  - (iii) Quenched and tempered specimen.
11. Microscopic Examination of
  - (i) Hardened samples and
  - (ii) Hardened and tempered samples.

**OUTCOME:**

- Ability to perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.

**LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS**

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity	1
2	Torsion Testing Machine (60 NM Capacity)	1
3	Impact Testing Machine (300 J Capacity)	1
4	Brinell Hardness Testing Machine	1
5	Rockwell Hardness Testing Machine	1
6	Spring Testing Machine for tensile and compressive loads (2500 N)	1
7	Metallurgical Microscopes	3
8	Muffle Furnace (800 C)	1

**FLUID MECHANICS AND MACHINES LABORATORY****30****LIST OF EXPERIMENTS**

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.

4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

Upon completion of this course, the students will be able to:

- Perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.
- Use the measurement equipments for flow measurement.
- Perform test on different fluid machinery.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

S. NO.	NAME OF THE EQUIPMENT	Qty.
1	Orifice meter setup	1
2	Venturi meter setup	1
3	Rotameter setup	1
4	Pipe Flow analysis setup	1
5	Centrifugal pump/submergible pump setup	1
6	Reciprocating pump setup	1
7	Gear pump setup	1
8	Pelton wheel setup	1
9	Francis turbine setup	1
10	Kaplan turbine setup	1

**MT8311**

**ELECTRICAL MACHINES AND DRIVES LABORATORY**

**L    T    P    C**  
**0    0    4    2**

**OBJECTIVES:**

- To familiarize the basic concepts of electrical circuits and associated theorems.
- To understand the fundamentals of DC shunt motors and induction motors.
- To understand the load test and performance characteristics of DC shunt motor, stepper motor and induction motors.

**LIST OF EXPERIMENTS**

1. Load test on D.C. shunt motor.
2. Speed control of D.C. shunt motor.
3. Swinburne's test.
4. Load test on three phase induction motor.
5. No load and blocked rotor tests on three – phase induction motor.
6. Load test on single phase induction motor.
7. No load and blocked rotor tests on single phase induction motor.
8. Load test on Synchronous motors.
9. Performance characteristics of Stepper motor.
10. Performance characteristics of single phase transformer.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**Upon Completion of the course, the students will be able to:**

**CO1:** Test and assess the performances of the DC motors and single phase AC motor for varying load.

**CO2:** Control the speed of AC and DC motor.

**CO3:** Analyze and present the findings of experimental observations in both written and oral format.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

<b>S. NO</b>	<b>NAME OF THE EQUIPMENT</b>	<b>Qty</b>
1	Shunt motor 5HP	3
2	Single phase Induction Motor 2HP	2
3	Three phase induction Motor 5HP	2
4	Single phase transformer 2KVA	1
5	Three phase auto transformer	2
6	Single phase auto transformer	2
7	3 point starter	3
8	DPST, TPST Each	2
9	DC source 300v, 100A	1
10	Ammeter(0-5A),(0-10A)MC Each	2
11	Ammeter(0-5A),(0-10A)MI Each	2
12	Voltmeter(0-300V) MC	3
13	Voltmeter(0-150V),(0-300V),(0-600V)MI Each	2
14	Wattmeter 150/300V, 5/10A UPF	2
15	Wattmeter 300/600V,5/10A UPF	2
16	Wattmeter 150/300V,5/10A LPF	2
17	Wattmeter 300/600V,5/10A LPF	2
18	Stepper motor 5Kg	1
19	Synchronous motor 5KW	1
20	Rheostat 360 ohm/1.2A	3
21	Tachometer	5
22	Rheostat 50 ohm/5A	3

**HS8381**

**INTERPERSONAL SKILLS/LISTENING & SPEAKING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**OBJECTIVES: The Course will enable learners to:**

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- improve general and academic listening skills
- Make effective presentations.

**UNIT I**

Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

## **UNIT II**

Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

## **UNIT III**

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail

## **UNIT IV**

Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

## **UNIT V**

Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

**TOTAL : 30 PERIODS**

### **OUTCOMES: At the end of the course Learners will be able to:**

- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal

### **TEXT BOOKS:**

1. Brooks, Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.
2. Richards, C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

### **REFERENCES**

1. Bhatnagar, Nitin and Mamta Bhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.
2. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
3. Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013.
4. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
5. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014

**OBJECTIVES:**

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

**UNIT I TESTING OF HYPOTHESIS****12**

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means - Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

**UNIT II DESIGN OF EXPERIMENTS****12**

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design -  $2^2$  factorial design.

**UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS****12**

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

**UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION****12**

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

**UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS****12**

Single step methods : Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods : Milne's and Adams - Bash forth predictor corrector methods for solving first order equations.

**TOTAL : 60 PERIODS****OUTCOMES :**

Upon successful completion of the course, students will be able to:

- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture.
- Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

**TEXT BOOKS :**

1. Grewal. B.S. and Grewal. J.S., "Numerical Methods in Engineering and Science ", 10<sup>th</sup> Edition, Khanna Publishers, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8<sup>th</sup> Edition, 2015.

**REFERENCES :**

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9<sup>th</sup> Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8<sup>th</sup> Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 2006.
4. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 2004.
5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 8<sup>th</sup> Edition, Pearson Education, Asia, 2007.

**ME8392****MANUFACTURING TECHNOLOGY****L T P C  
3 0 0 3****OBJECTIVE:**

- The automobile components such as piston, connecting rod, crankshaft, engine block, front axle, frame, body etc., are manufactured by various types of production processes involving casting, welding, machining, metal forming, power metallurgy etc.

**UNIT I           CASTING****8**

Casting types, procedure to make sand mould, types of core making, moulding tools, machine moulding, special moulding processes – CO<sub>2</sub> moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

**UNIT II           WELDING****8**

Classification of welding processes. Principles of Oxy-acetylene gas welding. A.C metal arc welding, resistance welding, submerged arc welding, tungsten inert gas welding, metal inert gas welding, plasma arc welding, thermit welding, electron beam welding, laser beam welding, defects in welding, soldering and brazing.

**UNIT III           MACHINING****13**

General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines. General principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining and Laser beam machining.

**UNIT IV FORMING AND SHAPING OF PLASTICS****7**

Types of plastics - Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of - Injection moulding – Plunger and screw machines – Blow moulding – Rotational moulding – Film blowing – Extrusion - Typical industrial applications – Thermoforming – Processing of Thermosets – Working principles and typical applications - Compression moulding – Transfer moulding – Bonding of Thermoplastics – Fusion and solvent methods – Induction and Ultrasonic methods

**UNIT V METAL FORMING AND POWDER METALLURGY****9**

Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing and Spinning, Powder metallurgy – Principal steps involved advantages, disadvantages and limitations of powder metallurgy.

**TOTAL: 45 PERIODS****OUTCOME:**

- The Students can able to use different manufacturing process and use this in industry for component production

**TEXT BOOKS**

1. Hajra Choudhury, "Elements of Workshop Technology", Vol. I and II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2005.
2. Nagendra Parashar B.S. and Mittal R.K., "Elements of Manufacturing Processes", Prentice-Hall of India Private Limited, 2007.

**REFERENCES**

1. Adithan. M and Gupta. A.B., "Manufacturing Technology", New Age, 2006.
2. "H.M.T. Production Technology – Handbook", Tata McGraw-Hill, 2000.
3. Jain. R.K. and S.C. Gupta, "Production Technology", Khanna Publishers. 16<sup>th</sup> Edition,2001.
4. Roy. A. Linberg, "Process and Materials of Manufacture", PHI, 2000.
5. Serope Kalpajian, Steven R.Schmid, "Manufacturing Processes for Engineering Materials", Fourth Edition, Pearson Education, Inc. 2007.

**MT8491****MICROPROCESSORS AND MICROCONTROLLERS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

Through the use of assembly language, by the end of the course students will become thoroughly familiar with the elements of microprocessor and microcontroller software and hardware. They will be able to:

- Understand fundamental operating concepts behind microprocessors and microcontrollers.
- Emphasis on the hardware features of Microprocessor 8085, 8086 and Microcontroller 8051 with their functions
- Understand commonly used peripheral / interfacing

**UNIT I 8085 PROCESSOR****9**

Hardware Architecture, pin diagram – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.





**TEXT BOOKS:**

1. F.B. Sayyad, "Kinematics of Machinery", MacMillan Publishers Pvt Ltd., Tech-max Educational resources, 2011.
2. Rattan, S.S, "Theory of Machines", 4<sup>th</sup> Edition, Tata McGraw-Hill, 2014.
3. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 4<sup>th</sup> Edition, Oxford University Press, 2014.

**REFERENCES:**

1. Allen S. Hall Jr., "Kinematics and Linkage Design", Prentice Hall, 1961
2. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2014
3. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", 3<sup>rd</sup> Edition Affiliated East-West Pvt. Ltd., New Delhi, 2006.
4. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
5. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.

<b>MT8401</b>	<b>THERMODYNAMICS AND HEAT TRANSFER</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVE:**

To acquire knowledge on laws of thermodynamics, types of I.C engines, refrigeration techniques, air conditioning system and heat transfer concepts, principles and mechanism for physical systems.

**UNIT I FIRST LAW OF THERMODYNAMICS 8**

Thermodynamics – microscopic and macroscopic point of view – systems, properties, process, path, cycle. Units – pressure, temperature – Zeroth law. First law – application to closed and open systems, internal energy, specific heat capacities  $C_V$  and  $C_P$  – enthalpy

**UNIT II SECOND LAW OF THERMODYNAMICS 8**

Second Law of thermodynamics – statements – equivalents of Kelvin Plank and Clausius statements. Reversibility – Irreversibility, reversible cycle – Carnot cycle and theorem.

**UNIT III INTERNAL COMBUSTION ENGINES(Qualitative Treatment Only) 12**

Classification of IC engine - IC engine components and functions. Valve timing diagram and port timing diagram - Comparison of two stroke and four stroke engines, Comparison of petrol & diesel engine, Fuel supply systems, total fuel consumption, specific fuel consumption, mechanical efficiency, BHP, IHP, FP - Ignition Systems, Lubrication system, Cooling system, MPFI, DTSI, CRDI.

**UNIT IV REFRIGERATION AND AIR-CONDITIONING 8**

Principles of refrigeration, refrigerator & heat pump cycle, refrigerants, refrigerant properties, refrigerant selection, vapour compression refrigeration cycle, vapour absorption cycle, dry bulb temperature, wet bulb temperature, relative humidity, comfort air-conditioning, Psychometric chart, humidification, de-humidification, air coolers, cooling towers.

**UNIT V HEAT TRANSFER (Qualitative Treatment Only) 9**

Heat transfer through conduction and convection, Fourier's law of conduction - Problems on one dimensional heat conduction through plain walls, composite walls, cylinder walls, spheres. Extended surfaces: Fins. Problems on heat transfer through rectangular fin, triangular fin, circumferential fin, pin fin, fin efficiency, fin effectiveness. Heat transfer through radiation, Stefan Boltzman Law, black body, grey body, shape factor. Types of Heat Exchangers.

**TOTAL 45 PERIODS**

**OUTCOMES:**

Upon completion of this course, the students can able to

- CO1: Understand the basic concepts associated first law of thermodynamics  
 CO2: Understand basic concepts associated with second law of thermodynamics  
 CO3: Describing the working of I.C engines and to determine its performance parameters  
 CO4: Basic principles of refrigeration, air conditioning and psychometric chart  
 CO5: Distinguishing the various modes of heat transfer and its applications

**TEXT BOOK:**

- Nag P. K, 'Engineering Thermodynamics' Tata McGraw-Hill, 6<sup>th</sup>Edition, 2017.

**REFERENCES:**

- Holman.J.P., "Thermodynamics", 4<sup>th</sup> Edition. McGraw-Hill, 1988.
- Kothandaraman. C.P., Domkundwar. S. & Domkundwar. A.V., "A course in Thermal Engineering" Dhanpatrai & Co (P) Ltd, Fifth edition, Reprint 2004.
- Kothandaraman. C.P., "Heat and Mass Transfer", New Age International (P) Publishers, 4<sup>th</sup>Edition Reprint 2015.
- Michael A. Boles, Yunus A. Cengel, YunusCengel, "Thermodynamics", 8<sup>th</sup> Edition, Mc Graw-Hill India, 2017.

<b>MT8411</b>	<b>MICROPROCESSOR AND MICROCONTROLLERS LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**OBJECTIVES:**

- To focus on the implementation of arithmetic operations using microprocessors and microcontroller.
- To simulate assembly language programs.
- To implement various on-chip and off-chip interfacing and algorithms

**LIST OF EXPERIMENTS**

- Simple arithmetic operations: addition / subtraction / multiplication / division.
- Programming with control instructions
  - Ascending / Descending order, Maximum / Minimum of numbers
  - Programs using Rotate instructions.
  - Hex / ASCII / BCD code conversions
- Interface Experiments: with 8085
  - A/D Interfacing. & D/A Interfacing.
- Traffic light controller
- I/O Port / Serial communication
- Programming Practices with Simulators/Emulators/open source
- Read a key interface display
- Demonstration of basic instructions with 8051 Micro controller execution, including:
  - Conditional jumps, looping
  - Calling subroutines
- Programming I/O Port 8051
  - study on interface with A/D & D/A
  - study on interface with DC & AC motor
- Mini project development with processors

**TOTAL: 60 PERIODS**

**OUTCOMES:**

Upon Completion of the course, the students will be able to:

**CO1:** Solve the arithmetic operations using microcontrollers and various on-chip and off-chip interfacing and algorithms.

**CO2:** Design the digital and analog hardware interface for microcontroller-based systems

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

<b>S.NO</b>	<b>NAME OF THE EQUIPMENT</b>	<b>Qty</b>
1	8085 Microprocessor Trainer with Power Supply	15
2	8051 Micro Controller Trainer Kit with power supply	15
3	8255 Interface board	5
4	8251 Interface board	5
5	8259 Interface board	5
6	8279 Keyboard / Display Interface board	5
7	8254 timer counter	5
8	ADC and DAC card	5
19	AC & DC motor with Controller	5
10	Traffic Light Control System	5

**ME8461**

**MANUFACTURING TECHNOLOGY LABORATORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**OBJECTIVE:**

- Demonstration and study of the VARIOUS machines. The Main emphasis will be on a complete understanding of the machine capabilities and processes.

**UNIT I                    LATHE PRACTICE**

1. Plain Turning
2. Taper Turning
3. Thread Cutting

Estimation of machining time for the above turning processes.

**UNIT II                    DRILLING PRACTICE**

1. Drilling
2. Tapping
3. Reaming.

**UNIT III                    MILLING**

1. Surface Milling.
2. Gear Cutting.
3. Contour Milling.

**UNIT IV                    PLANNING AND SHAPING**

1. Cutting Key Ways.
2. Dovetail machining.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

- Ability to use different machine tools to manufacturing gears.
- Ability to use different machine tools for finishing operations
- Ability to manufacture tools using cutter grinder
- Develop CNC part programming



**TEXT BOOK:**

1. Gopalakrishna K.R., "Machine Drawing", 22nd Edition, Subhas Stores Books Corner, Bangalore, 2013

**REFERENCES:**

1. Junnarkar, N.D., "Machine Drawing", 1st Edition, Pearson Education, 2004
2. N. D. Bhatt and V.M. Panchal, "Machine Drawing", 48th Edition, Charotar Publishers, 2013
3. N. Siddeshwar, P. Kanniah, V.V.S. Sastri, "Machine Drawing", published by Tata Mc GrawHill, 2006
4. S. Trymbaka Murthy, "A Text Book of Computer Aided Machine Drawing", CBS Publishers, New Delhi, 2007

**HS8461****ADVANCED READING AND WRITING**

L	T	P	C
0	0	2	1

**OBJECTIVES:**

- Strengthen the reading skills of students of engineering.
- Enhance their writing skills with specific reference to technical writing.
- Develop students' critical thinking skills.
- Provide more opportunities to develop their project and proposal writing skills.

**UNIT I**

Reading - Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence –Write a descriptive paragraph

**UNIT II**

Reading-Read for details-Use of graphic organizers to review and aid comprehension Writing-State reasons and examples to support ideas in writing- Write a paragraph with reasons and examples- Write an opinion paragraph

**UNIT III**

Reading- Understanding pronoun reference and use of connectors in a passage- speed reading techniques-Writing- Elements of a good essay-Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

**UNIT IV**

Reading- Genre and Organization of Ideas- Writing- Email writing- resumes – Job application- project writing-writing convincing proposals.

**UNIT V**

Reading- Critical reading and thinking- understanding how the text positions the reader- identify Writing- Statement of Purpose- letter of recommendation- Vision statement

**TOTAL: 30 PERIODS**

**OUTCOMES: At the end of the course Learners will be able to:**

- Write different types of essays.
- Write winning job applications.
- Read and evaluate texts critically.
- Display critical thinking in various professional contexts.

**TEXT BOOKS:**

1. Gramer F. Margot and Colin S. Ward Reading and Writing (Level 3) Oxford University Press: Oxford, 2011
2. Debra Daise, CharlNorloff, and Paul Carne Reading and Writing (Level 4) Oxford University Press: Oxford, 2011

**REFERENCES**

1. Davis, Jason and Rhonda LIss.Effective Academic Writing (Level 3) Oxford University Press: Oxford, 2006
2. E. Suresh Kumar and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Black swan: Hyderabad, 2012
3. Withrow, Jeans and et al. Inspired to Write. Readings and Tasks to develop writing skills. Cambridge University Press: Cambridge, 2004
4. Goatly, Andrew. Critical Reading and Writing. Routledge: United States of America, 2000
5. Petelin, Roslyn and Marsh Durham. The Professional Writing Guide: Knowing Well and Knowing Why. Business & Professional Publishing: Australia, 2004

**EE8552**

**POWER ELECTRONICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

To impart knowledge on the following Topics

- Different types of power semiconductor devices and their switching
- Operation, characteristics and performance parameters of controlled rectifiers
- Operation, switching techniques and basics topologies of DC-DC switching regulators.
- Different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- Operation of AC voltage controller and various configurations.

**UNIT I**

**POWER SEMI-CONDUCTOR DEVICES**

**9**

Study of switching devices, SCR, TRIAC, GTO, BJT, MOSFET, IGBT and IGCT- Static characteristics: SCR, MOSFET and IGBT - Triggering and commutation circuit for SCR- Introduction to Driver and snubber circuits.

**UNIT II**

**PHASE-CONTROLLED CONVERTERS**

**9**

2-pulse, 3-pulse and 6-pulseconverters– performance parameters –Effect of source inductance— Firing Schemes for converter–Dual converters, Applications-light dimmer, Excitation system, Solar PV systems.

**UNIT III**

**DC TO DC CONVERTERS**

**9**

Step-down and step-up chopper-control strategy– Introduction to types of choppers-A, B, C, D and E -Switched mode regulators- Buck, Boost, Buck- Boost regulator, Introduction to Resonant Converters, Applications-Battery operated vehicles.





**OBJECTIVES:**

- To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
- To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
- To understand the effect of Dynamics of undesirable vibrations.
- To understand the principles in mechanisms used for speed control and stability control.

**UNIT I FORCE ANALYSIS****12**

Dynamic force analysis – Inertia force and Inertia torque– D Alembert's principle –Dynamic Analysis in reciprocating engines – Gas forces – Inertia effect of connecting rod– Bearing loads – Crank shaft torque – Turning moment diagrams –Fly Wheels – Flywheels of punching presses- Dynamics of Cam- follower mechanism.

**UNIT II BALANCING****12**

Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder engine – Balancing of Multi-cylinder inline, V-engines – Partial balancing in engines – Balancing of linkages – Balancing machines-Field balancing of discs and rotors.

**UNIT III FREE VIBRATION****12**

Basic features of vibratory systems – Degrees of freedom – single degree of freedom – Free vibration– Equations of motion – Natural frequency – Types of Damping – Damped vibration– Torsional vibration of shaft – Critical speeds of shafts – Torsional vibration – Two and three rotor torsional systems.

**UNIT IV FORCED VIBRATION****12**

Response of one degree freedom systems to periodic forcing – Harmonic disturbances – Disturbance caused by unbalance – Support motion –transmissibility – Vibration isolation vibration measurement.

**UNIT V MECHANISM FOR CONTROL****12**

Governors – Types – Centrifugal governors – Gravity controlled and spring controlled centrifugal governors – Characteristics – Effect of friction – Controlling force curves. Gyroscopes –Gyroscopic forces and torques – Gyroscopic stabilization – Gyroscopic effects in Automobiles, ships and airplanes.

**TOTAL : 60 PERIODS****OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Calculate static and dynamic forces of mechanisms.  
 CO2 Calculate the balancing masses and their locations of reciprocating and rotating masses.  
 CO3 Compute the frequency of free vibration.  
 CO4 Compute the frequency of forced vibration and damping coefficient.  
 CO5 Calculate the speed and lift of the governor and estimate the gyroscopic effect on automobiles, ships and airplanes.

**TEXT BOOKS:**

1. F. B. Sanyal, "Dynamics of Machinery", McMillan Publishers India Ltd., Tech-Max Educational resources, 2011.
2. Rattan, S.S, "Theory of Machines", 4<sup>th</sup> Edition, Tata McGraw-Hill, 2014.
3. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 4<sup>th</sup> Edition, Oxford University Press, 2014.

**REFERENCES:**

1. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2014
2. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", 3<sup>rd</sup> Edition Affiliated East-West Pvt. Ltd., New Delhi, 2006.
3. Khurmi, R.S., "Theory of Machines", 14<sup>th</sup> Edition, S Chand Publications, 2005.
4. V.Ramamurthi, "Mechanics of Machines", Narosa Publishing House, 2002.
5. Rao.J.S. and Dukkupati.R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
6. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.

EC8391

**CONTROL SYSTEMS ENGINEERING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To introduce the components and their representation of control systems
- To learn various methods for analyzing the time response, frequency response and stability of the systems.
- To learn the various approach for the state variable analysis.

**UNIT I                      SYSTEMS COMPONENTS AND THEIR REPRESENTATION                      9**

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory- Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchros -Multivariable control system

**UNIT II                      TIME REPOSE ANALYSIS                      9**

Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control-Analytical design for PD,PI,PID control systems

**UNIT III                      FREQUENCY RESPONSE AND SYSTEM ANALYSIS                      9**

Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation

**UNIT IV                      CONCEPTS OF STABILITY ANALYSIS                      9**

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.

**UNIT V CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS 9**

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Identify the various control system components and their representations.
- Analyze the various time domain parameters.
- Analysis the various frequency response plots and its system.
- Apply the concepts of various system stability criterions.
- Design various transfer functions of digital control system using state variable models.

**TEXT BOOK:**

1. M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2012.

**REFERENCES:**

1. J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2007.
2. K. Ogata, 'Modern Control Engineering', 5th edition, PHI, 2012.
3. S.K.Bhattacharya, Control System Engineering, 3rd Edition, Pearson, 2013.
4. Benjamin.C.Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition,1995.

**MT8511**

**POWER ELECTRONICS LABORATORY**

**L T P C  
0 0 4 2**

**OBJECTIVES:**

- To introduce the students different power electronics components and use of them in electronic circuits.
- To study characteristic of different power electronics components.

**LIST OF EXPERIMENTS**

1. Study of SCR, MOSFET & IGBT characteristics
2. UJT, R, RC firing circuits for SCR
3. Voltage & current commutated chopper
4. SCR phase control circuit
5. TRIAC phase control circuit
6. Study of half controlled & fully controller converters
7. Study of three phase AC regulator
8. Speed control of DC shunt motor using three phase fully controlled converter.
9. SCR single-phase cyclo converter
10. SCR series and parallel inverters
11. IGBT Chopper
12. IGBT based PWM inverter (single phase)

**TOTAL : 60 PERIODS**

**OUTCOMES:**

- Ability to use SCR, MOSFET, TRIAC in electronic circuit
- Ability to perform characteristic study on the electronics components.

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl.No	Name of the Equipment	Qty
1	Study of SCR, MOSFET & IGBT characteristics module	1
2	UJT, R, RC firing circuits for SCR module	1
3	Voltage & current commutated chopper module	1
4	SCR phase control circuit module	1
5	TRIAC phase control circuit module	1
6	Study of half controlled & fully controller converters module	1
7	Study of three phase AC regulator module	1
8	Speed control of DC shunt motor using three phase fully controlled converter module	1
9	SCR single phase cyclo converter module	1
10	SCR series and parallel inverters module	1
11	IGBT chopper module	1
12	IGBT based PWM inverter (single phase) module	1
13	Ammeter (0-5A) MC, (0-2A) MC, (0-2A) MI, (0-5V) MI	15
14	Voltmeter (0-300V) MC, (0-600V) MC, (0-300V) MI, (0-600V) MI, Multimeter	16
15	CRO ,Transformer 1KVA, 1:1, 230V	Each 3

MT8512

**SENSORS AND INSTRUMENTATION LABORATORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**OBJECTIVES:**

- To provide knowledge about sensors and actuators
- To provide hands on experience to measure different signal using sensor and processing them in required form.

**LIST OF EXPERIMENTS**

1. Design and testing of Digital Comparator
2. Design and testing of Voltage to frequency converter and frequency to voltage converter.
3. Design and testing of sample and hold circuit.
4. Design and testing of Flash type Analog to Digital Converters.
5. Design and testing of instrumentation amplifier using OP-AMP.
6. Displacement measurement using potentiometer and LVDT and plotting the characteristic curves.
7. Study of Characteristics and calibration of strain gauge and Load Cell
  - a. Measurement of strain using resistive type strain gauges with temperature compensation and various bridge configurations.
8. Temperature measurement using Thermocouple, Thermistor and RTD and comparing the characteristics.
9. Comparison of capacitive and resistive type transducer for humidity measurement with their characteristics.
10. Measurement of sound using microphones and sound level meter.
11. Conversion of time domain audio signal into frequency domain signal (FFT).
12. Measurements of 3 phase power and power factor.

**TOTAL: 45 PERIODS**

## OUTCOMES:

Upon Completion of the course the students will be able to:

- CO1:** Generate appropriate design procedure, suitable for signal conversion to interface with computer.
- CO2:** Design appropriate circuits by using conventional formulas used in signal conditioning and conversion.
- CO3:** Implement their design in bread board and test it.
- CO4:** Generate appropriate design procedure to obtain a required measurement data for temperature, force, humidity, displacement and sound.
- CO5:** Log the data in computer using LABVIEW/ MATLAB/PSILAB.
- CO6:** Present data in a clear and meaningful manner.
- CO7:** Use transducers to create simple Mechatronics applications using data logging software.

## EQUIPMENTS FOR A BATCH OF 30 STUDENTS

Sl.No	Name of the Equipment	Qty
1	Digital Signal Oscilloscope	6
2	Function Generator	5
3	Breadboard	10
4	Regulated Power supply	6
5	LVDT	1
6	Thermistor	1
7	Thermocouple	1
8	RTD	1
9	Load cell setup	1
10	4 Channel data acquisition system for strain gauge	1
11	Sound level meter	1
12	Computer with LABVIEW/ MATLAB/SCILAB	1
13	Prony brake dynamometer	1
14	Hygrometer	1

ME8481

DYNAMICS LABORATORY

L T P C  
0 0 4 2

## OBJECTIVES:

- To supplement the principles learnt in kinematics and Dynamics of Machinery.
- To understand how certain measuring devices are used for dynamic testing.

## LIST OF EXPERIMENTS

1. a) Study of gear parameters.  
b) Experimental study of velocity ratios of simple, compound, Epicyclic and differential gear trains.
2. a) Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinder Mechanisms.  
b) Kinematics of single and double universal joints.
3. a) Determination of Mass moment of inertia of Fly wheel and Axle system.  
b) Determination of Mass Moment of Inertia of axisymmetric bodies using Turn Table apparatus.  
c) Determination of Mass Moment of Inertia using bifilar suspension and compound pendulum.
4. Motorized gyroscope – Study of gyroscopic effect and couple.

5. Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.
6. Cams – Cam profile drawing, Motion curves and study of jump phenomenon
7. a) Single degree of freedom Spring Mass System – Determination of natural Frequency and verification of Laws of springs – Damping coefficient determination.  
b) Multi degree freedom suspension system – Determination of influence coefficient.
8. a) Determination of torsional natural frequency of single and Double Rotor systems.- Undamped and Damped Natural frequencies. b) Vibration Absorber – Tuned vibration absorber.
9. Vibration of Equivalent Spring mass system – undamped and damped vibration.
10. Whirling of shafts – Determination of critical speeds of shafts with concentrated loads.
11. a) Balancing of rotating masses. (b) Balancing of reciprocating masses.
12. a) Transverse vibration of Free-Free beam – with and without concentrated masses.  
b) Forced Vibration of Cantilever beam – Mode shapes and natural frequencies.  
c) Determination of transmissibility ratio using vibrating table.

**TOTAL : 60 PERIODS**

### OUTCOMES

- Ability to demonstrate the principles of kinematics and dynamics of machinery
- Ability to use the measuring devices for dynamic testing.

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Cam follower setup.	1 No.
2	Motorised gyroscope.	1 No.
3	Governor apparatus - Watt, Porter, Proell and Hartnell governors.	1 No.
4	Whirling of shaft apparatus.	1 No.
5	Dynamic balancing machine.	1 No.
6	Two rotor vibration setup.	1 No.
7	Spring mass vibration system.	1 No.
8	Torsional Vibration of single rotor system setup.	1 No.
9	Gear Models	1 No.
10	Kinematic Models to study various mechanisms.	1 No.
11	Turn table apparatus.	1 No.
12	Transverse vibration setup of a) cantilever b) Free-Free beam c) Simply supported beam.	1 No.

HS8581

**PROFESSIONAL COMMUNICATION**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**OBJECTIVES: The course aims to:**

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

**UNIT I**

Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

**UNIT II**

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

**UNIT III**

Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -- questioning and clarifying –GD strategies- activities to improve GD skills

**UNIT IV**

Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

**UNIT V**

Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

**TOTAL : 30 PERIODS**

**OUTCOMES: At the end of the course Learners will be able to:**

- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

**Recommended Software**

1. Open Source Software
2. Win English

**REFERENCES:**

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Interact English Lab Manual for Undergraduate Students,. OrientBalckSwan: Hyderabad, 2016.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

**OBJECTIVE:**

- This course will give an appreciation of the fundamental principles, design and operation of hydraulic and pneumatic components and systems and their application in manufacturing and mechanical systems.

**UNIT I FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS 9**

Introduction to Fluid power- Advantages and Applications- Fluid power systems – Types of fluids- Properties of fluids – Basics of Hydraulics – Pascal’s Law- Principles of flow – Friction loss- Work, Power and Torque. Problems Sources of Hydraulic power: Pumping Theory – Pump Classification- Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criterion of Linear, Rotary- Fixed and Variable displacement pumps-Problems

**UNIT II HYDRAULIC ACTUATORS AND VALVES 9**

Hydraulic Actuators: Cylinders– Types and construction, Application, Hydraulic cushioning - Hydraulic motors Control Components: Direction control, Flow control and Pressure control valves-Types, Construction and Operation- Servo and Proportional valves - Applications – Types of actuation. Accessories: Reservoirs, Pressure Switches- Applications- Fluid Power ANSI Symbols - Problems

**UNIT III HYDRAULIC SYSTEMS 9**

Accumulators, Intensifiers, Industrial hydraulic circuits- Regenerative, Pump Unloading, Double-pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-safe, Speed control, Hydrostatic transmission, Electro hydraulic circuits, Mechanical Hydraulic servo systems.

**UNIT IV PNEUMATIC SYSTEMS 9**

Properties of air– Perfect Gas Laws - Compressors- Filter, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust valves, Pneumatic actuators, Design of pneumatic circuit cascade method- Electro pneumatic circuits, Introduction to Fluidics, Pneumatic logic circuits.

**UNIT V TROUBLE SHOOTING AND APPLICATIONS 9**

Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems. Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for a Pick and Place application and tool handling in a CNC machine. - Low cost Automation – Hydraulic and Pneumatic power packs- case studies.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Understanding operating principles and constructional features of hydraulic and pneumatic systems.
- Knowledge with selection of hydraulic / pneumatic components
- understanding of designing and layout of Hydraulic Power package and trouble shooting.

**TEXT BOOK:**

1. Anthony Esposito, “Fluid Power with Applications”, Prentice Hall, 2009.

**REFERENCES:**

1. Shanmugasundaram.K, “Hydraulic and Pneumatic Controls”, Chand & Co, 2006.
2. Majumdar, S.R., “Oil Hydraulics Systems- Principles and Maintenance”, Tata Mc Graw Hill, 2001
3. Majumdar, S.R., “Pneumatic Systems – Principles and Maintenance”, Tata Mc Graw Hill, 2007.
4. Dudelyt, A Pease and John J Pippenger, “Basic Fluid Power”, Prentice Hall, 1987.
5. Srinivasan.R, “Hydraulic and Pneumatic Controls”, Vijay Nicole Imprints, 2008.
6. Joji.P, “Pneumatic Controls”, John Wiley & Sons India, 2008

**MT8601**

**DESIGN OF MECHATRONICS SYSTEM**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- Mechatronics system design and simulation, ergonomics and safety
- Theoretical and practical aspects of computer interfacing, real time data acquisition and control
- Design of motion control, motion converter and temperature control.

**UNIT I INTRODUCTION TO DESIGN OF MECHATRONICS SYSTEM 9**

Key elements – Mechatronics design process – design parameters – mechatronics and traditional design – Advanced approaches in mechatronics design – Introduction to industrial design, modelling, simulation and analysis – Ergonomics and safety.

**UNIT II BASIC SYSTEM MODELLING 9**

Introduction – model categories – model development – Simulation using softwares – verification and validation – Mathematical modelling : Basic system modelling – mechanical electrical, fluid and thermal.

**UNIT III MECHATRONIC SYSTEM MODELLING 7**

Engineering systems: Rotational – translational, electro-mechanical, pneumatic-mechanical, hydraulic-mechanical, micro electro mechanical system – Dynamic responses of system: first order, second order system – Performance measures

**UNIT IV REAL TIME INTERFACING 11**

Introduction – Selection of interfacing standards- elements of data acquisition and control systems – Overview of I/O process – general purpose I/O cards and its installation – Data conversion process – Application softwares – Man machine interface

**UNIT V CASE STUDIES ON DESIGN OF MECHATRONICS SYSTEM 9**

Motion control using DC Motor, AC Motor and Servomotor - Temperature control of hot/cold reservoir – Pick and place robot – Car parking barriers – Motion and temperature control of washing machine – Auto focus camera, exposure control

**TOTAL : 45 PERIODS**

**OUTCOMES**

**Students will be able to understand the mechatronics design**

CO1: Understand the basics and key elements of Mechatronics design process

CO2: Familiar with basic system modelling

CO3: Understand the concepts of engineering system and dynamic response of the system

CO4: Realize the concepts of real time interfacing and data acquisition

CO5: Understanding the concepts of design of Mechatronics system through case studies

**TEXT BOOKS:**

1. Devdas shetty, Richard A. Kolk, "Mechatronics System Design", 2<sup>nd</sup> Edition, Cengage Learning 2011.
2. Georg pelz, "Mechatronic Systems: Modeling and simulation" with HDL's, John wiley and sons Ltd, 2003.

**REFERENCES**

1. Bishop, Robert H, "Mechatronics Hand book", CRC Press, 2002.
2. Bradley, D.Dawson, N.C. Burd and A.J. Loader, "Mechatronics: Electronics in Products and Processes", CRC Press 1991 , First Indian print 2010.
3. De Silva, "Mechatronics: A Foundation Course", Taylor & Francis, Indian Reprint, 2013.

ME8593

**DESIGN OF MACHINE ELEMENTS**

L	T	P	C
3	0	0	3

**OBJECTIVES**

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components  
(Use of P S G Design Data Book is permitted)

**UNIT I            STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS            9**

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – curved beams – crane hook and ‘C’ frame- Factor of safety - theories of failure – Design based on strength and stiffness – stress concentration – Design for variable loading.

**UNIT II            SHAFTS AND COUPLINGS            9**

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines - Rigid and flexible couplings.

**UNIT III            TEMPORARY AND PERMANENT JOINTS            9**

Threaded fasteners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints, riveted joints for structures - theory of bonded joints.

**UNIT IV            ENERGY STORING ELEMENTS AND ENGINE COMPONENTS            9**

Various types of springs, optimization of helical springs - rubber springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

**UNIT V            BEARINGS            9**

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs, -- Selection of Rolling Contact bearings.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Explain the influence of steady and variable stresses in machine component design.
- CO2 Apply the concepts of design to shafts, keys and couplings.
- CO3 Apply the concepts of design to temporary and permanent joints.
- CO4 Apply the concepts of design to energy absorbing members, bearings and connecting rod.
- CO5 Apply the concepts of design to bearings.

**TEXT BOOKS:**

1. Bhandari V, “Design of Machine Elements”, 4<sup>th</sup> Edition, Tata McGraw-Hill Book Co, 2016.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett “Mechanical Engineering Design”, 9<sup>th</sup> Edition, Tata McGraw-Hill, 2011.

## REFERENCES:

1. Alfred Hall, Halowenko, A and Laughlin, H., "Machine Design", Tata McGraw-Hill BookCo.(Schaum's Outline), 2010
2. Ansel Ugural, "Mechanical Design – An Integral Approach", 1<sup>st</sup> Edition, Tata McGraw-Hill Book Co, 2003.
3. P.C. Gope, "Machine Design – Fundamental and Application", PHI learning private ltd, New Delhi, 2012.
4. R.B. Patel, "Design of Machine Elements", MacMillan Publishers India P Ltd., Tech-Max Educational resources, 2011.
5. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design", 4<sup>th</sup> Edition, Wiley, 2005
6. Sundararajamoorthy T. V. Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2015.

**MT8602**

**INDUSTRIAL AUTOMATION**

**L T P C**  
**3 0 0 3**

## OBJECTIVES:

- To understand the construction, operation and installation of PLCs.
- To provide the knowledge on interfacing the PLCs and field devices with communication protocols.
- To understand the concepts of DCS and SCADA systems.

### **UNIT I PROGRAMMABLE LOGIC CONTROLLER 9**

Introduction — Principles of operation – PLC Architecture and specifications – PLC hardware components Analog & digital I/O modules, CPU & memory module – Programming devices – PLC ladder diagram, Converting simple relay ladder diagram into ladder diagram. PLC programming- Simple instructions – Manually operated switches – Mechanically operated switches - Latching relays.

### **UNIT II APPLICATIONS OF PLC 9**

Timer instructions - On delay, Off delay, Cyclic and Retentive timers, Up /Down Counters, control instructions – Data manipulating instructions, math instructions; Applications of PLC – Motor start and stop, Simple materials handling applications, Automatic water level controller, Automatic lubrication of supplier Conveyor belt, Automatic car washing machine, Bottle label detection and process control application.

### **UNIT III SCADA SYSTEM & ARCHITECTURE 9**

Data acquisition systems, Evolution of SCADA, Communication technologies, Monitoring and supervisory functions, SCADA applications in Utility Automation, Industries - SCADA System Components: Schemes- Remote Terminal Unit (RTU), Intelligent Electronic Devices (IED), Communication Network, SCADA Server, SCADA/HMI Systems Various SCADA architectures, advantages and disadvantages of each system

### **UNIT IV DISTRIBUTED CONTROL SYSTEM 9**

Introduction to DCS – Various Architectures – Comparison – Local control unit – Process interfacing issues – Communication facilities Operator interfaces - Low level and high level operator interfaces – Displays - Engineering interfaces – Low level and high level engineering interfaces – Factors to be considered in selecting DCS – Case studies – Sugar industry and Power plant

**UNIT V INDUSTRIAL PROCESS CONTROL****9**

Study of Advanced Process control blocks: Statistical Process Control, Model Predictive Control, Fuzzy Logic Based Control, Neural-Network Based Control, PID Control

**TOTAL : 45 PERIODS****OUTCOMES:****On the successful completion of the course, students will be able to**

- CO1: Choose appropriate PLC and explain the architecture, installation procedures and trouble shooting.
- CO2: Develop PLC programs using various functions of PLCs for a given application.
- CO3: Explain the application development procedures in SCADA and manage data, alarm and storage.
- CO4: Distinguish DCS, SCADA and PLC and explain the architecture of DCS
- CO5: Describe the controller elements and program methods.

**TEXT BOOKS:**

1. Gary Dunning, "Introduction to Programmable Logic Controllers", 3<sup>rd</sup> India edition, Cengage Learning, 2007
2. John Webb, "Programmable Logic Controllers: Principles and Applications", 5<sup>th</sup> edition Prentice Hall of India, 2012.
3. Krishna Kant "Computer Based Process Control", Prentice Hall of India, 2004.
4. Michael P. Lukas, Distributed Control Systems: Their Evaluation and Design, Van Nostrand Reinhold Co., 1986

**REFERENCES**

1. B. G. Liptak "Instrument Engineer's Handbook – Process Software and Digital Network", 3<sup>rd</sup> edition, CRC Press, 2002.
2. Jose A. Romagnoli, Ahmet Palazoglu, "Introduction to Process control", CRC Taylor and Francis group, 2005.
3. Richard Cox, "Programmable Controllers", Delmer Thomson learning, 2001.
4. Richard Zurawski, "Industrial Communication Technology Handbook" 2<sup>nd</sup> edition, CRC Press, 2015.
5. William T. Shaw, Cybersecurity for SCADA systems, Penn Well Books, 2006

**MG8591****PRINCIPLES OF MANAGEMENT**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVE:**

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization

**UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS****9**

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

**UNIT II PLANNING 9**  
Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

**UNIT III ORGANISING 9**  
Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

**UNIT IV DIRECTING 9**  
Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

**UNIT V CONTROLLING 9**  
System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

**TEXT BOOKS:**

1. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, 6th Edition, Pearson Education, 2004.
2. Stephen P. Robbins & Mary Coulter, “Management”, Prentice Hall (India) Pvt. Ltd., 10<sup>th</sup> Edition, 2009.

**REFERENCES:**

1. Harold Koontz & Heinz Weihrich, “Essentials of Management”, Tata McGraw Hill, 1998.
2. Robert Kreitner & Mamata Mohapatra, “Management”, Biztantra, 2008.
3. Stephen A. Robbins & David A. Decenzo & Mary Coulter, “Fundamentals of Management”, 7<sup>th</sup> Edition, Pearson Education, 2011.
4. Tripathy PC & Reddy PN, “Principles of Management”, Tata McGraw Hill, 1999

**MT8611 APPLIED HYDRAULICS AND PNEUMATICS LABORATORY L T P C**  
**0 0 4 2**

**OBJECTIVE:**

To design and test the hydraulic and pneumatic circuits using MATLAB/LABVIEW software and simulate the circuits using Automation studio software.

## LIST OF EXPERIMENTS

1. Design and testing of hydraulic circuits such as  
Pressure control  
Flow control  
Direction control  
Design of circuit with programmed logic sequence, using an optional PLC in hydraulic Electro hydraulic Trainer.
2. Design and testing of pneumatic circuits such as  
Pressure control  
Flow control  
Direction control  
Circuits with logic controls  
Circuits with timers  
Circuits with multiple cylinder sequences in Pneumatic Electro pneumatic Trainer.  
Modeling and analysis of basic electrical, hydraulic, and pneumatic systems using MATLAB/LABVIEW software.
3. Simulation of basic hydraulic, pneumatic and electrical circuits using Automation studio software.

**TOTAL: 60 PERIODS**

## OUTCOMES:

**Upon Completion of the course, the students will be able to:**

**CO1:** Select the actuators and valves for the design of fluid power circuits.

**CO2:** Design and simulate the fluid power circuits using software tool.

**CO3:** Test the simulated output by constructing the fluid power circuits using suitable actuators and valves.

## LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	Name of the Equipment	Qty
<b>Hydraulic equipments</b>		
1	Pressure relief valve	4
2	Pressure reducing valves	2
3	Flow control valves	2
4	Pressure switch	1
5	Limit switches	2
6	Linear actuator	1
7	Rotary actuator	1
8	Double solenoid actuated DCV	1
9	Single solenoid actuated DCV	1
10	Hydraulic power pack with pump and pressure relief valve	1
11	PLC	1
<b>Pneumatics equipments</b>		
1	Pneumatic trainer kit with FRL Unit, Single acting cylinder, push button	1
2	Pneumatic training kit with FRL unit, Double acting cylinder, manually actuated DCV	1
3	Pneumatic trainer kit with FRL unit, Double acting cylinder, Pilot actuated DCV	1
4	Pneumatic trainer kit with FRL unit Double acting cylinder, Double solenoid actuated DCV, DCV with sensor / magnetic reed switches	1
5	PLC with interface card	1
6	LABVIEW software	1
7	Automation studio software	1

**OBJECTIVES:**

- To identify the differences between various PLCs.
- To provide the skills to install and trouble shoot PLC systems.
- To provide working experience in various programming techniques.
- To control some process parameters and test PID algorithm.
- To use the VFD to control the speed of AC motor.

**LIST OF EXPERIMENTS**

1. Study of different PLCs and their specification
2. Study of installations and troubleshooting of PLC.
3. Development of Ladder Diagram (LD) and Structured Text (ST) programming in PLC for simple applications.
4. Development of an application by using timer and counter of PLC.
5. Solving simple problems using Functional Block Diagram (FBD) programming in PLC
6. Interfacing between PLC and Process loop (temperature)
7. Interfacing between PLC and Process loop (level)
8. Interfacing between PLC and Process loop (flow)
9. Verification and testing of PID controller in a process loop.
10. Develop one application using SCADA system.
11. AC motor speed control using PLC and VFD

**TOTAL: 60 PERIODS****OUTCOMES:****Upon Completion of the course, the students will be able to:**

CO1: Carryout wiring connections and troubleshoot in different PLCs.

CO2: Develop simple applications using LD, ST and FBD mode of programming.

CO3: Use timers and counter functions of PLC to construct simple applications.

CO4: Integrate and control process station with PLC.

CO5: Develop SCADA application using open source software.

CO6: Perform speed control on AC motor using VFD and PLC.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

S.No	Name of the Equipment	Qty
<b>Hardware:</b>		
1	PLC panel board kit with power supply Any three PLCs from the following list can be used but not limited to 1.Allen Bradley (Micro Logix 1200) 2. Siemens ( SIMATIC S7 200) PLC 3. DELTA (DVP-SS Series) PLC 4. Schneider Modicon (M238 series) PLC 5. Mitsubishi Nexgenie (1000 series)	7
2	PLC panel board kit with power supply Any three PLCs from the following list can be used but not limited to 1. Allen Bradley (Micro Logix 1200) 2. Siemens ( SIMATIC S7) PLC 3. DELTA (DVP-SS Series) PLC 4. Schneider Modicon (M238 series) PLC 5. Mitsubishi Nexgenie (1000 series)	7
3	Process control station	1
4	½ HP AC motor	1
5	VFD to control ½ HP AC motor	1

<b>Software:</b>		
1	Delta PLC software – free ware and corresponding PLC programming software.	1
2	Open source SCADA software such as Free SCADA, Open SCADA, Indigo SCADA CodeSys Open source for PLC programming and interfacing with real time PLC.	1

**ME8682**

**DESIGN AND FABRICATION PROJECT**

**L T P C**  
**0 0 4 2**

**OBJECTIVE:**

- The main objective is to give an opportunity to the student to get hands on training in the fabrication of one or more components of a complete working model, which is designed by them.

**GUIDELINE FOR REVIEW AND EVALUATION**

The students may be grouped into 2 to 4 and work under a project supervisor. The device/system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL : 60 PERIODS**

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 design and Fabricate the machine element or the mechanical product.
- CO2 demonstrate the working model of the machine element or the mechanical product.

**ME8691**

**COMPUTER AIDED DESIGN AND MANUFACTURING**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To provide an overview of how computers are being used in mechanical component design
- To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

**UNIT I INTRODUCTION**

**9**

Product cycle- Design process- sequential and concurrent engineering- Computer aided design – CAD system architecture- Computer graphics – co-ordinate systems- 2D and 3D transformations- homogeneous coordinates - Line drawing -Clipping- viewing transformation-Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM –CAD/CAM concepts —Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance

<b>UNIT II</b>	<b>GEOMETRIC MODELING</b>	<b>9</b>
Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves-Techniques for surface modeling – surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG and B-rep		
<b>UNIT III</b>	<b>CAD STANDARDS</b>	<b>9</b>
Standards for computer graphics- <b>Graphical Kernel System (GKS)</b> - standards for exchange images- <b>Open Graphics Library (OpenGL)</b> - Data exchange standards - IGES, STEP, CALS etc. - communication standards.		
<b>UNIT IV</b>	<b>FUNDAMENTAL OF CNC AND PART PROGRAMMING</b>	<b>9</b>
Introduction to NC systems and CNC - Machine axis and Co-ordinate system- CNC machine tools- Principle of operation CNC- Construction features including structure- Drives and CNC controllers- 2D and 3D machining on CNC- Introduction of Part Programming, types - Detailed Manual part programming (FANUC) on Lathe & Milling machines using G codes and M codes- Cutting Cycles, Loops, Sub program and Macros- Introduction of CAM package.		
<b>UNIT V</b>	<b>CELLULAR MANUFACTURING AND FLEXIBLE MANUFACTURING SYSTEM (FMS)</b>	<b>9</b>
Group Technology(GT),Part Families–Parts Classification and coding–Simple Problems in Opitz Part Coding system–Production flow Analysis–Cellular Manufacturing–Composite part concept–Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control– Quantitative analysis in FMS		
		<b>TOTAL : 45 PERIODS</b>

**OUTCOMES:**

**Upon the completion of this course the students will be able to**

- CO1 Explain the 2D and 3D transformations, clipping algorithm, Manufacturing models and Metrics
- CO2 Explain the fundamentals of parametric curves, surfaces and Solids
- CO3 Summarize the different types of Standard systems used in CAD
- CO4 Apply NC & CNC programming concepts to develop part programme for Lathe & Milling Machines
- CO5 Summarize the different types of techniques used in Cellular Manufacturing and FMS

**TEXT BOOKS:**

1. Ibrahim Zeid “Mastering CAD CAM” Tata McGraw-Hill Publishing Co.2007
2. Mikell.P.Groover “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India, 2008.
3. Radhakrishnan P, Subramanyan S. and Raju V., “CAD/CAM/CIM”, 2nd Edition, New Age International (P) Ltd, New Delhi, 2000.

**REFERENCES:**

1. Chris McMahon and Jimmie Browne “CAD/CAM Principles”, "Practice and Manufacturing management “ Second Edition, Pearson Education, 1999.
2. Donald Hearn and M. Pauline Baker “Computer Graphics”. Prentice Hall, Inc, 1992.
3. Foley, Wan Dam, Feiner and Hughes - "Computer graphics principles & practice" Pearson Education -2003
4. William M Neumann and Robert F.Sproul “Principles of Computer Graphics”, McGraw Hill Book Co. Singapore, 1989.

**OBJECTIVE:**

Students will learn about basics of robots, programming and machine vision applications in robots

**UNIT I BASICS OF ROBOTICS****9**

Introduction- Basic components of robot-Laws of robotics- classification of robot-work space-accuracy-resolution –repeatability of robot. Power transmission system: Rotary to rotary motion, Rotary to linear motion, Harmonics drives – gear system - belt drives.

**UNIT II ROBOT END EFFECTORS****9**

Robot End effectors: Introduction- types of End effectors- Mechanical gripper- types of gripper mechanism- gripper force analysis- other types of gripper- special purpose grippers.

**UNIT III ROBOT MECHANICS****10**

Robot kinematics: Introduction- Matrix representation- rigid motion & homogeneous transformation- forward & inverse kinematics- trajectory planning. Robot Dynamics: Introduction - Manipulator dynamics – Lagrange - Euler formulation- Newton - Euler formulation

**UNIT IV ROBOT PROGRAMMING****8**

Robot programming: Robot Languages- Classification of robot language-Computer control and robot software-Val system and Languages- application of robots.

**UNIT V MACHINE VISION FUNDAMENTALS****9**

Machine vision: image acquisition, digital images-sampling and quantization-levels of computation Feature extraction-windowing technique- segmentation- Thresholding- edge detection- binary morphology - grey morphology

**TOTAL :45 PERIODS****OUTCOMES:**

**Upon completion of this course, the students can able to**

CO1: Express the basic concepts, laws, components and parameters of robots

CO2: Explain the types of grippers and its functions.

CO3: Evaluate the kinematic calculations and apply Lagrangian and Newton-Euler methods to analyze dynamic characteristics of robots

CO4: Describing the various programming techniques used in industrial robots

CO5: Basis of machine vision and apply the concept of image processing

**TEXT BOOK:**

1. M.P.Groover, M.Weiss ,R.N. Nagal, N.G.Odrey, "Industrial Robotics - Technology, programming and Applications" Tata , McGraw-Hill Education Pvt Limited 2<sup>nd</sup>Edition, 2012

**REFERENCES:**

1. John.J.Craig, " Introduction to Robotics: Mechanics & control" Pearson Publication, Fourth edition, 2018.
2. Jazar, "Theory of Applied Robotics: Kinematics, Dynamics and Control", Springer, 2<sup>nd</sup>Edition, 2010
3. K.S.Fu, R.C.Gonzalez, C.S.G.Lee, "Robotics: Sensing, Vision & Intelligence", Tata McGraw-Hill Publication, First Edition, 1987.
4. Sathya Ranjan Deb, "Robotics Technology & flexible Automation" Second edition, Tata McGraw-Hill Publication, 2009.

**OBJECTIVES:**

- To provide the overview of embedded system design principles
- To understand the concepts of real time operating systems
- To provide exposure to embedded system development tools with hands on experience in using basic programming techniques.

**UNIT I INTRODUCTION TO EMBEDDED SYSTEMS****7**

Overview of embedded systems, embedded system design process, challenges - common design metrics and optimizing them. Hardware - Software codesign embedded product development.

**UNIT II REAL TIME OPERATING SYSTEM****7**

Real time operating systems Architecture - Tasks and Task states - Tasks and Data - Semaphore and shared data - Message queues, mail boxes and pipes - Encapsulating semaphores and queues - interrupt routines in an RTOS Environment. Introduction to Vx works, R<sub>T</sub> Linux.

**UNIT III PIC MICROCONTROLLER****9**

Architecture - Instruction set - Addressing modes - Timers - Interrupt logic - CCP modules - ADC.

**UNIT IV EMBEDDED NETWORKING****7**

Introduction - CAN BUS - I<sup>2</sup>C - GSM - GPRS - Zig bee.

**UNIT V EMBEDDED PROGRAMMING LABORATORY : LIST OF EXPERIMENTS****30**

I/O Programming

Interrupts and Timer application

Interfacing Keypad

Interfacing LCD

Interfacing ADC/DAC

**TOTAL : 60 PERIODS****OUTCOMES:**

CO1. Explain the need of embedded systems and their development procedures.

CO2. Summaries the concepts involved in Real time operating systems.

CO3. Use various tools for developing embedded applications.

CO4. Explain the construction, addressing modes and instructions sets of PIC micro controller.

CO5. Conduct experiments with I/O systems used in embedded systems.

**TEXT BOOKS:**

1. Frank Vahid, Tony John Givargis, Embedded System Design: A Unified Hardware/ Software Introduction - Wiley & Sons, Inc.2002 .
2. Rajkamal, 'Embedded System – Architecture, Programming, Design', Tata Mc Graw Hill, 2011
3. John B. Peatman, "Design with PIC Microcontrollers" Prentice Hall, 2003.

**REFERENCES**

1. Steve Heath, 'Embedded System Design', II edition, Elsevier, 2003.
2. David E. Simon, "An embedded software primer", Addison – Wesley, Indian Edition Reprint (2009).
3. Robert Foludi "Building Wireless Sensor Networks", O'Reilly, 2011.



6. Robot programming and simulation for Shape identification
7. Robot programming and simulation for machining (cutting, welding)
8. Robot programming and simulation for writing practice
9. Robot programming and simulation for any industrial process (Packaging, Assembly)
10. Robot programming and simulation for multi process.

**TOTAL: 60 PERIODS**

**OUTCOME:**

Upon Completion of the course, the students will be able to:

CO1: Use of any robotic simulation software to model the different types of robots and calculate work volume for different robots

**LIST OF EQUIPMENTS BATCH OF 30 STUDENTS:**

- ROS ( Robotic Operating System)
- 30 Systems with server
- Verification of direct kinematics equations and inverse kinematics equations of 1DOF “R-configuration” robot.
- Verification of direct kinematics equations and inverse kinematics equations of 2DOF “R-R-configuration” robot.

**MT8801**

**AUTOMOTIVE ELECTRONICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- The intention and purpose of this course is to study the basics of electronics, emission controls and its Importance in automobiles.
- To study the various sensors and actuators used in automobiles for improving fuel economy and emission control.
- To study the various blocks of control units used for control of fuel, ignition and exhaust systems.

**UNIT I INTRODUCTION**

**8**

Evolution of electronics in automobiles – emission laws – introduction to Euro I, Euro II, Euro III, Euro IV, Euro V standards – Equivalent Bharat Standards. Charging systems: Working and design of charging circuit diagram – Alternators – Requirements of starting system - Starter motors and starter circuits.

**UNIT II IGNITION AND INJECTION SYSTEMS**

**10**

Ignition systems: Ignition fundamentals - Electronic ignition systems - Programmed Ignition – Distribution less ignition - Direct ignition – Spark Plugs. Electronic fuel Control: Basics of combustion – Engine fuelling and exhaust emissions – Electronic control of carburetion – Petrol fuel injection – Diesel fuel injection.

**UNIT III SENSOR AND ACTUATORS IN AUTOMOTIVES**

**7**

Working principle and characteristics of Airflow rate, Engine crankshaft angular position, Hall effect, Throttle angle, temperature, exhaust gas oxygen sensors – study of fuel injector, exhaust gas recirculation actuators, stepper motor actuator, vacuum operated actuator.

**UNIT IV ENGINE CONTROL SYSTEMS**

**10**

Control modes for fuel control-engine control subsystems – ignition control methodologies – different ECU’s used in the engine management – block diagram of the engine management system. In vehicle networks: CAN standard, format of CAN standard – diagnostics systems in modern automobiles.

## UNIT V CHASSIS AND SAFETY SYSTEMS

10

Traction control system – Cruise control system – electronic control of automatic transmission – antilock braking system – electronic suspension system – working of airbag and role of MEMS in airbag systems – centralized door locking system – climate control of cars.

**TOTAL : 45 PERIODS**

### OUTCOMES:

**After successful completion of this course, the students should be able to**

**CO1:** Know the importance of emission standards in automobiles.

**CO2:** Understand the electronic fuel injection/ignition components and their function.

**CO3:** Choose and use sensors and equipment for measuring mechanical quantities, temperature and appropriate actuators.

**CO4:** Diagnose electronic engine control systems problems with appropriate diagnostic tools.

**CO5:** Analyses the chassis and vehicle safety system.

### TEXT BOOK:

1. Ribbens, "Understanding Automotive Electronics", 8<sup>th</sup> Edition, Elsevier, Indian Reprint, 2013

### REFERENCES

1. Barry Hollembeak, "Automotive Electricity, Electronics & Computer Controls", Delmar Publishers, 2001.
2. Richard K. Dupuy "Fuel System and Emission controls", Check Chart Publication, 2000.
3. Ronald. K. Jurgon, "Automotive Electronics Handbook", McGraw-Hill, 1999.
4. Tom Denton, "Automobile Electrical and Electronics Systems", Edward Arnold Publishers, 2000.

MT8811

PROJECT WORK

L	T	P	C
0	0	20	10

### OBJECTIVES:

- To develop knowledge to formulate a real world problem and project's goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques.
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations.

Students in the form of group, not exceeding 3 members in a group to carry out their main project. It should be a Mechatronics project. However, special considerations can be given for interdisciplinary measurement and computer based simulation projects. This exception should be recorded and approved by the department committee. Management related projects will not be allowed. The interdisciplinary projects will carry more weight age. It is mandatory to publish their main project in national/international level conferences to appear in the viva-voce exam.

**TOTAL: 300 PERIODS**

### OUTCOMES:

**After successful completion of this course, the students should be able to**

**CO1:** Design, analyze, realize / simulate a physical system by using the technology they learnt during the program.

**CO2:** Integrate various systems into one Mechatronics product.

**CO3:** Work in a team with confined time duration.

**CO4:** Disseminate his work both in oral and written format.

**OBJECTIVES:**

- To understand the basics of discrete time signals, systems and their classifications.
- To analyze the discrete time signals in both time and frequency domain.
- To design lowpass digital IIR filters according to predefined specifications based on analog filter theory and analog-to-digital filter transformation.
- To design Linear phase digital FIR filters using fourier method, window technique
- To realize the concept and usage of DSP in various engineering fields.

**UNIT I DISCRETE TIME SIGNALS AND SYSTEMS 9**

Introduction to DSP – Basic elements of DSP– Sampling of Continuous time signals–Representation, Operation and Classification of Discrete Time Signal–Classification of Discrete Time Systems–Discrete Convolution: Linear and Circular–Correlation.

**UNIT II ANALYSIS OF LTI DISCRETE TIME SIGNALS AND SYSTEMS 9**

Analysis of LTI Discrete Time Systems using DFT–Properties of DFT–Inverse DFT– Analysis of LTI Discrete Time Systems using FFT Algorithms– Inverse DFT using FFT Algorithm.

**UNIT III INFINITE IMPULSE RESPONSE FILTERS 9**

Frequency response of Analog and Digital IIR filters–Realization of IIR filter–Design of analog low pass filter–Analog to Digital filter Transformation using Bilinear Transformation and Impulse Invariant method–Design of digital IIR filters (LPF, HPF, BPF, and BRN) using various transformation techniques.

**UNIT IV FINITE IMPULSE RESPONSE FILTERS 9**

Linear Phase FIR filter–Phase delay–Group delay–Realization of FIR filter–Design of Causal and Non-causal FIR filters (LPF, HPF, BPF and BRN) using Window method (Rectangular, Hamming window, Hanning window) –Frequency Sampling Technique.

**UNIT V APPLICATIONS OF DSP 9**

Multirate Signal Processing: Decimation, Interpolation, Spectrum of the sampled signal –Processing of Audio and Radar signal.

**TOTAL: 45 PERIODS****OUTCOMES:**

**At the end of the course, the students should be able to:**

- Perform mathematical operations on signals.
- Understand the sampling theorem and perform sampling on continuous-time signals to get discrete time signal by applying advanced knowledge of the sampling theory.
- Transform the time domain signal into frequency domain signal and vice-versa.
- Apply the relevant theoretical knowledge to design the digital IIR/FIR filters for the given analog specifications.

**TEXT BOOK:**

1. John G. Proakis & Dimitris G. Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Fourth Edition, Pearson Education / Prentice Hall, 2007.

**REFERENCES**

1. Richard G. Lyons, "*Understanding Digital Signal Processing*". Second Edition, Pearson Education.
2. A.V. Oppenheim, R.W. Schaffer and J.R. Buck, "*Discrete-Time Signal Processing*", 8th Indian Reprint, Pearson, 2004.
3. Emmanuel C. Ifeachor, & Barrie.W. Jervis, "*Digital Signal Processing*", Second Edition, Pearson Education / Prentice Hall, 2002.
4. William D. Stanley, "Digital Signal Processing", Second Edition, Reston Publications.

MT8001

**OBJECT ORIENTED PROGRAMMING IN C++**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

- To introduce the C++ programming and its use in object oriented environment

**UNIT I OOP PARADIGM 9**

Software crisis – Software evolution – A look at procedure oriented programming – Object oriented programming paradigm – Basic concepts of object oriented programming – Benefits of OOP – Reusability – Security – Object oriented programming fundamental – Abstraction – Encapsulation – Derivation – Object oriented languages and packages–Applications of OOP – A simple C++ program – More C++ statements – Structure of C++ Program

**UNIT II INTRODUCTION TO C++ 10**

Tokens – Keywords – Identifiers and constants – Basic data types – User defined data types – Derived data types – Symbolic constants – Declaration of variables – Dynamic initialization of variables – Reference variables – Operators in C++ – Scope resolution operator – Manipulators– Type cast operator – Expressions and their types – Special assignment expressions – Control structures - The main function – Function prototyping – Call by reference – Return by reference – Inline functions – Default arguments – Function overloading

**UNIT III CLASSES AND OBJECTS 9**

Specifying a class – Defining member functions – Private member functions –Arrays within a class – Memory allocation for objects – Static data members – Static member functions – Arrays of objects – Objects as function arguments –Friendly functions – Returning objects. Constructors: Parameterized constructors – Multiple constructors in a class – Constructors with default arguments – Dynamic initialization of objects – Copy constructor – Dynamic constructors– Destructors

**UNIT IV OPERATOR OVERLOADING, INHERITANCE AND POLYMORPHISM 10**

Defining operator overloading: Overloading unary, binary operators. Manipulation of strings using operators – Rules for overloading operators – Type Conversions - Defining derived classes – Single inheritance – Multilevel inheritance – Multiple inheritance – Hierarchical inheritance – Hybrid inheritance – Virtual base classes – Abstract classes - Introduction to pointers to objects: This pointer – Pointers to derived classes – Virtual functions – Pure virtual functions

**UNIT V CASE STUDIES 7**

Over view of typical object oriented systems – Case studies- Applications

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**On the successful completion of the course, students will be able to**

**CO1:** Distinguish between Structured and Object Oriented problem solving approaches and apply them based on the problem given

**CO2:** Define the fundamental concepts in programming with C++.

**CO3:** Identify classes and objects from the given problem description and able to create classes and objects using C++

**CO4:** Achieve code reusability and extensibility by means of Inheritance and Polymorphism.

**CO5:** Translate the informal description of an algorithm to solutions for problems in engineering, science and text processing using Object Oriented Programming.

**TEXT BOOK:**

1. Balagurusamy E, Object Oriented Programing with C++ Tata McGraw Hill *Education* Pvt.Ltd , Fourth Edition 2010.



**TEXT BOOKS:**

1. Jain K.K. and Asthana .R.B, "Automobile Engineering" Tata McGraw Hill Publishers, New Delhi, 2002.
2. Kirpal Singh, "Automobile Engineering", Vol 1 & 2, Seventh Edition, Standard Publishers, New Delhi, 13th Edition 2014..

**REFERENCES:**

1. Ganesan V. "Internal Combustion Engines", Third Edition, Tata McGraw-Hill, 2012.
2. Heinz Heisler, "Advanced Engine Technology," SAE International Publications USA, 1998.
3. Joseph Heitner, "Automotive Mechanics," Second Edition, East-West Press, 1999.
4. Martin W, Stockel and Martin T Stockle , "Automotive Mechanics Fundamentals," The Good heart - Will Cox Company Inc, USA ,1978.
5. Newton ,Steeds and Garet, "Motor Vehicles", Butterworth Publishers,1989.

**GE8075****INTELLECTUAL PROPERTY RIGHTS****L T P C**  
**3 0 0 3****OBJECTIVE:**

- To give an idea about IPR, registration and its enforcement.

**UNIT I INTRODUCTION****9**

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

**UNIT II REGISTRATION OF IPRs****10**

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

**UNIT III AGREEMENTS AND LEGISLATIONS****10**

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

**UNIT IV DIGITAL PRODUCTS AND LAW****9**

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

**UNIT V ENFORCEMENT OF IPRs****7**

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

**TOTAL :45 PERIODS****OUTCOME:**

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

**TEXT BOOKS**

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S.V. Satarkar, Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002

## REFERENCES

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli, "Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

**GE8073**

**FUNDAMENTALS OF NANOSCIENCE**

**L T P C**  
**3 0 0 3**

### OBJECTIVE:

To learn about basis of nanomaterial science, preparation method, types and application

### UNIT I INTRODUCTION

**8**

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering- Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

### UNIT II GENERAL METHODS OF PREPARATION

**9**

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

### UNIT III NANOMATERIALS

**12**

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO<sub>2</sub>, MgO, ZrO<sub>2</sub>, NiO, nanoalumina, CaO, AgTiO<sub>2</sub>, Ferrites, Nanoclays- functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

### UNIT IV CHARACTERIZATION TECHNIQUES

**9**

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

### UNIT V APPLICATIONS

**7**

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

**TOTAL : 45 PERIODS**

### OUTCOMES:

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

**TEXT BOOKS :**

1. A.S. Edelstein and R.C. Cammebarata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale Characterisation of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

**REFERENCES:**

1. G Timp, "Nanotechnology", AIP press/Springer, 1999.
2. Akhlesh Lakhtakia, "The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

**AN8091****MAINTENANCE ENGINEERING****L T P C**  
**3 0 0 3****OBJECTIVES:**

- To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
- To explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.
- To illustrate some of the simple instruments used for condition monitoring in industry.

**UNIT I PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING 9**

Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and benefits of sound Maintenance systems – Reliability and machine availability – MTBF, MTTR and MWT – Factors of availability – Maintenance organization – Maintenance economics.

**UNIT II MAINTENANCE POLICIES – PREVENTIVE MAINTENANCE 9**

Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repair cycle - Principles and methods of lubrication – TPM.

**UNIT III CONDITION MONITORING 9**

Condition Monitoring – Cost comparison with and without CM – On-load testing and offload testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear- debris analysis

**UNIT IV REPAIR METHODS FOR BASIC MACHINE ELEMENTS 10**

Repair methods for beds, slide ways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location.

**UNIT V REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT 8**

Repair methods for Material handling equipment - Equipment records –Job order systems -Use of computers in maintenance

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Upon completion of the programme, the students can able to implement the maintenance function and different practices in industries for the successful management of maintenance activities
- To identify the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.

**TEXT BOOKS:**

1. Srivastava S.K., "Industrial Maintenance Management", S. Chand and Co., 1981
2. Venkataraman .K "Maintenance Engineering and Management", PHI Learning, Pvt.Ltd., 2007

**REFERENCES:**

1. Armstrong, "Condition Monitoring", BSIRSA, 1988.
2. Bhattacharya S.N., "Installation, Servicing and Maintenance", S. Chand and Co., 1995
3. Davies, "Handbook of Condition Monitoring", Chapman &Hall, 1996.
4. Garg M.R., "Industrial Maintenance", S. Chand & Co., 1986.
5. Higgins L.R., "Maintenance Engineering Hand book", McGraw Hill, 5<sup>th</sup> Edition, 1988.
6. White E.N., "Maintenance Planning", I Documentation, Gower Press, 1979
7. "Advances in Plant Engineering and Management", Seminar Proceedings - IPE, 1996.

<b>ME8793</b>	<b>PROCESS PLANNING AND COST ESTIMATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVE:**

- To introduce the process planning concepts to make cost estimation for various products after process planning

**UNIT I INTRODUCTION TO PROCESS PLANNING 9**

Introduction- methods of process planning-Drawing interpretation-Material evaluation – steps in process selection-.Production equipment and tooling selection

**UNIT II PROCESS PLANNING ACTIVITIES 9**

Process parameters calculation for various production processes-Selection jigs and fixtures election of quality assurance methods - Set of documents for process planning-Economics of process planning- case studies

**UNIT III INTRODUCTION TO COST ESTIMATION 9**

Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of over head charges- Calculation of depreciation cost

**UNIT IV PRODUCTION COST ESTIMATION 9**

Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop

**UNIT V MACHINING TIME CALCULATION 9**

Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations ,Drilling and Boring - Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding.

**TOTAL: 45 PERIODS**



**UNIT V DECISION MODELS****10**

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

**TOTAL: 45 PERIODS****OUTCOME:**

- Upon completion of this course, the students can able to use the optimization techniques for use engineering and Business problems

**TEXT BOOKS:**

1. Hillier and Libebberman, "Operations Research", Holden Day, 2005
2. Taha H.A., "Operations Research", Sixth Edition, Prentice Hall of India, 2003.

**REFERENCES:**

1. Bazara M.J., Jarvis and Sherali H., "Linear Programming and Network Flows", John Wiley, 2009.
2. Budnick F.S., "Principles of Operations Research for Management", Richard D Irwin, 1990.
3. Philip D.T. and Ravindran A., "Operations Research", John Wiley, 1992.
4. Shennoy G.V. and Srivastava U.K., "Operation Research for Management", Wiley Eastern, 1994.
5. Tulsian and Pasdey V., "Quantitative Techniques", Pearson Asia, 2002.

**MT8002****ADVANCED MANUFACTURING TECHNOLOGY**

L	T	P	C
3	0	0	3

**OBJECTIVES:**

- To understand the concepts of forming and sheet metal working of metals with its different types of operations and simultaneously to know about various non-traditional machining processes, surface finishing and surface hardening processes with its types and various applications.
- To understand the work and tool holding devices with its principles and its industrial applications

**UNIT I SHEET METAL WORKING OF METALS****8**

Hot and Cold Working- rolling, forging, wire drawing, extrusion-types-forward, backward & tube extrusion. Blanking-blank size calculation, draw ratio, drawing force, piercing, punching, trimming, stretch forming, tube bending, tube forming -embossing & coining-explosive forming electro hydraulic forming-electromagnetic forming

**UNIT II NON TRADITIONAL MACHINING****9**

Ultrasonic machining (USM) – process and description of USM-applications and limitations- Electron Beam Machining (EBM)-Process principles of EBM-applications-process principles- Laser Beam Machining (LBM)-Laser beam production-applications-laser beam welding-Plasma Arc Machining (PAM)-Generation of plasma arc-process parameters-applications

**UNIT III SURFACE FINISHING AND SURFACE HARDENING PROCESS 10**  
Grinding process, various types of grinding machine-grinding wheel-types-selection of grinding wheel for different applications-selection of cutting speed and work speed- mounting of grinding wheel-galvanizing, electroplating, anodising. Surface hardening- carburizing, carbonitriding, cyaniding, nitriding, ion nitriding, boronizing, laser hardening, thin film coating (PVD, CVD).

**UNIT IV EDM AND ECM 10**  
Electrical Discharge Machining (EDM) - Description of EDM equipment-electrical circuits - electrolyte-metal removal rate-applications-EDWC - process principles – equipments - applications. Electro Chemical Machining (ECM) - Description of the equipment-electrolyte-metal removal rate -accuracy and surface finish obtained. Electro Chemical grinding (ECG) – Chemical machining-electro chemical grinding equipment-application-electro chemical deburring - honing applications.

**UNIT V JIGS AND FIXTURES 8**  
Jigs-Locating and Clamping devices-principles-elements-mechanical-pneumatic and hydraulic actuation-types of Jigs-general consideration in Jig design-jig bushing, types- methods of construction. Fixtures-types of fixtures- fixture for machine tools –lathe, milling, boring, broaching, grinding-assembly inspection of welding fixture design.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- CO1: Understand the basics and working principles of various sheet metal working and forming processes
- CO2: Knowledge on various non-traditional machining processes with its applications
- CO3: Understand the various type of surface finishing and surface hardening process
- CO4: Understand the concept of EDM and ECM with its characteristics and application
- CO5: Understand the work and tool holding devices used for different machine tools

**TEXT BOOKS:**

1. Rao P.N., “Manufacturing Technology, Metal cutting and Machine Tools”, Tata McGraw Hill, 2013
2. Sharma .P.C., “A text book of Production Technology- vol I &II ”, S.Chand & Company Ltd, New Delhi, 2014

**REFERENCES**

1. Donaldson. C. “Tool design”, Tata McGraw Hill Co. Ltd.,2003
2. HajraChoudhary.S.K. and Hajra Choudhary.A.K, “workshop Technology”, Vol-I&Vol-II”, Media Publishers 2008
3. H.M.T Bangalore "Production Technology" Tata McGraw Hill, 2016.

**AE8751**

**AVIONICS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To introduce the basic of avionics and its need for civil and military aircrafts
- To impart knowledge about the avionic architecture and various avionics data buses
- To gain more knowledge on various avionics subsystems

**UNIT I INTRODUCTION TO AVIONICS 9**  
Need for avionics in civil and military aircraft and space systems – integrated avionics and weapon systems – typical avionics subsystems, design, technologies – Introduction to digital computer and memories.

**UNIT II DIGITAL AVIONICS ARCHITECTURE 9**  
Avionics system architecture – data buses – MIL-STD-1553B – ARINC – 420 – ARINC – 629.

**UNIT III FLIGHT DECKS AND COCKPITS 9**  
Control and display technologies: CRT, LED, LCD, EL and plasma panel – Touch screen – Direct voice input (DVI) – Civil and Military Cockpits: MFDS, HUD, MFK, HOTAS.

**UNIT IV INTRODUCTION TO NAVIGATION SYSTEMS 9**  
Radio navigation – ADF, DME, VOR, LORAN, DECCA, OMEGA, ILS, MLS – Inertial Navigation Systems (INS) – Inertial sensors, INS block diagram – Satellite navigation systems – GPS.

**UNIT V AIR DATA SYSTEMS AND AUTO PILOT 9**  
Air data quantities – Altitude, Air speed, Vertical speed, Mach Number, Total air temperature, Mach warning, Altitude warning – Auto pilot – Basic principles, Longitudinal and lateral auto pilot.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Ability to built Digital avionics architecture
- Ability to Design Navigation system
- Ability to design and perform analysis on air system.
- Integrate avionics systems using data buses.
- Analyze the performance of various cockpit display technologies.
- Design autopilot for small aircrafts using MATLAB

**TEXT BOOKS:**

1. Albert Helfrick.D., "Principles of Avionics", Avionics Communications Inc., 2004
2. Collinson.R.P.G. "Introduction to Avionics", Chapman and Hall, 1996.

**REFERENCES:**

1. Middleton, D.H., Ed., "Avionics systems, Longman Scientific and Technical", Longman Group UK Ltd., England, 1989.
2. Pallet.E.H.J., "Aircraft Instruments and Integrated Systems", Pearsons, Indian edition 2011.
3. Spitzer, C.R. "Digital Avionics Systems", Prentice-Hall, Englewood Cliffs, N.J.,U.S.A. 1993.
4. Spitzer. C.R. "The Avionics Hand Book", CRC Press, 2000

**MF8071**

**ADDITIVE MANUFACTURING**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To know the principle, methods, possibilities and limitations as well as environmental effects of Additive Manufacturing technologies.
- To be familiar with the characteristics of the different materials those are used in Additive Manufacturing technologies.

**UNIT I INTRODUCTION 9**  
Overview – Need - Development of Additive Manufacturing Technology -Principle – AM Process Chain- Classification –Rapid Prototyping- Rapid Tooling – Rapid Manufacturing – Applications- Benefits – Case studies.



**UNIT II TQM PRINCIPLES****9**

Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

**UNIT III TQM TOOLS AND TECHNIQUES I****9**

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

**UNIT IV TQM TOOLS AND TECHNIQUES II****9**

Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

**UNIT V QUALITY MANAGEMENT SYSTEM****9**

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--**ENVIRONMENTAL MANAGEMENT SYSTEM:** Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

**TOTAL: 45 PERIODS****OUTCOME:**

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

**TEXT BOOK:**

1. Dale H.Besterfield, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

**REFERENCES:**

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8<sup>th</sup> Edition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. ISO 9001-2015 standards

**EC8093****DIGITAL IMAGE PROCESSING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods



MT8003

**MEDICAL MECHATRONICS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To understand how to measure biochemical parameters and various physiological information.
- To study the need and technique of electrical safety in Hospitals.
- To study the use of radiation for diagnostic and therapy.
- To study about recorders and advanced equipment in medicine

**UNIT I INTRODUCTION**

**9**

Cell structure – electrode – electrolyte interface, electrode potential, resting and action potential – electrodes for their measurement, ECG, EEG, EMG – machine description – methods of measurement – three equipment failures and trouble shooting

**UNIT II TRANSDUCERS FOR BIO-MEDICAL INSTRUMENTATION**

**9**

Basic transducer principles Types – source of bioelectric potentials – resistive, inductive, capacitive, fiber-optic, photoelectric and chemical transducers – their description and feature applicable for biomedical instrumentation – Bio & Nano sensors & application

**UNIT III SIGNAL CONDITIONING, RECORDING AND DISPLAY**

**9**

Input isolation, DC amplifier, power amplifier, and differential amplifier – feedback, op-Amp-electrometer amplifier, carrier Amplifier – instrument power supply. Oscilligraphic – galvanometric - X-Y, magnetic recorder, storage oscilloscopes – electron microscope – PMMC writing systems – Telemetry principles – Bio telemetry.

**UNIT IV MEDICAL SUPPORT**

**10**

Electrocardiograph measurements – blood pressure measurement: by ultrasonic method – plethysonography – blood flow measurement by electromagnetic flow meter cardiac output measurement by dilution method – phonocardiography – vector cardiography. Heart lung machine – artificial ventilator – Anesthetic machine – Basic ideas of CT scanner – MRI and ultrasonic scanner – Bio-telemetry – laser equipment and application – cardiac pacemaker – DC– defibrillator patient safety - electrical shock hazards. Centralized patient monitoring system.

**UNIT V BIO-MEDICAL DIAGNOSTIC INSTRUMENTATION**

**8**

Introduction – computers in medicine – basis of signal conversion and digital filtering data reduction technique – time and frequency domain technique – ECG Analysis.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**After successful completion of this course, the students should be able to**

**CO1:** Explain different measurement techniques used in physiological parameters measurement.

**CO2:** Describe the sensors and signal conditioning circuits used in biomedical engineering.

**CO3:** Understand about various amplifiers, recording and display devices.

**CO4:** Differentiate the working of recorders and explain the advanced systems used in medicine

**CO5:** Understand about various Bio- medical diagnostics instrumentation.

**TEXT BOOKS:**

1. Arumugam M., “Bio Medical Instrumentation”, Anuradha agencies Pub., 2003
2. Cromwell, Weibell and Pfeiffer, “Biomedical Instrumentation and Measurements”, 2<sup>nd</sup> Edition, Printice Hall of india , 2012.
3. Siamak Najarian “ Mechatronics in Medicine – A Bio medical engg approach” , McGraw – Hill Education , 2011.

## REFERENCES

1. Geddes L.A., and Baker, L.E., "Principles of Applied Bio-medical Instrumentation", 3<sup>rd</sup> Edition, John Wiley and Sons, 2010
2. Khandpur, R.S., "Handbook of Biomedical Instrumentation", TMH, 2009.
3. Tompkins W.J., "Biomedical Digital Signal Processing", Prentice Hall of India, 1998

**MT8071**

**VIRTUAL INSTRUMENTATION**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

## OBJECTIVE:

- Introduce the principle, programming technique with instrument interfaces and applications of virtual instruments and to understand the basics of data acquisition are introduced in mechatronics systems.

## **UNIT I REVIEW OF VIRTUAL INSTRUMENTATION 9**

Historical perspectives, advantages, block diagram and architecture of a virtual instrument, data -flow techniques, graphical programming in data flow, comparison with conventional programming.

## **UNIT II VI PROGRAMMING TECHNIQUES 9**

VIS and sub-VIS loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O.

## **UNIT III DATA ACQUISITION BASICS 9**

AOC.OAC. 010. Counters & timers. PC Hardware structure, timing. Interrupts OMA, software and hardware installation

## **UNIT IV COMMON INSTRUMENT INTERFACES 9**

Current loop, RS.232C/RS.485, GPIB, System buses, interface buses: USB, PCMCIA, VXI, SCXI, PXI, etc., networking basics for office &.Industrial applications, Visa and IVI, image acquisition and processing. Motion control.

## **UNIT V USE OF ANALYSIS TOOLS 9**

Fourier transforms, power spectrum correlation methods, windowing & filtering, VI application in various fields.

**TOTAL : 45 PERIODS**

## OUTCOMES:

- CO1: Understand the evolution, advantages, techniques, architecture and applications of visual instrumentation
- CO2: Acquiring knowledge on VI programming techniques
- CO3: Study about the basics of data acquisition
- CO4: Understanding the concept of common instrument interfaces with industrial applications
- CO5: Study about the use of analysis tools with various applications.

## TEXT BOOK:

1. Gupta , " Virtual Instrumentation Using Lab view" 2<sup>nd</sup> Edition, Tata McGraw-Hill Education, 2010

## REFERENCES:

1. Gary Jonson, "Labview Graphical Programming", Fourth Edition, McGraw Hill, New York, 2006
2. Gupta.S., Gupta.J.P., "PC interfacing for Data Acquisition & Process Control", Second Edition, Instrument Society of America, 1994.
3. Sokoloff; "Basic concepts of Labview 4", Prentice Hall Inc., New Jersey 1998

IT8075

**SOFTWARE PROJECT MANAGEMENT**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To understand the Software Project Planning and Evaluation techniques.
- To plan and manage projects at each stage of the software development life cycle (SDLC).
- To learn about the activity planning and risk management principles.
- To manage software projects and control software deliverables.
- To develop skills to manage the various phases involved in project management and people management.
- To deliver successful software projects that support organization's strategic goals.

**UNIT I PROJECT EVALUATION AND PROJECT PLANNING 9**

Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

**UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9**

Software process and Process Models – Choice of Process models - Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II - a Parametric Productivity Model.

**UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 9**

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

**UNIT IV PROJECT MANAGEMENT AND CONTROL 9**

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

**UNIT V STAFFING IN SOFTWARE PROJECTS 9**

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

**TOTAL 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the students should be able to:**

- Understand Project Management principles while developing software.
- Gain extensive knowledge about the basic project management concepts, framework and the process models.
- Obtain adequate knowledge about software process models and software effort estimation techniques.
- Estimate the risks involved in various project activities.
- Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.
- Learn staff selection process and the issues related to people management



**UNIT IV      SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT      9**

Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation - **Sustenance** -Maintenance and Repair – Enhancements - **Product EoL** - Obsolescence Management – Configuration Management - EoL Disposal

**UNIT V      BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY      9**

**The Industry** - Engineering Services Industry - Product Development in Industry versus Academia –**The IPD Essentials** - Introduction to Vertical Specific Product Development processes -Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and Software Systems – Product Development Trade-offs - Intellectual Property Rights and Confidentiality – Security and Configuration Management.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

**TEXTBOOKS:**

1. Book specially prepared by NASSCOM as per the MoU.
2. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2011.
3. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, 2005.

**REFERENCES:**

1. Hiriappa B, "Corporate Strategy – Managing the Business", Author House, 2013.
2. Peter F Drucker, "People and Performance", Butterworth – Heinemann [Elsevier], Oxford, 2004.
3. Vinod Kumar Garg and Venkita Krishnan N K, "Enterprise Resource Planning – Concepts", Second Edition, Prentice Hall, 2003.
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2013

**GE8074**

**HUMAN RIGHTS**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

- To sensitize the Engineering students to various aspects of Human Rights.

**UNIT I**

**9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

**UNIT II** **9**  
Evolution of the concept of Human Rights Magna carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

**UNIT III** **9**  
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

**UNIT IV** **9**  
Human Rights in India – Constitutional Provisions / Guarantees.

**UNIT V** **9**  
Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

**TOTAL : 45 PERIODS**

**OUTCOME:**

- Engineering students will acquire the basic knowledge of human rights.

**REFERENCES:**

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

**GE8071**

**DISASTER MANAGEMENT**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

**UNIT I INTRODUCTION TO DISASTERS** **9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

**UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)** **9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Process and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

**UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

**UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

**UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management.

**TEXT BOOKS:**

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IAS and Sage Publishers, New Delhi, 2010.

**REFERENCES**

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

## ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

CS8691

### OBJECTIVES:

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI.

### UNIT I INTRODUCTION

9

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

### UNIT II PROBLEM SOLVING METHODS

9

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing - Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games

### UNIT III KNOWLEDGE REPRESENTATION

9

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information

### UNIT IV SOFTWARE AGENTS

9

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

### UNIT V APPLICATIONS

9

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving

**TOTAL :45 PERIODS**

### OUTCOMES:

**Upon completion of the course, the students will be able to:**

- Use appropriate search algorithms for any AI problem
- Represent a problem using first order and predicate logic
- Provide the apt agent strategy to solve a given problem
- Design software agents to solve a problem
- Design applications for NLP that use Artificial Intelligence.

### TEXT BOOKS:

- 1 S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2009.
- 2 I. Bratko, "Prolog: Programming for Artificial Intelligence", Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

### REFERENCES:

1. M. Tim Jones, "Artificial Intelligence: A Systems Approach(Computer Science)", Jones and Bartlett Publishers, Inc.; First Edition, 2008
2. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press,

- 2009.
3. William F. Clocksin and Christopher S. Mellish," Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.
  4. Gerhard Weiss, "Multi Agent Systems", Second Edition, MIT Press, 2013.
  5. David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Cambridge University Press, 2010.

**MG8091**

**ENTREPRENEURSHIP DEVELOPMENT**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

- To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

**UNIT I ENTREPRENEURSHIP**

**9**

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur  
Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

**UNIT II MOTIVATION**

**9**

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

**UNIT III BUSINESS**

**9**

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

**UNIT IV FINANCING AND ACCOUNTING**

**9**

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.

**UNIT V SUPPORT TO ENTREPRENEURS**

**9**

Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures - Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- Upon completion of the course, students will be able to gain knowledge and skills needed to run a business successfully.

**TEXT BOOKS :**

1. Khanka S.S., "Entrepreneurial Development" S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.
2. Donald F Kuratko, " Entrepreneurship – Theory, Process and Practice", Cengage Learning 9th edition, 2014.

## REFERENCES :

1. EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers:
2. Entrepreneurship Development", Institute of India, Ahmadabad, 1986.
3. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.
4. Mathew J Manimala, Enterprenuership theory at cross roads: paradigms and praxis" 2nd Edition, Dream Tech, 2005.
5. Rajeev Roy, 'Entrepreneurship' 2nd Edition, Oxford University Press, 2011.

**RO8791**

## **MODELING AND SIMULATION**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **OBJECTIVE:**

- To provide an overview of how computers are being used in mechanical component design with the use of various CAD standards and to introduce the concepts of Mathematical Modelling of Engineering Problems using FEM with 2D scalar and vector variables problems respectively.

### **UNIT I           MODELLING AND ASSEMBLY**

**9**

Assembly modelling – interferences of positions and orientation – tolerance analysis-mass property calculations – mechanism simulation and interference checking

### **UNIT II           CAD STANDARDS**

**9**

Standards for computer graphics- Graphical Kernel System (GKS) - standards for exchange images- Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, CALS etc. - communication standards

### **UNIT III          INTRODUCTION TO ANALYSIS**

**9**

Basic concepts of the Finite Element Method - Discretization -Meshing – Mesh refinement- Mesh Enrichment- Natural co-ordinate systems -Types of elements- Special Elements- Crack tip Element- Introduction to Analysis Software.

### **UNIT IV          TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS**

**9**

Second Order 2D Equations involving Scalar Variable Functions – Variational formulation –Finite Element formulation – Triangular elements – Shape functions and element matrices and vectors. Application to Field Problems - Thermal problems.

### **UNIT V          TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS**

**9**

Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements.

**TOTAL : 45 PERIODS**

### **OUTCOMES:**

- CO1: To know the basic concepts of modelling and assembly for different mechanical components  
CO2: To know the different types of CAD standards used in modeling of mechanical components  
CO3: To know about basic concepts of FEA and analysis software for analyzing mechanical components  
CO4: To know about different mathematical techniques used in finite element analysis to solve structural and thermal problems

### **TEXT BOOKS:**

1. Ibrahim Zeid "Mastering CAD CAM" Tata McGraw-Hill Publishing Co.2007
2. Rao, S.S., "The Finite Element Method in Engineering", 5th Edition, Butterworth Heinemann, 2010

## REFERENCES

1. Donald Hearn and M. Pauline Baker "Computer Graphics". Prentice Hall, Inc, 1996.
2. Foley, Wan Dam, Feiner and Hughes - "Computer graphics principles & practice" Pearson, 2<sup>nd</sup> edition, 1995.
3. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", 4th Edition, Wiley Student Edition, 2002.

**EE8091**

**MICRO ELECTRO MECHANICAL SYSTEMS**

**L T P C**  
**3 0 0 3**

## OBJECTIVES

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

### **UNIT I INTRODUCTION 9**

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

### **UNIT II SENSORS AND ACTUATORS-I 9**

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys

### **UNIT III SENSORS AND ACTUATORS-II 9**

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

### **UNIT IV MICROMACHINING 9**

Silicon Anisotropic Etching – Anisotropic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

### **UNIT V POLYMER AND OPTICAL MEMS 9**

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

**TOTAL : 45 PERIODS**

## OUTCOMES

- Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.
- Ability to understand and analyse, linear and digital electronic circuits.

**TEXT BOOKS:**

1. Chang Liu, "Foundations of MEMS", Pearson Education Inc., 2006.
2. Stephen D Senturia, "Microsystem Design", Springer Publication, 2000.
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

**REFERENCES:**

1. James J.Allen, "Micro Electro Mechanical System Design", CRC Press Publisher, 2010
2. Julian w. Gardner, Vijay K. Varadan, Osama O. Awadelkarim, "Micro Sensors MEMS and Smart Devices", John Wiley & Son LTD,2002
3. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2000
4. Nadim Maluf," An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
5. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer 2012.

**CS8492****DATABASE MANAGEMENT SYSTEMS****L T P C  
3 0 0 3****OBJECTIVES**

- To learn the fundamentals of data models and to represent a database system using ER diagrams.
- To study SQL and relational database design.
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design.
- To understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.
- To have an introductory knowledge about the Storage and Query processing Techniques

**UNIT I RELATIONAL DATABASES****10**

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL

**UNIT II DATABASE DESIGN****8**

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

**UNIT III TRANSACTIONS****9**

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery – Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery.

**UNIT IV IMPLEMENTATION TECHNIQUES****9**

RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics and Cost Estimation.

**UNIT V            ADVANCED TOPICS****9**

Distributed Databases: Architecture, Data Storage, Transaction Processing – Object-based Databases: Object Database Concepts, Object-Relational features, ODMG Object Model, ODL, OQL - XML Databases: XML Hierarchical Model, DTD, XML Schema, XQuery – Information Retrieval: IR Concepts, Retrieval Models, Queries in IR systems.

**TOTAL: 45 PERIODS****OUTCOMES:****Upon completion of the course, the students will be able to:**

- Classify the modern and futuristic database applications based on size and complexity
- Map ER model to Relational model to perform database design effectively
- Write queries using normalization criteria and optimize queries
- Compare and contrast various indexing strategies in different database systems
- Appraise how advanced databases differ from traditional databases.

**TEXT BOOKS:**

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2011.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Sixth Edition, Pearson Education, 2011.

**REFERENCES:**

1. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, Database Management Systems , Fourth Edition, McGraw-Hill College Publications, 2015.
3. G.K.Gupta,"Database Management Systems", Tata McGraw Hill, 2011.

**MG8892****MARKETING MANAGEMENT****L T P C  
3 0 0 3****OBJECTIVE:**

- To enable students to deal with newer concepts of marketing concepts like strategic marketing segmentation, pricing, advertisement and strategic formulation. The course will enable a student to take up marketing as a professional career.

**UNIT I            MARKETING PROCESS****9**

Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy.

**UNIT II            BUYING BEHAVIOUR AND MARKET SEGMENTATION****9**

Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic - Psycho graphic and geographic segmentation, process, patterns.

**UNIT III            PRODUCT PRICING AND MARKETING RESEARCH****9**

Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.



clustering – geometric layout development – fundamental and incidental interactions – related system level design issues – secondary systems – architecture of the chunks – creating detailed interface specifications.

**UNIT IV INDUSTRIAL DESIGN 9**

Integrate process design – Managing costs – Robust design – Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically – Need for industrial design – impact – design process – investigation of for industrial design – impact – design process – investigation of customer needs – conceptualization – refinement – management of the industrial design process – technology driven products – user – driven products – assessing the quality of industrial design.

**UNIT V DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT 9**

Definition – Estimation of Manufacturing cost – reducing the component costs and assembly costs – Minimize system complexity – Prototype basics – principles of prototyping – planning for prototypes – Economic Analysis – Understanding and representing tasks – baseline project planning – accelerating the project – project execution.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- The student will be able to design some products for the given set of applications; also the knowledge gained through prototyping technology will help the student to make a prototype of a problem and hence product design and development can be achieved.

**TEXT BOOK:**

1. Kari T.Ulrich and Steven D.Eppinger, "Product Design and Development", McGraw-Hill International Edns. 1999.

**REFERENCES:**

1. Kemneth Crow, "Concurrent Engg./Integrated Product Development", DRM Associates, 26/3,Via Olivera, Palos Verdes, CA 90274(310) 377-569, Workshop Book.
2. Stephen Rosenthal, "Effective Product Design and Development", Business One Orwin, Home wood, 1992, ISBN 1-55623-603-4.
3. Staurt Pugh, "Tool Design –Integrated Methods for Successful Product Engineering", Addison Wesley Publishing, New york, NY.

**GE8076**

**PROFESSIONAL ETHICS IN ENGINEERING**

**L T P C  
3 0 0 3**

**OBJECTIVE:**

- To enable the students to create an awareness on Engineering Ethics and Human Values to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

**UNIT I HUMAN VALUES 10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.



**AFFILIATED INSTITUTIONS**

**REGULATIONS 2017**  
**CHOICE BASED CREDIT SYSTEM**  
**COMMON TO ALL POST GRADUATE PROGRAMMES**

The following Regulations is applicable to the students admitted to M.E / M.Tech., M.C.A and M.B.A. Programmes at all Engineering Colleges affiliated to Anna University, Chennai (other than Autonomous Colleges) and to all the University Colleges of Engineering of Anna University, Chennai from the academic year 2017-2018.

**1 PRELIMINARY DEFINITIONS AND NOMENCLATURE**

In these Regulations, unless the context otherwise requires:

- i. **“Programme”** means Post graduate Degree Programme e.g. M.E., M.Tech. Degree Programme.
- ii. **“Branch”** means specialization or discipline of M.E. / M.Tech. Degree Programme like “Structural Engineering”, “Engineering Design”, etc.
- iii. **“Course”** means Theory or Practical subject that is normally studied in a semester, like Applied Mathematics, Advanced Thermodynamics, etc.
- iv. **“Director, Academic Courses”** means the authority of the University who is responsible for all academic activities of the University for implementation of relevant Rules and Regulations.
- v. **“Chairman”** means the Head of the Faculty.
- vi. **“Head of the Department”** means Head of the Department concerned.
- vii. **“Head of the Institution”** means the Principal of a College / Institution who is responsible for all academic activities of that College / Institution and for implementation of relevant Rules and Regulations.
- viii. **“Controller of Examinations”** means the Authority of the University who is responsible for all activities of the University Examinations.
- ix. **“University”** means ANNA UNIVERSITY, CHENNAI.

## **2 PROGRAMMES OFFERED, MODES OF STUDY AND ADMISSION REQUIREMENTS**

### **2.1 P.G. PROGRAMMES OFFERED:**

1. M.E
2. M.Tech.
3. M.B.A.
4. M.C.A.

### **2.2 MODES OF STUDY:**

#### **2.2.1 Full-Time:**

Candidates admitted under 'Full-Time' should be available in the College / Institution during the entire duration of working hours (From Morning to Evening on Full-Time basis) for the curricular, co-curricular and extra-curricular activities assigned to them.

The Full-Time candidates should not attend any other Full-Time programme(s) / course(s) or take up any Full-Time job / Part-Time job in any Institution or Company during the period of the Full-Time programme. Violation of the above rules will result in cancellation of admission to the PG programme.

#### **2.2.2 Part-Time Mode:**

In this mode of study, the students are required to attend classes conducted in the evenings and complete the course in three years.

2.2.3 Conversion from one mode of study to the other is not permitted.

### **2.3 ADMISSION REQUIREMENTS:**

2.3.1 Candidates for admission to the first semester of the Post-Graduate Degree Programme shall be required to have passed an appropriate Under-Graduate Degree **Examination of Anna University** or equivalent as specified under qualification for admission as per the Tamil Nadu Common Admission (TANCA) criteria.

**Note:** TANCA releases the updated criteria during the admissions every academic year. Admission shall be offered only to the candidates who possess the qualification prescribed against each programme.

Any other relevant qualification which is not prescribed against each programme shall be considered for equivalence by the committee constituted for the purpose. Admission to such degrees shall be offered only after obtaining equivalence to such degrees.

2.3.2 However, the Syndicate of the University may decide to restrict admission in any particular year to candidates having a subset of qualifications prescribed at the time of admission.

2.3.3 Notwithstanding the qualifying examination the candidate might have passed, he/she shall have a minimum level of proficiency in the appropriate programme / courses as prescribed by the Syndicate of the University from time to time.

2.3.4 Eligibility conditions for admission such as the class obtained, the number of attempts in qualifying examination and physical fitness will be as prescribed by the Syndicate of the University from time to time.

2.3.5 All Part-Time candidates should satisfy other conditions regarding Experience, Sponsorship etc. that may be prescribed by the Syndicate from time to time.

### 3 STRUCTURE OF THE PROGRAMMES

#### 3.1 Categorization of Courses

Every Post Graduate Degree Programme will have a curriculum with syllabi consisting of theory and practical courses that shall be categorized as follows:

- i. **Foundation Courses (FC)** may include Mathematics or other basic courses
- ii. **Professional Core (PC)** courses include the core courses relevant to the chosen specialization/branch.
- iii. **Professional Elective (PE)** courses include the elective courses relevant to the chosen specialization/ branch.
- iv. **Employability Enhancement Courses (EEC)** include Project Work and/or Internship, Seminar, Professional Practices, Summer Project, Case Study and Industrial / Practical Training.

Instead of two electives in the curriculum, the student may be permitted to choose a maximum of 2 courses from other PG programmes with the approval of the Head of the Department offering such courses.

#### 3.2 Courses per Semester

Curriculum of a semester shall normally have a blend of lecture courses and practical courses including Employability Enhancement Courses. Each course may have credits assigned as per clause 3.3.

#### 3.3 Credit Assignment

Each course is assigned certain number of credits based on the following:

Contact period per week	CREDITS
1 Lecture Period	1
2 Tutorial Periods	1
2 Practical Periods (Laboratory / Seminar / Project Work etc.)	1

The Contact Periods per week for Tutorials and Practical can only be in multiples of 2.

#### 3.4 Project Work

3.4.1 The project work for M.E. / M.Tech. Programmes consist of Phase-I and Phase-II. The Phase-I is to be undertaken during III semester and Phase-II, which is a continuation of Phase-I is to be undertaken during IV semester.

3.4.2 In case of candidates of M.E. / M.Tech. Programmes not completing Phase-I of project work successfully, the candidates can undertake Phase-I again in the subsequent semester. In such cases the candidates can enroll for Phase-II, only after successful completion of Phase-I.

3.4.3 Project work shall be carried out under the supervision of a “qualified teacher” in the Department concerned. In this context “qualified teacher” means the faculty member possessing (i) PG degree with a minimum of 3 years experience in teaching or (ii) Ph.D. degree.

3.4.4 A candidate may, however, in certain cases, be permitted to work on projects in an Industrial/Research Organization, on the recommendations of the Head of the Department Concerned. In such cases, the Project work shall be jointly supervised by a supervisor of the department and an expert, as a joint supervisor from the organization and the student shall be instructed to meet the supervisor periodically and to attend the review committee meetings for evaluating the progress.

3.4.5 The Project work (Phase II in the case of M.E/M.Tech.) shall be pursued for a minimum of 16 weeks during the final semester.

**3.6** The deadline for submission of final Project Report is 60 calendar days from the last working day of the semester in which project / thesis / dissertation is done. However, the Phase-I of the Project work in the case M.E. / M.Tech. Programmes shall be submitted within a maximum period of 30 calendar days from the last working day of the semester as per the academic calendar published by the University.

### **3.7 Industrial Training / Internship**

The students may undergo Industrial training for a period as specified in the curriculum during summer / winter vacation. In this case the training has to be undergone continuously for the entire period.

The students may undergo Internship at Research organization / University (after due approval from the Department Consultative Committee) for the period prescribed in the curriculum during summer / winter vacation, in lieu of Industrial training.

### **3.8 Value Added Courses**

**The Students may optionally undergo Value Added Courses and** the credits earned through the Value Added Courses shall be over and above the total credit requirement prescribed in the curriculum for the award of the degree. One / Two credit courses shall be offered by a Department **of an institution with the prior approval from the Head of the Institution.** The details of the syllabus, time table and faculty may be sent to the Centre for Academic Courses and the Controller of Examinations after approval from the **Head of the Institution** concerned atleast one month before the course is offered. **Students can take a maximum of two one credit courses / one two credit course** during the entire duration of the Programme.

### **3.9 Online Courses**

3.9.1 Students may be permitted to credit only one online course of 3 credits with the approval of **Head of the Institution** and Centre for Academic Courses.

3.9.2 Students may be permitted to credit one online course (which are provided with certificate) subject to a maximum of three credits. The approved list of online courses will be provided by the Centre for Academic courses from time to time. The student needs to obtain certification or credit to become eligible for writing the End Semester Examination to be conducted by Controller of Examinations, Anna University. The details regarding online courses taken up by students should be sent to the Controller of Examinations, Anna University and Centre for Academic Courses one month before the commencement of end Semester Examination.

### **3.10 Medium of Instruction**

The medium of instruction is English for all courses, examinations, seminar presentations and project / thesis / dissertation reports.

#### 4 DURATION AND STRUCTURE OF THE PROGRAMMES:

4.1 The minimum and maximum period for completion of the P.G. Programmes are given below:

<b>Programme</b>	<b>Min. No. of Semesters</b>	<b>Max. No. of Semesters</b>
M.E. / M.Tech. (Full-Time)	4	8
M.E. / M.Tech. (Part Time)	6	12
M.C.A. (Full Time)	6	12
M.B.A. (Full Time)	4	8
M.B.A. (Part Time)	6	12

4.2 The Curriculum and Syllabi of all the P.G. Programmes shall be approved by the Academic Council of Anna University. The number of Credits to be earned for the successful completion of the programme shall be as specified in the Curriculum of the respective specialization of the P.G. Programme

4.3 Each semester shall normally consist of 75 working days or 540 periods of each 50 minutes duration, for full-time mode of study or 250 periods for part-time mode of study. The Head of the Institution shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course being taught. For the purpose of calculation of attendance requirement for writing the end semester examinations (as per clause 9) by students, following method shall be used.

$$\text{Percentage of Attendance} = \frac{\text{Total no. of periods attended in all the courses per semester}}{(\text{No. of periods / week as prescribed in the curriculum}) \times 15 \text{ taken together for all courses of the semester}} \times 100$$

End Semester Examinations conducted by the University will be scheduled after the last working day of the semester.

4.4 The minimum prescribed credits required for the award of the degree shall be within the limits specified below:

<b>Programme</b>	<b>Prescribed Credit Range</b>
M.E. / M.Tech.	70 to 75

<b>Programme</b>	<b>Prescribed Credit Range</b>
M.C.A.	115 - 120
M.B.A.	86 - 90

#### 5. COURSE REGISTRATION

5.1 The Institution is responsible for registering the courses that each student is proposing to undergo in the ensuing semester. Each student has to register for all courses to be undergone in the curriculum of a particular semester (with the facility to drop courses to a maximum of 6 credits (vide clause 5.2)). The student can also register for courses for which the student has failed in the earlier semesters.

The registration details of the candidates may be approved by the Head of the Institution and forwarded to the Controller of Examinations. This registration is for undergoing the course as well as for writing the End Semester Examinations.

**The courses that a student registers in a particular semester may include**

- i. Courses of the current semester.
- ii. The core (Theory/Lab /EEC) courses that the student has not cleared in the previous semesters.
- iii. Elective courses which the student failed (either the same elective or a different elective instead).

**5.2 Flexibility to Drop courses**

- 5.2.1 A student has to earn the total number of credits specified in the curriculum of the respective Programme of study in order to be eligible to obtain the degree.
- 5.2.2 From the II to Final semesters, the student has the option of dropping existing courses in a semester during registration. Total number of credits of such courses cannot exceed 6 for PG (Full Time) programmes and cannot exceed 3 for PG (Part Time) programmes.

**6 EVALUATION OF PROJECT WORK**

The evaluation of Project Work for Phase-I & Phase-II in the case of M.E. / M.Tech. and project work of M.B.A and M.C.A shall be done independently in the respective semesters and marks shall be allotted as per the weightages given in Clause 6.1.

- 6.1 There shall be three assessments (each 100 marks) during the Semester by a review committee. The Student shall make presentation on the progress made before the Committee. The Head of the Institution shall constitute the review committee for each branch of study. The total marks obtained in the three assessments shall be reduced to 20 marks and rounded to the nearest integer (as per the Table given below). There will be a vice-voce Examination during End Semester Examinations conducted by a Committee consisting of the supervisor, one internal examiner and one external examiner. The internal examiner and the external examiner shall be appointed by the Controller of Examination. The distribution of marks for the internal assessment and End semester examination is given below:

Internal Assessment (20 Marks)			End Semester Examination (80 Marks)			
Review - I	Review - II	Review - III	Thesis Submission (30 Marks)	Viva – Voce (Rounded to 50 Marks)		
			External Examiner	Internal Examiner	External Examiner	Supervisor Examiner
5	7.5	7.5	30	15	20	15

- 6.2 The Project Report prepared according to approved guidelines as given by Director, Academic Courses and duly signed by the supervisor(s) and the Head of the Department concerned shall be submitted to the Head of the Institution.

- 6.3** If the candidate fails to obtain 50% of the internal assessment marks in the Phase–I and Phase–II / final project, he/she will not be permitted to submit the report for that particular semester and has to re-enroll for the same in the subsequent semester.

If a candidate fails to submit the project report on or before the specified deadline, he/she is deemed to have failed in the Project Work and shall re-enroll for the same in a subsequent semester. This applies to both Phase–I and Phase–II in the case of M.E. / M.Tech. Project Work and the Final Project work of M.B.A. / M.C.A.

If a candidate fails in the end semester examinations of Phase–I, he/she has to resubmit the Project Report within 30 days from the date of declaration of the results. If he / she fails in the End semester examination of Phase–II of Project work of M.E. / M.Tech. or the Final Project work of M.B.A. / M.C.A, he/she shall resubmit the Project Report within 60 days from the date of declaration of the results. The resubmission of a project report and subsequent viva-voce examination will be considered as reappearance with payment of exam fee. For this purpose the same Internal and External examiners shall evaluate the resubmitted report.

- 6.3.1 A copy of the approved Project Report after the successful completion of viva-voce examinations shall be kept in the library of the college / institution.
- 6.3.2 Practical / Industrial Training, Summer Project if specified in the Curriculum shall not exceed the maximum duration of 4 weeks and should be organized by the Head of the Department for every student.
- 6.3.3 At the end of Practical / Industrial Training, Summer Project the candidate shall submit a certificate from the organization where he/she has undergone training and also a brief report. The evaluation for 100 marks will be carried out internally based on this report and a Viva-Voce Examination will be conducted by a Departmental Committee constituted by the Head of the Institution. Certificates submitted by the students shall be attached to the mark list sent by the Head of the Institution to the Controller of Examination.

## **7 CLASS ADVISER**

There shall be a class advisor for each class. The class advisor will be one among the (course-instructors) of the class. He / She will be appointed by the Head of the department concerned. The class advisor is the ex-officio member and the Convener of the class committee. The responsibilities for the class advisor shall be:

- To act as the channel of communication between the HoD and the students of the respective class.
- To collect and maintain various statistical details of students.
- To help the chairperson of the class committee in planning and conduct of the class committee meetings.
- To monitor the academic performance of the students including attendance and to inform the class committee.
- To attend to the students' welfare activities like awards, medals, scholarships and industrial visits.

## **8 CLASS COMMITTEE**

- 8.1 A Class Committee consists of teachers of the concerned class, student representatives and a chairperson who is not teaching the class. It is like the 'Quality Circle' (more commonly used in industries) with the overall goal of improving the teaching-learning process. The functions of the class committee include:

- Solving problems experienced by students in the class room and in the laboratories.
- Clarifying the regulations of the programme and the details of rules therein.
- Informing the student representatives, the “academic schedule” including the dates of assessments and the syllabus coverage for each assessment period.
- Informing the student representatives, the details of regulations regarding the weightage used for each assessment. In the case of practical courses (laboratory / project work / seminar etc.) the breakup of marks for each experiment/ exercise/ module of work, should be clearly discussed in the class committee meeting and informed to the students.
- Analyzing the performance of the students of the class after each test and finding the ways and means of improving the Students Performance
- Identifying the weak students, if any, in any specific subject and requesting the teachers concerned to provide some additional help or guidance or coaching to such weak students as frequently as possible.

8.2 The class committee for a class under a particular programme is normally constituted by the Head of the Department. However, if the students of different programmes are mixed in a class, the class committee is to be constituted by the Head of the Institution.

8.3 The class committee shall be constituted on the first working day of any semester or earlier.

8.4 At least 2 student representatives (usually 1 boy and 1 girl) shall be included in the class committee.

8.5 The chairperson of the class committee shall invite the Class adviser(s) and the Head of the Department to the meeting of the class committee.

8.6 The Head of the Institution may participate in any class committee of the institution.

8.7 The Chairperson of the Class Committee is required to prepare the minutes of every meeting, submit the same to the Head of the Institution within two days of the meeting and arrange to circulate among the concerned students and teachers. If there are some points in the minutes requiring action by the management, the same shall be brought to the notice of the management by the Head of the Institution.

8.8 The first meeting of the class committee shall be held within one week from the date of commencement of the semester in order to inform the students about the nature and weightage of assessments within the framework of the Regulations. Two or three subsequent meetings may be held at suitable intervals. During these meetings the student members, representing the entire class, shall meaningfully interact and express the opinions and suggestions of the class students to improve the effectiveness of the teaching-learning process.

## **9 COURSE COMMITTEE FOR COMMON COURSES**

Each common course offered to more than one group of students shall have a “Course Committee” comprising all the teachers teaching the common course with one of them nominated as Course Coordinator. The nomination of the course Coordinator shall be made by the Head of the Department / Head of the Institution depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The ‘Course committee’ shall meet as often as possible and ensure uniform evaluation of the tests and arrive at a common scheme of evaluation for the tests. Wherever it is feasible, the course committee may also prepare a common question paper for the Assessment Test(s).

## 10 ATTENDANCE REQUIREMENTS FOR COMPLETION OF A SEMESTER

- 10.1 A candidate who has fulfilled the following conditions shall be deemed to have satisfied the attendance requirements for completion of a semester.

Ideally every student is expected to attend all classes and earn 100% attendance. However in order to allow provision for certain unavoidable reasons such as prolonged hospitalization / accident / specific illness the student is expected to earn a minimum of 75% attendance to become eligible to write the End-Semester Examinations.

Therefore, every student shall secure not less than 75% of overall attendance in that semester as per clause 4.3.

- 10.2 However, a candidate who secures overall attendance between 65% and 74% in that current semester due to medical reasons (prolonged hospitalization / accident / specific illness / participation in sports events) may be permitted to appear for the current semester examinations subject to the condition that the candidate shall submit the medical certificate / sports participation certificate to the Head of the Institution. The same shall be forwarded to the Controller of Examinations for record purposes.
- 10.3 Candidates who could secure less than 65% overall attendance and **Candidates who do not satisfy the clauses 10.1 & 10.2** will not be permitted to write the end-semester examination of that current semester and are not permitted to go to next semester. They are required to repeat the incomplete semester in the next academic year.

## 11 PROCEDURES FOR AWARDING MARKS FOR INTERNAL ASSESSMENT(IA)

The maximum marks assigned to different courses shall be as given below:

Each of the theory and practical courses (including project work) shall carry a maximum of 100 marks of which 20 marks will be through internal assessment and the End Semester Examination (ESE) will carry 80 marks.

- 11.1 The marks for the continuous assessment shall be awarded as per the procedure given below:

### (i) Theory Courses:

Three tests each carrying 100 marks shall be conducted during the semester by the Department / College concerned. The total marks obtained in all tests put together out of 300, shall be proportionately reduced for 20 marks and rounded to the nearest integer (This also implies equal weightage to all the three tests).

### (ii) Practical Courses:

The maximum marks for Internal Assessment shall be 20 in case of practical courses. Every practical exercise / experiment shall be evaluated based on conduct of experiment / exercise and records maintained. There shall be at least one test. The criteria for arriving at the Internal Assessment marks of 20 is as follows: 75 marks shall be awarded for successful completion of all the prescribed experiments done in the Laboratory and 25 marks for the test. The total mark shall be reduced to 20 and rounded to the nearest integer.

### (iii) Theory Courses with Laboratory component:

The maximum marks for Internal Assessment shall be 20 in case of theory courses with Laboratory component. For a theory course with Laboratory component, there shall be three assessments: the first two assessments (each with a maximum of 100 marks) will be from theory portions and the third assessment (maximum marks 100) will be for laboratory component. The sum of marks of all three assessments shall be reduced to 20 marks and rounded to the nearest integer.

#### **(iv) Other Employability Enhancement Courses**

- (a)** The seminar / Case study is to be considered as purely INTERNAL (with 100% internal marks only). Every student is expected to present a minimum of 2 seminars per semester before the evaluation committee and for each seminar marks can be equally apportioned. The three member committee appointed by Head of the Institution will evaluate the seminar and at the end of the semester the marks can be consolidated and taken as the final mark. The evaluation shall be based on the seminar paper (40%), presentation (40%) and response to the questions asked during presentation (20%).
- (b)** The Industrial / Practical Training shall carry 100 marks and shall be evaluated through internal assessment only. At the end of Industrial / Practical training / internship / Summer Project, the candidate shall submit a certificate from the organization where he / she has undergone training and a brief report. The evaluation will be made based on this report and a Viva-Voce Examination, conducted internally by a three member Departmental Committee constituted by the Head of the Institution. Certificates submitted by the candidate shall be attached to the mark list sent by the Head of the Department.

#### **11.2 Assessment for Value Added Course**

The one / two credit course shall carry 100 marks and shall be evaluated through **continuous assessments only**. Two Assessments shall be conducted during the semester by the Department concerned. The total marks obtained in the tests shall be reduced to 100 marks and rounded to the nearest integer. A committee consisting of the Head of the Department, staff handling the course and a senior Faculty member nominated by the Head of the Institution shall monitor the evaluation process. The list of students along with the marks and the grades earned may be forwarded to the Controller of Examinations for appropriate action at least one month before the commencement of End Semester Examinations

#### **11.3 Assessment for Online Courses**

Students may be permitted to credit one online course (which are provided with certificate) subject to a maximum of three credits. The approved list of online courses will be provided by the Centre for Academic courses from time to time. **This online course of 3 credits can be considered instead of one elective course**. The student needs to obtain certification or credit to become eligible for writing the End Semester Examination to be conducted by Anna University. **The course shall be evaluated through the End Semester Examination only conducted by Controller of Examinations, Anna University.**

11.4 Internal marks approved by the Head of the Institution shall be displayed by the respective HODs within 5 days from the last working day.

11.5 Every teacher is required to maintain an 'ATTENDANCE AND ASSESSMENT RECORD' which consists of attendance marked in each lecture or practical or project work class, the test marks and the record of class work (topics covered), separately for each course. This should be submitted to the Head of the Department periodically (at least three times in a semester) for checking the syllabus coverage and the records of test marks and attendance. The Head of the department will put his signature and date after due verification. At the end the semester, the record should be verified by the Head of the institution who will keep this document in safe custody (for five years). The university or any inspection team appointed by the University may inspect the records of attendance and assessments of both current and previous semesters.

## **12 REQUIREMENTS FOR APPEARING FOR SEMESTER EXAMINATION**

- 12.1 A candidate shall normally be permitted to appear for the University examinations of the current semester if he/she has satisfied the semester completion requirements as per clause 10.1 & 10.2 and has registered for examination in all courses of the current semester.
- 12.2 Further, registration is mandatory for all the courses in the current semester as well as for arrear(s) course(s) for the university examinations failing which, the candidate will not be permitted to move to the higher semester.
- 12.3 A student who has passed all the courses prescribed in the curriculum for the award of the degree shall not be permitted to re-enroll to improve his/her marks in a course or the aggregate marks / CGPA.

## **13 UNIVERSITY EXAMINATIONS**

- 13.1 There shall be an End- Semester Examination of 3 hours duration in each lecture based course.

The examinations shall ordinarily be conducted between October and December during the odd semesters and between April and June in the even semesters.

For the practical examinations (including project work), both internal and external examiners shall be appointed by the University.

## **13.2 WEIGHTAGE**

The following will be the weightage for different courses.

i) Lecture or Lecture cum Tutorial based course:

Internal Assessment	-	20%
End Semester Examination	-	80%

ii) Laboratory based courses

Internal Assessment	-	20%
End Semester Examination	-	80%

iii) Project work

Internal Assessment	-	20%
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Evaluation of Project Report by external examiner	-	30%
Viva-Voce Examination	-	50%

iv) Practical training / summer project / seminar

Internal Assessment	-	100%
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## **14 PASSING REQUIREMENTS**

- 14.1 A candidate who secures not less than 50% of total marks prescribed for the course with a minimum of 50% of the marks prescribed for each of the course of the End-Semester University Examination in both theory and practical courses shall be declared to have passed in the course and acquired the relevant number of credits.

14.2 If a student fails to secure a pass in theory courses in the current semester examination, he/she is allowed to write arrear examinations for the next three consecutive semesters and their internal marks shall be carried over for the above mentioned period of three consecutive semesters.

In case, if he/she has not successfully completed all the courses of semester I at the end of semester IV, he/she shall redo the semester I courses along with regular students. For the subsequent semesters of II, III and IV, the same procedure shall be followed, subject to the maximum permissible period for this programme.

For MCA programme, to register for courses in V and VI semesters, the student should have successfully completed all the courses of I and II semesters respectively. In case, if he/she has not successfully completed all the courses of semester III at the end of semester VI, he/she shall redo the semester III courses along with regular students. For the subsequent semesters of IV, V and VI, the same procedure shall be followed, subject to the maximum permissible period for this programme.

14.3 If a student fails to secure a pass in a laboratory course, **the student shall register** for the course again, when offered next.

14.4 If a student fails to secure a pass in project work even after availing clause (6.3), **the student shall register** for the course again, when offered next.

14.5 The passing requirement for the courses which are assessed only through purely internal assessment (EEC courses except project work), is 50% of the internal assessment marks only.

14.6 A student can apply for revaluation of the student's semester examination answer paper in a theory course, within 2 weeks from the declaration of results, on payment of a prescribed fee along with prescribed application to the COE through the Head of the Institution. The COE will arrange for the revaluation and the results will be intimated to the student concerned through the Head of the Institution. Revaluation is not permitted for laboratory course and project work.

## 15 AWARD OF LETTER GRADES

15.1 All assessments of a course will be evaluated on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the candidate in each subject as detailed below:

Letter Grade	Grade Points	Marks Range
O (Outstanding)	10	91 - 100
A + (Excellent)	9	81 - 90
A (Very Good)	8	71 - 80
B + (Good)	7	61 - 70
B (Average)	6	50 - 60
RA	0	<50
SA (Shortage of Attendance)	0	
W	0	

A student is deemed to have passed and acquired the corresponding credits in a particular course if he/she obtains any one of the following grades: "O", "A+", "A", "B+", "B".

'SA' denotes shortage of attendance (as per clause 10.3) and hence prevention from writing the end semester examinations. 'SA' will appear only in the result sheet.

"RA" denotes that the student has failed to pass in that course. "W" denotes **withdrawal** from the exam for the particular course. The grades RA and W will figure both in Marks Sheet as well as in Result Sheet). In both cases the student has to earn Continuous Assessment marks and appear for the End Semester Examinations.

If the grade W is given to course, the attendance requirement need not be satisfied.

If the grade RA is given to a core **theory course**, the attendance requirement need not be satisfied, but if the grade RA is given to a **Laboratory Course/ Project work / Seminar and any other EEC course**, the attendance requirements (vide clause 10) should be satisfied.

**15.2** The grades O, A+, A, B+, B obtained for the one credit course shall figure in the Mark sheet under the title '**Value Added Courses**'. The Courses for which the grades are RA, SA **will not figure in the mark sheet.**

**15.3 GRADE SHEET**

After results are declared, Grade Sheets will be issued to each student which will contain the following details:

- The college in which the candidate has studied.
- The list of courses enrolled during the semester and the grades scored.
- The Grade Point Average (GPA) for the semester and
- The Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

GPA for a semester is the ratio of the sum of the products of the number of credits for courses acquired and the corresponding points to the sum of the number of credits for the courses acquired in the semester. CGPA will be calculated in a similar manner, considering all the courses registered from first semester. RA grades will be excluded for calculating GPA and CGPA.

$$\text{GPA / CGPA} = \frac{\sum_{i=1}^n C_i GP_i}{\sum_{i=1}^n C_i}$$

where

**C<sub>i</sub>** is the number of credits assigned to the course

**GP<sub>i</sub>** is the Grade point corresponding to the grade obtained for each Course

**n** is number of all Courses successfully cleared during the particular semester in the case of GPA and during all the semesters in the case of **CGPA**.

## 16 ELIGIBILITY FOR THE AWARD OF THE DEGREE

- 16.1 A student shall be declared to be eligible for the award of the PG Degree (M.E./ M.Tech., M.C.A., M.B.A.) provided the student has
- i. Successfully gained the required number of total credits as specified in the curriculum corresponding to the student's programme within the stipulated time.
  - ii. **a. M.E./ M.Tech., M.B.A.(Full Time)**  
Successfully completed the course requirements, appeared for the End-Semester examinations and passed all the subjects prescribed in all the 4 semesters within a maximum period of 4 years reckoned from the commencement of the first semester to which the candidate was admitted.
  - b. M.E./ M.Tech., M.B.A.(Part Time) and M.C.A.(Full Time)**  
Successfully completed the course requirements, appeared for the End-Semester examinations and passed all the subjects prescribed in all the 6 semesters within a maximum period of 6 years reckoned from the commencement of the first semester to which the candidate was admitted.
  - iii. Successfully passed any additional courses prescribed by the Director, Academic Courses whenever readmitted under regulations other than R-2017 (vide clause **19.3**)
  - iv. No disciplinary action pending against the student.
  - v. The award of Degree must have been approved by the Syndicate of the University.

## 17 CLASSIFICATION OF THE DEGREE AWARDED

### 17.1 FIRST CLASS WITH DISTINCTION:

A Student who satisfies the following conditions shall be declared to have passed the examination in **First class with Distinction**:

#### **M.E. / M.Tech. M.B.A.(Full Time)**

- Should have passed the examination in all the courses of all the four semesters in the student's First Appearance within **three** years, which includes authorised break of study of one year (if availed). Withdrawal from examination (vide Clause 18) will not be considered as an appearance.
- Should have secured a CGPA of not less than **8.50**.
- Should NOT have been prevented from writing end Semester examination due to lack of attendance in any of the courses.

#### **M.E. / M.Tech. M.B.A.(Part Time) and M.C.A (Full Time)**

- Should have passed the examination in all the courses of all the six semesters in the student's First Appearance within **four** years, which includes authorised break of study of one year (if availed). Withdrawal from examination (vide Clause 18) will not be considered as an appearance.
- Should have secured a CGPA of not less than **8.50**.
- Should NOT have been prevented from writing end Semester examination due to lack of attendance in any of the courses.

## 17.2 **FIRST CLASS:**

A student who satisfies the following conditions shall be declared to have passed the examination in **First class**:

### **M.E. / M.Tech. M.B.A.(Full Time)**

- Should have passed the examination in all the courses of all four semesters **within three years** , which includes one year of authorized break of study (if availed) or prevention from writing the End Semester Examination due to lack of attendance (if applicable).
- Should have secured a CGPA of not less than **7.00**.

### **M.E. / M.Tech. M.B.A. (Part Time) and M.C.A (Full Time)**

- Should have passed the examination in all the courses of all six semesters **within four years** , which includes one year of authorized break of study (if availed) or prevention from writing the End Semester Examination due to lack of attendance (if applicable).
- Should have secured a CGPA of not less than **7.00**.

## 17.3 **SECOND CLASS:**

All other students (not covered in clauses 17.1 and 17.2) who qualify for the award of the degree (vide Clause 16.1) shall be declared to have passed the examination in **Second Class**.

17.4 A student who is absent in End Semester Examination in a course / project work after having registered for the same shall be considered to have appeared in that examination (except approved withdrawal from end semester examinations as per clause 18) for the purpose of classification.

## 17.5 **Photocopy / Revaluation**

A candidate can apply for photocopy of his/her semester examination answer paper in a theory course, within 2 weeks from the declaration of results, on payment of a prescribed fee through proper application to the Controller of Examinations through the Head of Institutions. The answer script is to be valued and justified by a faculty member, who handled the subject and recommend for revaluation with breakup of marks for each question. Based on the recommendation, the candidate can register for the revaluation through proper application to the Controller of Examinations. The Controller of Examinations will arrange for the revaluation and the results will be intimated to the candidate concerned through the Head of the Institutions. Revaluation is not permitted for practical courses and for project work.

A candidate can apply for revaluation of answer scripts for not exceeding 5 subjects at a time.

## 17.6 **Review**

Candidates not satisfied with Revaluation can apply for Review of his/ her examination answer paper in a theory course, within the prescribed date on payment of a prescribed fee through proper application to Controller of Examination through the Head of the Institution.

Candidates applying for Revaluation only are eligible to apply for Review.

## 18 **PROVISION FOR WITHDRAWAL FROM EXAMINATION:**

18.1 A student may, for valid reasons, (medically unfit / unexpected family situations / sports approved by Chairman, sports board and HOD) be granted permission to withdraw from appearing for the end semester examination in any course or courses in **ANY ONE** of the semester examinations during the entire duration of the degree programme. The application shall be sent to Director, Student Affairs through the Head of the Institutions with required documents.

- 18.2 Withdrawal application is valid if the student is otherwise eligible to write the examination (Clause 10) and if it is made within TEN days prior to the commencement of the examination in that course or courses and recommended by the Head of the Institution and approved by the Controller of Examinations.
- 18.2.1 Notwithstanding the requirement of mandatory 10 days notice, applications for withdrawal for special cases under extraordinary conditions will be considered on the merit of the case.
- 18.3 In case of withdrawal from a course / courses (Clause 12) the course will figure both in Marks Sheet as well as in Result Sheet. **Withdrawal essentially requires the student to register for the course/courses** The student has to register for the course, fulfill the attendance requirements (vide clause 10), earn continuous assessment marks and attend the end semester examination. However, withdrawal shall not be construed as an appearance for the eligibility of a candidate for First Class with Distinction.
- 18.4 Withdrawal is permitted for the end semester examinations in the final semester only if the period of study the student concerned does not exceed 3 years as per clause 17.1.

## **19 AUTHORIZED BREAK OF STUDY FROM A PROGRAMME**

- 19.1 A student is permitted to go on break of study for a maximum period of one year as a single spell.
- 19.2 Break of Study shall be granted only once for valid reasons for a maximum of one year during the entire period of study of the degree programme. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for break of study. If a candidate intends to temporarily discontinue the programme in the middle of the semester for valid reasons, and to rejoin the programme in a subsequent year, permission may be granted based on the merits of the case provided he / she applies to the Director, Student Affairs in advance, but not later than the last date for registering for the end semester examination of the semester in question, through the Head of the Institution stating the reasons therefore and the probable date of rejoining the programme.
- 19.3 The candidates permitted to rejoin the programme after break of study / prevention due to lack of attendance, shall be governed by the Curriculum and Regulations in force at the time of rejoining. The students rejoining in new Regulations shall apply to the Director, Academic Courses in the prescribed format through Head of the Institution at the beginning of the readmitted semester itself for prescribing additional courses, if any, from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.
- 19.4 The authorized break of study would not be counted towards the duration specified for passing all the courses for the purpose of classification (vide Clause 17.1).
- 19.5 The total period for completion of the Programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 4.1 irrespective of the period of break of study in order that he/she may be eligible for the award of the degree.
- 19.6 If any student is prevented for want of required attendance, the period of prevention shall not be considered as authorized 'Break of Study' (Clause 19.1)

## **20 DISCIPLINE**

- 20.1 Every student is required to observe disciplined and decorous behavior both inside and outside the college and not to indulge in any activity which will tend to bring down the prestige of the University / College. The Head of Institution shall constitute a disciplinary committee consisting of Head of Institution, Two Heads of Department of which one should be from the faculty of the student, to enquire into acts of indiscipline and notify the University about the disciplinary action

recommended for approval. In case of any serious disciplinary action which leads to suspension or dismissal, then a committee shall be constituted including one representative from Anna University, Chennai. In this regard, the member will be nominated by the University on getting information from the Head of the Institution.

20.2 If a student indulges in malpractice in any of the University / internal examination he / she shall be liable for punitive action as prescribed by the University from time to time.

## **21 REVISION OF REGULATIONS, CURRICULUM AND SYLLABI**

The University may from time to time revise, amend or change the Regulations, Curriculum, Syllabus and scheme of examinations through the Academic Council with the approval of Syndicate.

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**ANNA UNIVERSITY, CHENNAI**  
**AFFILIATED INSTITUTIONS**  
**REGULATIONS – 2017**  
**CHOICE BASED CREDIT SYSTEM**  
**MASTER OF BUSINESS ADMINISTRATION (GENERAL)**

**PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) :**

MBA programme curriculum is designed to prepare the post graduate students

- I. To have a thorough understanding of the core aspects of the business.
- II. To provide the learners with the management tools to identify, analyze and create business opportunities as well as solve business problems.
- III. To prepare them to have a holistic approach towards management functions.
- IV. To motivate them for continuous learning.
- V. To inspire and make them practice ethical standards in business.

**PROGRAMME OUTCOMES (POs):**

On successful completion of the programme,

1. Ability to apply the business acumen gained in practice.
2. Ability to understand and solve managerial issues.
3. Ability to communicate and negotiate effectively, to achieve organizational and individual goals.
4. Ability to upgrade their professional and managerial skills in their workplace.
5. Ability to explore and reflect about managerial challenges, develop informed managerial decisions in a dynamically unstable environment.
6. Ability to take up challenging assignments.
7. Ability to understand one's own ability to set achievable targets and complete them.
8. Ability to pursue lifelong learning.
9. To have a fulfilling business career.

Programme Educational Objectives	Programme Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
I	✓	✓					✓		
II				✓	✓	✓			
III	✓		✓		✓	✓	✓		
IV				✓		✓	✓	✓	
V		✓	✓					✓	✓

			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	
<b>YEAR 1</b>	<b>SEM 1</b>	Principles of Management	✓	✓	✓		✓					
		Accounting for Management	✓			✓						
		Economic Analysis for Business	✓	✓							✓	✓
		Legal Aspects of Business	✓									
		Organizational Behaviour	✓		✓							
		Statistics for Management	✓									
		Total Quality Management				✓	✓					✓
		Spoken and Written Communication	✓		✓							
	<b>SEM 2</b>	Applied Operations Research		✓				✓		✓		
		Business Research Methods		✓				✓		✓		
		Financial Management	✓	✓		✓	✓			✓		✓
		Human Resource Management	✓	✓		✓	✓			✓		✓
		Information Management	✓	✓		✓	✓			✓		✓
		Operations Management	✓	✓		✓	✓			✓		✓
		Marketing Management		✓		✓	✓			✓		
Data Analysis and Business Modeling					✓	✓	✓				✓	
<b>YEAR 2</b>	<b>SEM 3</b>	International Business Management				✓	✓				✓	
		Strategic Management	✓	✓		✓	✓	✓	✓	✓	✓	
		Elective I	Given below for each stream/Specialization									
		Elective II										
		Elective III										
		Elective IV										
		Elective V										
		Elective VI										
	Summer Training	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	<b>SEM 4</b>	Project Work	✓	✓	✓	✓	✓	✓	✓	✓	✓	

			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
	<b>Stream/ Specialization : Marketing Management</b>										
	Brand Management		✓		✓		✓			✓	✓
	Consumer Behaviour		✓				✓	✓	✓	✓	✓
	Customer Relationship Management		✓				✓	✓	✓	✓	✓
	Integrated Marketing Communication		✓		✓		✓				✓
	Retail Marketing		✓		✓		✓			✓	✓
	Services Marketing		✓				✓	✓	✓		✓
	Social Marketing		✓				✓	✓	✓	✓	✓
	<b>Stream/ Specialization : Financial Management</b>										
	Banking Financial Services Management		✓		✓		✓			✓	✓
	Corporate Finance		✓		✓	✓				✓	✓
	Derivatives Management		✓		✓				✓	✓	✓
	Merchant Banking and Financial Services		✓		✓		✓			✓	✓
	Security Analysis and Portfolio Management		✓				✓				✓
	Strategic Investment and Financing Decisions		✓		✓			✓		✓	✓
	International Trade Finance		✓		✓		✓			✓	✓
	<b>Stream/ Specialization : Human Resource Management</b>										
	Entrepreneurship Development		✓		✓		✓			✓	✓
	Industrial Relations and Labour Welfare		✓		✓		✓			✓	✓
	Labour Legislations		✓		✓			✓			✓
	Managerial Behaviour and Effectiveness				✓		✓			✓	✓
	Organizational Theory, Design and Development		✓		✓		✓			✓	✓
	Strategic Human Resource Management				✓			✓			✓
	<b>Stream/ Specialization : Systems Management</b>										
	Advanced Database Management System		✓	✓	✓		✓	✓	✓		✓
	Data mining for Business Intelligence		✓		✓			✓			✓
	E-Business Management		✓					✓			✓

		Software Project Management and Quality								
		Enterprise Resource Planning	✓				✓			✓ ✓
	<b>Stream/ Specialization : Operations Management</b>									
		Logistics Management	✓		✓					✓ ✓
		Materials Management	✓				✓			✓
		Product Design	✓		✓		✓			✓
		Project Management	✓		✓		✓			✓ ✓
		Services Operations Management	✓		✓		✓			✓
		Supply Chain Management	✓		✓		✓			✓ ✓

**ANNA UNIVERSITY, CHENNAI**  
**AFFILIATED INSTITUTIONS**  
**REGULATIONS – 2017**  
**CHOICE BASED CREDIT SYSTEM**  
**MASTER OF BUSINESS ADMINISTRATION (FULL TIME)**  
**CURRICULA AND SYLLABI I TO IV SEMESTERS**  
**SEMESTER - I**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	BA5101	Economic Analysis for Business	PC	4	4	0	0	4
2.	BA5102	Principles of Management	PC	3	3	0	0	3
3.	BA5103	Accounting for Management	PC	4	4	0	0	4
4.	BA5104	Legal Aspects of Business	PC	3	3	0	0	3
5.	BA5105	Organizational Behaviour	PC	3	3	0	0	3
6.	BA5106	Statistics for Management	PC	3	3	0	0	3
7.	BA5107	Total Quality Management	PC	3	3	0	0	3
<b>PRACTICALS</b>								
8	BA5111	Spoken and Written Communication #	EEC	4	0	0	4	2
<b>TOTAL</b>				<b>27</b>	<b>23</b>	<b>0</b>	<b>4</b>	<b>25</b>

# No end semester examination is required for this course.

**SEMESTER - II**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	BA5201	Applied Operations Research	PC	3	3	0	0	3
2.	BA5202	Business Research Methods	PC	3	3	0	0	3
3.	BA5203	Financial Management	PC	3	3	0	0	3
4.	BA5204	Human Resource Management	PC	3	3	0	0	3
5.	BA5205	Information Management	PC	3	3	0	0	3
6.	BA5206	Operations Management	PC	3	3	0	0	3
7	BA5207	Marketing Management	PC	4	4	0	0	4
<b>PRACTICALS</b>								
8	BA5211	Data Analysis and Business Modelling	EEC	4	0	0	4	2
<b>TOTAL</b>				<b>26</b>	<b>22</b>	<b>0</b>	<b>4</b>	<b>24</b>

**SUMMER SEMESTER (4 WEEKS)**

**SUMMER TRAINING**

Summer Training – The training report along with the company certificate should be submitted within the two weeks of the reopening date of 3<sup>rd</sup> semester. The training report should be around 40 pages containing the details of training undergone, the departments wherein he was trained with duration (chronological diary), along with the type of managerial skills developed during training. The training report should be sent to the Controller of Examinations by the HOD through the Principal, before the last working day of the 3<sup>rd</sup> Semester.

**SEMESTER - III**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	BA5301	International Business Management	PC	3	3	0	0	3
2	BA5302	Strategic Management	PC	3	3	0	0	3
3		Professional Elective I ***	PE	3	3	0	0	3
4		Professional Elective II***	PE	3	3	0	0	3
5		Professional Elective III***	PE	3	3	0	0	3
6		Professional Elective IV***	PE	3	3	0	0	3
7		Professional Elective V***	PE	3	3	0	0	3
8		Professional Elective VI***	PE	3	3	0	0	3
<b>PRACTICALS</b>								
9	BA5311	Summer Training	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>26</b>	<b>24</b>	<b>0</b>	<b>2</b>	<b>25</b>

\*\*\* Chosen electives should be from two streams of management of three electives each.

**SEMESTER - IV**

SI. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>PRACTICALS</b>								
1.	BA5411	Project Work	EEC	24	0	0	24	12
<b>TOTAL</b>				<b>0</b>	<b>0</b>	<b>24</b>	<b>12</b>	

**TOTAL NO. OF CREDITS:86**

**PROFESSIONAL CORE (PC)**

<b>SL. NO.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>CONTACT PERIODS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1.		Principles of Management	PC	3	3	0	0	3
2.		Accounting for Management	PC	4	4	0	0	4
3.		Economic Analysis for Business	PC	4	4	0	0	4
4.		Legal Aspects of Business	PC	3	3	0	0	3
5.		Organizational Behaviour	PC	3	3	0	0	3
6.		Statistics for Management	PC	3	3	0	0	3
7.		Marketing Management	PC	4	4	0	0	4
8.		Spoken and Written Communication	PC	4	0	0	4	2
9.		Applied Operations Research	PC	3	3	0	0	3
10.		Business Research Methods	PC	3	3	0	0	3
11.		Strategic Management	PC	3	3	0	0	3
12.		Financial Management	PC	3	3	0	0	3
13.		Human Resource Management	PC	3	3	0	0	3
14.		Information Management	PC	3	3	0	0	3
15.		Operations Management	PC	3	3	0	0	3
16.		International Business Management	PC	3	3	0	0	3
17.		Total Quality Management	PC	3	3	0	0	3

## PROFESSIONAL ELECTIVES (PE)

### FUNCTIONAL SPECIALIZATIONS

1. Students can take three elective subjects from two functional specializations
- Or
2. Students can take six elective subjects from any one sectoral specializations

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>Stream/ Specialization : Marketing Management</b>								
1.	BA5001	Brand Management	PE	3	3	0	0	3
2.	BA5002	Consumer Behaviour	PE	3	3	0	0	3
3.	BA5003	Customer Relationship Management	PE	3	3	0	0	3
4.	BA5004	Integrated Marketing Communication	PE	3	3	0	0	3
5.	BA5005	Retail Marketing	PE	3	3	0	0	3
6.	BA5006	Services Marketing	PE	3	3	0	0	3
7.	BA5007	Social Marketing	PE	3	3	0	0	3
<b>Stream/ Specialization : Financial Management</b>								
8.	BA5008	Banking Financial Services Management	PE	3	3	0	0	3
9.	BA5009	Corporate Finance	PE	3	3	0	0	3
10.	BA5010	Derivatives Management	PE	3	3	0	0	3
11.	BA5011	Merchant Banking and Financial Services	PE	3	3	0	0	3
12.	BA5012	Security Analysis and Portfolio Management	PE	3	3	0	0	3
13.	BA5013	Strategic Investment and Financing Decisions	PE	3	3	0	0	3
14.	BA5031	International Trade Finance	PE	3	3	0	0	3
<b>Stream/ Specialization : Human Resource Management</b>								
15.	BA5014	Entrepreneurship Development	PE	3	3	0	0	3
16.	BA5015	Industrial Relations and Labour Welfare	PE	3	3	0	0	3
17.	BA5016	Labour Legislations	PE	3	3	0	0	3
18.	BA5017	Managerial	PE	3	3	0	0	3

		Behaviour and Effectiveness						
19.	BA5018	Organizational Theory, Design and Development	PE	3	3	0	0	3
20.	BA5019	Strategic Human Resource Management	PE	3	3	0	0	3
<b>Stream/ Specialization : Systems Management</b>								
21.	BA5020	Advanced Database Management System	PE	3	3	0	0	3
22.	BA5021	Datamining for Business Intelligence	PE	3	3	0	0	3
23.	BA5022	Enterprise Resource Planning	PE	3	3	0	0	3
24.	BA5023	Software Project Management and Quality	PE	3	3	0	0	3
25.	BA5024	E-Business Management	PE	3	3	0	0	3
<b>Stream/ Specialization : Operations Management</b>								
26.	BA5025	Logistics Management	PE	3	3	0	0	3
27.	BA5026	Materials Management	PE	3	3	0	0	3
28.	BA5027	Product Design	PE	3	3	0	0	3
29.	BA5028	Project Management	PE	3	3	0	0	3
30.	BA5029	Services Operations Management	PE	3	3	0	0	3
31.	BA5030	Supply Chain Management	PE	3	3	0	0	3

## SECTORAL SPECIALIZATIONS

1. Students can take three electives subjects from two functional specializations  
or
2. Students can take six elective subjects from any one sectoral specializations

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>Sectoral Specialization : Logistics and Supply Chain Management</b>								
1.	BA5051	Supply Chain Concepts and Planning	PE	3	3	0	0	3
2.	BA5052	Sourcing and Supply Management	PE	3	3	0	0	3
3.	BA5053	Supply Chain Inventory Management	PE	3	3	0	0	3
4.	BA5054	Supply Chain Information System	PE	3	3	0	0	3
5.	BA5055	Warehouse Management	PE	3	3	0	0	3
6.	BA5056	Transportation and Distribution Management	PE	3	3	0	0	3
7.	BA5057	Reverse and Contract Logistics	PE	3	3	0	0	3
8.	BA5058	Air Cargo Management	PE	3	3	0	0	3
9.	BA5059	Containerization and Allied Business	PE	3	3	0	0	3
10.	BA5060	Exim Management	PE	3	3	0	0	3
11.	BA5061	Fundamentals of Shipping	PE	3	3	0	0	3
12.	BA5062	Port and Terminal Management	PE	3	3	0	0	3
<b>Sectoral Specialization :Infrastructure and Real Estate Management</b>								
13.	BA5063	Infrastructure Planning Scheduling and Control	PE	3	3	0	0	3
14.	BA5064	Contracts and Arbitration	PE	3	3	0	0	3
15.	BA5065	Project Management for Infrastructure	PE	3	3	0	0	3
16.	BA5066	Management of Human Resources, Safety and Quality	PE	3	3	0	0	3
17.	BA5067	Disaster Mitigation and Management	PE	3	3	0	0	3
18.	BA5068	Economics and Financial Management in Construction	PE	3	3	0	0	3
19.	BA5069	Urban Environmental Management	PE	3	3	0	0	3
20.	BA5070	Smart Materials, Techniques and Equipments for Infrastructure	PE	3	3	0	0	3
21.	BA5071	Strategic Airport Infrastructure Management	PE	3	3	0	0	3
22.	BA5072	Real Estate Marketing and Management	PE	3	3	0	0	3
23.	BA5073	Infrastructure and Real Estate Entrepreneurship	PE	3	3	0	0	3
24.	BA5074	Valuation of Real Estate and Infrastructure Assets	PE	3	3	0	0	3

**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

<b>SL. NO.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>CONTACT PERIODS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1.	BA5111	Spoken and Written Communication #	EEC	4	0	0	4	2
2.	BA5211	Data Analysis and Business Modeling	EEC	4	0	0	4	2
3.	BA5311	Summer Training	EEC	2	0	0	2	1
4.	BA5411	Project Work	EEC	24	0	0	24	12

**OBJECTIVES:**

- To introduce the concepts of scarcity and efficiency; to explain principles of micro economics relevant to managing an organization; to describe principles of macro economics to have the understanding of economic environment of business.

**UNIT I INTRODUCTION****8**

The themes of economics – scarcity and efficiency – three fundamental economic problems – society's capability – Production possibility frontiers (PPF) – Productive efficiency Vs economic efficiency – economic growth & stability – Micro economies and Macro economies – the role of markets and government – Positive Vs negative externalities.

**UNIT II CONSUMER AND PRODUCER BEHAVIOUR****13**

Market – Demand and Supply – Determinants – Market equilibrium – elasticity of demand and supply – consumer behaviour – consumer equilibrium – Approaches to consumer behaviour – Production – Short-run and long-run Production Function – Returns to scale – economies Vs diseconomies of scale – Analysis of cost – Short-run and long-run cost function – Relation between Production and cost function.

**UNIT III PRODUCT AND FACTOR MARKET****13**

Product market – perfect and imperfect market – different market structures – Firm's equilibrium and supply – Market efficiency – Economic costs of imperfect competition – factor market – Land, Labour and capital – Demand and supply – determination of factor price – Interaction of product and factor market – General equilibrium and efficiency of competitive markets.

**UNIT IV PERFORMANCE OF AN ECONOMY – MACRO ECONOMICS****13**

Macro-economic aggregates – circular flow of macroeconomic activity – National income determination – Aggregate demand and supply – Macroeconomic equilibrium – Components of aggregate demand and national income – multiplier effect – Demand side management – Fiscal policy in theory.

**UNIT V AGGREGATE SUPPLY AND THE ROLE OF MONEY****13**

Short-run and Long-run supply curve – Unemployment and its impact – Okun's law – Inflation and the impact – reasons for inflation – Demand Vs Supply factors – Inflation Vs Unemployment tradeoff – Phillips curve – short-run and long-run – Supply side Policy and management – Money market – Demand and supply of money – money-market equilibrium and national income – the role of monetary policy.

**TOTAL: 60 PERIODS****OUTCOMES:**

- Students are expected to become familiar with both principles of micro and macro economics. They would also become familiar with application of these principles to appreciate the functioning of both product and input markets as well as the economy.

**REFERENCES :**

- Paul A. Samuelson, William D. Nordhaus, Sudip Chaudhuri and Anindya Sen, Economics, 19<sup>th</sup> edition, Tata McGraw Hill, New Delhi, 2010.
- William Boyes and Michael Melvin, Textbook of economics, Biztantra, 9<sup>th</sup> Edition, 2012.
- N. Gregory Mankiw, Principles of Economics, 7th edition, Cengage, New Delhi, 2014
- Richard Lipsey and Alec Charystal, Economics, 12<sup>th</sup> edition, Oxford, University Press, New Delhi, 2011.
- Karl E. Case and Ray C. Fair, Principles of Economics, 12th edition, Pearson, Education Asia, New Delhi, 2014.

**OBJECTIVES:**

- To familiarize the students to the basic concepts of management in order to aid in understanding how an organization functions, and in understanding the complexity and wide variety of issues managers face in today's business firms.

**UNIT I INTRODUCTION TO MANAGEMENT 9**

Organization- Management- Role of managers- Evolution of management thought- Organization and the environmental factors- Managing globally- Strategies for International business.

**UNIT II PLANNING 9**

Nature and purpose of planning- Planning process- Types of plans- Objectives- Managing by Objective (MBO) strategies- Types of strategies – Policies – Decision Making- Types of decision- Decision making process- Rational decision making process- Decision making under different conditions.

**UNIT III ORGANISING 9**

Nature and purpose of organizing- Organization structure- Line and staff authority- Departmentation- Span of control- Centralization and decentralization- Delegation of authority- Staffing- Selection and Recruitment- Career development- Career stages- Training- Performance appraisal

**UNIT IV DIRECTING 9**

Managing people- Communication- Hurdles to effective communication- Organization culture- Elements and types of culture- Managing cultural diversity.

**UNIT V CONTROLLING 9**

Process of controlling- Types of control- Budgetary and non-budgetary control techniques - Managing productivity- Cost control- Purchase control- Maintenance control- Quality control- Planning operations.

**TOTAL: 45 PERIODS****OUTCOMES:**

- The students should be able to describe and discuss the elements of effective management,
- discuss and apply the planning, organizing and control processes,
- describe various theories related to the development of leadership skills, motivation techniques, team work and effective communication,
- communicate effectively through both oral and written presentation.

**REFERENCES:**

- Andrew J. Dubrin, Essentials of Management, Thomson Southwestern, 9<sup>th</sup> edition, 2012.
- Samuel C. Certo and Tervis Certo, Modern management: concepts and skills, Pearson education, 12<sup>th</sup> edition, 2012.
- Harold Koontz and Heinz Weihrich, Essentials of management: An International & Leadership Perspective, 9<sup>th</sup> edition, Tata McGraw-Hill Education, 2012.
- Don Hellriegel, Susan E. Jackson and John W. Slocum, Management- A competency-based approach, Thompson South Western, 11<sup>th</sup> edition, 2008.
- Heinz Weihrich, Mark V Cannice and Harold Koontz, Management- A global entrepreneurial perspective, Tata McGraw Hill, 13<sup>th</sup> edition, 2010.
- Stephen P. Robbins, David A. De Cenzo and Mary Coulter, Fundamentals of Management, Prentice Hall of India, 2012.

**OBJECTIVES :**

- Acquire a reasonable knowledge in accounts
- Analysis and evaluate financial statements

**UNIT I FINANCIAL ACCOUNTING****12**

Introduction to Financial, Cost and Management Accounting- Generally accepted accounting principles, Conventions and Concepts-Balance sheet and related concepts- Profit and Loss account and related concepts - Introduction to inflation accounting- Introduction to human resources accounting.

**UNIT II COMPANY ACCOUNTS****12**

Meaning of Company -Maintenance of Books of Account-Statutory Books- Profit or Loss Prior to incorporation- Final Accounts of Company- Alteration of share capital- Preferential allotment, Employees stock option- Buyback of securities.

**UNIT III ANALYSIS OF FINANCIAL STATEMENTS****12**

Analysis of financial statements – Financial ratio analysis, cash flow (as per Accounting Standard 3) and funds flow statement analysis.

**UNIT IV COST ACCOUNTING****12**

Cost Accounts - Classification of manufacturing costs - Accounting for manufacturing costs. Cost Accounting Systems: Job order costing - Process costing- Activity Based Costing- Costing and the value chain- Target costing- Marginal costing including decision making- Budgetary Control & Variance Analysis - Standard cost system.

**UNIT V ACCOUNTING IN COMPUTERISED ENVIRONMENT****12**

Significance of Computerised Accounting System- Codification and Grouping of Accounts-Maintaining the hierarchy of ledgers- Prepackaged Accounting software.

**TOTAL: 45+15 = 60 PERIODS****OUTCOME**

- Possess a managerial outlook at accounts.

**REFERENCES :**

1. M.Y.Khan & P.K.Jain, Management Accounting, Tata McGraw Hill, 2011.
2. R.Narayanaswamy, Financial Accounting – A managerial perspective, PHI Learning, New Delhi, 2011.
3. Jan Williams, Financial and Managerial Accounting – The basis for business Decisions, 15<sup>th</sup> edition, Tata McGraw Hill Publishers, 2010.
4. Horngren, Surdem, Stratton, Burgstahler, Schatzberg, Introduction to Management Accounting, PHI Learning, 2011.
5. Stice & Stice, Financial Accounting Reporting and Analysis, 8<sup>th</sup> edition, Cengage, 2010.
6. Singhvi Bodhanwala, Management Accounting -Text and cases, PHI Learning, 2009.
7. Ashish K. Battacharya, Introduction to Financial Statement Analysis, Elsevier, 2009.
8. Sawyers, Jackson, Jenkins, Arora, Managerial Accounting, 2<sup>nd</sup> edition, Cengage, 2011
9. Godwin, Alderman, Sanyal , Financial Accounting, 2<sup>nd</sup> edition, Cengage, 2011
10. Narashiman.M.S, Financial statement analysis, Cengage, 2016.

**OBJECTIVE:**

- To create the knowledge of Legal perspective and its practices to improvise the business.

**UNIT I COMMERCIAL LAW 9****THE INDIAN CONTRACT ACT 1872**

Definition of contract, essentials elements and types of a contract, Formation of a contract, performance of contracts, breach of contract and its remedies, Quasi contracts - Contract Of Agency: Nature of agency, Creation and types of agents, Authority and liability of Agent and principal: Rights and duties of principal and agents, termination of agency.

**THE SALE OF GOODS ACT 1930**

Nature of Sales contract, Documents of title, risk of loss, Guarantees and Warranties, performance of sales contracts, conditional sales and rights of an unpaid seller - Negotiable Instruments Act 1881: Nature and requisites of negotiable instruments. Types of negotiable instruments, liability of parties, holder in due course, special rules for Cheque and drafts, discharge of negotiable instruments-GST

**UNIT II COMPANY LAW 2013 (amended on 03.05.18) 9**

Major principles – Nature and types of companies, Formation, Memorandum and Articles of Association, Prospectus, Power, duties and liabilities of Directors, winding up of companies, Corporate Governance. Amendments of Companies Act, 2013

**UNIT III INDUSTRIAL LAW 9**

An Overview of Factories Act - Payment of Wages Act - Payment of Bonus Act - Industrial Disputes Act.

**UNIT IV CORPORATE TAX AND GST (amended on 03.05.18) 9**

Corporate Tax planning, Income Tax, Goods and Services Tax – Introduction, Objective, Classification and practical implications of GST

**UNIT V CONSUMER PROTECTION ACT AND INTRODUCTION OF CYBER LAWS 9**

Consumer Protection Act – Consumer rights, Procedures for Consumer grievances redressal, Types of consumer Redressal Mechanism and Forums- Competition Act 2002 - Cyber crimes, IT Act 2000 and 2008, Cyber Laws, Introduction of IPR – Copy rights, Trade marks, Patent Act.

**TOTAL: 45 PERIODS****OUTCOME:**

- Legal insight will be established in the business practices according to the situation of changing environment.

**TEXT BOOKS**

1. Kapoor, N. D.; Elements of Mercantile Law, 30th edition, Sultan Chand & Sons, NewDelhi,2015
2. P. K. Goel, Business Law for Managers, Biztantatara Publishers, India, 2008.
3. Akhileshwar Pathack, Legal Aspects of Business, 4th Edition, Tata McGraw Hill, 2009.
4. P. P. S. Gogna, Mercantile Law, S. Chand & Co. Ltd., India, 11th Edition, 2015
5. Maheshwari, S.N. and S.K. Maheshwari; A Manual of Business Law, 6th Edition, Himalaya Publishing House, 2015.
6. V.S.Datey, GST Ready Reckoner, Taxmann Publishing, July 2017.

**OBJECTIVE:**

- To provide an overview of theories and practices in organizational behavior in individual, group and organizational level.

**UNIT I FOCUS AND PURPOSE****5**

Definition, need and importance of organizational behaviour – Nature and scope – Frame work – Organizational behaviour models.

**UNIT II INDIVIDUAL BEHAVIOUR****12**

Personality – types – Factors influencing personality – Theories – Learning – Types of learners – The learning process – Learning theories – Organizational behaviour modification.

Misbehaviour – Types – Management Intervention. Emotions - Emotional Labour – Emotional Intelligence – Theories. Attitudes – Characteristics – Components – Formation – Measurement-Values. Perceptions – Importance – Factors influencing perception – Interpersonal perception- Impression Management. Motivation – Importance – Types – Effects on work behavior.

**UNIT III GROUP BEHAVIOUR****10**

Organization structure – Formation – Groups in organizations – Influence – Group dynamics – Emergence of informal leaders and working norms – Group decision making techniques – **Team building** - Interpersonal relations – Communication – Control.

**UNIT IV LEADERSHIP AND POWER****8**

Meaning – Importance – Leadership styles – Theories – Leaders Vs Managers – Sources of power – Power centers – Power and Politics.

**UNIT V DYNAMICS OF ORGANIZATIONAL BEHAVIOUR****10**

Organizational culture and climate – Factors affecting organizational climate – Importance. Job satisfaction – Determinants – Measurements – Influence on behavior. Organizational change – Importance – Stability Vs Change – Proactive Vs Reaction change – the change process – Resistance to change – Managing change. Stress – Work Stressors – Prevention and Management of stress – Balancing work and Life. Organizational development – Characteristics – objectives –. Organizational effectiveness Developing Gender sensitive workplace

**TOTAL: 45 PERIODS****OUTCOME:**

- Students will have a better understanding of human behavior in organization. They will know the framework for managing individual and group performance.

**REFERENCES :**

- Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, Edition 17, 2016 (Global edition)
- Fred Luthans, Organisational Behavior, McGraw Hill, 12<sup>th</sup> Edition,
- Mc Shane & Von Glinov, Organisational Behaviour, 4<sup>th</sup> Edition, Tata Mc Graw Hill, 2007.
- Nelson, Quick, Khandelwal. ORGB – An innovative approach to learning and teaching. Cengage, 2<sup>nd</sup> edition. 2012
- Ivancevich, Konopaske & Maheson, Oranisational Behaviour & Management, 7<sup>th</sup> edition, Tata McGraw Hill, 2008.
- Udai Pareek, Understanding Organisational Behaviour, 3<sup>rd</sup> Edition, Oxford Higher Education, 2011.
- Jerald Greenberg, Behaviour in Organization, PHI Learning. 10<sup>th</sup> edition. 2011

**OBJECTIVE:**

- To learn the applications of statistics in business decision making.

**UNIT I INTRODUCTION****9**

Basic definitions and rules for probability, conditional probability independence of events, Baye's theorem, and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions.

**UNIT II SAMPLING DISTRIBUTION AND ESTIMATION****9**

Introduction to sampling distributions, sampling distribution of mean and proportion, application of central limit theorem, sampling techniques. Estimation: Point and Interval estimates for population parameters of large sample and small samples, determining the sample size.

**UNIT III TESTING OF HYPOTHESIS - PARAMETIRC TESTS****9**

Hypothesis testing: one sample and two sample tests for means and proportions of large samples (z-test), one sample and two sample tests for means of small samples (t-test), F-test for two sample standard deviations. ANOVA one and two way.

**UNIT IV NON-PARAMETRIC TESTS****9**

Chi-square test for single sample standard deviation. Chi-square tests for independence of attributes and goodness of fit. Sign test for paired data. Rank sum test. Kolmogorov-Smirnov – test for goodness of fit, comparing two populations. Mann – Whitney U test and Kruskal Wallis test. One sample run test.

**UNIT V CORRELATION AND REGRESSION****9**

Correlation – Coefficient of Determination – Rank Correlation – Regression – Estimation of Regression line – Method of Least Squares – Standard Error of estimate.

**TOTAL: 45 PERIODS****OUTCOME:**

To facilitate objective solutions in business decision making under subjective conditions.

**REFERENCES:**

- Richard I. Levin, David S. Rubin, Sanjay Rastogi Masood Husain Siddiqui, Statistics for Management, Pearson Education, 7th Edition, 2016.
- Prem.S.Mann, Introductory Statistics, 7th Edition, Wiley India, 2016.
- Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, Springer, 2016.
- Aczel A.D. and Sounderpandian J., "Complete Business Statistics", 6th edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2012.
- Anderson D.R., Sweeney D.J. and Williams T.A., Statistics for business and economics, 11th edition, Thomson (South – Western) Asia, Singapore, 2012.
- N. D. Vohra, Business Statistics, Tata McGraw Hill, 2012.
- Ken Black, Applied Business Statistics, 7th Edition, Wiley India Edition, 2012.

**OBJECTIVE:**

- To learn the quality philosophies and tools in the managerial perspective.

**UNIT I INTRODUCTION****9**

Quality – vision, mission and policy statements. Customer Focus – customer perception of quality, Translating needs into requirements, customer retention. Dimensions of product and service quality. Cost of quality.

**UNIT II PRINCIPLES AND PHILOSOPHIES OF QUALITY MANAGEMENT****9**

Overview of the contributions of Deming, Juran Crosby, Masaaki Imai, Feigenbaum, Ishikawa, Taguchi techniques – introduction, loss function, parameter and tolerance design, signal to noise ratio. Concepts of Quality circle, Japanese 5S principles and 8D methodology.

**UNIT III STATISTICAL PROCESS CONTROL****9**

Meaning and significance of statistical process control (SPC) – construction of control charts for variables and attributed. Process capability – meaning, significance and measurement – Six sigma - concepts of process capability. Reliability concepts – definitions, reliability in series and parallel, product life characteristics curve. Total productive maintenance (TMP), Terotechnology. Business process Improvement (BPI) – principles, applications, reengineering process, benefits and limitations.

**UNIT IV TOOLS AND TECHNIQUES FOR QUALITY MANAGEMENT****9**

Quality functions development (QFD) – Benefits, Voice of customer, information organization, House of quality (HOQ), building a HOQ, QFD process. Failure mode effect analysis (FMEA) – requirements of reliability, failure rate, FMEA stages, design, process and documentation. Seven Tools (old & new). Bench marking and POKA YOKE.

**UNIT V QUALITY SYSTEMS ORGANIZING AND IMPLEMENTATION****9**

Introduction to IS/ISO 9004:2000 – quality management systems – guidelines for performance improvements. Quality Audits. TQM culture, Leadership – quality council, employee involvement, motivation, empowerment, recognition and reward - TQM framework, benefits, awareness and obstacles.

**TOTAL: 45 PERIODS****OUTCOME:**

- To apply quality philosophies and tools to facilitate continuous improvement and ensure customer delight.

**REFERENCES :**

- Dale H. Besterfield, Carol Besterfield – Michna, Glen H. Besterfield, Mary Besterfield – Sacre, Hermant – Urdhwareshe, Rashmi Urdhwareshe, Total Quality Management, Revised Third edition, Pearson Education, 2011
- Shridhara Bhat K, Total Quality Management – Text and Cases, Himalaya Publishing House, II Edition 2010
- Douglas C. Montgomery, Introduction to Statistical Quality Control, Wiley Student Edition, 4<sup>th</sup> Edition, Wiley India Pvt Limited, 2008.
- James R. Evans and William M. Lindsay, The Management and Control of Quality, Sixth Edition, Thomson, 2005.
- Poornima M. Charantimath, Total Quality Management, Pearson Education, Second Edition, 2011
- Indian standard – quality management systems – Guidelines for performance improvement (Fifth Revision), Bureau of Indian standards, New Delhi.

**OBJECTIVES :**

- To familiarize learners with the mechanics of writing
- To enable learners to write in English precisely and effectively.
- To enable learners to speak fluently and flawlessly in all kinds of communicative contexts with all nationalities.

**UNIT I PERSONAL COMMUNICATION 12**

Day-to-day conversation with family members, neighbours, relatives, friends on various topics, context specific - Journal writing, mails/emails, SMS, greeting cards, situation based – accepting/declining invitations, congratulating, consoling, conveying information, oral reports, extempore.

**UNIT II EMPLOYABILITY SKILLS 12**

Interview skills – HR and technical – Types of interview, preparation for interview, mock interview, Group Discussion – Communication skills in Group Discussion, Structure of GD, GD process, successful GD techniques. Time management and effective planning – identifying barriers to effective time management, time management techniques, relationship between time management and stress management.

**UNIT III WORK PLACE COMMUNICATION 12**

e-mails, minutes, reports of different kinds – annual report, status report, survey report, proposals, memorandums, presentations, interviews, profile of institutions, speeches, responding to enquiries, complaints, resumes, applications, summarizing, strategies for writing.

**UNIT IV RESEARCH WRITING 12**

Articles for publication (Journals), developing questionnaire, writing abstract, dissertation, qualities of research writing, data (charts, tables) analysis, documentation.

**UNIT V WRITING FOR MEDIA AND CREATIVE WRITING 12**

Features for publication (Newspapers, magazines, newsletters, notice-board), case studies, short stories, travelogues, writing for children, translation, techniques of writing.

**TOTAL: 60 PERIODS**

Note: It is an activity based course. Student individually or as a group can organize event(s), present term papers etc. This will be evaluated by the faculty member(s) handling the course and the consolidated marks can be taken as the final mark.

No end semester examination is required for this course.

**OUTCOMES :****Learners should be able to**

- Get into the habit of writing regularly.
- Express themselves in different genres of writing from creative to critical to factual writing.
- Take part in print and online media communication
- Read quite widely to acquire a style of writing and
- Identify their area of strengths and weaknesses in writing.
- Speak confidently with any speakers of English, including native speakers.
- Speak effortlessly in different contexts – informal and formal.

## REFERENCES :

1. Raymond V Lesikar, John D Pettit, and Mary E Flatly, 2009. Lesikar's Basic Business Communication, 11<sup>th</sup> ed. Tata McGraw-Hill, New Delhi.
2. E.H. McGrath, S.J. 2012, Basic Managerial Skills for All. 9<sup>th</sup> ed. Prentice-Hall of India, New Delhi.

### Management books

Robin Sharma - The greatness guide  
Steven Covey - 7 Habits of Effective people  
Arindham Chaudhuri- Count your chickens before they hatch  
Ramadurai - TCS Story

Blogs : Seth Godwin, Guy Kawasaki, Kiruba Shankar

Review : Harvard Business review

Reports : Deloitte Netsis

Magazines : Bloomberg Businessweek, Economist

3. Richard Denny, 'Communication to Win; Kogan Page India Pvt. Ltd., New Delhi, 2008.

**BA5201**

**APPLIED OPERATIONS RESEARCH**

**L T P C**

**3 0 0 3**

### OBJECTIVE:

- To learn the concepts of operations research applied in business decision making.

### **UNIT I INTRODUCTION TO LINEAR PROGRAMMING (LP) 9**

Introduction to applications of operations research in functional areas of management. Linear Programming-formulation, solution by graphical and simplex methods (Primal - Penalty, Two Phase), Special cases. Dual simplex method. Principles of Duality. Sensitivity Analysis.

### **UNIT II LINEAR PROGRAMMING EXTENSIONS 9**

Transportation Models (Minimising and Maximising Problems) – Balanced and unbalanced Problems – Initial Basic feasible solution by N-W Corner Rule, Least cost and Vogel's approximation methods. Check for optimality. Solution by MODI / Stepping Stone method. Case of Degeneracy. Transshipment Models. Assignment Models (Minimising and Maximising Problems) – Balanced and Unbalanced Problems. Solution by Hungarian and Branch and Bound Algorithms. Travelling Salesman problem. Crew Assignment Models.

### **UNIT III INTEGER PROGRAMMING AND GAME THEORY 9**

Solution to pure and mixed integer programming problem by Branch and Bound and cutting plane algorithms. Game Theory-Two person Zero sum games-Saddle point, Dominance Rule, Convex Linear Combination (Averages), methods of matrices, graphical and LP solutions.

### **UNIT IV INVENTORY MODELS, SIMULATION AND DECISION THEORY 9**

Inventory Models – EOQ and EBQ Models (With and without shortages), Quantity Discount Models. Decision making under risk – Decision trees – Decision making under uncertainty. Monte-carlo simulation.

### **UNIT V QUEUING THEORY AND REPLACEMENT MODELS 9**

Queuing Theory - single and Multi-channel models – infinite number of customers and infinite calling source. Replacement Models-Individuals replacement Models (With and without time value of money) – Group Replacement Models.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- To facilitate quantitative solutions in business decision making under conditions of certainty, risk and uncertainty.

**REFERENCES :**

1. Paneerselvam R., Operations Research, Prentice Hall of India, Fourth Print, 2008.
2. N. D Vohra, Quantitative Techniques in Management, Tata Mcgraw Hill, 2010.
3. Hamdy A Taha, Introduction to Operations Research, Prentice Hall India, Ninth Edition, 2010.
4. Anderson , Sweeney Williams Solutions Manual to Accompany An Introduction to Management Science Quantitative Approaches To Decision, Cengage , 12<sup>th</sup> edition , 2012
5. G. Srinivasan, Operations Research – Principles and Applications, II edition , PHI, 2010.
6. Bernard W.Taylor ,Introduction to Management Science , 12 th edition, 2012

**BA5202****BUSINESS RESEARCH METHODS****L T P C  
3 0 0 3****OBJECTIVE:**

- To familiarise the students to the principles of scientific methodology in business enquiry; to develop analytical skills of business research; to develop the skills for scientific communications.

**UNIT I INTRODUCTION****9**

Business Research – Definition and Significance – the research process – Types of Research – Exploratory and causal Research – Theoretical and empirical Research – Cross –Sectional and time – series Research – Research questions / Problems – Research objectives – Research hypotheses – characteristics – Research in an evolutionary perspective – the role of theory in research.

**UNIT II RESEARCH DESIGN AND MEASUREMENT****9**

Research design – Definition – types of research design – exploratory and causal research design – Descriptive and experimental design – different types of experimental design – Validity of findings – internal and external validity – Variables in Research – Measurement and scaling – Different scales – Construction of instrument – Validity and Reliability of instrument.

**UNIT III DATA COLLECTION****9**

Types of data – Primary Vs Secondary data – Methods of primary data collection – Survey Vs Observation – Experiments – Construction of questionnaire and instrument – Validation of questionnaire – Sampling plan – Sample size – determinants optimal sample size – sampling techniques – Probability Vs Non–probability sampling methods.

**UNIT IV DATA PREPARATION AND ANALYSIS****9**

Data Preparation – editing – Coding –Data entry – Validity of data – Qualitative Vs Quantitative data analyses – Bivariate and Multivariate statistical techniques – Factor analysis – Discriminant analysis – cluster analysis – multiple regression and correlation – multidimensional scaling – Conjoint Analysis - Application of statistical software for data analysis.

**UNIT V REPORT DESIGN, WRITING AND ETHICS IN BUSINESS RESEARCH****9**

Research report – Different types – Contents of report – need of executive summary – chapterization – contents of chapter – report writing – the role of audience – readability – comprehension – tone – final proof – report format – title of the report – ethics in research – ethical behaviour of research – subjectivity and objectivity in research.

**TOTAL: 45 PERIODS**

## OUTCOME:

- Students would become acquainted with the scientific methodology in business domain. They would also become analytically skillful. They would become familiar with the nuances of scientific communications.

## REFERENCES :

1. Donald R. Cooper, Pamela S. Schindler and J K Sharma, Business Research methods, 11<sup>th</sup> Edition, Tata Mc Graw Hill, New Delhi, 2012.
2. Alan Bryman and Emma Bell, Business Research methods, 3<sup>rd</sup> Edition, Oxford University Press, New Delhi, 2011.
3. Uma Sekaran and Roger Bougie, Research methods for Business, 5<sup>th</sup> Edition, Wiley India, New Delhi, 2012.
4. William G Zikmund, Barry J Babin, Jon C.Carr, Atanu Adhikari, Mitch Griffin, Business Research methods, A South Asian Perspective, 8<sup>th</sup> Edition, Cengage Learning, New Delhi, 2012.

BA5203

FINANCIAL MANAGEMENT

L T P C  
4 0 0 4

## OBJECTIVES:

Facilitate student to

- Understand the operational nuances of a Finance Manager
- Comprehend the technique of making decisions related to finance function

### UNIT I FOUNDATIONS OF FINANCE:

9

Introduction to finance- Financial Management – Nature, scope and functions of Finance, organization of financial functions, objectives of Financial management, Major financial decisions – Time value of money – features and valuation of shares and bonds – Concept of risk and return – single asset and of a portfolio.

### UNIT II INVESTMENT DECISIONS:

9

Capital Budgeting: Principles and techniques - Nature of capital budgeting- Identifying relevant cash flows - Evaluation Techniques: Payback, Accounting rate of return, Net Present Value, Internal Rate of Return, Profitability Index - Comparison of DCF techniques Concept and measurement of cost of capital - Specific cost and overall cost of capital.

### UNIT III FINANCING AND DIVIDEND DECISION:

9

Leverages - Operating and Financial leverage – measurement of leverages – degree of Operating & Financial leverage – Combined leverage, EBIT – EPS Analysis- Indifference point.

Capital structure – Theories – Net Income Approach, Net Operating Income Approach, MM Approach – Determinants of Capital structure.

Dividend decision- Issues in dividend decisions, Importance, Relevance & Irrelevance theories – Walter's – Model, Gordon's model and MM model. – Factors determining dividend policy – Types of dividend policies – forms of dividend

### UNIT IV WORKING CAPITAL MANAGEMENT:

9

Principles of working capital: Concepts, Needs, Determinants, issues and estimation of working capital - Accounts Receivables Management and factoring - Inventory management - Cash management - Working capital finance : Trade credit, Bank finance and Commercial paper.

**UNIT V LONG TERM SOURCES OF FINANCE: 9**  
 Indian capital and stock market, New issues market Long term finance: Shares, debentures and term loans, lease, hire purchase, venture capital financing, Private Equity.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- Possess the techniques of managing finance in an organization

**REFERENCES :**

1. M.Y. Khan and P.K.Jain Financial management, Text, Problems and cases Tata McGraw Hill, 6<sup>th</sup> edition, 2011.
2. M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd., 10<sup>th</sup> edition, 2012.
3. Aswat Damodaran, Corporate Finance Theory and practice, John Wiley & Sons, 2011.
4. James C. Vanhorne –Fundamentals of Financial Management– PHI Learning, 11<sup>th</sup> Edition, 2012.
5. Prasanna Chandra, Financial Management, 9<sup>th</sup> edition, Tata McGraw Hill, 2012.
6. G.Sudersena Reddy, Financial Management- Principles & Practices, Himalaya Publishing House, 2nd Edition, 2010
7. Srivatsava, Mishra, Financial Management, Oxford University Press, 2011
8. Parasuraman.N.R, Financial Management, Cengage, 2014.
9. William R.Lasher, Financial Management, 7<sup>th</sup> Edition, Cengage, 2014 .
10. Brigham and Ehrhardt, Financial Management, 14<sup>th</sup> edition, Cengage, 2015.

**BA5204 HUMAN RESOURCE MANAGEMENT L T P C**  
**3 0 0 3**

**OBJECTIVE:**

- To provide knowledge about management issues related to staffing, training, performance, compensation, human factors consideration and compliance with human resource requirements.

**UNIT I PERSPECTIVES IN HUMAN RESOURCE MANAGEMENT 5**  
 Evolution of human resource management – The importance of the human factor – Challenges – Inclusive growth and affirmative action -Role of human resource manager – Human resource policies – Computer applications in human resource management – Human resource accounting and audit.

**UNIT II THE CONCEPT OF BEST FIT EMPLOYEE 8**  
 Importance of Human Resource Planning – Forecasting human resource requirement –matching supply and demand - Internal and External sources. Recruitment - Selection – induction – Socialization benefits.

**UNIT III TRAINING AND EXECUTIVE DEVELOPMENT 10**  
 Types of training methods –purpose- benefits- resistance. Executive development programmes – Common practices - Benefits – Self development – Knowledge management.

**UNIT IV SUSTAINING EMPLOYEE INTEREST 12**  
 Compensation plan – Reward – Motivation – Application of theories of motivation – Career management – Development of mentor – Protégé relationships.

**UNIT V PERFORMANCE EVALUATION AND CONTROL PROCESS 10**  
 Method of performance evaluation – Feedback – Industry practices. Promotion, Demotion, Transfer and Separation – Implication of job change. The control process – Importance – Methods – Requirement of effective control systems grievances – Causes – Implications – Redressal methods.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- Students will gain knowledge and skills needed for success as a human resources professional

**REFERENCES :**

1. Dessler Human Resource Management, Pearson Education Limited, 14th Edition, 2015.
2. Decenzo and Robbins, Fundamentals of Human Resource Management, Wiley, 11<sup>th</sup> Edition, 2013.
3. Luis R.Gomez-Mejia, David B.Balkin, Robert L Cardy. Managing Human Resource. PHI Learning. 2012
4. Bernadin , Human Resource Management ,Tata Mcgraw Hill ,8<sup>th</sup> edition 2012.
5. Wayne Cascio, Managing Human Resource, McGraw Hill, 2007.
6. Ivancevich, Human Resource Management, McGraw Hill 2012.
7. Uday Kumar Haldar, Juthika Sarkar. Human Resource management. Oxford. 2012

**BA5205****INFORMATION MANAGEMENT****L T P C  
3 0 0 3****OBJECTIVES :**

- To understand the importance of information in business
- To know the technologies and methods used for effective decision making in an organization.

**UNIT I INTRODUCTION****10**

Data, Information, Intelligence, Information Technology, Information System, evolution, types based on functions and hierarchy, System development methodologies, Functional Information Systems, DSS, EIS, KMS, GIS, International Information System.

**UNIT II SYSTEM ANALYSIS AND DESIGN****10**

Case tools - System flow chart, Decision table, Data flow Diagram (DFD), Entity Relationship (ER), Object Oriented Analysis and Design(OOAD), UML diagram.

**UNIT III DATABASE MANAGEMENT SYSTEMS****9**

DBMS – HDBMS, NDBMS, RDBMS, OODBMS, Query Processing, SQL, Concurrency Management, Data warehousing and Data Mart

**UNIT IV SECURITY, CONTROL AND REPORTING****8**

Security, Testing, Error detection, Controls, IS Vulnerability, Disaster Management, Computer Crimes, Securing the Web, Intranets and Wireless Networks, Software Audit, Ethics in IT, User Interface and reporting.

**UNIT V NEW IT INITIATIVES****8**

Role of information management in ERP, e-business, e-governance, Data Mining, Business Intelligence, Pervasive Computing, Cloud computing, CMM.

**TOTAL: 45 PERIODS****OUTCOME**

- Gains knowledge on effective applications of information systems in business

**REFERENCES :**

1. Robert Schultheis and Mary Summer, Management Information Systems – The Managers View, Tata McGraw Hill, 2008.

2. Kenneth C. Laudon and Jane Price Laudon, Management Information Systems – Managing the digital firm, PHI Learning / Pearson Education, PHI, Asia, 2012.
3. Rahul de, MIS in Business, Government and Society, Wiley India Pvt Ltd, 2012
4. Gordon Davis, Management Information System : Conceptual Foundations, Structure and Development, Tata McGraw Hill, 21<sup>st</sup> Reprint 2008.
5. Haag, Cummings and Mc Cubbrey, Management Information Systems for the Information Age, McGraw Hill, 2005. 9<sup>th</sup> edition, 2013.
6. Turban, McLean and Wetherbe, Information Technology for Management –Transforming Organisations in the Digital Economy, John Wiley, 6<sup>th</sup> Edition, 2008.
7. Raymond McLeod and Jr. George P. Schell, Management Information Systems, Pearson Education, 2007.
8. James O Brien, Management Information Systems – Managing Information Technology in the E-business enterprise, Tata McGraw Hill, 2004.
9. Ralph Stair and George Reynolds, Information Systems, Cengage Learning, 10<sup>th</sup> Edition, 2012
10. Corey Schou and Dan Shoemaker, Information Assurance for the Enterprise – A Roadmap to Information Security, Tata McGraw Hill, 2007.
11. Frederick Gallegor, Sandra Senft, Daniel P. Manson and Carol Gonzales, Information Technology Control and Audit, Auerbach Publications, 4<sup>th</sup> Edition, 2013.

**BA5206**

**OPERATIONS MANAGEMENT**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

- To provide a broad introduction to the field of operations management and explain the concepts, strategies , tools and techniques for managing the transformation process that can lead to competitive advantage.

**UNIT I INTRODUCTION TO OPERATIONS MANAGEMENT 9**

Operations Management – Nature, Importance, historical development, transformation processes, differences between services and goods, a system perspective, functions, challenges, current priorities, recent trends; Operations Strategy – Strategic fit , framework; Supply Chain Management

**UNIT II FORECASTING, CAPACITY AND FACILITY DESIGN 9**

Demand Forecasting – Need, Types, Objectives and Steps. Overview of Qualitative and Quantitative methods. Capacity Planning – Long range, Types, Developing capacity alternatives. Overview of sales and operations planning. Overview of MRP, MRP II and ERP. Facility Location – Theories, Steps in Selection, Location Models. Facility Layout – Principles, Types, Planning tools and techniques.

**UNIT III DESIGN OF PRODUCT, PROCESS AND WORK SYSTEMS 9**

Product Design – Influencing factors, Approaches, Legal, Ethical and Environmental issues. Process – Planning, Selection, Strategy, Major Decisions. Work Study – Objectives, Procedure. Method Study and Motion Study. Work Measurement and Productivity – Measuring Productivity and Methods to improve productivity.

**UNIT IV MATERIALS MANAGEMENT 9**

Materials Management – Objectives, Planning, Budgeting and Control. Purchasing – Objectives, Functions, Policies, Vendor rating and Value Analysis. Stores Management – Nature, Layout, Classification and Coding. Inventory – Objectives, Costs and control techniques. Overview of JIT.

**UNIT V SCHEDULING AND PROJECT MANAGEMENT 9**

Project Management – Scheduling Techniques, PERT, CPM; Scheduling - work centers – nature, importance; Priority rules and techniques, shop floor control; Flow shop scheduling – Johnson’s Algorithm – Gantt charts; personnel scheduling in services.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- Understanding of the strategic and operational decisions in managing manufacturing and service organizations and appreciation of the role of operations management function in an organization.

**REFERENCES :**

1. Richard B. Chase, Ravi Shankar, F. Robert Jacobs, Nicholas J. Aquilano, Operations and Supply Management, Tata McGraw Hill, 12<sup>th</sup> Edition, 2010.
2. Norman Gaither and Gregory Frazier, Operations Management, South Western Cengage, 2002.
3. William J Stevenson, Operations Management, Tata McGraw Hill, 11<sup>th</sup> Edition, 2015.
4. Russel and Taylor, Operations Management, Wiley, 8th Edition, 2015.
5. Kanishka Bedi, Production and Operations Management, Oxford University, 3<sup>rd</sup> Edition, 2013.
6. Chary S. N, Production and Operations Management, Tata McGraw Hill, 5<sup>th</sup> Edition, 2013.
7. Aswathappa K and Shridhara Bhat K, Production and Operations Management, Himalaya Publishing House, Revised Second Edition, 2008.
8. Mahadevan B, Operations Management Theory and practice, Pearson Education, 3<sup>rd</sup> Edition, 2015
9. Pannerselvam R, Production and Operations Management, Prentice Hall India, Second Edition, 2008.

**BA5207 MARKETING MANAGEMENT L T P C  
4 0 0 4**

**OBJECTIVES:**

- Developing an understanding of ideas and nuances of modern marketing
- Describe the process to formulate and manage the B2B marketing strategy including all key components.
- Explain the techniques to conduct market analysis practices including market segmentation and targeting.
- Compare and contrast different perspectives that characterize the study of consumer behavior.
- Explain the role of IMC in the overall marketing program.

**UNIT I INTRODUCTION 12**

Marketing – Definitions - Conceptual frame work – Marketing environment : Internal and External - Marketing interface with other functional areas – Production, Finance, Human Relations Management, Information System. Marketing in global environment – Prospects and Challenges.

**UNIT II MARKETING STRATEGY 12**

Marketing strategy formulations – Key Drivers of Marketing Strategies - Strategies for Industrial Marketing – Consumer Marketing — Services marketing – Competitor analysis - Analysis of consumer and industrial markets – Strategic Marketing Mix components.

**UNIT III MARKETING MIX DECISIONS 12**

Product planning and development – Product life cycle – New product Development and Management – Market Segmentation – Targeting and Positioning – Channel Management – Advertising and sales promotions – Pricing Objectives, Policies and methods.

**UNIT IV BUYER BEHAVIOUR****12**

Understanding industrial and individual buyer behavior - Influencing factors – Buyer Behaviour Models – Online buyer behaviour - Building and measuring customer satisfaction – Customer relationships management – Customer acquisition, Retaining, Defection.

**UNIT V MARKETING RESEARCH & TRENDS IN MARKETING****12**

Marketing Information System – Research Process – Concepts and applications : Product – Advertising – Promotion – Consumer Behaviour – Retail research – Customer driven organizations - Cause related marketing - Ethics in marketing –Online marketing trends.

**TOTAL: 60 PERIODS****OUTCOMES:**

- knowledge of analytical skills in solving marketing related problems
- awareness of marketing management process

**REFERENCES :**

1. Philip Kotler and Kevin Lane Keller, Marketing Management, PHI 14<sup>th</sup> Edition, 2012
2. KS Chandrasekar, “Marketing management-Text and Cases”, Tata McGraw Hill, First edition,2010
3. Lamb, hair, Sharma, Mc Daniel– Marketing – An Innovative approach to learning and teaching-A south Asian perspective, Cengage Learning — 2012
4. Paul Baines, Chris Fill and Kelly Page, Marketing, Oxford University Press, 2<sup>nd</sup> Edition,2011.
5. Micheal R.Czinkota & Masaaki Kotabe, Marketing Management, Cengage, 2000.

**BA5211****DATA ANALYSIS AND BUSINESS MODELING****L T P C  
0 0 4 2****OBJECTIVE :**

- to have hands-on experience on decision modeling.

[Business models studied in theory to be practiced using Spreadsheet / Analysis Software]

S.No.	Exp. No.	Details of experiments	Duration
		Name	
1	1	Descriptive Statistics	4
2	2	Hypothesis - Parametric	4
3	3	Hypothesis – Non-parametric	4
4	4	Correlation & Regression	4
5	5	Forecasting	4
6	-	Extended experiment – 1	4
7	6	Portfolio Selection	4
8	7	Risk Analysis & Sensitivity Analysis	4
9	8	Revenue Management	4
10	-	Extended experiment – 2	4
11	9	Transportation & Assignment	4
12	10	Networking Models	4
13	11	Queuing Theory	4
14	12	Inventory Models	4
15	-	Extended experiments – 3	4

- Spreadsheet Software and
- Data Analysis Tools

**TOTAL: 60 PERIODS**

## OUTCOME

- Knowledge of spreadsheets and data analysis software for business modeling.

## TEXTBOOKS

1. David M. Levine et al, "Statistics for Managers using MS Excel" (6<sup>th</sup> Edition) Pearson, 2010
2. David R. Anderson, et al, 'An Introduction to Management Sciences: Quantitative approaches to Decision Making, (13<sup>th</sup> edition) South-Western College Pub, 2011.
3. Hansa Lysander Manohar , " Data Analysis and Business Modelling using MS Excel ",PHI Learning private Ltd, 2017.
4. William J. Stevenson, Ceyhun Ozgur, 'Introduction to Management Science with Spreadsheet', Tata McGraw Hill, 2009.
5. Wayne L. Winston, Microsoft Excel 2010: Data Analysis & Business Modeling, 3<sup>rd</sup> edition, Microsoft Press, 2011.
6. Vikas Gupta, Comdex Business Accounting with Ms Excel, 2010 and Tally ERP 9.0 Course Kit, Wiley India, 2012
7. Kiran Pandya and Smriti Bulsari, SPSS in simple steps, Dreamtech, 2011.

**BA5301**

**INTERNATIONAL BUSINESS MANAGEMENT**

**L T P C**  
**3 0 0 3**

## OBJECTIVE:

- To familiarize the students to the basic concepts of international business management.

### **UNIT I INTRODUCTION**

**6**

International Business –Definition – Internationalizing business-Advantages – factors causing globalization of business- international business environment – country attractiveness –Political, economic and cultural environment – Protection Vs liberalization of global business environment.

### **UNIT II INTERNATIONAL TRADE AND INVESTMENT**

**11**

Promotion of global business – the role of GATT/WTO – multilateral trade negotiation and agreements – VIII & IX, round discussions and agreements – Challenges for global business – global trade and investment – theories of international trade and theories of international investment – Need for global competitiveness – Regional trade block – Types – Advantages and disadvantages – RTBs across the globe – brief history.

### **UNIT III INTERNATIONAL STRATEGIC MANAGEMENT**

**11**

Strategic compulsions-Standardization Vs Differentiation – Strategic options – Global portfolio management- global entry strategy – different forms of international business – advantages - organizational issues of international business – organizational structures – controlling of international business – approaches to control – performance of global business- performance evaluation system.

### **UNIT IV PRODUCTION, MARKETING, FINANCIAL AND HUMAN RESOURCE MANAGEMENT OF GLOBAL BUSINESS**

**11**

Global production –Location –scale of operations- cost of production – Make or Buy decisions – global supply chain issues – Quality considerations- Globalization of markets, marketing strategy – Challenges in product development , pricing, production and channel management- Investment decisions – economic- Political risk – sources of fund- exchange –rate risk and management – strategic orientation – selection of expatriate managers- Training and development – compensation.

**UNIT V CONFLICT MANAGEMENT AND ETHICS IN INTERNATIONAL BUSINESS MANAGEMENT**

**6**

Disadvantages of international business – Conflict in international business- Sources and types of conflict – Conflict resolutions – Negotiation – the role of international agencies –Ethical issues in international business – Ethical decision-making.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- Students would be familiar with global business environment, global strategic management practices and get acquainted with functional domain practices. They would be familiar with conflicts situations and ethical issues in global business.

**REFERENCES :**

1. Charles W.I. Hill and Arun Kumar Jain, International Business, 6<sup>th</sup> edition, Tata McGraw Hill, New Delhi, 2010.
2. John D. Daniels and Lee H. Radebaugh, International Business, Pearson Education Asia, 12th Edition, New Delhi, 2010
3. K. Aswathappa, International Business, 6<sup>th</sup> Edition, Tata Mc Graw Hill, New Delhi, 2015.
4. Michael R. Czinkota, Ilkka A. Ronkainen and Michael H. Moffet, International Business, 7<sup>th</sup> Edition, Cengage Learning, New Delhi, 2010.
5. Rakesh Mohan Joshi, International Business, Oxford University Press, New Delhi, 2009.
6. Vyuptakesh Sharan, International Business, 3<sup>rd</sup> Edition, Pearson Education in South Asia, New Delhi, 2011.

**BA5302**

**STRATEGIC MANAGEMENT**

**L T P C  
3 0 0 3**

**OBJECTIVE:**

- To learn the major initiatives taken by a company's top management on behalf of corporates, involving resources and performance in external environments. It entails specifying the organization's mission, vision and objectives, developing policies and plan to understand the analysis and implementation of strategic management in strategic business units.

**UNIT I STRATEGY AND PROCESS**

**9**

Conceptual framework for strategic management, the Concept of Strategy and the Strategy Formation Process – Stakeholders in business – Vision, Mission and Purpose – Business definition, Objectives and Goals - Corporate Governance and Social responsibility-case study.

**UNIT II COMPETITIVE ADVANTAGE**

**9**

External Environment - Porter's Five Forces Model-Strategic Groups Competitive Changes during Industry Evolution-Globalisation and Industry Structure - National Context and Competitive advantage Resources- Capabilities and competencies–core competencies-Low cost and differentiation Generic Building Blocks of Competitive Advantage- Distinctive Competencies-Resources and Capabilities durability of competitive Advantage- Avoiding failures and sustaining competitive advantage-Case study.

**UNIT III STRATEGIES**

**10**

The generic strategic alternatives – Stability, Expansion, Retrenchment and Combination strategies - Business level strategy- Strategy in the Global Environment-Corporate Strategy-Vertical Integration-Diversification and Strategic Alliances- Building and Restructuring the corporation- Strategic analysis and choice - Environmental Threat and Opportunity Profile (ETOP) - Organizational Capability Profile - Strategic Advantage Profile - Corporate Portfolio Analysis - SWOT Analysis - GAP Analysis - Mc

Kinsey's 7s Framework - GE 9 Cell Model - Distinctive competitiveness - Selection of matrix - Balance Score Card-case study.

**UNIT IV STRATEGY IMPLEMENTATION & EVALUATION 9**

The implementation process, Resource allocation, Designing organisational structure-Designing Strategic Control Systems- Matching structure and control to strategy-Implementing Strategic change-Politics-Power and Conflict-Techniques of strategic evaluation & control-case study.

**UNIT V OTHER STRATEGIC ISSUES 8**

Managing Technology and Innovation-Strategic issues for Non Profit organisations. New Business Models and strategies for Internet Economy-case study

**TOTAL: 45 PERIODS**

**OUTCOME :**

- This Course will create knowledge and understanding of management concepts principles and skills from a people, finance, marketing and organisational perspectives the development of appropriate organisational policies and strategies within a changing context to meet stakeholder interests information systems to learn from failure key tools and techniques for the analysis and design of information systems, including their human and organisational as well as technical aspects.

**REFERENCES :**

1. Hill. Strategic Management : An Integrated approach, 2009 Edition Wiley (2012).
2. John A.Parnell. Strategic Management, Theory and practice Biztantra (2012).
3. Azhar Kazmi, Strategic Management and Business Policy, 3<sup>rd</sup> Edition, Tata McGraw Hill,2008
4. Adriaue Haberberg and Alison Rieple, Strategic Management Theory & Application, Oxford University Press, 2008.
5. Gupta, Gollakota and Srinivasan, Business Policy and Strategic Management – Concepts and Application, Prentice Hall of India, 2005.
6. Dr.Dharma Bir Singh, Strategic Management & Business Policy, KoGent Learning Solutions Inc., Wiley, 2012.
7. John Pearce, Richard Robinson and Amitha Mittal, Strategic Management, McGraw Hill, 12<sup>th</sup> Edition, 2012

## FUNCTIONAL SPECIALIZATIONS

**BA5001**

**BRAND MANAGEMENT**

**L T P C**  
**3 0 0 3**

### **OBJECTIVES :**

- To understand the basic Principles of branding.
- To understand the key issues in crafting and evaluating brand strategies
- To improve the skills in delivering persuasive brand presentations.
- To evaluate brand extension and its contribution to parent brand
- To develop an understanding of brand equity and a range of performance related outcomes.

### **UNIT I INTRODUCTION**

**8**

Basics Understanding of Brands – Definitions - Branding Concepts – Functions of Brand - Significance of Brands – Different Types of Brands – Co branding – Store brands.

### **UNIT II BRAND STRATEGIES**

**10**

Strategic Brand Management process – Building a strong brand – Brand positioning – Establishing Brand values – Brand vision – Brand Elements – Branding for Global Markets – Competing with foreign brands.

### **UNIT III BRAND COMMUNICATIONS**

**8**

Brand image Building – Brand Loyalty programmes – Brand Promotion Methods – Role of Brand ambassadors, celebrities – On line Brand Promotions.

### **UNIT IV BRAND EXTENSION**

**9**

Brand Adoption Practices – Different type of brand extension – Factors influencing Decision for extension – Re-branding and re-launching.

### **UNIT V BRAND PERFORMANCE**

**10**

Measuring Brand Performance – Brand Equity Management - Global Branding strategies - Brand Audit – Brand Equity Measurement – Brand Leverage -Role of Brand Managers– Branding challenges & opportunities.

**TOTAL: 45 PERIODS**

### **OUTCOMES :**

- Have a solid understanding of the key 'branding' concepts, methods and tools used by marketing practitioners.
- Be able to more confidently engage in and contribute to 'brand building' projects, developments, and discussions.

### **REFERENCES :**

1. Kevin Lane Keller, Strategic Brand Management: Building, Measuring and Managing Brand Equity, Pearson, 4th Edition, 2013.
2. Aker, David, Building Strong Brands, Simon and Schuster, 1995
3. Kapferer J.N, Strategic Brand Management, 4th edition, Kogan Press, 2008
4. Moorthi YLR, Brand Management – I edition, Vikas Publishing House 2001.

**OBJECTIVES :**

- To understand the concepts of consumer behaviour and its application in purchase decisions.
- To Analyse of the reasons and motives for consumer buying behaviour
- To analyse the relationship between psychological social and cultural drivers behind consumer behaviour and marketing
- To identify the dynamics of human behaviour and the basic factors that influence the consumers decision process.

**UNIT I INTRODUCTION 9**

Concepts – Significance – Dimensions of Consumer Behavior – Application of knowledge of Consumer Behaviour in marketing decisions.

**UNIT II CONSUMER BEHAVIOR MODELS 9**

Industrial and individual consumer behaviour models - Howard- Sheth, Engel – Kollat, Webster and wind Consumer Behaviour Models – Implications of the models on marketing decisions.

**UNIT III INTERNAL INFLUENCES 9**

Psychological Influences on consumer behavior – motivation – perception – personality Learning and Attitude- Self Image and Life styles – Consumer expectation and satisfaction.

**UNIT IV EXTERNAL INFLUENCES 9**

Socio-Cultural, Cross Culture - Family group – Reference group – Communication - Influences on Consumer behavior

**UNIT V PURCHASE DECISION PROCESS 9**

High and low involvement - Pre-purchase and post-purchase behavior – Online purchase decision process – Diffusion of Innovation – Managing Dissonance - Emerging Issues.

**TOTAL: 45 PERIODS****OUTCOMES :**

- Identify the major individual, social and cultural factors that affect consumers' decision making process;
- Explain and analyze the major stages which consumers usually go through when making a consumption-related decision
- Understand the essence of how consumers make decisions and assess the relevant implications for marketing practitioners

**REFERENCES :**

1. Leon G Schiffman, Joseph Wisemblit, S Ramesh Kumar , Consumer Behaviour, 11th edition, Pearson, 2015
2. Barry J.Babin, Eric G.Harris, Ashutosh Mohan, Consumer Behavior: A South Asian Perspective, Cengage Learning, Indian Edition, 6th Edition, 2016
3. P.C.Jain and Monika Bhatt., Consumer Behavior in Indian Context, S.Chand & Company, 2013.
4. Srabanti Mukherjee, Consumer behavior, Cengage Learning, 2012.
5. Assael, Consumer Behavior - A Strategic Approach, Biztranza, 2008
6. Dinesh kumar ,Consumer Behaviour, Oxford University Press,2015.

**OBJECTIVE:**

- To understand the need and importance of maintaining a good customer relationship.

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Definitions - Concepts and Context of relationship Management – Evolution - Transactional Vs Relationship Approach – CRM as a strategic marketing tool – CRM significance to the stakeholders.		
<b>UNIT II</b>	<b>UNDERSTANDING CUSTOMERS</b>	<b>9</b>
Customer information Database – Customer Profile Analysis - Customer perception, Expectations analysis – Customer behavior in relationship perspectives; individual and group customer's - Customer life time value – Selection of Profitable customer segments.		
<b>UNIT III</b>	<b>CRM STRUCTURES</b>	<b>9</b>
Elements of CRM – CRM Process – Strategies for Customer acquisition – Retention and Prevention of defection – Models of CRM – CRM road map for business applications.		
<b>UNIT IV</b>	<b>CRM PLANNING AND IMPLEMENTATION</b>	<b>9</b>
Strategic CRM planning process – Implementation issues – CRM Tools- Analytical CRM – Operational CRM – Call center management – Role of CRM Managers.		
<b>UNIT V</b>	<b>TRENDS IN CRM</b>	<b>9</b>
e- CRM Solutions – Data Warehousing – Data mining for CRM – an introduction to CRM software packages.		

**TOTAL: 45 PERIODS****OUTCOME :**

- To use strategic customer acquisition and retention techniques in CRM.

**REFERENCES :**

- G.Shainesh, Jagdish, N.Sheth, Customer Relationship Management A Strategic Prespective, Macmillan 2010
- Alok Kumar et al, Customer Relationship Management : Concepts and applications, Biztantra, 2008
- H.Peeru Mohamed and A.Sahadevan, Customer Relation Management, Vikas Publishing 2005.
- Jim Catheart, The Eight Competencies of Relationship selling, Macmillan India, 2005.
- Assel, Consumer Behavior, Cengage, 6<sup>th</sup> Edition.
- Kumar, Customer Relationship Management - A Database Approach, Wiley India, 2007.
- Francis Buttle, Customer Relationship Management : Concepts & Tools, Elsevier, 2004.
- Zikmund. Customer Relationship Management, Wiley 2012 ..

**OBJECTIVE:**

- This course introduces students to the basic concepts of advertising and sales promotion and how business organizations and other institutions carry out such activities.

**UNIT I INTRODUCTION TO ADVERTISEMENT****9**

Concept –definition-scope-Objectives-functions-principles of advertisement – Social, Economic and Legal Implications of advertisements – setting advertisement objectives – Advertisement Agencies – Selection and remuneration – Advertisement campaigns – case studies.

**UNIT II ADVERTISEMENT MEDIA****9**

Media plan – Type and choice criteria – Reach and frequency of advertisements – Cost of advertisements - related to sales – Media strategy and scheduling. design and execution of advertisements -Message development – Different types of advertisements – Layout – Design appeal – Copy structure – Advertisement production – Print – Radio. T.V. and Web advertisements – Media Research – Testing validity and Reliability of ads – Measuring impact of advertisements – case studies.

**UNIT III SALES PROMOTION****9**

Scope and role of sale promotion – Definition – Objectives of sales promotion - sales promotion techniques – Trade oriented and consumer oriented. Sales promotion – Requirement identification – Designing of sales promotion campaign – Involvement of salesmen and dealers – Out sourcing sales promotion national and international promotion strategies – Integrated promotion – Coordination within the various promotion techniques – Online sales promotions- case studies.

**UNIT IV PERSONAL SELLING****9**

Introduction – Meaning – Functions- Personal selling process – Evaluation – Compensation – Motivation- Territory Management – Sales Report Preparation and Presentation- Ethical Issues

**UNIT V PUBLICITY AND PUBLIC RELATIONS****9**

Introduction – Meaning – Objectives –Scope-Functions-integrating PR in to Promotional Mix-Marketing Public Relation function- Process of Public Relations-advantages and disadvantages of PR-Measuring the Effectiveness of PR- PR tools and techniques. Difference between Marketing, PR and Publicity -- Social publicity – Web Publicity and Social media – Publicity Campaigns

**TOTAL: 45 PERIODS****OUTCOME :**

- Insight into the importance of advertising and sales promotion campaigns planning and objective setting in relation to consumer decision making processes.

**REFERENCES :**

1. George E Belch and Michel A Belch, Advertising & Promotion, Tata McGraw Hill, 10th edition, 2014
2. Wells, Moriarty & Burnett, Advertising, Principles & Practice, Pearson Education, 7th Edition, 2007.
3. Kenneth Clow. Donald Baack, Integrated Advertisements, Promotion and Marketing communication, Prentice Hall of India, New Delhi, 3rd Edition, 2006.
4. Terence A. Shimp and J.Craig Andrews, Advertising Promotion and other aspects of Integrated Marketing Communications, CENGAGE Learning, 9th edition, 2016
5. S. H. H. Kazmi and Satish K Batra, Advertising & Sales Promotion, Excel Books, New Delhi, 3rd Revised edition edition, 2008.
6. Julian Cummings, Sales Promotion: How to Create, Implement and Integrate Campaigns that Really Work, Kogan Page, London, Fifth Edition Edition ,2010.
7. Jaishri Jefhwaney, Advertising Management, Oxford University Press, 2nd Edition, 2013.

**OBJECTIVE:**

- To understand the concepts of effective retailing

**UNIT I INTRODUCTION 9**

An overview of Global Retailing – Challenges and opportunities – Retail trends in India – Socio economic and technological Influences on retail management – Government of India policy implications on retails.

**UNIT II RETAIL FORMATS 9**

Organized and unorganized formats – Different organized retail formats – Characteristics of each format – Emerging trends in retail formats – MNC's role in organized retail formats.

**UNIT III RETAILING DECISIONS 9**

Choice of retail locations - internal and external atmospheric – Positioning of retail shops – Building retail store Image - Retail service quality management – Retail Supply Chain Management – Retail Pricing Decisions. Mercandising and category management – buying.

**UNIT IV RETAIL SHOP MANAGEMENT 9**

Visual Merchandise Management – Space Management – Retail Inventory Management – Retail accounting and audits - Retail store brands – Retail advertising and promotions – Retail Management Information Systems - Online retail – Emerging trends .

**UNIT V RETAIL SHOPPER BEHAVIOUR 9**

Understanding of Retail shopper behavior – Shopper Profile Analysis – Shopping Decision Process - Factors influencing retail shopper behavior – Complaints Management - Retail sales force Management – Challenges in Retailing in India.

**TOTAL: 45 PERIODS****OUTCOME:**

- To manage the retail chains and understand the retail customer's behavior

**REFERENCES :**

1. Michael Havy ,Baston, Aweitz and Ajay Pandit, Retail Management, Tata Mcgraw Hill, Sixth Edition, 2007
2. J K Nayak, Prakash C.Dash, Retail Management, Cengage, 2017
3. Dr.Harjit Singh, Retail Management A Global Perspective, S.Chand Publishing, 3rd Edition,2014
4. Patrick M. Dunne and Robert F Lusch, Retailing, Cengage, 8th edition, 2013.
5. Chetan Bajaj, Rajnish Tow and Nidhi V. Srivatsava, Retail Management, Oxford University Press, 3rd Edition 2016.
6. Swapna Pradhan, Retail Management -Text and Cases, Tata McGraw Hill, 4th Edition, 2012.
7. Ramkrishnan and Y.R.Srinivasan, Indian Retailing Text and Cases, Oxford University Press, 2008

**BA5006**

**SERVICES MARKETING**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

- To understand the meaning of services and the significance of marketing the services.

**UNIT I INTRODUCTION**

**9**

Definition – Service Economy – Evolution and growth of service sector – Nature and Scope of Services – Unique characteristics of services - Challenges and issues in Services Marketing.

**UNIT II SERVICE MARKETING OPPORTUNITIES**

**9**

Assessing service market potential - Classification of services – Expanded marketing mix – Service marketing – Environment and trends – Service market segmentation, targeting and positioning.

**UNIT III SERVICE DESIGN AND DEVELOPMENT**

**9**

Service Life Cycle – New service development – Service Blue Printing – GAP model of service quality – Measuring service quality – SERVQUAL – Service Quality function development.

**UNIT IV SERVICE DELIVERY AND PROMOTION**

**9**

Positioning of services – Designing service delivery System, Service Channel – Pricing of services, methods – Service marketing triangle - Integrated Service marketing communication.

**UNIT V SERVICE STRATEGIES**

**9**

Service Marketing Strategies for health – Hospitality – Tourism – Financial – Logistics - Educational – Entertainment & public utility Information technique Services

**TOTAL: 45 PERIODS**

**OUTCOME:**

- Will be able to apply the concepts of services marketing in promoting services.

**REFERENCES :**

1. Christopher H.Lovelock and Jochen Wirtz, Services Marketing, Pearson Education, New Delhi, 7<sup>th</sup> edition, 2011.
2. Hoffman, Marketing of Services, Cengage, 4<sup>th</sup> Edition, 2010.
3. Kenneth E Clow, et al, Services Marketing Operation Management and Strategy, Biztantra, 2<sup>nd</sup> Edition, New Delhi, 2004.
4. Valarie Zeithaml et al, Services Marketing, 5<sup>th</sup> International Edition, Tata McGraw Hill, 2007.
5. Gronroos, Service Management and Marketing –Wiley India, 3<sup>rd</sup> Edition, 2009.

**BA5007**

**SOCIAL MARKETING**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

- To enhance Competiveness in Social Marketing by ethical values and social media in Marketing.

**UNIT I INTRODUCTION**

**9**

Social marketing - Definition - Scope and concept - Evolution of Social marketing - Need for Social marketing - A comparative study between Commercial and Social marketing - Use of market research - social change tools - Factors influencing Social marketing - Challenges and opportunities.

## **UNIT II SOCIAL MARKETING PROCESS AND PLANNING 9**

Introduction - Environment Monitoring - Social Class and self-efficacy - social capital - Social ecology - Advocacy - A global phenomenon - Social marketing Process - Stages - Ethical considerations. Planning - Formative Research in Social marketing. Analysis - Problem - Environment - Resource.

Segmentation - Motives and benefits - Sheth's and Frazier's attitude - behavior segmentation - Stage approach to segmentation - Selecting target audiences - Cross cultural targeting - cultural and individual tailoring.

## **UNIT III SOCIAL MARKETING MIX 9**

Social marketing mix - policy - product - place - price - promotion - people - partnership. Rating & Reviews - Virtual world - Using media in social marketing - Importance - effectiveness of mass media in social marketing - Practical model for media use in social marketing - Advertisement - Publicity - Edutainment - Civic or Public - Choosing media & methods.

Role of media in social marketing campaigns - planning and developing Social media campaigning – Campaign vs Programme - Programme planning models – conceptual model Lawrence Green's PRECEDE-PROCEED model.

## **UNIT IV ETHICAL ISSUES AND CHALLENGES 9**

Ethical principles - Codes of behaviour - Critics of social marketing - Critic of power imbalance in social marketing - Criticism of unintended consequences - Competition in social marketing- Definition - monitoring - countering competition - competition and principle of differential advantage - Internal competition.

## **UNIT V TRENDS IN SOCIAL MARKETING 9**

Future of Social marketing - setting priorities in social marketing - Repositioning strategies- Future of Public sector – NGO – Private sector social marketing.

Social Media marketing - Importance - Big Brands & Small business - E mail marketing -Social Media Tools –Marketing with Social network sites, blogging, micro blogging, podcasting with Podomatic

**TOTAL: 45 PERIODS**

### **OUTCOME:**

- Applying Ethical Principles in Social Marketing through advanced marketing medias

### **REFERENCES :**

1. Rob Donovan & Nadine Henley. (2011). Principles and Practice of Social Marketing-an international perspective. Cambridge University Press.
2. Kotler, P., Roberto, N., & Lee, N. (2008). Social Marketing – Influencing Behaviors for Good. (3rd ed.). Thousand Oaks, CA: Sage Publications, Inc.
3. French, J., Blair-Stevens, C., McVey, D., & Merritt, R. Social Marketing and Public Health. Oxford, UK: University Press 2010.
4. Hastings, G. Social Marketing: Why should the Devil Have All the Best Tunes, Routledge 2013
5. Social marketing in the 21<sup>st</sup> Century- Alan R. Andreasen- sage Publication, 2012

**OBJECTIVES:**

- Grasp how banks raise their sources and how they deploy it and manage the associated risks
- Understand e-banking and the threats that go with it.

**UNIT I OVERVIEW OF INDIAN BANKING SYSTEM 9**

Overview of Indian Banking System, Functions of banks, key Acts governing the functioning of Indian banking system – RBI Act 1934, Negotiable Instruments Act 1881, Banking Regulations Act 1948 – Rights and obligations of a banker, Overview of Financial statement of banks – Balance sheet and Income Statement.

**UNIT II SOURCES AND APPLICATION OF BANK FUNDS 9**

Capital adequacy, Deposits and non-deposit sources, Designing of deposit schemes and pricing of deposit services, application of bank funds – Investments and Lending functions, Types of lending – Fund based, non-fund based, asset based – Different types of loans and their features, Major components of a typical loan policy document, Steps involved in Credit analysis, Credit delivery and administration, Pricing of loans, Customer profitability analysis.

**UNIT II CREDIT MONITORING AND RISK MANAGEMENT 9**

Need for credit monitoring, Signals of borrowers’ financial sickness, Financial distress prediction models – Rehabilitation process, Risk management – Interest rate, liquidity, forex, credit, market, operational and solvency risks – risk measurement process and mitigation, Basic understanding of NPAs and ALM.

**UNIT IV MERGERS, DIVERSIFICATION AND PERFORMANCE EVALUATION 9**

Mergers and Diversification of banks into securities market, underwriting, Mutual funds and Insurance business, Risks associated therewith. Performance analysis of banks – background factors, ratio analysis and CAMELS.

**UNIT V HIGH TECH E-BANKING 9**

Payment system in India – Paper based, e-payments – Electronic banking – advantages – Plastic money, E-money – Forecasting of cash demand at ATMs – Security threats in e-banking and RBI’s initiatives.

**TOTAL: 45 PERIODS****OUTCOME:**

- Price various types of loans proposed by banks to various prospective borrowers with different risk profiles and evaluate the performance of banks

**REFERENCES :**

1. Padmalatha Suresh and Justin Paul, “Management of Banking and Financial Services, Pearson, Delhi, 2012.
2. Meera Sharma, “Management of Financial Institutions – with emphasis on Bank and Risk Management”, PHI Learning Pvt. Ltd., New Delhi 2010.
3. Peter S. Rose and Sylvia C. and Hudgins, “Bank Management and Financial Services”, Tata McGraw Hill, New Delhi, 2012.
4. Madura, Financial Institutions & Markets, 10<sup>th</sup> edition, Cengage, 2016.

**OBJECTIVES :**

Student will acquire

- Nuances involved in short term corporate financing
- Good ethical practices

**UNIT I INDUSTRIAL FINANCE****9**

Indian Capital Market – Basic problem of Industrial Finance in India. Equity – Debenture financing – Guidelines from SEBI, advantages and disadvantages and cost of various sources of Finance – Finance from international sources, financing of exports – role of EXIM bank and commercial banks.– Finance for rehabilitation of sick units.

**UNIT II SHORT TERM-WORKING CAPITAL FINANCE****6**

Estimating working capital requirements – Approach adopted by Commercial banks, Commercial paper- Public deposits and inter corporate investments.

**UNIT III ADVANCED FINANCIAL MANAGEMENT****12**

Appraisal of Risky Investments - certainty equivalent of cash flows and risk adjusted discount rate - risk analysis in the context of DCF methods using Probability information - nature of cash flows - Sensitivity analysis - Simulation and investment decision, Decision tree approach in investment decisions.

**UNIT IV FINANCING DECISION****10**

Simulation and financing decision - cash inadequacy and cash insolvency - determining the probability of cash insolvency- Financing decision in the Context of option pricing model and agency costs- Interdependence of investment- financing and Dividend decisions.

**UNIT V CORPORATE GOVERNANCE****8**

Corporate Governance - SEBI Guidelines- Corporate Disasters and Ethics-Corporate Social Responsibility- Stakeholders and Ethics- Ethics, Managers and Professionalism.

**TOTAL: 45 PERIODS****OUTCOME :**

- Good ethical corporate manager

**REFERENCES :**

1. Richard A.Brealey, Stewart C.Myers and Mohanthy, Principles of Corporate Finance, Tata McGraw Hill, 9<sup>th</sup> Edition, 2011
2. I.M.Pandey, Financial Management, Vikas Publishing House Pvt., Ltd., 12<sup>th</sup> Edition, 2012.
3. Brigham and Ehrhardt, Corporate Finance - A focused Approach, Cengage Learning, 2nd Edition, 2011.
4. M.Y Khan, Indian Financial System, Tata McGraw Hill, 6<sup>th</sup> Edition, 2011
5. Smart, Megginson, and Gitman, Corporate Finance, 2nd Edition, 2011.
6. Krishnamurthy and Viswanathan, Advanced Corporate Finance, PHI Learning, 2011.
7. Website of SEBI
8. Besley, Brigham, Parasuraman, Corporate Finance, Cengage Learning, 2015
9. Michael C.Ehrhardt, Eugene F.Brigham, Corporate Finance – A focused approach, Cengage Learning, 2011.
10. Madura, International Corporate Finance, 10<sup>th</sup> edition, Cengage Learning, 2014.

**OBJECTIVE :**

- To understand the nuances involved in derivatives and to understand the basic operational mechanisms in derivatives.

**UNIT I INTRODUCTION 9**

Derivatives – Definition – Types – Forward Contracts – Futures Contracts – Options – Swaps – Differences between Cash and Future Markets – Types of Traders – OTC and Exchange Traded Securities – Types of Settlement – Uses and Advantages of Derivatives – Risks in Derivatives.

**UNIT II FUTURES CONTRACT 9**

Specifications of Futures Contract - Margin Requirements – Marking to Market – Hedging uses Futures – Types of Futures Contracts – Securities, Stock Index Futures, Currencies and Commodities – Delivery Options – Relationship between Future Prices, Forward Prices and Spot Prices.

**UNIT III OPTIONS 9**

Definition – Exchange Traded Options, OTC Options – Specifications of Options – Call and Put Options – American and European Options – Intrinsic Value and Time Value of Options – Option payoff, options on Securities, Stock Indices, Currencies and Futures – Options pricing models – Differences between future and Option contracts.

**UNIT IV SWAPS 9**

Definition of SWAP – Interest Rate SWAP – Currency SWAP – Role of Financial Intermediary – Warehousing – Valuation of Interest rate SWAPs and Currency SWAPs Bonds and FRNs – Credit Risk.

**UNIT V DERIVATIVES IN INDIA 9**

Evolution of Derivatives Market in India – Regulations - Framework – Exchange Trading in Derivatives – Commodity Futures – Contract Terminology and Specifications for Stock Options and Index Options in NSE – Contract Terminology and specifications for stock futures and Index futures in NSE – Contract Terminology and Specifications for Interest Rate Derivatives.

**TOTAL: 45 PERIODS****OUTCOME :**

- This course aims at providing an in-depth understanding of financial derivatives in terms of concepts, structure, instruments and trading strategies for profit and risk management.

**REFERENCES :**

- David Dubofsky – ‘Option and Financial Futures – Valuation and Uses, McGraw Hill International Edition.
- Don M. Chance, Robert Brooks, An Introduction to Derivatives and Risk Management, 9<sup>th</sup> edition, Cengage, 2015.
- John. C. Hull, Options, Futures and Other Derivative Securities’, PHI Learning, 9th Edition, 2012
- Keith Redhead, ‘Financial Derivatives – An Introduction to Futures, Forwards, Options and SWAPs’,– PHI Learning, 2011.
- S. L. Gupta, Financial Derivatives- Theory, Concepts and Practice, Prentice Hall of India, 2011.
- Stulz, Risk Management and Derivatives, Cengage, 2nd Edition, 2011.
- Varma, Derivatives and Risk Management, 2<sup>nd</sup> Edition, 2011.
- Website of NSE, BSE.

**OBJECTIVES :**

To enable student

- Understand the modes of issuing securities
- Acquire financial evaluation technique of leasing and hire purchase

**UNIT I MERCHANT BANKING 5**

Introduction – An Over view of Indian Financial System – Merchant Banking in India – Recent Developments and Challenges ahead – merchant banking services offered by banks – NBFC'S offering merchant banking – Banking system – types of banks – payment banking -Legal and Regulatory Framework – Relevant Provisions of Companies Act- SERA- SEBI guidelines- FEMA, etc. - Relation with Stock Exchanges and OTCEI.

**UNIT II ISSUE MANAGEMENT 12**

Role of Merchant Banker in Appraisal of Projects, Designing Capital Structure and Instruments – Issue Pricing – Book Building – Preparation of Prospectus Selection of Bankers, Advertising Consultants, etc. - Role of Registrars –Bankers to the Issue, Underwriters, and Brokers. – Offer for Sale – Green Shoe Option – E-IPO, Private Placement – Bought out Deals – Placement with FIs, MFs, FII, etc. Off - Shore Issues. – Issue Marketing – Advertising Strategies – NRI Marketing – Post Issue Activities.

**UNIT III OTHER FEE BASED SERVICES 10**

Mergers and Acquisitions – Portfolio Management Services – Credit Syndication – Credit Rating – Mutual Funds - Business Valuation.

**UNIT IV FUND BASED FINANCIAL SERVICES 10**

Leasing and Hire Purchasing – Basics of Leasing and Hire purchasing – Financial Evaluation.

**UNIT V OTHER FUND BASED FINANCIAL SERVICES 8**

Consumer Credit – Credit Cards – Real Estate Financing – Bills Discounting – factoring and Forfeiting – Venture Capital - venture debt funds – start up financing.

**TOTAL: 45 PERIODS**

**OUTCOME**

- Good knowledge on merchant banking activities

**REFERENCES :**

1. M.Y.Khan, Financial Services, Tata McGraw-Hill, 12<sup>th</sup> Edition, 2012
2. Nalini Prava Tripathy, Financial Services, PHI Learning, 2011.
3. Machiraju, Indian Financial System, Vikas Publishing House, 2nd Edition, 2010.
4. J.C.Verma, A Manual of Merchant Banking, Bharath Publishing House, New Delhi,
5. Varshney P.N. & Mittal D.K., Indian Financial System, Sultan Chand & Sons, New Delhi.
6. Sasidharan, Financial Services and System, Tata Mcgraw Hill, New Delhi, 2nd Edition, 2011.
7. Website of SEBI
8. Madura, Financial Institutions & Markets, 10<sup>th</sup> edition, Cengage, 2016.

**OBJECTIVES :**

Enables student to

- Understand the nuances of stock market operations.
- Understand the techniques involved in deciding upon purchase or sale of securities.

**UNIT I INVESTMENT SETTING****8**

Financial and economic meaning of Investment – Characteristics and objectives of Investment – Types of Investment – Investment alternatives – Choice and Evaluation – Risk and return concepts.

**UNIT II SECURITIES MARKETS****10**

Financial Market - Segments – Types - - Participants in financial Market – Regulatory Environment, Primary Market – Methods of floating new issues, Book building – Role of primary market – Regulation of primary market, Stock exchanges in India – BSE, OTCEI , NSE, ISE, and Regulations of stock exchanges – Trading system in stock exchanges –SEBI.

**UNIT III FUNDAMENTAL ANALYSIS****9**

Economic Analysis – Economic forecasting and stock Investment Decisions – Forecasting techniques. Industry Analysis : Industry classification, Industry life cycle – Company Analysis Measuring Earnings – Forecasting Earnings – Applied Valuation Techniques – Graham and Dodds investor ratios.

**UNIT IV TECHNICAL ANALYSIS****9**

Fundamental Analysis Vs Technical Analysis – Charting methods – Market Indicators. Trend – Trend reversals – Patterns - Moving Average – Exponential moving Average – Oscillators – Market Indicators – Efficient Market theory.

**UNIT V PORTFOLIO MANAGEMENT****9**

Portfolio analysis – Portfolio Selection –Capital Asset Pricing model – Portfolio Revision Portfolio Evaluation – Mutual Funds.

**TOTAL: 45 PERIODS****OUTCOME**

- Become a good investment analyst

**REFERENCES :**

1. Donald E.Fischer & Ronald J.Jordan, Security Analysis & Portfolio Management, PHI Learning., New Delhi, 8<sup>th</sup> edition, 2011.
2. Prasannachandra, Investment analysis and Portfolio Management, Tata McGraw Hill, 2011.
3. Reilly & Brown, Investment Analysis and Portfolio Management, Cengage, 10<sup>th</sup> edition, 2016.
4. S. Kevin , Securities Analysis and Portfolio Management , PHI Learning , 2012.

**OBJECTIVE :**

- Enable students to acquire techniques of evaluating strategic investment decisions understand the causes of prediction modes of financial distress.

**UNIT I INVESTMENT DECISIONS 9**  
Project Investment Management Vs Project Management – Introduction to profitable projects – evaluation of Investment opportunities – Investment decisions under conditions of uncertainty – Risk analysis in Investment decision – Types of investments and disinvestments.

**UNIT II CRITICAL ANALYSIS OF APPRAISAL TECHNIQUES 10**  
Significance of Information and data bank in project selections – Investment decisions under capital constraints – capital rationing, Portfolio – Portfolio risk and diversified projects.

**UNIT III STRATEGIC ANALYSIS OF SELECTED INVESTMENT DECISIONS 10**  
Lease financing – Lease Vs Buy decision – Hire Purchase and installment decision – Hire Purchase Vs Lease Decision – Mergers and acquisition – Cash Vs Equity for mergers.

**UNIT IV FINANCING DECISIONS 8**  
Capital Structure – Capital structure theories – Capital structure Planning in Practice.

**UNIT V FINANCIAL DISTRESS 8**  
Consequences, Issues, Bankruptcy, Settlements, reorganization and Liquidation in bankruptcy.

**TOTAL: 45 PERIODS****OUTCOME :**

- Possess good knowledge in techniques for making strategic investment decision and tackling financial distress

**REFERENCES:**

1. Prasanna Chandra, Financial Management, Tata McGraw Hill, 9th Edition, 2012.
2. Prasanna Chandra, Projects : Planning, Analysis, Financing Implementation and Review, TMH, New Delhi, 2011.
3. Bodie, Kane, Marcus: Investment, Tata McGraw Hill, New Delhi, 2010.
4. Brigham E. F & Houston J.F. Financial Management, Thomson Publications, 9 th edition, 2010.
5. M. Pandey, Financial Management, Vikas Publishing House, 10th edition, 2010.
6. M. Y. Khan and P. K. Jain, Financial Management Text and Problems, Tata McGraw Hill Publishing Co, 2011.
7. Website of IDBI Related to Project Finance.

**OBJECTIVES :**

To enable student

- Understand export import finance and forex management
- Understand the documentation involved in international trade

<b>UNIT I</b>	<b>INTERNATIONAL TRADE</b>	<b>9</b>
International Trade – Meaning and Benefits – Basis of International Trade –Foreign Trade and Economic Growth – Balance of Trade – Balance of Payment – Current Trends in India – Barriers to International Trade – WTO – Indian EXIM Policy.		
<b>UNIT II</b>	<b>EXPORT AND IMPORT FINANCE</b>	<b>9</b>
Special need for Finance in International Trade – INCO Terms (FOB, CIF, etc.,) – Payment Terms – Letters of Credit – Pre Shipment and Post Shipment Finance – Forfaiting – Deferred Payment Terms – EXIM Bank – ECGC and its schemes Import Licensing – Financing methods for import of Capital goods		
<b>UNIT III</b>	<b>FOREX MANAGEMENT</b>	<b>9</b>
Foreign Exchange Markets – Spot Prices and Forward Prices – Factors influencing Exchange rates – The effects of Exchange rates in Foreign Trade – Tools for hedging against Exchange rate variations – Forward, Futures and Currency options – FEMA – Determination of Foreign Exchange rate and Forecasting.		
<b>UNIT IV</b>	<b>DOCUMENTATION IN INTERNATIONAL TRADE</b>	<b>9</b>
Export Trade Documents: Financial Documents – Bill of Exchange- Type- Commercial Documents - Proforma, Commercial, Consular, Customs, Legalized Invoice, Certificate of Origin Certificate Value, Packing List, Weight Certificate, Certificate of Analysis and Quality, Certificate of Inspection, Health certificate. Transport Documents -Bill of Lading, Airway Bill, Postal Receipt, Multimodal Transport Document. Risk Covering Document: Insurance Policy, Insurance Cover Note. Official Document: Export Declaration Forms, GR Form, PP Form, COD Form, Softer Forms, Export Certification, GSPS – UPCDC Norms.		
<b>UNIT V</b>	<b>EXPORT PROMOTION SCHEMES</b>	<b>9</b>
Government Organizations Promoting Exports – Export Incentives : Duty Exemption – IT Concession – Marketing Assistance – EPCG, DEPB – Advance License – Other efforts I Export Promotion – EPZ – EQU – SEZ and Export House.		

**TOTAL: 45 PERIODS**

**OUTCOME**

- Possess good knowledge on international trade and the documentation involved in it.

**TEXT BOOKS**

1. Apte P.G., International Financial Management, Tata McGraw Hill, 2011.
2. Jeff Madura, International Corporate Finance, Cengage Learning, 9th Edition, 2011.

**REFERENCES**

1. Alan C. Shapiro, Multinational Financial Management, PHI Learning, 5th Edition, 2010.
2. Eun and Resnik, International Financial Management, Tata McGraw Hill, 5th Edition, 2011.
3. Website of Indian Government on EXIM policy

**OBJECTIVE:**

- To develop and strengthen entrepreneurial quality and motivation in students. To impart basic entrepreneurial skills and understandings to run a business efficiently and effectively.

**UNIT I ENTREPRENEURIAL COMPETENCE 6**

Entrepreneurship concept – Entrepreneurship as a Career – Entrepreneurial Personality - Characteristics of Successful, Entrepreneur – Knowledge and Skills of Entrepreneur.

**UNIT II ENTREPRENEURIAL ENVIRONMENT 12**

Business Environment - Role of Family and Society - Entrepreneurship Development Training and Other Support Organisational Services - Central and State Government Industrial Policies and Regulations - International Business.

**UNIT III BUSINESS PLAN PREPARATION 12**

Sources of Product for Business - Prefeasibility Study - Criteria for Selection of Product - Ownership - Capital - Budgeting Project Profile Preparation - Matching Entrepreneur with the Project - Feasibility Report Preparation and Evaluation Criteria.

**UNIT IV LAUNCHING OF SMALL BUSINESS 10**

Finance and Human Resource Mobilization Operations Planning - Market and Channel Selection - Growth Strategies - Product Launching – Incubation, Venture capital, IT startups.

**UNIT V MANAGEMENT OF SMALL BUSINESS 5**

Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units- Effective Management of small Business.

**TOTAL: 45 PERIODS****OUTCOME:**

- Students will gain knowledge and skills needed to run a business.

**REFERENCES:**

- Hisrich, Entrepreneurship, Edition 9, Tata McGraw Hill, New Delhi, 2014
- S.S.Khanka, Entrepreneurial Development, S.Chand and Company Limited, New Delhi, (Revised Edition) 2013.
- Mathew Manimala, Entrepreneurship Theory at the Crossroads, Paradigms & Praxis, Biztrantra, 2<sup>nd</sup> Edition, 2005
- Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill, 1996.
- P.Saravanavel, Entrepreneurial Development, Ess Pee kay Publishing House, Chennai
- 1997.
- Arya Kumar. Entrepreneurship. Pearson, 2012.
- Donald F Kuratko, T.V Rao. Entrepreneurship: A South Asian perspective. Cengage, 2012

**OBJECTIVE:**

- To explore contemporary knowledge and gain a conceptual understanding of industrial relations.

**UNIT I INDUSTRIAL RELATIONS****7**

Concepts – Importance – Industrial Relations problems in the Public Sector – Growth of Trade Unions – Codes of conduct.

**UNIT II INDUSTRIAL CONFLICTS****12**

Disputes – Impact – Causes – Strikes – Prevention – Industrial Peace – Government Machinery – Conciliation – Arbitration – Adjudication.

**UNIT III LABOUR WELFARE****8**

Concept – Objectives – Scope – Need – Voluntary Welfare Measures – Statutory Welfare Measures – Labour – Welfare Funds – Education and Training Schemes.

**UNIT IV INDUSTRIAL SAFETY****9**

Causes of Accidents – Prevention – Safety Provisions – Industrial Health and Hygiene – Importance – Problems – Occupational Hazards – Diseases – Psychological problems – Counseling – Statutory Provisions.

**UNIT V WELFARE OF SPECIAL CATEGORIES OF LABOUR****9**

Child Labour – Female Labour – Contract Labour – Construction Labour – Agricultural Labour – Differently abled Labour – BPO & KPO Labour - Social Assistance – Social Security – Implications.

**TOTAL: 45 PERIODS****OUTCOME:**

- Students will know how to resolve industrial relations and human relations problems and promote welfare of industrial labour.

**REFERENCES :**

- Mamoria C.B., Sathish Mamoria, Gankar, Dynamics of Industrial Relations, Himalaya Publishing House, New Delhi, 2012.
- Arun Monappa, Ranjeet Nambudiri, Patturaja Selvaraj. Industrial relations & Labour Laws. Tata McGraw Hill. 2012.
- Ratna Sen, Industrial Relations in India, Shifting Paradigms, Macmillan India Ltd., New Delhi, 2007.
- C.S.Venkata Ratnam, Globalisation and Labour Management Relations, Response Books, 2007.
- Srivastava, Industrial Relations and Labour laws, Vikas, 2007.
- P.N.Singh, Neeraj Kumar. Employee relations Management. Pearson. 2011.
- P.R.N Sinha, Indu Bala Sinha, Seema Priyadarshini Shekhar. Industrial Relations, Trade Unions and Labour Legislation. Pearson. 2004

**OBJECTIVE:**

- To have a broad understanding of the legal principles governing the employment relationship at individual and collective level.
- To familiarise the students to the practical problems inherent in the implementation of labour statutes.

Contained in the following acts are to be studied.

	Periods
1. The Factories Act, 1948	3
2. The Trade Unions Act, 1926	4
3. The Payment of Wages Act, 1936	3
4. The Minimum Wages Act, 1948	2
5. The Industrial Disputes Act, 1947	5
6. The Workmen's Compensation Act, 1923	2
7. The Payment of Gratuity Act, 1972	3
8. The Payment of Bonus Act, 1965	3
9. The Employee's Provident Fund & Misc. Act, 1952	3
10. The Employees State Insurance Act, 1948	4
11. The Industrial Employment (Standing Orders) Act, 1946	3
12. The Apprentices Act, 1961	2
13. The Equal Remuneration Act, 1976	2
14. The Maternity Benefit Act, 1961	2
15. Contract Labour Regulations and Abolition Act, 1970	2
16. The Child Labour Prevention and Regulation Act, 1986	2

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- To appreciate the application of labour laws.
- Legal Provision relating to
  - a) Wages
  - b) Working Conditions and Labour Welfare
  - c) Industrial Relations
  - d) Social Security

**REFERENCES :**

1. P.K. Padhi, Industrial Laws, PHI, 2008.
2. Kapoor N. D , Elements of Mercantile Law, Sultan Chand, 2008
3. Tax Mann, Labour Laws, 2008.
4. D. R. N. Sinha, Indu Balasinha & Semma Priyadarshini Shekar, Industrial Relation, Trade unions and Labour Legislation, 2004.
5. Arun Monappa, Ranjeet Nambudiri, Patturaja Selvaraj. Industrial relations & Labour Laws. Tata McGraw Hill. 2012
6. Srivastava, Industrial Relations and Labour laws, Vikas, 2007.
7. Respective Bare Acts.

**OBJECTIVE:**

- To examine managerial styles in terms of concern for production and concern for people. To assess different systems of management and relate these systems to organisational characteristics.

<b>UNIT I</b>	<b>DEFINING THE MANAGERIAL JOB</b>	<b>8</b>
Descriptive Dimensions of Managerial Jobs – Methods – Model – Time Dimensions in Managerial Jobs – Effective and Ineffective Job behaviour – Functional and level differences in Managerial Job behaviour.		
<b>UNIT II</b>	<b>DESIGNING THE MANAGERIAL JOB</b>	<b>12</b>
Identifying Managerial Talent – Selection and Recruitment – Managerial Skills Development – Pay and Rewards – Managerial Motivation – Effective Management Criteria – Performance Appraisal Measures – Balanced Scorecard - Feedback – Career Management – Current Practices.		
<b>UNIT III</b>	<b>THE CONCEPT OF MANAGERIAL EFFECTIVENESS</b>	<b>7</b>
Definition – The person, process, product approaches – Bridging the Gap – Measuring Managerial Effectiveness – Current Industrial and Government practices in the Management of Managerial Effectiveness- the Effective Manager as an Optimizer.		
<b>UNIT IV</b>	<b>ENVIRONMENTAL ISSUES IN MANAGERIAL EFFECTIVENESS</b>	<b>8</b>
Organisational Processes – Organisational Climate – Leader – Group Influences – Job Challenge – Competition – Managerial Styles.		
<b>UNIT V</b>	<b>DEVELOPING THE WINNING EDGE</b>	<b>10</b>
Organisational and Managerial Efforts – Self Development – Negotiation Skills – Development of the Competitive Spirit – Knowledge Management – Fostering Creativity and innovation.		

**TOTAL:45 PERIODS****OUTCOME:**

- Students will gain knowledge about appropriate style of managerial behaviour.

**REFERENCES:**

- Peter Drucker, Management, Harper Row, 2006.
- Milkovich and Newman, Compensation, McGraw-Hill International, 2013.
- Blanchard and Thacker, Effective Training Systems, Strategies and Practices Pearson 2012.
- Dubrin, Leadership, Research Findings, Practices & Skills, Biztantra, 2015.
- Joe Tidd , John Bessant, Keith Pavitt , Managing Innovation ,Wiley 3<sup>rd</sup> edition,2006.
- T.V.Rao,Appraising and Developing Managerial Performance, Excel Books,2002.
- R.M.Omkar, Personality Development and Career Management, S.Chand 1<sup>st</sup>edition,2008.
- Richard L.Daft, Leadership, Cengage, 1 st Indian Reprint 2008.

**OBJECTIVE:**

- To learn how an organization can be designed and developed to deal with the challenges from environment, technology, and its own processes.

**UNIT I ORGANISATION & ITS ENVIRONMENT 8**  
Meaning of Organisation – Need for existence - Organisational Effectiveness – Creation of Value – Measuring Organisational Effectiveness – External Resources Approach, Internal Systems Approach and Technical approach - HR implications.

**UNIT II ORGANIZATIONAL DESIGN 15**  
Organizational Design – Determinants – Components – Types - Basic Challenges of design – Differentiation, Integration, Centralization, Decentralization, Standardization, Mutual adjustment- Mechanistic and Organic Structures- Technological and Environmental Impacts on Design- Importance of Design – Success and Failures in design - Implications for Managers.

**UNIT III ORGANISATIONAL CULTURE 6**  
Understanding Culture – Strong and Weak Cultures – Types of Cultures – Importance of Culture - Creating and Sustaining Culture - Culture and Strategy - Implications for practicing Managers.

**UNIT IV ORGANISATIONAL CHANGE 6**  
Meaning – Forces for Change - Resistance to Change – Types and forms of change – Evolutionary and Revolutionary change – Change process -Organisation Development – HR functions and Strategic Change Management - Implications for practicing Managers.

**UNIT V ORGANISATION EVOLUTION AND SUSTENANCE 10**  
Organizational life cycle – Models of transformation – Models of Organizational Decision making – Organizational Learning – Innovation, Intrapreneurship and Creativity-HR implications.

**TOTAL: 45 PERIODS****OUTCOME:**

- Students will be able to analyze organizations more accurately and deeply by applying organization theory.

**REFERENCES:**

1. Thomson G. Cummings and Christopher G. Worley, Organisational development and Change, Cengage, 9<sup>th</sup> edition 2011
2. Robbins Organisation Theory; Structure Design & Applications, Prentice Hall of India, 2009.
3. Bhupen Srivastava, Organisational Design and Development: Concepts application, Biztantra , 2010.
4. Robert A Paton, James Mc Calman, Change Management, A guide to effective implementation, Response Books, 2012.
5. Adrian Thorn Hill, Phil Lewis, Mike Mill more and Mark Saunders, Managing Change -A Human Resource Strategy Approach, Wiley, 2010.
6. Gareth R.Jones, Organisational Theory, Design & Change, Pearson Education, 6<sup>th</sup> Edition 2011.
7. Richard L. Daft, Understanding theory & Design of Organisations, Cengage, Western, 10<sup>th</sup> Edition 2012.

**OBJECTIVE:**

- To help students understand the transformation in the role of HR functions from being a support function to strategic function.

**UNIT I HUMAN RESOURCE DEVELOPMENT 10**

Meaning – Strategic framework for HRM and HRD – Vision, Mission and Values – Importance – Challenges to Organisations – HRD Functions - Roles of HRD Professionals - HRD Needs Assessment - HRD practices – Measures of HRD performance – Links to HR, Strategy and Business Goals – HRD Program Implementation and Evaluation – Recent trends – Strategic Capability, Benchmarking and HRD Audit.

**UNIT II E-HRM 6**

e- Employee profile– e- selection and recruitment - Virtual learning and Orientation – e - training and development – e- Performance management and Compensation design – Development and Implementation of HRIS – Designing HR portals – Issues in employee privacy – Employee surveys online.

**UNIT III CROSS CULTURAL HRM 7**

Domestic Vs International HRM - Cultural Dynamics - Culture Assessment - Cross Cultural Education and Training Programs – Leadership and Strategic HR Issues in International Assignments - Current challenges in Outsourcing, Cross border Mergers and Acquisitions - Repatriation etc - Building Multicultural Organisation - International Compensation.

**UNIT IV CAREER & COMPETENCY DEVELOPMENT 10**

Career Concepts – Roles – Career stages – Career planning and Process – Career development Models– Career Motivation and Enrichment –Managing Career plateaus- Designing Effective Career Development Systems – Competencies and Career Management – Competency Mapping Models – Equity and Competency based Compensation.

**UNIT V EMPLOYEE COACHING & COUNSELING 12**

Need for Coaching – Role of HR in coaching – Coaching and Performance – Skills for Effective Coaching – Coaching Effectiveness– Need for Counseling – Role of HR in Counseling - Components of Counseling Programs – Counseling Effectiveness – Employee Health and Welfare Programs – Work Stress – Sources - Consequences – Stress Management Techniques.- Eastern and Western Practices - Self Management and Emotional Intelligence.

**TOTAL: 45 PERIODS****OUTCOME:**

- Students will have a better understanding of the tools and techniques used by organizations to meet current challenges.

**REFERENCES :**

- Randy L. Desimone, Jon M. Werner – David M. Mathis, Human Resource Development, Cengage Learning, Edition 6, 2012.
- Paul Boselie. Strategic Human Resource Management. Tata McGraw Hill. 2012.
- Jeffrey A Mello, Strategic Human Resource Management, Cengage, Southwestern 2007.
- Robert L. Mathis and John H. Jackson, Human Resource Management, Cengage, 2007.
- Monir Tayeb. International Human Resource Management. Oxford. 2007
- Randall S Schuler and Susan E Jackson. Strategic Human Resource Management. Wiley India. 2<sup>nd</sup> edition
- McLeod. The Counsellor's workbook. Tata McGraw Hill. 2011

**OBJECTIVES :**

- To understand the various advanced databases used in the organization
- To be aware of recent trends in database management.

**UNIT I INTRODUCTION 9**

DBMS Models - Multimedia Databases, Parallel Databases, embedded, web, spatial, temporal databases, Virtualization, Active Databases - Embedded databases - Web databases.

**UNIT II DATABASE IMPLEMENTATION 9**

Query Processing basics and optimization – Heuristic Optimization – Transactions Models – Concurrency Control – Recovery – Security and Authorization – Storage – Indexing and Hashing – ISAM – B-Trees – Kd Trees – X Trees – Dynamic Hashing.

**UNIT III DISTRIBUTED DATABASES 9**

Distributed Databases – Queries – Optimization Access Strategies – Distributed Transactions Management – Concurrency Control – Reliability

**UNIT IV OBJECT ORIENTED DATABASES 9**

Object Oriented Concepts – Data Object Models – Object Oriented Databases – Issues in OODBMS - Object Oriented Relational Databases – Object Definition Languages – Object Query Languages

**UNIT V EMERGING TRENDS 9**

Data Mining – Data warehousing – Star, Snowflake, Fact Constellation; open source database systems, Scripting Language, JDBC, ODBC

**TOTAL: 45 PERIODS****OUTCOMES :**

- Awareness of database models
- Knowledge of database technologies

**REFERENCES :**

1. Peter Rob, Carlos Coronel, Database System and Design, Implementation and Management, 8<sup>th</sup> edition, Cengage,
2. Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, 7<sup>th</sup> edition, Pearson Education, 2015.
3. Jeffrey A Hoffer et al, Modern Database Management, 12<sup>th</sup> Edition, Pearson Education, 2016,
4. Abraham Silberchatz, Henry F. Korth and S.Sudarsan, Database System Concepts, 6<sup>th</sup> Edition, McGraw-Hill, 2015.
5. Thomas M. Connolly and Carolyn E. Begg, Database Systems – A Practical Approach to Design, Implementation and Management, 6<sup>th</sup> edition, Pearson Education, 2015.
6. Jeffrey D. Ullman and Jennifer Widom, A First Course in Database Systems, 3<sup>rd</sup> edition, Pearson Education Asia, 2013.
7. Stefano Ceri and Giuseppe Pelagatti, Distributed Databases Principles and Systems, McGraw-Hill International Editions, 2008.
8. Rajesh Narang, Object Oriented Interfaces and Databases, 1<sup>st</sup> edition, Prentice Hall of India, 2004.
9. Mark L. Gillenson & el, Introduction to database management, 2<sup>nd</sup> edition, Wiley India Pvt. Ltd, 2012
10. Charkrabarti, Advanced Database Management Systems, Wiley India Pvt Ltd, 2011

**OBJECTIVES :**

- To know how to derive meaning form huge volume of data and information
- To understand how knowledge discovering process is used in business decision making

**UNIT I INTRODUCTION****9**

Data mining, Text mining, Web mining, Spatial mining, Process mining, BI process- Private and Public intelligence, Strategic assessment of implementing BI

**UNIT II DATA WAREHOUSING****9**

Data ware house – characteristics and view - OLTP and OLAP - Design and development of data warehouse, Meta data models, Extract/ Transform / Load (ETL) design

**UNIT III DATA MINING TOOLS, METHODS AND TECHNIQUES****9**

Regression and correlation; Classification- Decision trees; clustering –Neural networks; Market basket analysis- Association rules-Genetic algorithms and link analysis, Support Vector Machine, Ant Colony Optimization

**UNIT IV MODERN INFORMATION TECHNOLOGY AND ITS BUSINESS OPPORTUNITIES****9**

Business intelligence software, BI on web, Ethical and legal limits, Industrial espionage, modern techniques of crypto analysis, managing and organizing for an effective BI Team.

**UNIT V BI AND DATA MINING APPLICATIONS****9**

Applications in various sectors – Retailing, CRM, Banking, Stock Pricing, Production, Crime, Genetics, Medical, Pharmaceutical.

**TOTAL: 45 PERIODS****OUTCOMES :**

- Big Data Management
- Appreciate the techniques of knowledge discovery for business applications

**REFERENCES :**

1. Jaiwei Ham and Micheline Kamber, Data Mining concepts and techniques, Kauffmann Publishers 3 rd edition, 2011
2. Efraim Turban, Ramesh Sharda, Jay E. Aronson and David King, Business Intelligence, 3<sup>rd</sup> edition, Prentice Hall, 2014.
3. W.H.Inmon, Building the Data Warehouse, fourth edition Wiley India pvt. Ltd. 2005.
4. Ralph Kimball and Richard Merz, The data warehouse toolkit, John Wiley, 2005.
5. Michel Berry and Gordon Linoff, Mastering Data mining, John Wiley and Sons Inc, 3<sup>nd</sup> Edition, 2011
6. Michel Berry and Gordon Linoff, Data mining techniques for Marketing, Sales and Customer support, John Wiley, 3 rd edition 2011
7. G. K. Gupta, Introduction to Data mining with Case Studies, Prentice hall of India, 2014.
8. Giudici, Applied Data mining – Statistical Methods for Business and Industry, John Wiley. 2009
9. Elizabeth Vitt, Michael Luckevich Stacia Misner, Business Intelligence, Microsoft, 2011
10. Michalewicz Z., Schmidt M. Michalewicz M and Chiriac C, Adaptive Business Intelligence, Springer – Verlag, edition 2016
11. Galit Shmueli, Nitin R. Patel and Peter C. Bruce, Data Mining for Business Intelligence – Concepts, Techniques and Applications Wiley, India ,3rd edition, 2016

**OBJECTIVES :**

- To understand the business process of an enterprise
- To grasp the activities of erp project management cycle
- To understand the emerging trends in erp developments

**UNIT I INTRODUCTION****8**

Overview of enterprise systems – Evolution - Risks and benefits - Fundamental technology - Issues to be consider in planning design and implementation of cross functional integrated ERP systems.

**UNIT II ERP SOLUTIONS AND FUNCTIONAL MODULES****10**

Overview of ERP software solutions- Small, medium and large enterprise vendor solutions, BPR, and best business practices - Business process Management, Functional modules.

**UNIT III ERP IMPLEMENTATION****10**

Planning Evaluation and selection of ERP systems - Implementation life cycle - ERP implementation, Methodology and Frame work- Training – Data Migration. People Organization in implementation- Consultants, Vendors and Employees.

**UNIT IV POST IMPLEMENTATION****8**

Maintenance of ERP- Organizational and Industrial impact; Success and Failure factors of ERP Implementation.

**UNIT V EMERGING TRENDS ON ERP****9**

Extended ERP systems and ERP add-ons -CRM, SCM, Business analytics- Future trends in ERP systems-web enabled, Wireless technologies, cloud computing.

**TOTAL: 45 PERIODS****OUTCOMES**

- Knowledge of ERP implementation cycle
- Awareness of core and extended modules of ERP

**REFERENCES :**

1. Alexis Leon, ERP demystified, second Edition Tata McGraw-Hill, 2008.
2. Sinha P. Magal and Jeffery Word, Essentials of Business Process and Information System, Wiley India, 2012
3. Jagan Nathan Vaman, ERP in Practice, Tata McGraw-Hill, 2008
4. Alexis Leon, Enterprise Resource Planning, third edition, Tata McGraw-Hill, 2014.
5. Mahadeo Jaiswal and Ganesh Vanapalli, first edition,ERP Macmillan India, 2013
6. Vinod Kumar Grag and N.K. Venkitakrishnan, ERP- Concepts and Practice, second edition Prentice Hall of India, 2009.
7. Summer, ERP, Pearson Education, 2016

**OBJECTIVES:**

- To understand the various project management phases – Initiation, Planning, Tracking and Closure
- To study various project estimation methodologies, process models and risk management
- To understand quality assurance in software development

**UNIT I PROJECT MANAGEMENT OVERVIEW 8**

What is Project and Project Management, Various phase of Project Management, Project Stakeholders, Project Management Organisation (PMO); Roles and Responsibilities of Project Manager. Brief introduction to various process models - Waterfall, RAD, V, Spiral, Incremental, Prototyping, Agile– SCRUM, Extreme Programming (XP) and Kanban **Project Initiation** - Project Charter; Statement of Work (SoW)

**UNIT II PROJECT PLANNING 10**

Project Planning Activities- Project Scope, Work Breakdown Structures (WBS), Software estimation methodologies - COCOMO Model and Function Point  
**Project Scheduling Techniques** – Program Evaluation and Review Technique (PERT), Gantt Chart and Critical Path Method (CPM)

**UNIT III PROJECT TRACKING 10**

Monitoring and Control, Project Status Reporting; Project Metrics; Earned Value Analysis (EVA); Project Communication Plan & Techniques; Steps for Process Improvement.

**Risk Management:** Concepts of Risks and Risk Management; Risk Management Activities; Effective Risk Management; Risk Categories; Aids for Risk Identification; Potential Risk Treatments; Risk Components and Drivers; Risk Prioritization.

**UNIT IV PROJECT CLOSURE 8**

Project Closure Analysis, Lesson Learnt

**Software Quality Assurance**-Software Quality Assurance Activities; Software Qualities; Software Quality Standards – ISO Standards for Software Organization, Capability Maturity Model (CMM), Comparison between ISO 9001 & SEI CMM, Other Standards.

**UNIT V AGILE PROJECT MANAGEMENT WITH SCRUM 9**

Agile Manifesto and Agile Principles

**Agile Scrum** - Purpose, Values, Scrum Framework, Scrum Roles – Product Owner, Scrum Master & Team, Scrum Events – Sprint Planning, Daily Scrum/Stand-up Meeting, Sprint Review, Sprint Retrospective, Scrum Artefacts – Product Backlog, Sprint Backlog, Increment and Definition of Done (DoD), Agile estimation – Story Point

**TOTAL:45 PERIODS****OUTCOMES:**

At the end of this course, student should be able to:

- Manage different phases of Software Project Management
- Identify Risk and create risk mitigation plan
- Apply software quality assurance for better quality software delivery

**REFERENCES:**

- Bob Hughes and Mike Cotterell, Software Project Management, Tata McGraw Hill, 5<sup>th</sup> Edition
- Jalote, "Software Project Management in Practice", Pearson Education
- Ramesh, Gopalaswamy, "Managing Global Projects", Tata McGraw Hill
- Ken Schwaber, Agile Project Management with Scrum, Microsoft Press
- Mike Cohn, Agile Estimating & Planning, Pearson
- Royce, "Software Project Management", Pearson Education, 1999.

## ONLINE RESOURCES:

- <http://agilemanifesto.org/>
- <https://www.scrum.org/Resources/What-is-Scrum>
- <http://www.scrumguides.org/scrum-guide.html#purpose>

BA5024

E- BUSINESS MANAGEMENT

L T P C  
3 0 0 3

## OBJECTIVES:

- To understand the practices and technology to start an online business

### UNIT I INTRODUCTION TO e-BUSINESS

8

e-business, e-business vs e-commerce, Economic forces – advantages – myths – e-business models, design, develop and manage business, Web 2.0 and Social Networking, Mobile Commerce, S-commerce.

### UNIT II TECHNOLOGY INFRASTRUCTURE

10

Internet and World Wide Web, internet protocols- FTP, intranet and extranet, Cloud Service Models – SAAS, PAAS, IAAS, Cloud Deployment Models – Public Cloud, Private Cloud, Hybrid Cloud, Auto-Scaling in the Cloud, Internet information publishing technology- basics of web server hardware and software

### UNIT III BUSINESS APPLICATIONS

10

Consumer oriented e-business – e-tailing and models – Marketing on web – advertising, e-mail marketing, affiliated programs - e-CRM; online services, Business oriented e-business, e- governance, EDI on the internet, Delivery management system, Web Auctions, Virtual communities and Web portals – social media marketing

### UNIT IV e-BUSINESS PAYMENTS AND SECURITY

9

E-payments - Characteristics of payment of systems, protocols, e-cash, e-cheque, e-Wallets and Micro payment systems- internet security – cryptography – security protocols – network security.

### UNIT V LEGAL AND PRIVACY ISSUES

8

Legal, Ethics and privacy issues – Protection needs and methodology – consumer protection, cyber laws, contracts and warranties, Taxation and encryption policies.

**TOTAL:45 PERIODS**

## OUTCOMES:

At the end of this course, student should be able to know how to build and manage an e-business

## REFERENCES

1. Harvey M. Deitel, Paul J. Deitel, Kate Steinbuhler, e-business and e-commerce for managers, Pearson, 2011.
2. Efraim Turban, Jae K. Lee, David King, Ting Peng Liang, Deborah Turban, Electronic Commerce – A managerial perspective, Pearson Education Asia, 2010.
3. Kelly Goetsch - e Commerce in the Cloud, O Reilly Media, 2014.
4. Parag Kulkarni, Sunita Jahirabad kao, Pradeep Chande, e-business, Oxford University Press, 2012.
5. Henry Chan & el, E-Commerce – fundamentals and Applications, Wiley India Pvt Ltd, 2007.
6. Gary P. Schneider, Electronic commerce, Thomson course technology, Fourth annual edition, 2007
7. Bharat Bhasker, Electronic Commerce, Framework technologies and Applications, 3<sup>rd</sup> Edition. Tata McGraw Hill Publications, 2009
8. Kamlesh K. Bajaj and Debjani Nag, Ecommerce- the cutting edge of Business, Tata McGraw Hill Publications, 7<sup>th</sup> reprint, 2009.

9. Kalakota et al, Frontiers of Electronic Commerce, Addison Wesley, 2004
10. Micheal Papaloelon and Peter Robert, e-business, Wiley India, 2006.
11. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, 2009

**BA5025** **LOGISTICS MANAGEMENT** **L T P C**  
**3 0 0 3**

**OBJECTIVE :**

- To learn the need and importance of logistics in product flow.

**UNIT I INTRODUCTION** **9**

Definition and Scope of Logistics – Functions & Objectives – Customer Value Chain – Service Phases and attributes – Value added logistics services – Role of logistics in Competitive strategy – Customer Service

**UNIT II DISTRIBUTION CHANNELS AND OUTSOURCING LOGISTICS** **9**

Distribution channel structure - channel members, channel strategy, role of logistics and support in distribution channels. Logistics requirements of channel members. Logistics outsourcing – catalysts, benefits, value proposition. Third and fourth party logistics. Selection of service provider.

**UNIT III TRANSPORTATION AND PACKAGING** **9**

Transportation System – Evolution, Infrastructure and Networks. Freight Management – Vehicle Routing – Containerization. Modal Characteristics, Inter-modal Operators and Transport Economies. Packaging- Design considerations, Material and Cost. Packaging as Unitisation. Consumer and Industrial Packaging.

**UNIT IV PERFORMANCE MEASUREMENT AND COSTS** **9**

Performance Measurement – Need, System, Levels and Dimensions. Internal and External Performance Measurement. Logistics Audit. Total Logistics Cost – Concept, Accounting Methods. Cost – Identification, Time Frame and Formatting.

**UNIT V CURRENT TRENDS** **9**

Logistics Information Systems – Need, Characteristics and Design. E-Logistics – Structure and Operation. Logistics Resource Management eLRM. Automatic Identification Technologies. Reverse Logistics – Scope, design and as a competitive tool. Global Logistics – Operational and Strategic Issues, ocean and air transportation. Strategic logistics planning. Green Logistics

**TOTAL: 45 PERIODS**

**OUTCOME :**

- To enable an efficient method of moving products with optimization of time and cost.

**REFERENCES :**

1. Bowersox Donald J, Logistics Management – The Integrated Supply Chain Process, Tata McGraw Hill, 3<sup>rd</sup> edition 2016
2. Sople Vinod V, Logistics Management – The Supply Chain Imperative, Pearson Education, 3<sup>rd</sup> Edition, 2012.
3. Coyle et al., The Management of Business Logistics, Cengage Learning, 7<sup>th</sup> Edition, 2004.
4. Ailawadi C Sathish & Rakesh Singh, Logistics Management, PHI, 2011.
5. Bloomberg David J et al., Logistics, Prentice Hall India, 2005.
6. Ronald H. Ballou, Business Logistics and Supply Chain Management, Pearson Education, 5<sup>th</sup> Edition, 2007.

**OBJECTIVE :**

- Understand how material management should be considered for profitability

**UNIT I INTRODUCTION****9**

Operating environment-aggregate planning-role, need, strategies, costs techniques, approaches-master scheduling-manufacturing planning and control system-manufacturing resource planning-enterprise resource planning-making the production plan

**UNIT II MATERIALS PLANNING****9**

Materials requirements planning-bill of materials-resource requirement planning-manufacturing resource planning-capacity management-scheduling orders-production activity control-codification.

**UNIT III INVENTORY MANAGEMENT****9**

Policy Decisions-objectives-control -Retail Discounting Model, Newsvendor Model; EOQ and EBQ models for uniform and variable demand With and without shortages -Quantity discount models. Probabilistic inventory models.

**UNIT IV PURCHASING MANAGEMENT****9**

Establishing specifications-selecting suppliers-price determination-forward buying-mixed buying strategy-price forecasting-buying seasonal commodities-purchasing under uncertainty-demand management-price forecasting-purchasing under uncertainty-purchasing of capital equipment-international purchasing

**UNIT V WAREHOUSE MANAGEMENT****9**

Warehousing functions – types - Stores management-stores systems and procedures-incoming materials control-stores accounting and stock verification-Obsolete, surplus and scrap-value analysis-material handling-transportation and traffic management -operational efficiency-productivity-cost effectiveness-performance measurement

**TOTAL: 45 PERIODS****OUTCOME :**

- Student gains knowledge on effective utilisation of materials in manufacturing and service organisation

**REFERENCES :**

1. J.R.Tony Arnold, Stephen N. Chapman, Lloyd M. Clive, Materials Management, Pearson, 2012.
2. P. Gopalakrishnan, Purchasing and Materials Management, Tata McGraw Hill, 2012
3. A.K.Chitale and R.C.Gupta, Materials Management, Text and Cases, PHI Learning, 2<sup>nd</sup> Edition, 2006
4. A.K.Datla, Materials Management, Procedure, Text and Cases, PHI Learning, 2<sup>nd</sup> Edition, 2006
5. Ajay K Garg, Production and Operations Management, Tata McGraw Hill , 2012
6. Ronald H. Ballou and Samir K. Srivastava, Business Logistics and Supply Chain Management, Pearson education, Fifth Edition
7. S. N. Chary, Production and Operations Management, Tata McGraw Hill , 2012

**OBJECTIVE:**

- Understand the application of structured methods to develop a product.

**UNIT I INTRODUCTION****9**

Defining Product, Types of products. Product development – characteristics, duration and cost, challenges. Development Process: Generic Process- Adapting to product types. Evaluation – decay curve – cost expenditure curve.

**UNIT II PRODUCT PLANNING****9**

Product Planning Process – Steps. Opportunity identification – breakdown structure- product development charter. Product Life Cycle. Technology Life Cycle - Understanding Customer Needs - Disruptive Technologies- Product Specification - Concept Generation – Activity- Steps- Techniques.

**UNIT III PRODUCT CONCEPT****9**

Concept Selection – Importance, Methodology, concept Screening, Concept Scoring. Concept Testing. Product Architecture- Definition, Modularity, implication, Establishment, Delayed Differentiation, Platform Planning.

**UNIT IV INDUSTRIAL DESIGN AND DESIGN TOOLS****9**

Industrial Design, Design for Manufacturing-Value Engineering-Ergonomics-Prototyping-Robust Design- Design for X-failure rate curve-product use testing-Collaborative Product development- Product development economics-scoring model- financial analysis.

**UNIT V PATENTS****9**

Defining Intellectual Property and Patents, Patent Searches and Application, Patent Ownership and Transfer, Patent Infringement, New Developments and International Patent Law.

**TOTAL: 45 PERIODS****OUTCOME**

- Student gains knowledge on how a product is designed based on the needs of a customer.

**REFERENCES :**

1. Karl T. Ulrich, Steven D. Eppinger, Anita Goyal Product Design and Development, Tata McGraw – Hill, Fourth Edition, reprint 2009.
2. Kenneth B.Kahn, New Product Planning, Sage, 2<sup>nd</sup> Edition 2011.
3. A.K. Chitale and R.C. Gupta, Product Design and Manufacturing, PHI, 2008.
4. Deborah E. Bouchoux, Intellectual Property Rights, Delmar, Cengage Learning, 2005.
5. Anil Mital. Anoop Desai, Anand Subramanian, Aashi Mital, Product Development, Elsevier, 2009.
6. Michael Grieves, Product Life Cycle Management, Tata McGraw Hill , 2006.
7. Kerber, Ronald L, Laseter, Timothy M., Strategic Product Creation, Tata-McGraw Hill, 2007.

**BA5028**

**PROJECT MANAGEMENT**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

- To learn the concepts of managing projects.

**UNIT I INTRODUCTION TO PROJECT MANAGEMENT 9**

Project Management – Definition –Goal - Lifecycles. Project Selection Methods. Project Portfolio Process – Project Formulation. Project Manager – Roles- Responsibilities and Selection – Project Teams.

**UNIT II PLANNING AND BUDGETING 9**

The Planning Process – Work Break down Structure – Role of Multidisciplinary teams. Budget the Project – Methods. Cost Estimating and Improvement. Budget uncertainty and risk management.

**UNIT III SCHEDULING & RESOURCE ALLOCATION 9**

PERT & CPM Networks - Crashing – Project Uncertainty and Risk Management – Simulation – Gantt Charts – Expediting a project – Resource loading and leveling. Allocating scarce resources – Goldratt's Critical Chain.

**UNIT IV CONTROL AND COMPLETION 9**

The Plan-Monitor-Control cycle – Data Collecting and reporting – Project Control – Designing the control system. Project Evaluation, Auditing and Termination.

**UNIT V PROJECT ORGANISATION & CONFLICT MANAGEMENT 9**

Formal Organisation Structure – Organisation Design – Types of project organizations. Conflict – Origin & Consequences. Managing conflict – Team methods for resolving conflict.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- To apply project management principles in business situations to optimize resource utilization and time optimisation.

**REFERENCES :**

1. Clifford Gray and Erik Larson, Project Management, Tata McGraw Hill Edition, 6e,2014.
2. John M. Nicholas, Project Management for Business and Technology - Principles and Practice, Second Edition, Pearson Education,5<sup>th</sup> Edition 2016
3. Gido and Clements, Successful Project Management, sixth Edition, Cengage, 2015.
4. Harvey Maylor, Project Management, Fourth Edition, Pearson Education, 2010

**BA5029**

**SERVICES OPERATIONS MANAGEMENT**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

- To help understand how service performance can be improved by studying services operations management

**UNIT I INTRODUCTION 9**

Services – Importance, role in economy, service sector – growth; Nature of services -Service classification , Service Package, distinctive characteristics , open-systems view; Service Strategy – Strategic service vision, competitive environment, generic strategies, winning customers; Role of information technology; stages in service firm competitiveness; Internet strategies - Environmental strategies.

**UNIT II SERVICE DESIGN 9**  
 New Service Development – Design elements – Service Blue-printing - process structure – generic approaches –Value to customer; Retail design strategies – store size – Network configuration ; Managing Service Experience –experience economy, key dimensions ; Vehicle Routing and Scheduling

**UNIT III SERVICE QUALITY 9**  
 Service Quality- Dimensions, Service Quality Gap Model; Measuring Service Quality –SERVQUAL - Walk-through Audit; Quality service by design - Service Recovery - Service Guarantees; Service Encounter – triad, creating service orientation, service profit chain; Front-office Back-office Interface – service decoupling.

**UNIT IV SERVICE FACILITY 9**  
 Services capes – behaviour - environmental dimensions – framework; Facility design – nature, objectives, process analysis – process flow diagram, process steps, simulation; Service facility layout; Service Facility Location – considerations, facility location techniques – metropolitan metric, Euclidean, centre of gravity, retail outlet location , location set covering problem

**UNIT V MANAGING CAPACITY AND DEMAND 9**  
 Managing Demand – strategies; Managing capacity – basic strategies, supply management tactics, operations planning and control; Yield management; Inventory Management in Services– Retail Discounting Model, Newsvendor Model; Managing Waiting Lines –Queuing systems, psychology of waiting; Managing for growth- expansion strategies, franchising , globalization.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- To design and operate a service business using the concepts, tools and techniques of service operations management.

**REFERENCES :**

1. James A. Fitzsimmons, Service Management – Operations, Strategy, Information Technology, Tata McGraw-Hill – 7<sup>th</sup> Edition 2013.
2. Richard Metters, Kathryn King-Metters, Madeleine Pullman, Steve Walton Successful Service Operations Management, South-Western, Cengage Learning, 2<sup>nd</sup> Edition ,2012
3. Cengiz Haksever, Barry Render, Roberta S. Russell, Rebert G. Murdick, Service Management and Operations, Pearson Education – Second Edition.
4. Robert Johnston, Graham Clark, Service Operations Management, Pearson Education, 2<sup>nd</sup> Edition, 2005.
5. Bill Hollins and Sadie Shinkins, Managing Service Operations, Sage, 2006
6. J.Nevan Wright and Peter Race, The management of service operations, Cengage, 2<sup>nd</sup> Edition, 2004

**BA5030 SUPPLY CHAIN MANAGEMENT L T P C**  
**3 0 0 3**

**OBJECTIVE:**

- To help understand the importance of and major decisions in supply chain management for gaining competitive advantage.

**UNIT I INTRODUCTION 9**  
 Supply Chain – Fundamentals –Evolution- Role in Economy - Importance - Decision Phases - Supplier-Manufacturer-Customer chain. - Enablers/ Drivers of Supply Chain Performance. Supply chain strategy - Supply Chain Performance Measures.

**UNIT II STRATEGIC SOURCING 9**  
Outsourcing – Make Vs buy - Identifying core processes - Market Vs Hierarchy - Make Vs buy continuum -Sourcing strategy - Supplier Selection and Contract Negotiation. Creating a world class supply base- Supplier Development - World Wide Sourcing.

**UNIT III SUPPLY CHAIN NETWORK 9**  
Distribution Network Design – Role - Factors Influencing Options, Value Addition – Distribution Strategies - Models for Facility Location and Capacity allocation. Distribution Center Location Models. Supply Chain Network optimization models. Impact of uncertainty on Network Design - Network Design decisions using Decision trees.

**UNIT IV PLANNING DEMAND, INVENTORY AND SUPPLY 9**  
Managing supply chain cycle inventory. Uncertainty in the supply chain -- Analyzing impact of supply chain redesign on the inventory - Risk Pooling - Managing inventory for short life - cycle products - multiple item -multiple location inventory management. Pricing and Revenue Management

**UNIT V CURRENT TRENDS 9**  
Supply Chain Integration - Building partnership and trust in SC Value of Information: Bullwhip Effect - Effective forecasting - Coordinating the supply chain. . SC Restructuring - SC Mapping -SC process restructuring, Postpone the point of differentiation – IT in Supply Chain - Agile Supply Chains -Reverse Supply chain. Agro Supply Chains.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- Ability to build and manage a competitive supply chain using strategies, models, techniques and information technology.

**REFERENCES :**

1. Janat Shah, Supply Chain Management – Text and Cases, Pearson Education, 2009.
2. Sunil Chopra and Peter Meindl, Supply Chain Management-Strategy Planning and Operation, PHI Learning / Pearson Education, Sixth edition, 2015.
3. Ballou Ronald H, Business Logistics and Supply Chain Management, Pearson Education, 5<sup>th</sup> Edition, 2007.
4. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, Designing and Managing the Supply Chain: Concepts, Strategies, and Cases, Tata McGraw-Hill, 2005.
5. Altekar Rahul V, Supply Chain Management-Concept and Cases, PHI, 2005.
6. Shapiro Jeremy F, Modeling the Supply Chain, Cengage, Second Reprint , 2002.
7. Joel D. Wisner, G. Keong Leong, Keah-Choon Tan, Principles of Supply Chain Management- A Balanced Approach, South-Western, Cengage, 2012.



**OBJECTIVES**

- To provide understanding of the framework.
- To illustrate current practices in industries.
- To provide knowledge on certain tools & techniques

**UNIT - I INTRODUCTION TO PURCHASING AND SUPPLY CHAIN MANAGEMENT 9**

The Purchasing Process. Purchasing Policies and Procedures. Supply Management Integration for Competitive Advantage, Purchasing and Supply Management Organization.

**UNIT - II STRATEGIC SOURCING 9**

Supply Management and Commodity Strategy Development, Supplier Evaluation and Selection Supplier Quality Management Supplier Management and Development, Creating a World-Class Supply Base, Worldwide Sourcing.

**UNIT - III STRATEGIC SOURCING PROCESS 9**

Strategic Cost Management, Purchasing and Supply Chain Analysis: Tools and Techniques, Negotiation and Conflict Management Contract Management Purchasing Law and Ethics.

**UNIT - IV SUPPLIER PERFORMANCE AND QUALITY MANAGEMENT 9**

Performance Measurement and Evaluation: Strategies, tools and techniques for measuring and managing supplier performance, Supplier performance evaluation, Purchasing services, Supply Chain Information Systems and Electronic Sourcing.

**UNIT - V FUTURE DIRECTIONS 9**

Purchasing and Supply Strategy Trends Green Buying, Sustainability, material research, Lean supply Chain Management

**TOTAL: 45 PERIODS****OUTCOMES:**

- To Understand basic functions and nuances.
- To Understand the holistic dimensions of SCM & corporate perspectives.
- Learn to acquire skills to become a sourcing professional.

**TEXT BOOKS:**

1. Purchasing and Supply Chain Management, Robert .M. Monczka, Handfield, Glunipero Paterson, Waters, 6th Edition, Cengage Publication
2. Purchasing and Supply Chain Management, . Benton, 3 rd Edition, Tata Mc Graw Hill.
3. World Class Supply Chain Management, Burt, Dobler, Starling, 7th Edition, Tata Mc Graw Hill.
4. Supply Chain Management For The 21st Century by B S SAHAY. Macmillan Education,2001

**OBJECTIVE:**

This course provides you the basic concepts and advanced models in inventory management. This course discusses issues related to inventory in a supply chain context. It also gives a multi-dimensional view to approach a problem with case studies.

**UNIT I INTRODUCTION TO INVENTORY MANAGEMENT 9**

Inventory in SCM, Cash to cash cycle time, measure of inventory in terms of days, Inventory turnover ratio and its relationship with working capital, Review of models, Q-models and P-models Aggregation of Inventory, Cycle stock concepts, Ordering multiple items in a single order to reduce cycle stock

**UNIT II INVENTORY MODELS 9**

Safety stock issues Safety stock with lead time and demand uncertainty (for Q-models), Short term discounting & Forward Buying, Periodic review models with safety stock, Comparison of P and Q systems

**UNIT III INVENTORY MANAGEMENT STRATEGIES 9**

Single period models, Inventory management for fashion supply chains, Postponement strategies to reduce inventory, Examples of Fashion supply chains: NFL Reebok, ZARA and Sport Obermeyer Risk Pooling, Applications, Risk pooling in different forms-Substitution, Specialisation, Postponement and Information pooling

**UNIT IV INVENTORY OPTIMIZATION 9**

Distribution resource planning techniques, Inventory and transportation integration decisions, Vendor Managed Inventory, Product availability measures, Product fill rate, order fill rate, Cycle service level.

**UNIT V LATEST TRENDS IN INVENTORY MANAGEMENT SYSTEMS 9**

Industry initiatives, Efficient consumer Response and Quick response ,CPFR and other industry initiatives, Inventory reduction strategies, Managing inventory in Reverse Logistics and Remanufacturing situations , Best practices in Inventory Management in a Supply Chain

**TOTAL: 45 PERIODS****OUTCOME:**

At the end of this course, the students can confidently approach their supply chain inventory issues and they can use different tools appropriately to solve the problems and enhance the performance of their supply chains.

**TEXT BOOKS:**

1. Sunil Chopra, Peter Meindl, Supply Chain Management: Strategy, Planning, and Operation, Pearson, 2010.
2. Janat Shah, Supply Chain Management, Pearson Education India, 2009
3. Supply chain management, Chandrasekaran,N., Oxford University Publications, 2010
4. Supply Chain Management For The 21st Century by B S SAHAY. Macmillan Education,2001

**OBJECTIVES:**

- To explain the various technological aspects that are described in the different logistical background
- To explain the real time description updated technologies in the logistics sector and supply chain industry

**UNIT - I ELECTRONIC SCM, COMMUNICATION NETWORKS 9**

Introduction e-SCM – e-SCM framework - Key success factors for e-SCM - Benefits of e-SCM- Positioning information in Logistics - Strategic information linkage - Supply chain communication networks - Role of communication networks in supply chains - Overview of telecommunication networks –EDI - Data security in supply chain networks - Overview of internet able models

**UNIT - II ENTERPRISE INFORMATION SYSTEMS 9**

Overview of enterprise information systems - Information functionality and principles -Introduction enterprise information systems -Classification of enterprise information systems- Information architecture -Framework for managing supply chain information - Describe on popular enterprise application packages -Benefits of enterprise information systems

**UNIT - III SCM SYSTEMS DEVELOPMENT, DEPLOYMENT AND MANAGEMENT 9**

Stakeholders in supply chain information systems - Stakeholders in SCM - Stakeholders in supply chain information systems - Information systems development- Logistics information systems design- Defining enterprise architecture - Choosing appropriate system development methodologies - Adopting relevant systems development model

**UNIT - IV DEPLOYMENT AND MANAGEMENT 9**

Information systems deployment - IT Operations and infrastructure management - Portfolio, programme and project management - Management of risk - Management of value

**UNIT - V INFORMATION INTEGRATION 9**

Enterprise application integration and supply chain visibility - Enterprise application integration - Supply chain visibility - Supply chain event management -Supply chain performance -Planning and design methodology - Problem definition and planning - Data collection and analysis - Recommendations and implementation -Decision support systems

**TOTAL: 45 PERIODS****OUTCOME:**

The students will be able to understand the various enterprise information system and its architecture and benefits. Students can gain knowledge about various e-commerce models, e-SCM, benefits and communication networks.

**TEXT BOOKS:**

1. Bowersox & Closs, Logistical Management, McGraw-Hill Companies, 1996.
2. R.H.Ballou, Business Logistics Management, Prentice-Hall, 2004.

**REFERENCES:**

1. Strauss,E-Marketing, 4/e, Pearson Education 2008
2. Chaffey, E- Business and E- Commerce Management, 3/e, Pearson Education 2008
3. Blanchard, Logistics Engineering & Management, 6/e, Pearson Education 2008
4. Statistics for Managers Using MS Excel, 4/e, Levine, Pearson Education 2007
5. Donald J. Bowersox and David J. Closs, Logistical Management - The Integrated Supply chain

**OBJECTIVES:**

- To help the students in explaining the significance of Warehousing.
- To provide timely customer service,
- To keep track of items so they can be found readily & correctly
- To minimize the total physical effort
- To minimize the cost of moving goods in & out of stage.

**UNIT - I INTRODUCTION WAREHOUSING 9**

Introduction Warehousing – Basic Warehousing Decisions – Warehouse Operations – Types of Warehouses – Functions – Centralized & Decentralized – Storage Systems – Warehousing Cost Analysis – Warehouse Layout – Characteristics of Ideal Warehouse

**UNIT - II INVENTORY MANAGEMENT 9**

Inventory: Basic Concepts – Role in Supply Chain – Role in Competitive Strategy – Independent Demand Systems – Dependent Demand Systems – Functions – Types – Cost – Need for Inventory – Just in Time

**UNIT - III INVENTORY CONTROL 9**

Inventory Control – ABC Inventory Control – Multi-Echelon Inventory Systems – Distribution Requirement Planning – Bull Whip Effect – Using WMS for Managing Warehousing Operations

**UNIT - IV MATERIALS HANDLING 9**

Principles and Performance Measures Of Material Handling Systems – Fundamentals of Material Handling – Various Types of Material Handling Equipments – Types of Conveyors – Refrigerated Warehouses- Cold Chain- Agri SCM

**UNIT - V MODERN WAREHOUSING METHODS 9**

Modern Warehousing – Automated Storage & Retrieval Systems & their Operations – Bar Coding Technology & Applications in Logistics Industry – RFID Technology & Applications – Advantages of RFID

**TOTAL: 45 PERIODS****OUTCOME:**

At the end of the course, the students will be able to get complete insight in to warehouse concepts, various inventory control techniques and application of inventory management in supply chain.

**TEXT BOOKS:**

1. Vinod.V.Sople, Logistics Management, Pearson Education, 2004.
2. Arnold, Introduction Materials Management, Pearson Education, 2009.

**REFERENCES:**

1. Frazelle, World Class Warehousing & Material Handling, Tata McGraw-Hill, 2008
2. Satish K. Kapoor and PurvaKansal, Basics of Distribution Management - A Logistical Approach, Prentice Hall, 2003
3. Satish K. Kapoor and PurvaKansal Marketing, Logistics - A Supply Chain Approach , Pearson Education, 2003

**OBJECTIVES:**

- To explore the fundamental concepts of transportation and distribution management
- To gain knowledge in network planning, routing and scheduling and application of IT in transportation and distribution management.

<b>UNIT - I</b>	<b>DISTRIBUTION</b>	<b>9</b>
Role of Distribution in Supply chain, Distribution channels – Functions, resources, Operations in Distribution, Designing Distribution network models - its features - advantages and disadvantages.		
<b>UNIT - II</b>	<b>PLANNING</b>	<b>9</b>
Distribution network planning, Distribution network decisions, Distribution requirement planning (DRP)		
<b>UNIT - III</b>	<b>TRANSPORTATION</b>	<b>9</b>
Role of Transportation in Logistics and Business, Principle and Participants-Scope and relationship with other business functions, Modes of Transportation - Mode and Carrier selection, Routing and scheduling.		
<b>UNIT - IV</b>	<b>TRANSPORTATION</b>	<b>9</b>
International transportation, Carrier, Freight and Fleet management, Transportation management systems-Administration, Rate negotiation, Trends in Transportation.		
<b>UNIT - V</b>	<b>INFORMATION TECHNOLOGY (IT)</b>	<b>9</b>
Usage of IT applications -E commerce – ITMS, Communication systems-Automatic vehicle location systems, Geographic information Systems.		

**TOTAL: 45 PERIODS****OUTCOMES:** The students will be able to:

- Gain knowledge about the distribution requirements planning.
- Predict the scope and relationship of transportation with other business functions
- Make use of the advantages and disadvantages of the various models.

**TEXT BOOKS:**

1. Raghuram and N. Rangaraj, Logistics and Supply chain Management – Leveraging Mathematical and Analytical Models: Cases and Concepts, New Delhi: Macmillan, 2000.
2. Janat Shah, Supply Chain Management, Pearson Education India, 2009.

**REFERENCES:**

1. Sunil Chopra, Peter Meindl, Supply Chain Management: Strategy, Planning, and Operation, Pearson, 2010.
2. Michael B Stroh, Practical Guide to Transportation and Logistics, Logistics Network, 2006.
3. Alan Rushton, John Oxley, Handbook of Logistics & Distribution Management, Kogan Page Publishers, 2000.

**OBJECTIVES:**

- To prepare students successfully implement a contract logistics and closed supply chain in Retail, FMCG and Automobile sectors.
- To explain the concept and principle of contract logistics and closed supply chain

**UNIT - I CONTRACT LOGISTICS 9**

Third party logistics industry overview - A framework for strategic alliances - Evolution of contract logistics - Types of third party logistics providers – Automobile, FMCG and Retail-Third party services and integration

**UNIT - II CLOSED LOOP SUPPLY CHAINS AND LOGISTICS 9**

Introduction closed loop supply chains and logistics – Logistics and closed loop supply chain service - Overview of return logistics and closed loop supply chain models – Introduction product returns - Product Vs Parts returns - Strategic issues in closed loop supply chains

**UNIT - III BUSINESS AND MARKET 9**

Overview - Introduction life cycle management - Trends and opportunities – Auto Warranty management, return process and benchmarks - Market overview - Reasons for using reverse logistics - General characteristics - Consumer goods Depot repair and value added services - Operating dynamics - Competitive evaluation - Secondary markets and final disposal.

**UNIT - IV EMERGING TRENDS 9**

Emerging trends in Retail, E-Commerce- FMCG and Automobile sectors- Systems and technology - For consumer goods operations, High tech logistics system - Impact and value of advanced logistics

**UNIT - V MANAGING PROCESSES 9**

Managing processes - Step by step process - Use of third party service providers - Additional factors – Contemporary issues – Make in India and its impact on Countries GDP and Economic Growth.

**TOTAL: 45 PERIODS****OUTCOME:**

The students will be able to understand the basics of contract logistics, third party logistics industry and third party logistics providers. And it helps to gain knowledge about Make in India concept and its impact on the GDP growth

**TEXT BOOKS:**

1. Janat Shah, Supply Chain Management: Text and Cases, Pearson Education India, 2009
2. John Manners-Bell, Logistics and Supply Chains in Emerging Markets, Kogan Page, 2014.

**REFERENCES:**

1. Coyle et.al, Management Of Transportation, 7th Edition, Cengage Learning, 2011
2. D. F. Blumberg, Reverse Logistics & Closed Loop Supply Chain Processes, Taylor and Francis, 2005
3. Hsin-I Hsiao, Wageningen, Logistics Outsourcing in the Food Processing Industry, Academic Pub, 2009.
4. Surendra M. Gupta, Sustainability in Supply Chain Management Casebook: Applications in SCM, McGraw Hill, 2013

**OBJECTIVES:**

- To provide the participants with a good knowledge of airfreight operations, services and management that can support them in various business functions and roles such as operations, customer service, account management and sales.
- To create awareness about the Air Cargo management.
- To provide general information or a framework on the setup of air cargo processes, for business.

**UNIT - I AIR PORTS AND SHIPMENT 9**

Ground Handling Agencies - Air Craft - Advantage of Air shipment - Economics of Air Shipment - Sensitive Cargo by Air shipment - Do's and Don'ts in Air Cargo Business

**UNIT - II AIR CARGO 9**

Air Cargo Console - Freighting of Air Cargo - Volume based Calculation of Freight - Weight based Calculation of Freight - Import Documentation - Export Documentation

**UNIT- III AIRWAY BILLS 9**

Airway Bills - FIATA - IATA - History of IATA - Mission of IATA - Price setting by IATA -Licensing of Agencies - Sub Leasing of Agencies - freight carriers by scheduled freight tonne kilometers flown

**UNIT - IV CARGO VILLAGE 9**

History of Dubai Cargo Village - Location of DCV - Equipment and Handling at DCV - Operations - Advantage of Sea Air Cargo - Why Sea Air Cargo is Cheaper - Why Air freight from Dubai is Cheaper?

**UNIT - V DG CARGO 9**

DG Cargo by Air - Classification and labelling - Types of Labels according Cargo – Samples of Labels - Packing and Transportation of DG Goods by Air

**TOTAL: 45 PERIODS****OUTCOME:**

The outcome of this course will provide the basics concepts of airports and aircrafts and various participants in air cargo transportation. Students will come to know about roles of the customs and the government in air transport.

**TEXT BOOKS:**

1. Yoon SeokChang, Air Cargo Management, CRC Press, 2015.
2. Xie Chun Xun Zhu, Air Cargo Management Introduction - Aviation Logistics, Management Series (Chinese Edition), Southeast University Press, 2006.
3. Hampton Simon Taylor, Air transport logistics, CRC Press, 2000.

**REFERENCES:**

1. Paul, Air cargo distributions: a management analysis of its economic and marketing benefits, Jackson and William Brackenridge (Gower Press), 1988.
2. Peter S. Smith, Air freight: operations, marketing and economics, Chu (Boston : Kluwer Academic Publishers), 2004.
3. John Walter wood, Airports; some elements of designs and future development, Chu(Boston : Kluwer Academic Publishers), 1981.

**OBJECTIVES:**

- To provide an overview of the various elements of containerization and allied businesses
- To realize the potential of containerization and allied businesses

**UNIT –I BASIC CONCEPT OF CONTAINERIZATION 9**

Introduction to Liner Shipping industry - Unitization concept and methods - Malcolm Mclean and the birth of containerization - Generations of container ships and their specification - Container types, their specifications and cargoes carried in them.

**UNIT –II FREIGHTING AND SIZE OF CONTAINER 9**

Container shipping business - FCL and LCL sea freight products - Freighting of FCL and LCL cargo - Slot utilization strategies - Estimation of optimum container fleet size - Multiport LCL consolidation

**UNIT – III CHARACTERISTICS AND PHYSICAL OPERATIONS 9**

Containerisation: Concept, Classification, Benefits and Constraints, Container terminal business-World's leading container terminals and location characteristics - container terminal infrastructure - container terminal productivity and profitability-Inland container Depots(ICD)Roles and functions - Container Freight Stations(CFS),Clearance at ICD, CONCOD,ICD's under CONCOD, Charting: Kinds of Charter, Charter Party and Arbitration.

**UNIT – IV CONTAINER TYPES AND BUSINESS 9**

Container manufacturing trends - Container leasing business - Types of container leasing and their terms - maintenance and repair of containers - tracking of container movements - Container interchange.

**UNIT – V MULTIMODAL TRANSPORT 9**

Alternate uses of containers -marketing of used containers -carriage of shipper own containers - multimodal transport options for containers -Insurance for containers -strategies for managing container imbalance.

**TOTAL: 45 PERIODS****OUTCOMES:**

- The students will learn the practices and ways to promote containerization and allied businesses
- The learners will have a complete idea about the different concepts, trends and strategies used for containerization and allied businesses

**REFERENCES:**

1. Marc Levinson, The Box: How the Shipping Container Made the World Smaller and the World Economy Bigger, Princeton University Press, 2008.
2. Dr. K. V. Hariharan, Containerisation, Multimodal Transport & Infrastructure Development In India, Sixth Edition, Shroff Publishers and Distributors, 2015.
3. Lee, C.-Y., Meng, Q. (Eds.), Handbook of Ocean Container Transport Logistics Making Global Supply Chains Effective, Springer, 2015
4. Coyle et.al, Management Of Transportation, 7th Edition, Cengage Learning, 2011

**OBJECTIVES:**

- To enlighten the students about the major functions in export and import processes.
- To provide the expertise for solving issues related to requirements in EXIM management.

**UNIT – I      FUNDAMENTALS OF IMPORT AND EXPORT      9**

Role of Import and Export Trade in an Economy - Institutional Framework for Foreign trade in India -Role of Director General of Foreign Trade and Commerce - Objectives of EXIM Policy - Global trade flows - Contract of International Sale of Goods - INCOTERMS 2010

**UNIT - II      OVERVIEW OF EXPORT AND IMPORT      9**

Marketing for Exports - Negotiation and finalization of Export contract - Export Documentation Procedures - Cargo Insurance - Export Promotion Councils and incentive schemes- Role of Logistics in Exports- Export Houses / Trading Houses

**UNIT - III      DOCUMENTATION FRAMEWORK      9**

Import for industrial use / trading - Import Documentation and Customs clearance procedures - Types of Imports - Import Licenses - Cargo Insurance - Role of Logistics in Import

**UNIT - IV      CREDIT AND PAYMENTS      9**

Payment methods in Foreign Trade - Documentary Credit / Letter of Credit–LOU-UCP 600 with respect to Shipping Documents and L/C Negotiation – Export / import financing strategies - Managing payment risks.

**UNIT - V      CUSTOMS CLEARANCE AND AGENCIES      9**

Roles of Service providers in EXIM transactions – Global Traders – Commodity Brokers - Custom House Agents – Transport Operators – Freight Forwarders – Warehousing and 3PL service providers – Liners /Ship Agencies – Container Freight Stations - Port – Inspection Agencies/ surveyors – Quarantine Agencies – Pest Control Agencies – Chamber of Commerce.

**TOTAL: 45 PERIODS****OUTCOMES:**

- The students would be aware about the formalities of export and import industry
- The students will be able to comprehend the importance of exim management.

**REFERENCES:**

1. Justin Pauland Rajiv Aserkar, Export Import Management, Second Edition, Oxford University Press, 2013.
2. UshaKiranRai, Export - Import and Logistics Management, Second Edition, PHI Learning, 2010.
3. Director General of Foreign Trade, Foreign Trade Policy and Handbook of Procedures, 2015
4. Coyle et.al, Management Of Transportation, 7th Edition, Cengage Learning, 2011

**OBJECTIVES:**

- To provide the knowledge about fundamentals of shipping management
- To equip the students with the knowledge of shipping, ship building and repair

**UNIT – I INTERDICTION OF SHIPPING 9**  
Role of Shipping in International trade-Types of ships and cargoes carried by them - International Organizations serving the shipping industry (IMO, BIMCO, ICS, IACS, IAPH)- Ship Registration and Classification.

**UNIT – II LINER SHIPPING OPERATIONS 9**  
Liner shipping business - Types of Liner services - Container shipping lines and their services - Break bulk, Ro-Ro and project cargo services - Liner freight rates - Liner cargo documentation - Liner agency functions

**UNIT – III DRY BULK BUSINESS 9**  
Dry Bulk shipping business- World's leading dry bulkports and cargoes handled by them - Types of Dry bulk ships and the Dry Bulk industry structure - Dry bulk market indices - Types of Chartering - Port agency functions.

**UNIT – IV TANKER OPERATIONS AND BUSINESS 9**  
Liquid Bulk shipping business - World's leading wet bulk ports and cargoes handled by them-Types of tankers and gas carriers - Tanker freighting system (worldscale) -Factors affecting Tanker markets-Marine pollution conventions.

**UNIT – V SHIP BUILDING AND REPAIR 9**  
Service providers to shipping industry -Ship management companies -Ports, inland terminals and Container Freight Stations- Ship building and repair yards -Financing the Shipping industry - Marine insurance providers.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- The students would be acquainted with the basics of shipping management
- The students will learn the skills needed for shipping industry

**REFERENCES:**

1. Michael Robarts, Branch"s Elements of Shipping, Ninth Edition, Routledge, 2014.
2. Peter Brodie, Commercial Shipping Handbook, Third Edition, Informa Law from Routledge, 2014.
3. Review of Maritime Transport, UNCTAD, 2014.
4. Coyle et.al, Management Of Transportation, 7th Edition, Cengage Learning, 2011

**BA5062 PORT AND TERMINAL MANAGEMENT**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To enlighten the students about the major functions in the port and terminal management
- To expose the students on the trends in port and terminal management

**UNIT – I INTRODUCTION TO PORT AND TERMINAL 9**  
Role of ports in international trade and transport - Economic impact of ports on the regional economy - Multiplier effect - Location characteristics of ports - Different types of ports (natural, manmade, river, estuary).

**UNIT – II PORT OPERATIONS 9**  
Design features of facilities in ports for handling various cargoes - Organization structure in Ports - Delivery of port services and the relationship between various departments - Marine Department – Traffic Department – other departments.

**UNIT – III PORT MARKETING AND SERVICES 9**

Marketing of Port services - Pricing of Port services - Components of port tariff - Concept of hinterland – Identifying the needs of ship owners and operators, ship agents, forwarders, truckers, rail and barge operators - Concept of Total Logistics cost.

**UNIT – IV PORT PERFORMANCE 9**

Measurement of port performance - vessel turn round time, cargo volume, speed of cargo handling - Information flow requirements of the port, statutory bodies and port users - Port community computer systems and EDI applications.

**UNIT – V PORT SECURITY AND ISSUES 9**

Environmental issues connected with Ports & Terminals - Health and safety issues - Port security issues - International Ships and Port facility security (ISPS) code - Role of national, regional and local governments in owning / operating / managing ports.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- The students would be aware about skills pertaining to port and terminal management
- The students should be able to understand the principles and applications for port and terminal management

**REFERENCES:**

1. Maria G. Burns, Port Management and Operations, CRC Press, 2014.
2. Patrick Alderton, Port Management and Operations, Third Edition, Lloyd's Practical Shipping Guides, 2008
3. H. Ligteringen, H. Velsink, Ports and Terminals, VSSD Publishers, 2012.
4. Coyle et.al, Management Of Transportation, 7th Edition, Cengage Learning, 2011

**SECTORAL SPECIALISATION IN**

**INFRASTRUCTURE AND REAL ESTATE MANAGEMENT**

**BA5063 INFRASTRUCTURE PLANNING, SCHEDULING AND CONTROL L T P C  
3 0 0 3**

**OBJECTIVE:**

- To give an exposure to the students on the concept and the principles of planning, scheduling and control about infrastructure industry.

**UNIT I INTRODUCTION 9**

Introduction to infrastructure - Need and importance of infrastructure in India - Overview of power sector - Overview of water supply and sanitation sector-Overview of road, rail, air and port transportation sectors-Overview of telecommunication sector-Overview of rural and urban infrastructure-Introduction to special economic zones-Organizations and players in infrastructure field -Overview of infrastructure project finance.

**UNIT II INFRASTRUCTURE PRIVATIZATION 9**

Privatization of infrastructure in India - Benefits of privatization-Problems with privatization-Challenges in privatization of water supply projects- Challenges in privatization of power sector projects – Challenges in privatization of road transportation projects.

**UNIT III RISKS IN INFRASTRUCTURE PROJECTS 9**  
Economic and demand risks, political risks, socio-economic risks and cultural risks in infrastructure projects -Legal and contractual issues in infrastructure projects- Challenges in construction of infrastructure projects.

**UNIT IV RISK MANAGEMENT FRAMEWORK 9**  
Planning to mitigate risk-Designing sustainable contracts-Introduction to fair process and negotiation-Negotiation with multiple stakeholders - Sustainable development- Information technology and systems for successful management.

**UNIT V DESIGN & MAINTENANCE OF INFRASTRUCTURE 9**  
Innovative design and maintenance of infrastructure facilities- Modeling and life cycle analysis techniques-Capacity building and improving Government's role in implementation- Integrated framework for successful planning and management.

**TOTAL :45 PERIODS**

### **OUTCOMES**

On successful completion of the course, students will be able to

- explain the basic concepts related to infrastructure and understand management.
- explain the benefits and problems with infrastructure
- identify the challenges and strategies for successful planning and implementation of infrastructure.
- apply the above concepts to various infrastructure domains.

### **REFERENCES**

1. Raina V.K, "Construction Management Practice – The inside Story", Tata McGraw Hill Publishing Limited, 2005
2. Leslie Feigenbaum, "Construction Scheduling With Primavera Project Planner", Prentice Hall, 2002
3. W.Ronald Hudson, Ralph Haas, Waheed Uddin, "Infrastructure Management: Integrating, Design, Construction, Maintenance, Rehabilitation and renovation", McGraw Hill Publisher, 2013
4. Prasanna Chandra, "Projects – Planning, Analysis, Selection, Implementation Review", Tata McGraw Hill Publishing Company Ltd., New Delhi. 2006.
5. Joy P.K., "Total Project Management - The Indian Context", Macmillan India Ltd., 1992
6. Report on Indian Urban Infrastructure and Services – The High Powered Expert Committee for estimating the Investment Requirements for Urban Infrastructure Services, March 2011
7. Urban Water Development in India 2011 – Published and Distributed by India Infrastructure Research
8. Manual on sewerage and sewage treatment, CPHEEO, Ministry of urban affairs and employment, Govt.of India, New Delhi, 2012
9. Manual of National Highway Authority of India, 1988

**BA5064**

**CONTRACTS AND ARBITRATION**

**L T P C  
3 0 0 3**

### **OBJECTIVE:**

- To create awareness on contracts for construction industry, impart knowledge on tender preparation, tendering process, laws on arbitration, arbitration procedure and laws on dispute resolution in India.

**UNIT I INTRODUCTION TO CONTRACTS IN CONSTRUCTION INDUSTRY 9**

Brief details of engineering contracts -Definition, types and essentials of contracts and clauses for contracts - Preparation of tender documents and contract documents - Issues related to tendering process- Awarding contract, e-tendering process - Time of performance - Provisions of contract law - Breach of contract - Performance of contracts - Discharge of a contract- Indian contract Act 1872 - Extracts and variations in engineering contracts - Risk management in contracts.

**UNIT II LAWS RELATED TO CONSTRUCTION INDUSTRY 9**

Labor and industrial laws - Payment of wages act, contract labor - Workmen's compensation act - Insurance, industrial dispute act- Role of RERA

**UNIT III ARBITRATION OF ENGINEERING CONTRACTS 9**

Background of Arbitration in India - Indian Arbitration Act 1937 - UNCITRAL model law -Forms of arbitration - Arbitration agreement - Commencement of arbitral proceedings - Constitution of arbitral tribunal - Institutional procedure of arbitration -Impartiality and independence of arbitrators jurisdiction of arbitral tribunal - Interim measures - Enforcement of awards.

**UNIT IV NEGOTIATION, MEDIATION AND CONCILIATION 9**

Concepts and purpose - Statutory back ground ADR and mediation rules - Duty of mediator and disclose facts - Power of court in mediation.

**UNIT V ALTERNATE DISPUTE RESOLUTION 9**

Structure of Indian Judicial - The arbitration and reconciliation ordinance 1996 -Dispute resolution mechanism under the Indian judicial system - Litigation in Indian courts - Case studies.

**TOTAL :45 PERIODS**

**OUTCOMES:**

On successful completion of the course, students will be able to

- understand the laws on contracts for construction industry in india
- apply knowledge of contracts in preparation of contract document and tendering process
- apply appropriate methods to assess the critical factors in contracts leading to arbitration and disputes between the parties
- suggest suitable type of arbitration or dispute resolution for the situation of problem

**REFERENCES**

1. American Arbitration Association, "Construction industry arbitration rules and mediation procedures", 2007
2. Case study of Southern Railway Arbitration Cases [wiki.ircen.gov.in/doku/lib/exe/fetch.php](http://wiki.ircen.gov.in/doku/lib/exe/fetch.php)
3. Collex.K, "Managing Construction Contracts", Reston publishing company, Virginia, 1982
4. Eastern Book Company "Arbitration and Conciliation Act 1996", June 2008
5. International Federation of Consulting Engineers (FIDIC) documents, Geneva, 2009 (<http://www.fidic.org>)
6. Gajaria. G.T., "Laws relating to building and Engineer's Contracts", M.M. Tripathi Pvt Ltd., Mumbai, 1985
7. Horgon.M.O and Roulstion F.R., "Project Control of Engineering Contracts" E and FN, SPON, Norway, 1988
8. Krishna Sharma, Momota Oinam and Angshuman Kaushik, "Development and Practice of Arbitration in India- Has it evolved as an effective legal Institution", CDDRL, Stanford, 103, Oct 2009
9. Park.W.B., "Construction Bidding for Projects", John Wiley, Norway, 1978
10. Roshan Namavati, "Professional Practice", Anuphai Publications, Lakhani Book Depot, 2013
11. Vasavada.B.J. "Engineering Contracts and Arbitration" , March 1996

**OBJECTIVE:**

- To impart projects types, time & resource management, resource optimization and new trends in project management.

**UNIT I PROJECT AND ITS PROCESS**

Define project and process -Boundaries of project - Objectives and functions of project management -Characteristics and types of projects -Organization structure / styles -Roles of project management group - Project management office and its role - Project knowledge area - Project integration- Process group interaction -project flow - Project life cycle- Influencing factors. - Case study.

**UNIT II PROJECT TIME MANAGEMENT**

Project scope management - Work break down structure - Activity/Task – Events - Case study - Project planning tools - Rolling wave planning - Gantt charts, Milestone chart, Program progress chart- Creating milestone plan - Project network- Fulkerson's rules - A-O-A and A-O-N networks - Analyze project time- Critical path method (deterministic approach) - Activity oriented network analysis- 80-20 rule- Case study - Type of time estimates & square network diagram - Project updating and monitoring- Case study - Estimate time- Program Evaluation & Review Technique (Probabilistic approach)- Event oriented network analysis- Optimistic, pessimistic and most likely time - Degree of variability in average time - Probabilistic estimate - % utilization of resources.

**UNIT III RESOURCE MANAGEMENT**

Types of Resource- Time, Men, Material, Machinery, Money, Space - Balancing of resource - Resource smoothing technique- Time constraint - Resource leveling technique- Resource constraint- Case study.

**UNIT IV RESOURCE OPTIMIZATION**

Types of cost – Direct, indirect and total cost - Variation of cost with time - Schedule compression techniques- Crashing, fast tracking & Re-estimation- Crash timeand crash cost - Optimize project cost for time and resource - CPM cost model - Life cycle assessment - Impacts and economical assessment - Life cycle cost- Maintenance and operation -Life cycle forecasting – Concept and applications.

**UNIT V EMERGING TRENDS IN PROJECT MANAGEMENT**

AGILE Project management and Project Management using latest tools- Case study.

**TOTAL :45 PERIODS**

**OUTCOMES:**

On successful completion of the course, the students will be able to

- explain the concept of projects, its process, objectives and functions of project management
- analyze and manage time in projects through gantt charts, cpm and pert techniques
- balance resource requirements of projects so as to avoid idling of resources
- update projects and determine revised schedule of activities and critical path, if any
- crash projects to determine its optimum time-minimum cost relationships

**REFERENCES**

1. "A Guide to the Project Management Body of Knowledge (PMBOK Guide) – Fourth Edition, An American National Standard, ANSI/PMI 990001-2008"
2. A Risk Management Standard, AIRMIC Publishers, ALARM, IRM: 2002
3. Gene Dixon, "Service Learning and Integrated Collaborative Project Management", Project Management Journal, DOI:10.1002/pmi, February 2011, pp.42-58
4. Jerome D. Wiest and Ferdinand K. Levy, "A Management Guide to PERT/CPM", Prentice Hall of India Publishers Ltd., New Delhi, 1994.

5. Punmia B. C. and Khandelwal K.K., "Project Planning and Control with PERT/CPM", Laxmi publications, New Delhi, 1989.
6. Srinath L.S., "PERT & CPM- Principles and Applications", Affiliated East West Press Pvt., Ltd., New Delhi, 2008
7. Sengupta. B and Guha. H, "Construction Management and Planning", Tata McGraw Hill, New Delhi, 1995
8. SangaReddi. S and Meiyappan. PL, "Construction Management", Kumaran Publications, Coimbatore, 1999

**BA5066 MANAGEMENT OF HUMAN RESOURCES, SAFETY AND QUALITY**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

- to impart knowledge on management of human resources, labor legislation, safety and quality aspects in construction

**UNIT I HUMAN RESOURCES MANAGEMENT 9**

Introduction - Concept- Growth - Role and function - Manpower planning for construction companies - Line and staff function - Recruitment, selection, placement, induction and training; over staffing; Time office and establishment functions; wage and salary administration - Discipline - Separation process.

**UNIT II LABOR LEGISLATION 9**

Labor laws- Labor law relating to construction industry- Interstate migration- Industrial relations- Collective bargaining- Worker's participation in management - Grievance handling - Discipline - Role of law enforcing agencies and judiciary -Women in construction industry.

**UNIT III SAFETY MANAGEMENT 9**

Importance of safety- Causes of accidents -Responsibility for safety - Role of various parties in safety management -Safety benefits- Approaches to improve safety in construction for different works - Measuring safety.

**UNIT IV SAFETY IMPLEMENTATION 9**

Application of ergonomics to the construction industry - Prevention of fires at construction site- Safety audit.

**UNIT V QUALITY MANAGEMENT IN CONSTRUCTION 9**

Importance of quality - Elements of quality - Quality characteristics- Quality by design - Quality conformance -Contractor quality control - Identification and traceability - Continuous chain management - Brief concept and application - Importance of specifications- Incentives and penalties in specifications - Workmanship as a mark of quality - Final inspection - Quality assurance techniques - Inspection, testing, sampling - Documentation - Organization for quality control, Cost of quality - Introduction to TQM, Six sigma concept- ISO 14000 in quality management.

**TOTAL :45 PERIODS**

**OUTCOMES:**

On successful completion of the course, students will be able to

- Identify the need and importance of human resource management, labour laws relating to construction industry
- Identify the need and measures to improve safety in construction industry and safety audit
- Identify the need for applying ergonomics to construction industry
- Enumerate the need, importance, elements of quality and significance of quality assurance in industry

## REFERENCES

1. Arya Ashok, "Human Resources Management – Human Dimensions in Management" March 24-26, 2011, Organizational Development Programme Division – New Delhi
2. Arya Ashok, "Essence of Labour Laws"- [www.odiindia.in/about-the-books.pdf](http://www.odiindia.in/about-the-books.pdf)
3. Arya Ashok "Discipline & Disciplinary procedure" Organisation Development Institute, 1998
4. Arya Ashok, "Management case studies – An analytical and Developmental Tool" Organisation Development Institute, New Delhi, 1999
5. Corlecon Coulter, Jill Justice Coulter, "The Complete Standard Hand Book of Construction Management", Prentice Hall, (1989)
6. Dwivedi R.S., "Human Relations and Organisational Behaviour", (BH – 1987)
7. Grant E.L., and Leavens worth, "Statistical Quality Control", Mc Graw Hill, 1984.
8. James J Obrien, "Construction Inspection Hand Book – Quality Assurance and Quality Control", Van NOstrand, New York, 1989
9. Josy J. Farrilaro, "Hand Book of Human Resources Administration" Mc.Graw Hill(International Edition) 1987.
10. Juran Frank, J.M. and Gryna F.M. "Quality Planning and Analysis", Tata Mc Graw Hill, 1982.
11. Malik, P.L., "Handbook of Labour & Industrial Law", Eastern book company, Lalbagh, Lucknow, 2010
12. Manoria C.B., "Personnel Management", Himalaya Publishing House, 1992.

BA5067

DISASTER MITIGATION AND MANAGEMENT

L T P C

3 0 0 3

## OBJECTIVES:

- To create an awareness on the various types of disasters and to expose the students about the measures, its effect against built structures, and hazard assessment procedure in India.
- To impart knowledge on the methods of mitigating various hazards such that their impact on communities is reduced.

## UNIT I INTRODUCTION

9

Difference between hazards and disaster -Types of disasters-Phases of disaster management - Hazards - Classification of hazards - Hazards affecting buildings - Building safety against hazards - Floods - Cyclone - Landslides -Tsunami - Fire.

## UNIT II EARTHQUAKE DISASTER

9

Earthquake hazard map -Causes of earthquakes -Classification of earthquakes -Seismic waves - Energy release - Inertia forces - Natural period - Resonance - Damping -Seismic response of free vibration -Seismic response of damped vibration -Performance of ground and buildings in past earthquakes-Earthquake resistant measures in RC and masonry buildings - Potential deficiencies of RC and masonry buildings.

## UNIT III OTHER DISASTERS

9

Landslides-Landslide zoning map - Causes -Protection measures Floods -Flood zone map - Effects on buildings -Protection measures from damage to buildings -Mitigation strategies -Tropical cyclones - Effects on buildings -Protection measures from damage to buildings - Tsunami - Tsunami wave characteristics -Peculiarities of tsunami deposits -Tsunami impact on coastal lines- Effects of Tsunami on built structures - Fire disaster - Causes and effects of fire disaster - Preventive mechanism .

#### **UNIT IV HAZARD ASSESSMENT**

**9**

Visual inspection and study of available documents -Detailed in-situ investigation planning and interpretation of results-Foundation capability -Non-structural components - Seismic strengthening of buildings –Repairs, restoration and strengthening of existing buildings - Strengthening materials -Retrofitting of load bearing wall buildings - Retrofitting of RC Buildings-RVS method of screening - RC and masonry structures -Seismic hazard assessment - Deterministic seismic hazard analysis - PSHA.

#### **UNIT V LAND USE ZONING REGULATIONS , QUALITY CONTROL AND DISASTER MANAGEMENT POLICY**

**9**

Introduction-Community planning - Community contingency plan - Report building and initial awareness - Recommendations for land use zoning regulations - Construction quality control - Evolution of quality management -Reasons for poor construction -Construction of quality control in masonry structures - Disaster management policy and procedure -Legal frame work - Institutional mechanism - Schemes and grants on DM - Recommendation of 13<sup>th</sup> finance commission -Plan schemes - Non plan schemes - Externally aided schemes Role of NDRF in Disaster Management - Medical First Responder - Flood Rescue & Relief Management.

**TOTAL :45 PERIODS**

#### **OUTCOMES:**

On successful completion of the course, students will be able to

- understand the various types of disaster viz hydrological, coastal and marine disasters, atmospheric disasters, geological, mass movement and land disasters, wind and water driven disasters.
- to identify the potential deficiencies of existing buildings for eq disaster and suggest suitable remedial measures.
- derive the guide lines for the precautionary measures and rehabilitation measures for eq disaster.
- understand the effects of disasters on built structures
- derive the protection measures against floods, cyclone and land slides
- understand the hazard assessment procedure
- get the awareness regarding landuse zoning regulations & quality control

#### **REFERENCES**

1. Annual Report, Ministry of Home Affairs, Government of India, 2009-10
2. Ayaz Ahmad, "Disaster Management: Through the New Millennium" Anmol Publications, 2003
3. Berg.GV, "Seismic Design codes and procedures", EERI, CA,1982
4. Booth, Edmund, "Concrete Structures in earthquake regions; Design and Analysis", Longman, 1994
5. Dowrick. D.J, "Earthquake resistant design for Engineers and Architects", John Wiley & Sons, Second Edition, 1987.
6. Ghosh G.K. "Disaster Management", A.P.H. Publishing Corporation, 2006
7. Goel, S. L. "Encyclopaedia of Disaster Management", Deep & Deep Publications Pvt Ltd.,2006
8. Jaikrishna & A.R.Chandrasekaran, "Elements of Earthquake Engineering", Sarita Prakashan, Meerut,1996
9. Singh R.B, "Disaster Management", Rawat Publications, 2008
10. Thirteenth Finance Commision Report, Ministry of Finance, Government of India, 2010-15

**OBJECTIVE:**

- To study the concepts of construction economics and finance such as comparing alternatives proposals, evaluating alternative investments, management of funds, Insurance procedures, risks involved and economics of costing.

**UNIT I BASIC PRINCIPLES 9**

Time Value of Money - Cash flow diagram - Nominal and effective Interest - Continuous interest - Nominal and effective interest- continuous interest . Single Payment Compound Amount Factor (P/F,F/P) – Uniform series of Payments (F/A,A/F,F/P,A/P)– Problem time zero (PTZ)- equation time zero (ETZ). Constant increment to periodic payments – Arithmetic Gradient(G), Geometric Gradient (C)

**UNIT II MARKET STRUCTURE AND CONSTRUCTION ECONOMICS 9**

Types of Market Structure in the Construction Industry – Markets and the competitive environment- Perfect competition -. Monopolistic competition - Oligopoly - Monopoly – Characteristics and economic Profit – Construction Economics – BOOT, BOT, BOO Methods - Depreciation - Inflation-Taxes

**UNIT III EVALUATING ALTERNATIVE INVESTMENTS 9**

Present worth analysis, Annual worth analysis, Future worth analysis, Rate of Return Analysis (ROR) and Incremental Rate of Return (IROR) Analysis, Benefit/Cost Analysis, Break Even Analysis - Replacement Analysis- Equipment Replacement Analysis.

**UNIT IV FUNDS MANAGEMENT 9**

Project Finance - Sources - Working capital management- Inventory Management- Mortgage Financing-- Interim construction financing - Security and risk aspects

**UNIT V ECONOMICS OF COSTING 9**

Construction accounting-Chart of accounts- Meaning and definition of costing - Types of costing - Methods of calculation (Marginal costing, cost sheet, budget preparation) – Equipment Cost- Replacement Analysis - Role of costing technique in real estate and infrastructure management.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- On completion of this course the students will be able to know the concepts in Economics and Finance in Construction.

**REFERENCES**

1. Pandey, I.M, Financial Management, 12th Edition Vikas Publishing House Pvt. Ltd., 2012.
2. Prasanna Chandra, Financial Management, 9th edition, Tata McGraw Hill, 2012.
3. Paul A. Samuelson, William D. Nordhaus, Sudip Chaudhuri and Anindya Sen, Economics, 19<sup>th</sup> edition, Tata McGraw Hill, 2010.
4. Blank, L.T., and Tarquin,a.J , Engineering Economy,4th Edn. Mc-Graw Hill, 1988.
5. Patel, B M, Project management- strategic Financial Planning, Evaluation and Control, Vikas Publishing House Pvt. Ltd. New Delhi, 2000.
6. Shrivastava,U.K., Construction Planning and Management,2nd Edn. Galgotia Publications Pvt. Ltd. New Delhi, 2000.
7. Steiner, H.M.,Engineering Economic principles, 2nd Edn. Mc-Graw Hill Book, New York, 1996.

**OBJECTIVES:**

- To create an awareness on the various environmental issues in an urban scenario and give an exposure to the urban water resources and its management.
- To impart knowledge on the stages of works involved in a water supply project of a city, safe wastewater collection system for generated wastewater and its management, solid waste and their safe disposal beyond urban limit to be free from pollution is also addressed in the course work.

**UNIT I URBAN ENVIRONMENTAL ISSUES 9**

Urbanization- Population growth scenario -Migration - Pollution of surface water resources - Rivers, tanks, channels -Ground water exploitation - Waste water -Characteristics -Pollution problems - Solid waste -Air pollution - CPCB norms.

**UNIT II URBAN MASTER PLANS 9**

Planning and organizational aspects -Urban waste resources management - Water in urban ecosystem -Urban water resources planning and organization aspects -Storm water management practices -Types of storage -Magnitude of storage -Storage capacity of urban components - Percolation ponds -Temple tanks -Rainwater harvesting -Urban water supply - Demand estimation -Population forecasting -Source identification -Water conveyance -Storage reservoirs -Fixing storage capacity - Distribution network -Types -Analysis -Computer applications - Conservation techniques -Integrated urban water planning - Smart city project planning - Green Building - LEED certification - Green audit

**UNIT III URBAN WASTEWATER MANAGEMENT 9**

Sewage generation -Storm drainage estimation -Industry contribution -Wastewater collection system -Separate and combined system -Hydraulic design of sewer and storm drain -Wastewater treatment -Disposal methods -Concept of decentralization - 3R concepts.

**UNIT IV MUNICIPAL SOLID WASTE MANAGEMENT 9**

Sources of solid waste -Characteristics -Rate of generation -Segregation at source -Collection of solid waste -Methods of collection -Route analysis -Transfer and transfer stations -Processing and disposal of solid waste.

**UNIT V CASE STUDIES 9**

Environmental economics- Social and physiological aspects of pollution - Successful urban management -Models- Urban management-Case studies from developed nations -Software.

**TOTAL :45 PERIODS****OUTCOMES:**

On successful completion of the course, students will be able to

- understand planning of a city and identify various urban environmental issues
- apply and prepare project plans to integrate urban water resource
- develop water resource management using available water resources
- understand and apply the principles of solid waste management

**REFERENCES**

1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil "Integrated Solid Waste Management", McGraw Hill Publishers, New York, 1993.
2. McGhee J., "Water supply and sewerage", McGraw Hill Publishers, 1991
3. Martin P. Wanelista and Yousef. "Storm Water Management and Operations", John Wiley and Sons, 1993.
4. Neil S. Grigg., "Urban Water Infrastructure Planning – Management and Operations", John Wiley and Sons, 1986.

**OBJECTIVE:**

- To give an exposure on the advanced materials, techniques and equipments used in infrastructure industry.

**UNIT I SPECIAL CONCRETES****9**

Concrete -Behavior of concrete - High strength and high performance concrete - Fibre reinforced concrete - Self compacting concrete - Bacterial concrete -Reactive powder concrete - Ready mix concrete -Geopolymer concrete -Alternative materials for concrete.

**UNIT II METALS****9**

Steels - New alloy steels - Coatings to reinforcement - Cold formed steel -Aluminum and its products -Applications. Composites: Plastics - Reinforced polymers- FRP -Applications. Smart and intelligent materials: smart and intelligent materials for intelligent buildings - Special features.

**UNIT III ADVANCED CONSTRUCTION TECHNIQUES****9**

Sub structure construction: Box jacking- Pipe jacking- Under water construction of diaphragm walls and basement- Tunneling techniques-Cable anchoring and grouting- Driving diaphragm walls, sheet piles, laying operations for built up offshore system- Shoring for deep cutting- Large reservoir construction -Trenchless technology.

**UNIT IV SUPERSTRUCTURE CONSTRUCTION FOR BUILDINGS****9**

Vacuum dewatering of concrete flooring- Concrete paving technology- Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections - Launching techniques suspended form work -Erection techniques of tall structures, large span structures- Launching techniques for heavy decks -Inset pre-stressing in high rise structures, aerial transporting, handling, erecting lightweight components on tall structures.

**UNIT V CONSTRUCTION OF SPECIAL STRUCTURES****9**

Erection of lattice towers and rigging of transmission line structures- Construction sequence in cooling towers, silos, chimney, sky scrapers, bow string bridges, cable stayed bridges - Launching and pushing of box decks -Advanced construction techniques of offshore structures- Construction sequence and methods in domes and prestress domes -Support structure for heavy equipment and conveyor and machinery in heavy industries -Erection of articulated structures, braced domes and space decks. Demolition Techniques -Advanced techniques and sequence in demolition and dismantling.

**TOTAL :45 PERIODS****OUTCOMES:**

On successful completion of the course, students will be able to

- explain the properties and applications of special concretes, composites, smart and intelligent materials
- identify and explain advanced construction techniques used for sub structure construction
- select appropriate techniques for super structure construction of buildings
- select suitable techniques for construction of special structures
- choose relevant technique for demolition and dismantling works

**REFERENCES**

- Jerry Irvine, "Advanced Construction Techniques", C.A. Rocketr, 1984
- Patrick Powers, "Construction Dewatering: New Methods and Applications", John Wiley & Sons, 1992
- Robertwade Brown, "Practical foundation Engineering handbook", McGraw Hill Publications, 1995.
- Sankar S.K. and Saraswathi. S, "Construction Technology", Oxford University Press, New Delhi, 2008.

**OBJECTIVE:**

- To provide the participants with a good knowledge on strategic planning and marketing in airport organizations.

**UNIT I INTRODUCTION TO AIRPORT INFRASTRUCTURE 9**

Growth of air transport, Airport organization and associations, Classification of airports airfield components, Air traffic zones and approach areas. Context of airport system planning - Development of airport planning process - Ultimate consumers - Airline decision - Other airport operations.

**UNIT II AIRPORT INFRASTRUCTURE CAPACITY DESIGN 9**

Components, size, turning radius, speed, airport characteristics. Capacity and Delay - Factors affecting capacity, determination of runway capacity related to delay, gate capacity and taxiway capacity.

**UNIT III AIRPORT INFRASTRUCTURE PLANNING AND SURVEYS 9**

Runway length and width, sight distances, longitudinal and transverse, runway intersections, taxiways, clearances, aprons, numbering, holding apron. Planning and design of the terminal area: Operational concepts, space relationships and area requirements, noise control, vehicular traffic and parking at airports. Air traffic control and aids: Runways and taxiways markings, day and night landing aids, airport lighting and other associated aids.

**UNIT IV AIRPORT INFRASTRUCTURE ENTERPRISE 9**

The economic impact on countries and regions - the main governance patterns in the airport business - The International path of evolution in the airport business - Airport transport value chain - Air enterprises - two primary actors in the air transport value chain - Skipping peripheral positions in the value chain. Rise of airport marketing for the aviation related business - Airport revenue management- Airport alliances- management contract.

**UNIT V THE DEVELOPMENT OF THE NON AVIATION INFRASTRUCTURE 9**

Related value Proposition. Evolution of traditional Airport - Evolutionary patterns for airport enterprises- Commercial Airport Philosophy - tourist and conference service - logistic services- property management- consulting services - BAA and the non aviation business - best airport in the world: The case of Singapore Airport - Role and meaning of loyalty for a service company- Bench marking airline experience - Provider - Customer relational link - benefits from ALPS implementation of ALPS.

**TOTAL :45 PERIODS****OUTCOMES :**

On the successful completion of the course, students will be able to:

- explain the classification of airports airfield components
- explain the main governance patterns in the airport business
- identify the evolutionary patterns for airport enterprises.
- explain the primary actors in the air transport value chain

**REFERENCES**

1. Aviation Safety Programs A Management Hand Book: Richard H. Wood - Jeppesen Sanderson Inc.
2. Airport Systems,: Planning, Design and Management, Second Edition, Richard L. De Neufville , Amedeo R. Odoni, Peter Belobaba,& Tom G. Reynolds ), 2013.
3. Airport Planning and Management, Sixth Edition, Seth B. Young, Ph.D., Alexander T. Wells, Ed.D., McGraw-Hill Education, 2011.
4. Asset and Infrastructure Management for Airports—Primer and Guidebook, The national academic press.

**OBJECTIVE:**

- To provide the participants with a good knowledge on real estate marketing and management.

<b>UNIT I</b>	<b>CONCEPT</b>	<b>9</b>
Fundamental concepts and techniques involved in real estate development process- Role of various organizations - CREDAI- BAI etc		
<b>UNIT II</b>	<b>EVENTS AND PRE-PROJECT STUDIES</b>	<b>9</b>
Modeling sequential events in real estate development process - Site evaluation - Land procurement - Development Team assembly - Market study		
<b>UNIT III</b>	<b>DEVELOPMENT PLANNING &amp; APPROVAL PROCESS</b>	<b>9</b>
Identifying technical inputs required, planning objectives, front end clearances from various authorities, timing of the project and scheduling		
<b>UNIT IV</b>	<b>CONSTRUCTION AND PROJECT MANAGEMENT</b>	<b>9</b>
Identifying the elements of infrastructure and the resource mobilization, disaggregating the project components, mobilizing the human and fiscal resources procuring and storing materials		
<b>UNIT V</b>	<b>PROJECT MARKETING &amp; HANDING OVER</b>	<b>9</b>
Over of the completed project- Communication tools required for presenting the project -In house sales promotion -Franchisee system -Joint venture and sharing issues - Procedure and laws relating to transfer of completed project.		

**TOTAL :45 PERIODS****OUTCOMES:**

On successful completion of the course, students will be able to

- Explain the fundamental concepts and techniques involved in real estate development process
- Explain the procedure and laws relating to transfer of completed project
- Identify the fiscal resources procuring and storing materials process.

**REFERENCES:**

1. Gerald R. Cortesi, "Mastering real estate principles" (2001); Dearborn Trade Publishing, New York, USA.
2. Fillmore W Galaty, "Modern real estate practice" (2002); Dearborn Trade publishing, New York, USA
3. Tanya Davis, "Real estate developer's handbook" (2007), Atlantic pub company, Ocala, USA.
4. Mike E. Miles, "Real estate development - Principles & process 3<sup>rd</sup> edition" (2000); Urban Land Institute, ULI, Washington DC.

**OBJECTIVES:**

- To develop and strengthen entrepreneurial quality and motivation in students.
- To impart basic entrepreneurial skills and understandings to run a business efficiently and effectively.

**UNIT I      ENTREPRENEURIAL COMPETENCE      9**  
Entrepreneurship concept - Entrepreneurship as a Career - Entrepreneurial Personality - Characteristics of Successful, Entrepreneur - Knowledge and Skills of Entrepreneur.

**UNIT II      ENTREPRENEURIAL ENVIRONMENT      9**  
Business Environment - Role of Family and Society - Entrepreneurship Development Training and Other Support Organizational Services - Central and State Government Industrial Policies and Regulations - International Business.

**UNIT III      BUSINESS PLAN PREPARATION      9**  
Sources of Product for Business - Prefeasibility Study - Criteria for Selection of Product - Ownership - Capital - Budgeting Project Profile Preparation - Matching Entrepreneur with the Project - Feasibility Report Preparation and Evaluation Criteria.

**UNIT IV      LAUNCHING OF SMALL BUSINESS      9**  
Finance and Human Resource Mobilization Operations Planning - Market and Channel Selection - Growth Strategies - Product Launching -Incubation, Venture capital, IT startups.

**UNIT V      MANAGEMENT OF SMALL BUSINESS      9**  
Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units- Effective Management of small Business.

**TOTAL :45 PERIODS**

**OUTCOME:**

Students will gain knowledge and skills needed to start and run an enterprise.

**REFERENCES**

1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2001.
2. S.S.Khanka, Entrepreneurial Development, S.Chand and Company Limited, New Delhi, 2001.
3. Mathew Manimala, Entrepreneurship Theory at the Crossroads, Paradigms & Praxis, Biztrantra ,2nd Edition ,2005
4. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill, 1996.
5. P.Saravanel, Entrepreneurial Development, Ess Pee kay Publishing House, Chennai -1997.
6. Arya Kumar. Entrepreneurship. Pearson. 2012
7. Donald F Kuratko, T.V Rao. Entrepreneurship: A South Asian perspective. Cengage Learning. 2012

**OBJECTIVE:**

- To gain knowledge about the valuation of different infrastructure assets

<b>UNIT I</b>	<b>REAL ESTATE VALUATION</b>	<b>9</b>
Scope and objectives -Concepts of valuation - Types of value - Value vs Price vs Cost-Different methods of valuation- SWOT analysis		
<b>UNIT II</b>	<b>APPROACHES TO REAL ESTATE VALUATION</b>	<b>9</b>
Sales comparison approach - Cost approach - Income approach - SWOT analysis		
<b>UNIT III</b>	<b>VALUATION OF VARIOUS CATEGORIES OF REAL ESTATE</b>	<b>9</b>
Residential real estate valuation - Commercial real estate valuation - Industrial real estate valuation - Retail real estate valuation- Mixed-use real estate valuation		
<b>UNIT IV</b>	<b>INFRASTRUCTURE ASSET VALUATION</b>	<b>9</b>
Objective and approaches-Different categories of infrastructure assets- Valuation methodology-Key operational and financial parameters -Valuation framework and models.		
<b>UNIT V</b>	<b>SECTORAL INFRASTRUCTURE VALUATION</b>	<b>9</b>
Power sector- IT sector - Telecom sector - Aviation-Education sector- Other service sectors- Plant and Machinery -Case studies		

**TOTAL :45 PERIODS**

**OUTCOME:**

- Students will gain knowledge and skills in connection to the valuation of different types of real estates and infrastructure assets.

**REFERENCES :**

1. Infrastructure valuation –Frederic Blanc - Brude and Majid Hasan, EDHEC Risk Institute
2. Infrastructure Asset Management - Frederic Blanc - Brude and Majid Hasan, EDHEC Risk Institute
3. Valuation techniques for infrastructure investment decisions, Michael J. Garvin, Department of Civil Engineering and Engineering Mechanics , Columbia University
4. <https://www.thebalance.com/different-types-of-real-estate-investments-you-can-make-357986>
5. [http://rbsa.in/valuation\\_of\\_infrastructure\\_assets\\_specialized\\_assets.html](http://rbsa.in/valuation_of_infrastructure_assets_specialized_assets.html)
6. [http://edhec.infrastructure.institute/wp-content/uploads/publications/blanc-brude\\_2015a.pdf](http://edhec.infrastructure.institute/wp-content/uploads/publications/blanc-brude_2015a.pdf)
7. Application of Real Options in Infrastructure Projects Charles Y.J. Cheah, PhD, CFA

**ANNA UNIVERSITY**  
**AFFILIATED INSTITUTIONS**  
**REGULATIONS – 2017**  
**CURRICULUM AND SYLLABUS I TO IV SEMESTERS (FULL TIME)**  
**MASTER OF COMPUTER APPLICATIONS**

**PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):**

- I. To prepare students to pursue lifelong learning and do research in computing field by providing solid technical foundations.
- II. To provide students with various computing skills like analysis, design and development of innovative software products to meet the industry needs and excel as software professionals.
- III. To prepare students to communicate and function effectively in teams in multidisciplinary fields within the global, societal and environmental context

**PROGRAM OUTCOMES (POS) :**

**On successful completion of the program:**

1. **Computational knowledge:** Apply knowledge of computing fundamentals, computing specialisation, mathematics, and domain knowledge appropriate for the computing specialisation to the solution of complex problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex computing problems reaching substantiated conclusions using first principles of mathematics, computing sciences, and relevant domain disciplines.
3. **Design/development of solutions:** Design solutions for complex computing problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern computing and IT tools including prediction and modeling to complex computing systems with an understanding of the limitations
6. **Research Aptitude:** Ability to independently carry out research / investigations, identify problems and develop solutions to solve practical problems.
7. **Innovation and Entrepreneurship:** Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the professional computing practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex system building activities with the stake holders and with society at large, such as, being able to comprehend

and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### PROGRAM SPECIFIC OBJECTIVES (PSO)

**PSO 1:** Able to select suitable data model, appropriate architecture, platform to implement a system with good performance.

**PSO 2:** Able to design and integrate various system based components to provide user interactive solutions for various challenges.

### Mapping Of Programme Educational Objectives With Programme Outcomes And Programme Specific Objectives

Programme Educational Objectives	Programme Outcomes												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
<b>1</b>	√	√	√	√	√	√	√				√			√
<b>2</b>		√	√	√	√	√	√	√	√		√		√	
<b>3</b>		√		√	√	√			√	√	√	√	√	√

### 3. SEMESTER COURSE WISE PEO MAPPING

YEAR	SEMESTER	SUBJECT NAME	PEO1	PEO2	PEO3
YEAR 1	SEM 1	Matrices, Probability and Statistics	√		
		Advanced Data Structures and Algorithms	√	√	
		Advanced Database Technology	√	√	
		Object Oriented Software Engineering	√	√	√
		Python Programming	√	√	
		Research Methodology and Intellectual Property Rights	√		
		Advanced Database Technology Lab	√	√	
		Advanced Data Structures and Python Programming Lab	√	√	
		Communication Skills Enhancement – I			√
	SEM 2	Internet Programming	√	√	
		Cloud Computing Technologies	√	√	
		Artificial Intelligence and Machine Learning	√	√	
		Mobile Application Development	√	√	√
		Cyber Security	√	√	√
		<b>Elective I</b>			
		1. Software Project Management	√	√	√
		2. Agile Methodologies	√	√	√
		3. E Learning	√	√	√
		4. Software Quality and Testing	√	√	√
		5. Advances in Operating Systems	√	√	
6. Digital Image Processing	√	√			
Internet Programming Laboratory	√	√			
Artificial Intelligence and Machine Learning Laboratory	√	√			
Communication Skills Enhancement– II			√		
YEAR	SEMESTER	SUBJECT NAME	PEO1	PEO2	PEO3
YEAR 2	SEM 3	Data Science	√	√	√
		Embedded Systems and Internet of Things	√	√	√
		Accounting and Financial Management for Application Development	√	√	√
		<b>Elective II</b>			
		1. Compiler Optimization Techniques	√	√	
2. C# and .NET programming		√			
3. Wireless Networking	√	√			

		4. Web Design	√	√	√
		5. Network Programming and Security	√	√	
		6. Microservices and Devops	√	√	
		<b>Elective III</b>			
		1. Social Network Analytics	√	√	√
		2. Bio Inspired Computing	√	√	
		3. Information Retrieval Techniques	√	√	
		4. Software Architecture	√	√	
		5. Digital Forensics	√	√	
		6. Data Mining and Data Warehousing Techniques	√	√	
		<b>Elective IV</b>			
		1. Data Visualization Techniques	√	√	
		2. Operations Research	√	√	
		3. Professional Ethics in IT	√	√	√
		4. Marketing Management			√
		5. Organizational Behavior	√	√	√
		6. Business Data Analytics		√	
		<b>Elective V</b>			
		1. Cryptocurrency and Blockchain Technologies	√	√	
		2. Advances in Networking	√	√	
		3. Soft Computing Techniques	√	√	
		4. Deep Learning	√	√	
		5. Big Data Processing	√	√	
		6. Natural Language Processing	√	√	
		Data Science Laboratory	√	√	
		Internet of Things Laboratory	√	√	
	<b>SEM 4</b>	Project Work	√	√	√

**ANNA UNIVERSITY, CHENNAI**  
**REGULATIONS – 2017**  
**AFFILIATED INSTITUTIONS**  
**CHOICE BASED CREDIT SYSTEM**  
**MASTER OF COMPUTER APPLICATIONS**

**SEMESTER I**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT HOURS	L	T	P	C
<b>THEORY</b>								
1.	MA5101	Matrices, Probability and Statistics	FC	5	3	2	0	4
2.	MC5301	Advanced Data Structures and Algorithms	PC	3	3	0	0	3
3.	MC5105	Advanced Database Technology	PC	3	3	0	0	3
4.	MC5106	Object Oriented Software Engineering	PC	3	3	0	0	3
5.	MC5107	Python Programming	PC	3	3	0	0	3
6.	MC5108	Research Methodology and Intellectual Property Rights	PC	2	2	0	0	2
<b>PRACTICALS</b>								
7.	MC5114	Advanced Database Technology Laboratory	PC	4	0	0	4	2
8.	MC5115	Advanced Data Structures and Python Programming Laboratory	PC	4	0	0	4	2
9.	MC5116	Communication Skills Enhancement – I	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>29</b>	<b>17</b>	<b>2</b>	<b>10</b>	<b>23</b>

**SEMESTER II**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT HOURS	L	T	P	C
<b>THEORY</b>								
1.	MC5206	Internet Programming	PC	3	3	0	0	3
2.	MC5207	Cloud Computing Technologies	PC	3	3	0	0	3
3.	MC5208	Artificial Intelligence and Machine Learning	PC	3	3	0	0	3
4.	MC5209	Mobile Application Development	PC	4	2	0	2	3
5.	MC5210	Cyber Security	PC	3	3	0	0	3
6.		Professional Elective I	PEC	3	3	0	0	3
<b>PRACTICALS</b>								
7.	MC5214	Internet Programming Laboratory	PC	4	0	0	4	2
8.	MC5215	Artificial Intelligence and Machine Learning Laboratory	PC	4	0	0	4	2
9.	MC5216	Communication Skills Enhancement– II	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>29</b>	<b>17</b>	<b>0</b>	<b>12</b>	<b>23</b>

### SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT HOURS	L	T	P	C
<b>THEORY</b>								
1.	MC5306	Data Science	PC	3	3	0	0	3
2.	MC5307	Embedded Systems and Internet of Things	PC	3	3	0	0	3
3.	MC5308	Accounting and Financial Management for Application Development	PC	3	3	0	0	3
4.		Professional Elective II	PE	3	3	0	0	3
5.		Professional Elective III	PE	3	3	0	0	3
6.		Professional Elective IV	PE	3	3	0	0	3
7.		Professional Elective V:	PE	3	3	0	0	3
<b>PRACTICALS</b>								
1.	MC5314	Data Science Laboratory	PC	4	0	0	4	2
2.	MC5315	Internet of Things Laboratory	PC	4	0	0	4	2
<b>TOTAL</b>				<b>29</b>	<b>21</b>	<b>0</b>	<b>8</b>	<b>25</b>

### SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT HOURS	L	T	P	C
<b>PRACTICALS</b>								
1.	MC5414	Project Work	PC	24	0	0	24	12
<b>TOTAL</b>				<b>24</b>	<b>0</b>	<b>0</b>	<b>24</b>	<b>12</b>

**TOTAL CREDITS: 83**

## PROFESSIONAL ELECTIVES

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>PROFESSIONAL ELECTIVE - I , Semester 2</b>								
1.	MC5003	Software Project Management	PE	3	3	0	0	3
2.	MC5016	Agile Methodologies	PE	3	3	0	0	3
3.	MC5017	E Learning	PE	3	3	0	0	3
4.	MC5018	Software Quality and Testing	PE	3	3	0	0	3
5.	MC5019	Advances in Operating Systems	PE	3	3	0	0	3
6.	MC5020	Digital Image Processing	PE	3	3	0	0	3
<b>PROFESSIONAL ELECTIVE – II, Semester 3</b>								
1.	MC5021	Compiler Optimization Techniques	PE	3	3	0	0	3
2.	MC5022	C# and .NET programming	PE	3	3	0	0	3
3.	MC5023	Wireless Networking	PE	3	3	0	0	3
4.	MC5024	Web Design	PE	3	3	0	0	3
5.	MC5025	Network Programming and Security	PE	3	3	0	0	3
6.	MC5026	Microservices and Devops	PE	3	3	0	0	3
<b>PROFESSIONAL ELECTIVE – III, Semester 3</b>								
1.	MC5027	Social Network Analytics	PE		3	0	0	3
2.	MC5028	Bio Inspired Computing	PE		3	0	0	3
3.	MC5029	Information Retrieval Techniques	PE		3	0	0	3
4.	MC5030	Software Architecture	PE		3	0	0	3
5.	MC5031	Digital Forensics	PE	3	3	0	0	3
6.	MC5032	Data Mining and Data Warehousing Techniques	PE	3	3	0	0	3
<b>PROFESSIONAL ELECTIVE – IV, Semester 3</b>								
1.	MC5033	Data Visualization Techniques	PE	3	3	0	0	3
2.	MC5034	Operations Research	PE	3	3	0	0	3
3.	MC5035	Professional Ethics in IT	PE	3	3	0	0	3
4.	MC5036	Marketing Management	PE	3	3	0	0	3
5.	MC5037	Organizational Behavior	PE	3	3	0	0	3
6.	MC5038	Business Data Analytics	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE – V, Semester 3								
1.	MC5039	Cryptocurrency and Blockchain Technologies	PE	3	3	0	0	3
2.	MC5040	Advances in Networking	PE	3	3	0	0	3
3.	MC5041	Soft Computing Techniques	PE	3	3	0	0	3
4.	MC5042	Deep Learning	PE	3	3	0	0	3
5.	MC5043	Big Data Processing	PE	3	3	0	0	3
6.	MC5044	Natural Language Processing	PE	3	3	0	0	3

#### FOUNDATION COURSES (FC)

SL. NO	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	MA5101	Matrices, Probability and Statistics	FC	5	3	2	0	4

#### PROFESSIONAL CORE (PC)

SL. NO	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	MC5301	Advanced Data Structures and Algorithms	PC	3	3	0	0	3
2.	MC5105	Advanced Database Technology	PC	3	3	0	0	3
3.	MC5106	Object Oriented Software Engineering	PC	3	3	0	0	3
4.	MC5107	Python Programming	PC	3	3	0	0	3
5.	MC5108	Research Methodology and Intellectual Property Rights	PC	2	2	0	0	2
6.	MC5114	Advanced Database Technology Lab	PC	4	0	0	4	2
7.	MC5115	Advanced Data Structures and Python Programming Lab	PC	4	0	0	4	2
8.	MC5206	Internet Programming	PC	3	3	0	0	3
9.	MC5207	Cloud Computing Technologies	PC	3	3	0	0	3
10	MC5208	Artificial Intelligence and Machine Learning	PC	3	3	0	0	3
11	MC5209	Mobile Application Development	PC	4	2	0	2	3
12	MC5210	Cyber Security	PC	3	3	0	0	3
13	MC5214	Internet Programming Laboratory	PC	4	0	0	4	2
14	MC5215	Artificial Intelligence and Machine Learning Laboratory	PC	4	0	0	4	2

15	MC5306	Data Science	PC	3	3	0	0	3
16	MC5307	Embedded Systems and Internet of Things	PC	3	3	0	0	3
17	MC5308	Accounting and Financial Management for Application Development	PC	3	3	0	0	3
18	MC5314	Data Science Laboratory	PC	4	0	0	4	2
19	MC5315	Internet of Things Laboratory	PC	4	0	0	4	2

#### EMPLOYABILITY ENHANCEMENT COURSE (EEC)

SL. NO	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	MC5116	Communication Skills Enhancement – I	EEC	2	0	0	2	1
2.	MC5216	Communication Skills Enhancement– II	EEC	2	0	0	2	1
3.	MC5414	Project Work	EEC	24	0	0	24	12

#### BRIDGE COURSES

SL. NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
<b>Semester I</b>							
1.	MA5102	Mathematical Foundations of Computer Science	3	3	0	0	3
2.	BX5001	Problem Solving And Programming In C	5	3	0	2	4
3.	BX5002	Digital logic and Computer Organization	3	3	0	0	3
4.	BX5003	Operating Systems	3	3	0	0	3
5.	BX5004	Data Structures and Algorithms	3	3	0	0	3
6.	BX5005	Programming and Data structures using C lab	4	0	0	4	2
<b>Semester II</b>							
7.	BX5006	Data Base Management Systems	3	3	0	0	3
8.	BX5007	Java Programming	3	3	0	0	3
9	BX5008	Software Engineering	3	3	0	0	3
10.	BX5009	Basics of Computer Networks	3	3	0	0	3
11	BX5010	Java Programming Lab	4	0	0	4	2
12	BX5011	Data Base Management Systems Lab	4	0	0	4	2

**OBJECTIVES:**

- To provide methods for understanding the consistency and solving the equation as well as for finding the Eigenvalues and Eigenvectors of square matrix.
- To provide foundation on Applied Probability
- To introduce the concepts of correlation and regression of random variables
- To use various statistical techniques in Application problems
- To introduce the concept of Design of Experiments for data analysis

**UNIT - I      MATRICES AND EIGENVALUE PROBLEMS      5**

Matrices - Rank of a Matrix - Consistency of a system of linear equations - Solution of the matrix equation  $\Delta x = b$  - Row - reduced Echelon Form - Eigenvalues and Eigenvectors - Properties - Cayley - Hamilton Theorem - Inverse of a matrix.

**UNIT - II      PROBABILITY AND RANDOM VARIABLES      15**

Probability - Axioms of Probability - Conditional Probability - Addition and multiplication laws of Probability - Baye's theorem - Random Variables - Discrete and continuous random variables - Probability mass function and Probability density functions - Cumulative distribution function - Moments and variance of random variables - Properties - Binomial, Poisson, Geometric, Uniform, Exponential, Normal distributions and their properties.

**UNIT - III      TWO-DIMENSIONAL RANDOM VARIABLES      15**

Joint probability distributions - Marginal and conditional probability distributions - Covariance - Correlation - Linear regression lines - Regression curves - Transform of random variables - Central limit theorem (for independent identically random variables).

**UNIT - IV      TESTING OF HYPOTHESIS      15**

Sampling distributions - Tests based on small and large samples - Normal, Student's t, Chi-square and F distributions for testing of mean, variance and proportion and testing of difference of means variances and proportions - Tests for independence of attributes and goodness of fit.

**UNIT - V      DESIGN OF EXPERIMENTS      15**

Analysis of variance - Completely randomized design - Random block design (One-way and Two-way classifications) - Latin square design -  $2^2$  Factorial design.

**TOTAL PERIODS:75****OUTCOMES:**

After the completion of the course the student will be able to

- Test the consistency and solve system of linear equations as well as find the Eigenvalues and Eigenvector.
- Apply the Probability axioms as well as rules and the distribution of discrete and continuous ideas in solving real world problems.
- Apply the concepts of correlation and regression of random variables in solving application problems.
- Use statistical techniques in testing hypothesis on data analysis.
- Use the appropriate statistical technique of design of experiments in data analysis.

**REFERENCE BOOKS:**

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43<sup>rd</sup> Edition, New Delhi, 2015.
2. R.K. Jain and S.R.K Iyenger, Advanced Engineering Mathematics, Narosa Publishing House, New Delhi, 2002.
3. Devore, J.L, Probability and Statistics for Engineering and Sciences, Cengage Learning, 8<sup>th</sup> Edition, New Delhi, 2014.
4. Miller and M. Miller, Mathematical Statistics, Pearson Education Inc., Asia 7<sup>th</sup> Edition, New Delhi, 2011.
5. Richard Johnson, Miller and Freund's Probability and Statistics for Engineer, Prentice Hall of India Private Ltd., 8<sup>th</sup> Edition, New Delhi, 2011.

Mapping of COs with POs and PSOs														
CO/POs & PSOs	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	√	√	-											
CO2	√	√	-	-									√	
CO3	√	√	√	√									√	
CO4	√	√	√	√	√	√							√	
CO5	√	√	√	√	√	√							√	

**MC5301**

**ADVANCED DATA STRUCTURES AND ALGORITHMS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- Understand and apply linear data structures-List, Stack and Queue
- Understand the graph algorithms.
- Learn different algorithm analysis techniques.
- Apply data structures and algorithms in real time applications
- Analyze the efficiency of an algorithm

**UNIT I            LINEAR DATA STRUCTURES**

**9**

Introduction - Abstract Data Types (ADT) – Stack – Queue – Circular Queue - Double Ended Queue - Applications of stack – Evaluating Arithmetic Expressions - Other Applications - Applications of Queue - Linked Lists - Singly Linked List - Circularly Linked List - Doubly Linked lists – Applications of linked list – Polynomial Manipulation.

**UNIT II            NON-LINEAR DATA STRUCTURES**

**9**

Binary Tree – expression trees – Binary tree traversals – applications of trees – Huffman Algorithm - Binary search tree - Balanced Trees - AVL Tree - B-Tree - Splay Trees – Heap-Heap operations- -Binomial Heaps - Fibonacci Heaps- Hash set.





**REFERENCES:**

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", 6<sup>th</sup> Edition, McGraw Hill, 2011.
2. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education/Addison Wesley, 2017.
3. C. J. Date, A. Kannan, S. Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
4. Jiawei Han, MichelineKamber ,Jian Pei, "Data Mining: Concepts and Techniques", Third Edition, Morgan Kaufmann, 2012.
5. Brad Dayley, "Teach Yourself NoSQL with MongoDB in 24 Hours", Sams Publishing, First Edition, 2014.
6. ShashankTiwari, "Professional NoSQL", O'Reilly Media, First Edition, 2011.
7. Vijay Kumar, "Mobile Database Systems", John Wiley & Sons, First Edition, 2006

Mapping of COs with POs and PSOs														
COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√	√	√	√				√	√			√	√
CO2	√	√	√	√	√				√	√			√	√
CO3	√	√	√	√	√				√	√			√	√
CO4	√	√	√	√	√				√	√			√	√
CO5	√	√	√	√	√				√	√			√	√

**MC5106****OBJECT ORIENTED SOFTWARE ENGINEERING****L T P C****3 0 0 3****OBJECTIVES:**

- To understand the phases in object oriented software development
- To gain fundamental concepts of requirements engineering and analysis.
- To know about the different approach for object oriented design and its methods
- To learn about how to perform object oriented testing and how to maintain software
- To provide various quality metrics and to ensure risk management.

**UNIT I SOFTWARE DEVELOPMENT LIFE CYCLE****9**

Introduction – Object Orientation - Object Oriented Methodologies – Terminologies - Software Development Life Cycle – Conventional Software Life Cycle Models – Build and Fix Model – Waterfall Model – Prototyping Model – Iterative Enhancement Model – Spiral Model – Extreme Programming - Object Oriented Software Life Cycle Models – Selection of Software Development Life Cycle Models

**UNIT II OBJECT ORIENTED REQUIREMENTS ELICITATION & ANALYSIS****9**

Software Requirement - Requirements Elicitation Techniques – Initial Requirements Document – Use Case Approach – Characteristics of a Good Requirement – SRS Document – Requirements Change Management – Object Oriented Analysis : Identification of Classes

and Relationships, Identifying State and Behavior – Case Study LMS - Managing Object Oriented Software Engineering: Projection Selection and Preparation – Product Development Organization – Project Organization and Management – Project Staffing

**UNIT III OBJECT ORIENTED SOFTWARE DESIGN 9**

Object Oriented Design – Interaction Diagrams – Sequence Diagram – Collaboration Diagrams – Refinement of Use Case Description – Refinement of Classes and Relationships – Construction of Detailed Class Diagram – Development of Detailed Design & Creation of Software Design Document - Object Oriented Methods : Object Oriented Analysis (OOA / Coad-Yourdon), Object Oriented Design (OOD/Booch) , Hierarchical Object Oriented Design (HOOD), Object Modeling Technique (OMT), Responsibility – Driven Design Case Studies : Warehouse Management System, Telecom

**UNIT IV OBJECT ORIENTED TESTING AND MAINTENANCE 9**

Software testing: Software Verification Techniques – Object Oriented Checklist :- Functional Testing – Structural Testing – Class Testing – Mutation Testing – Levels of Testing – Static and Dynamic Testing Tools - Software Maintenance – Categories – Challenges of Software Maintenance – Maintenance of Object Oriented Software – Regression Testing

**UNIT V SOFTWARE QUALITY & METRICS 9**

Need of Object Oriented Software Estimation – Lorenz and Kidd Estimation – Use Case Points Method – Class Point Method – Object Oriented Function Point – Risk Management – Software Quality Models – Analyzing the Metric Data – Metrics for Measuring Size and Structure – Measuring Software Quality - Object Oriented Metrics

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Able to identify the appropriate process model to develop the object oriented software
- Gain knowledge about requirement elicitation and analyzing techniques
- Able to choose and design suitable UML diagrams and methods
- Able to apply correct testing methods and maintain software systems.
- Able to estimate the object oriented application by applying metric data.

**REFERENCES:**

1. Yogesh Singh, Ruchika Malhotra, “ Object – Oriented Software Engineering”, PHI Learning Private Limited ,First edition,2012
2. Ivar Jacobson. Magnus Christerson, Patrik Jonsson, Gunnar Overgaard, “Object Oriented Software Engineering, A Use Case Driven Approach”, Pearson Education, Seventh Impression, 2009
3. Craig Larman, “Applying UML and Patterns, an Introduction to Object-Oriented Analysis and Design and Iterative Development”, Pearson Education, Third Edition, 2008.
4. Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Jim Conallen, Kelli A. Houston, “Object Oriented Analysis & Design with Applications, Third Edition, Pearson Education,2010
5. Roger S. Pressman, “Software Engineering: A Practitioner’s Approach, Tata McGraw-Hill Education, 8<sup>th</sup> Edition, 2015.
6. Timothy C. Lethbridge and Robert Laganier, “Object – Oriented Software Engineering, Practical Software Development using UML and Java”, Tata McGraw Hill Publishing Company Limited, Second Edition, 2004

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO1	PSO 2
CO 1	√	√	√							√	√		√	
CO 2		√	√	√	√					√	√		√	
CO 3			√		√	√			√	√				√
CO 4				√	√	√			√					√
CO 5	√		√		√			√	√			√		√

**MC5107**

**PYTHON PROGRAMMING**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To develop Python programs with conditionals and loops.
- To define Python functions and use function calls.
- To use Python data structures – lists, tuples, dictionaries.
- To do input/output with files in Python.

**UNIT I PYTHON BASICS**

**10**

Introduction to Python Programming – Python Interpreter and Interactive Mode– Variables and Identifiers – Arithmetic Operators – Values and Types – Statements. Operators – Boolean Values – Operator Precedence – Expression – Conditionals: If-Else Constructs – Loop Structures/Iterative Statements – While Loop – For Loop – Break Statement-Continue statement – Function Call and Returning Values – Parameter Passing – Local and GlobalScope – Recursive Functions.

**UNIT II DATA TYPES IN PYTHON**

**10**

Lists, Tuples, Sets, Strings, Dictionary, Modules: Module Loading and Execution – Packages – Making Your OwnModule – The Python Standard Libraries

**UNIT III FILE HANDLING AND EXCEPTION HANDLING**

**8**

Files: Introduction – File Path – Opening and Closing Files – Reading and Writing Files –File Position – Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions

**UNIT IV MODULES, PACKAGES**

**9**

Modules: Introduction – Module Loading and Execution – Packages – Making Your OwnModule – The Python Libraries for data processing, data mining and visualization- NUMPY, Pandas, Matplotlib, Plotly

**UNIT V OBJECT ORIENTED PROGRAMMING IN PYTHON**

**8**

Creating a Class, Class methods, Class Inheritance, Encapsulation, Polymorphism, class method vs. static methods, Python object persistence

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon completion of the course, students will be able to

- Develop algorithmic solutions to simple computational problems
- Structure simple Python programs for solving problems.

- Read and write data from/to files in Python Programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Decompose a Python program into functions.

**REFERENCES:**

1. ReemaThareja, “Python Programming using Problem Solving Approach”, Oxford University Press, First edition, 2017
2. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, Second Edition, Shroff,O’Reilly Publishers, 2016 (<http://greenteapress.com/wp/thinkpython/>)
3. Guido van Rossum, Fred L. Drake Jr., “An Introduction to Python – Revised and Updated for Python 3.2, Network Theory Ltd., First edition, 2011
4. John V Guttag, “Introduction to Computation and Programming Using Python”, Revised and Expanded Edition, MIT Press, 2013
5. Charles Dierbach, “Introduction to Computer Science using Python”, Wiley India Edition, First Edition, 2016
6. Timothy A. Budd, “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd., First edition, 2011
7. Kenneth A. Lambert, “Fundamentals of Python: First Programs”, Cengage Learning, second edition, 2012

Mapping of COs with POs and PSOs														
COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√	√	√	√				√	√			√	√
CO2	√	√	√	√	√				√	√			√	√
CO3	√	√	√	√	√				√	√			√	√
CO4	√	√	√	√	√				√	√			√	√
CO5	√	√	√	√	√				√	√			√	√

**MC5108 RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHTS**

**L T P C  
2 0 0 2**

**COURSE OBJECTIVES:**

The course should enable the students to:

- Identify an appropriate research problem in their interesting domain.
- Understand ethical issues; understand the Preparation of a research project thesis report.
- Understand the Preparation of a research project thesis report
- Understand the law of patent and copyrights.
- Acquire adequate knowledge of IPR.

**UNIT I RESEARCH METHODOLOGY 6**

**Research Methodology** – An Introduction, Objectives, Types of research, Research approaches, Significance, Research methods versus Methodology, Research and Scientific method, Importance, Research process, Criteria, Problems encountered by researchers.

**Defining the research problem** – Research problem, Selecting the problem, Necessity, Technique involved, An illustration.

**Reviewing the Literature** – The place of the literature review in research, How to review the Literature, Writing about the literature reviewed.

**UNIT II RESEARCH DESIGN 6**

**Research Design** – Meaning, Need, Features, Different research design, Basic principles of experimental designs, Important experimental designs.

**Measurement & Scaling techniques** – Sampling Design, Measurement in research, Measurement scales, Error, Measurement tools, Scaling, Meaning, Scale classification, Scale construction techniques

**Data Collection** – Collection of primary data, Collection of secondary data, Selection of appropriate method for data collection.

**UNIT III RESEARCH TECHNIQUE AND TOOLS 6**

**Testing of Hypothesis** – Basic concepts, Procedure, Test of Hypothesis, Important parametric Tests, Hypothesis Testing unifications.

**Interpretation & Report writing** – Meaning, techniques, Precaution in Interpretation, Significance of Report writing, steps, Layout, types, mechanics, precautions.

**Use of Tools/ Techniques for research** – Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline, Use of tools / techniques for Research methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism

**UNIT IV INTELLECTUAL PROPERTY RIGHTS 6**

**Intellectual Property** – The concept, IPS in India, development, Trade secrets, utility Models, IPR & Bio diversity, CBD, WIPO, WTO, Right of Property, Common rules, PCT, Features of Agreement, Trademark, UNESCO.

**UNIT V PATENTS 6**

**Patents** – Learning objectives, Concept, features, Novelty, Inventive step, Specification, Types of patent application, E-filing, Examination, Grant of patent, Revocation, Equitable Assignments, Licences, Licencing of related patents, patent agents, Registration of patent agents.

**TOTAL: 30 PERIODS**

**REFERENCE BOOKS:**

1. Research Methodology: Methods and Techniques by C.R.Kothari, GauravGarg, New Age International 4<sup>th</sup> Edition 2018 (UNIT I to UNIT III)
2. Research Methodology a step-by-step guide for beginners by Ranjit Kumar, SAGE publications Ltd 3<sup>rd</sup> Edition 2011 (For the topic Reviewing the Literature under Unit I)
3. Stuart Melville and Wayne Goddard, "Research Methodology: An Introduction for Science & engineering students. Juta and Co., Limited, 1996, First edition
4. Research methods: The concise knowledge base-Trochim, Atomic Dog publishing, First edition,2005..
5. John W. Best & James V. Khan, "Research in Education", Pearson 8<sup>th</sup> Edition 'year.
6. Professional Programme Intellectual Property Rights, Law and practice, The Institute of Company Secretaries of India, Statutory body under an Act of parliament, September 2013 (UNIT IV & UNIT V)

**OUTCOMES: (Cos)****On completion of the course the student would be able to :**

CO1: Understand the research problem and Literature review.

CO2: Understand the various research designs and their characteristics.

CO3: Prepare a well-structured research paper and scientific presentations.

CO4: Explore on various IPR Components and process of filing.

CO5 Develop awareness the patent law and procedural mechanism in obtaining a patent.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√	√		√	√	√	√			√		√	√	
CO 2		√	√		√	√	√					√		√
CO 3		√	√			√		√					√	
CO 4		√	√			√	√		√				√	
CO 5	√			√	√	√	√	√						√

**MC5114      ADVANCED DATABASE TECHNOLOGY LABORATORY****L T P C****0 0 4 2****OBJECTIVES:**

The student should be able:

- To understand the concepts of Open Source DBMS.
- To understand the process of distributing tables across multiple systems
- To understand the process of storing, retrieving spatial and temporal data
- To understand the process of storing, retrieving objects in a database
- To understand the process of storing and retrieving data from a XML Database
- To use the open source database for building a mobile application

**EXPERIMENTS IN THE FOLLOWING TOPICS:**

1. NOSQL Exercises
  - a. MongoDB – CRUD operations, Indexing, Sharding, Deployment
  - b. Cassandra: Table Operations, CRUD Operations, CQL Types
  - c. HIVE: Data types, Database Operations, Partitioning – HiveQL
  - d. OrientDB Graph database – OrientDB Features
2. MySQL Database Creation, Table Creation, Query
3. MySQL Replication – Distributed Databases
4. Spatial data storage and retrieval in MySQL
5. Temporal data storage and retrieval in MySQL
6. Object storage and retrieval in MySQL
7. XML Databases , XML table creation, XQuery FLWOR expression
8. Mobile Database Query Processing using open source DB (MongoDB/MySQL etc)

**TOTAL: 60 PERIODS****OUTCOMES:**

Upon completion of this course, the student should be able to:

- Design and Implement databases.

- Formulate complex queries using SQL
- Design and Implement applications that have GUI and access databases for backend connectivity
- To design and implement Mobile Databases
- To design and implement databases to store spatial and temporal data objects

Mapping of COs with POs and PSOs														
COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√	√	√	√				√	√			√	√
CO2	√	√	√	√	√				√	√			√	√
CO3	√	√	√	√	√				√	√			√	√
CO4	√	√	√	√	√				√	√			√	√
CO5	√	√	√	√	√				√	√			√	√

**MC5115      ADVANCED DATA STRUCTURES AND PYTHON PROGRAMMING  
LABORATORY**

**L T P C  
0 0 4 2**

**OBJECTIVES:**

- To learn the basic programming constructs in Python.
- To implement Recursive programming in Python
- To implement Divide and Conquer algorithmic technique in Python
- To implement Tree Data structures in Python
- To implement Graphs in Python
- To deploy the standard libraries in Python

**EXPERIMENTS:**

1. Towers of Hanoi using Recursion
2. To implement Binary Search
3. Merge Sort
4. To implement AVL Trees using Python
5. To implement Splay Trees using Python
6. To implement Red black Trees using Python
7. To implement Graphs using Python
8. Implementing programs using written modules and Python Standard Libraries.
9. Implementing real-time/technical applications using Files and Exception handling.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

On completion of the course, students will be able to:

1. Develop algorithmic solutions to simple computational problems
2. Develop and execute Python programs.
3. Decompose a Python program into functions.

4. Represent compound data using Python data structures.
5. Apply Python features in developing software applications.

Mapping of COs with POs and PSOs														
COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√	√	√	√				√	√			√	√
CO2	√	√	√	√	√				√	√			√	√
CO3	√	√	√	√	√				√	√			√	√
CO4	√	√	√	√	√				√	√			√	√
CO5	√	√	√	√	√				√	√			√	√

**MC5116**

**COMMUNICATION SKILLS - I**

**L T P C**  
**0 0 2 1**

**OBJECTIVES:**

- To provide opportunities to learners to practice English and thereby make them proficient users of the language.
- To enable learners to fine-tune their linguistic skills (LSRW) with the help of Technology.
- To enhance the performance of students listening, speaking, reading and writing and thereby develop their career opportunities.

**LIST OF ACTIVITIES:**

1. Listening:
  - Listening and practicing neutral accents
  - Listening to short talks and lectures and completing listening comprehension exercises
  - Listening to TED Talks
2. Speaking:
  - Giving one minute talks
  - Participating in small Group Discussions
  - Making Presentations
3. Reading:
  - Reading Comprehension
  - Reading subject specific material
  - Technical Vocabulary
4. Writing:
  - Formal vs Informal Writing
  - Paragraph Writing
  - Essay Writing
  - Email Writing

**TOTAL: 30 PERIODS**

**REFERENCES / MANUALS / SOFTWARE:** Open Sources / websites

**OUTCOMES:**

On completion of the course the students will be able to:

- Listen and comprehend Lectures in English
- Articulate well and give presentations clearly
- Participate in Group Discussions successfully
- Communicate effectively in formal and informal writing
- Write proficient essays and emails

Mapping of COs with POs and PSOs														
COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									√	√				
CO2									√	√				
CO3									√	√				
CO4										√				
CO5										√				

**MC5206**

**INTERNET PROGRAMMING**

**L T P C**  
**3 0 0 3**

**COURSE OBJECTIVES:**

- To understand the fundamentals of web programming and client side scripting.
- To learn the server side development using servlets, websocket.
- To learn the Spring framework and build applications using Spring.
- To learn and implement the concept of Java Persistence API.
- To learn the advanced client side scripting and framework.

**UNIT I INTRODUCTION TO WEB & CLIENT SIDE PROGRAMMING 9**

Introduction to Web: Server - Client - Communication Protocol (HTTP), JavaScript: Data Types and Variables - Expressions - Operators and Statements - Objects and Arrays - Functions - Classes - Modules - DOM - Events - Storage: LocalStorage, Cookies, IndexedDB, JSON, AJAX

**UNIT II SERVER SIDE PROGRAMMING 9**

Web Server: Web Containers - Web Components, Servlet: Lifecycle - Request - Servlet Context - Response - Filter - Session - Dispatching Requests, WebSocket, Logging - Log4j2, Build tool - Gradle. Introduction to Spring: IoC Container and Dependency Injection (DI)

**UNIT III SPRING 9**

Spring Configuration and Spring Boot, Spring MVC: DispatcherServlet and Configuration - Interceptors - Controllers - Views - Input Validation - File Upload, Building RESTful Web Services, Spring Security Architecture, Spring Cache.

**UNIT IV JAVA PERSISTENCE API AND HIBERNATE 9**

Entity: Basic, Embeddable and Collection Types - Identifiers - Entity Relationship - Inheritance, Persistence Context and Entity Manager, JPQL, Criteria API, Spring Data JPA - Specification and Projection.

**UNIT V          ADVANCED CLIENT SIDE PROGRAMMING****9**

Asynchronous JavaScript: Callbacks - Promises - async and await, React JS: ReactDOM - JSX - Components - Properties - State and Lifecycle - Events - Lifting State Up - Composition and Inheritance - Higher Order Components.

**TOTAL: 45 PERIODS****Course Outcomes:**

Upon completion of the course the students should be able to:

- To write client side scripting.
- To implement the server side of the web application.
- To implement Web Application using Spring.
- To implement a Java application using Java Persistence API.
- To implement a full-stack Single Page Application using React, Spring and JPA.

**REFERENCE BOOKS**

1. David Flanagan, "Java Script: The Definitive Guide", O'Reilly Media, Inc, 7th Edition, 2020
2. Matt Frisbie, "Professional JavaScript for Web Developers", Wiley Publishing, Inc, 4th Edition, ISBN: 978-1-119-36656-0, 2019
3. Alex Banks, Eve Porcello, "Learning React", O'Reilly Media, Inc, 2nd Edition, 2020  
<https://reactjs.org/docs>
4. David R. Heffelfinger, "Java EE 8 Application Development", Packt Publishing, First edition 2017
5. Benjamin Muschko, "Gradle in Action", Manning Publications, First edition 2014
6. Iuliana Cosmina, Rob Harrop, Chris Schaefer, Clarence Ho, "Pro Spring 5: An In-Depth Guide to the Spring Framework and Its Tools", Apress, Fifth edition 2017
7. Christian Bauer, Gavin King, and Gary Gregory, "Java Persistence with Hibernate", Manning Publications, 2nd Edition, 2015

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√	√	√		√								√	
CO 2	√	√	√										√	
CO 3	√	√	√	√	√	√	√	c	√	√	√		√	√
CO 4	√	√	√	√			√	√	√	√	√	√	√	√
CO 5	√	√	√	√	√		√					√	√	√

**MC5207****CLOUD COMPUTING TECHNOLOGIES****L T P C****3 0 0 3****OBJECTIVES:**

- To understand the basic concepts of Distributed systems
- To learn about the current trend and basics of Cloud computing
- To be familiar with various Cloud concepts
- To expose with the Server, Network and storage virtualization
- To be aware of Microservices and DevOps







Mapping of COs with POs and PSOs														
COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	3										
CO2	1	3	3	2	1								1	
CO3	1	2	3	2									1	
CO4	1	3	1	1									1	
CO5	1	3	1										1	

1 – Slight, 2 – Moderate, 3 – Substantial.

**MC5209**

**MOBILE APPLICATION DEVELOPMENT**

**L T P C  
2 0 2 3**

**OBJECTIVES:**

- To understand the need and characteristics of mobile applications.
- To design the right user interface for mobile application.
- To understand the design issues in the development of mobile applications.
- To understand the development procedure for mobile application.
- To develop mobile applications using various tools and platforms.

**UNIT I**

**INTRODUCTION**

**12**

Mobile Application Model – Infrastructure and Managing Resources – Mobile Device Profiles – Frameworks and Tools.

**UNIT II**

**USER INTERFACE**

**12**

Generic UI Development - Multimodal and Multichannel UI –Gesture Based UI – Screen Elements and Layouts – Voice XML.

**Lab Component:**

- i. Implement mobile application using UI toolkits and frameworks.
- ii. Design an application that uses Layout Managers and event listeners.

**UNIT III**

**APPLICATION DESIGN**

**12**

Memory Management – Design Patterns for Limited Memory – Work Flow for Application development – Java API – Dynamic Linking – Plugins and rule of thumb for using DLLs –Concurrency and Resource Management.

**Lab Component:**

- i. Design a mobile application that is aware of the resource constraints of mobile devices.
- ii. Implement an android application that writes data into the SD card.

**UNIT IV MOBILE OS****12**

Mobile OS: Android, iOS – Android Application Architecture – Android basic components – Intents and Services – Storing and Retrieving data – Packaging and Deployment – Security and Hacking.

**Lab Component:**

- i. Develop an application that makes use of mobile database
- ii. Implement an android application that writes data into the SD card.

**UNIT V APPLICATION DEVELOPMENT****12**

Communication via the Web – Notification and Alarms – Graphics and Multimedia: Layer Animation, Event handling and Graphics services – Telephony – Location based services

**Lab Component:**

- i. Develop web based mobile application that accesses internet and location data.
- ii. Develop an android application using telephony to send SMS.

**TOTAL: 60 PERIODS****OUTCOMES**

On completion of the course, the student will be able to

- Understand the basics of mobile application development frameworks and tools
- To be able to develop a UI for mobile application
- To design mobile applications that manages memory dynamically
- To build applications based on mobile OS like Android, iOS
- To build location based services

**REFERENCES:**

1. Reto Meier, "Professional Android 4 Application Development", Wiley, First Edition, 2012
2. ZigurdMednieks, Laird Dornin, G. Blake Meike, Masumi Nakamura, "ProgrammingAndroid", O'Reilly, 2<sup>nd</sup> Edition, 2012.
3. Alasdair Allan, "iPhone Programming", O'Reilly, First Edition, 2010.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO 1		√			√	√			√		√		√	
CO 2	√	√	√		√				√	√	√		√	
CO 3	√	√		√							√	√	√	
CO 4	√	√	√	√							√	√		√
CO 5		√	√	√		√						√	√	

**OBJECTIVES**

- To learn the principles of cyber security and to identify threats and risks.
- To learn how to secure physical assets and develop system security controls.
- To understand how to apply security for Business applications and Network Communications.
- To learn the technical means to achieve security.
- To learn to monitor and audit security measures.

**UNIT I PLANNING FOR CYBER SECURITY 9**

Best Practices-Standards and a plan of Action-Security Governance Principles, components and Approach-Information Risk Management-Asset Identification-Threat Identification-Vulnerability Identification-Risk Assessment Approaches-Likelihood and Impact Assessment-Risk Determination, Evaluation and Treatment-Security Management Function-Security Policy-Acceptable Use Policy-Security Management Best Practices.

**UNIT II SECURITY CONTROLS 9**

People Management-Human Resource Security-Security Awareness and Education-Information Management- Information Classification and handling-Privacy-Documents and Record Management-Physical Asset Management-Office Equipment-Industrial Control Systems-Mobile Device Security- System Development-Incorporating Security into SDLC-Case study on information security policies.

**UNIT III CYBER SECURITY FOR BUSINESS APPLICATIONS AND NETWORKS 9**

Business Application Management-Corporate Business Application Security-End user Developed Applications-System Access- Authentication Mechanisms-Access Control-System Management-Virtual Servers-Network Storage Systems-Network Management Concepts-Firewall-IP Security-Electronic Communications – Case study on OWASP vulnerabilities using OWASP ZAP tool.

**UNIT IV TECHNICAL SECURITY 9**

Supply Chain Management-Cloud Security-Security Architecture-Malware Protection-Intrusion Detection-Digital Rights Management-Cryptographic Techniques-Threat and Incident Management-Vulnerability Management-Security Event Management-Forensic Investigations-Local Environment Management-Business Continuity. – Case study on cloud and cryptographic vulnerabilities.

**UNIT V SECURITY ASSESSMENT 9**

Security Monitoring and Improvement-Security Audit-Security Performance-Information Risk Reporting-Information Security Compliance Monitoring-Security Monitoring and Improvement Best Practices. – Case study on vulnerability assessment using ACUNETIX.

**TOTAL: 45 PERIODS****OUTCOMES****On completion of the course, the student will be able to**

- Develop a set of risk and security requirements to ensure that there are no gaps in an organization's security practices.
- Achieve management, operational and technical means for effective cyber security.
- Audit and monitor the performance of cyber security controls.
- To spot gaps in the system and devise improvements.

- Identify and report vulnerabilities in the system

**REFERENCES:**

1. William Stallings, “Effective Cyber Security- A guide to using Best Practices and Standards”, Addison-Wesley Professional, First Edition,2018.
2. Adam Shostack, “Threat Modelling- Designing for Security”, Wiley Publications,First Edition,2014.
3. Gregory J. Touhill and C. Joseph Touhill, “Cyber Security for Executives- A Practical guide”, Wiley Publications, First Edition,2014.
4. [RaefMeeuwisse](#), “Cyber Security for Beginners”, Second Edition, Cyber Simplicity Ltd, 2017.
5. Patrick Engebretson, “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy”, 2nd Edition, Syngress, 2013.
6. OWASP ZAP : <https://owasp.org/www-project-zap/>
7. ACUNETIX: <https://www.acunetix.com/>

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1		√			√	√			√		√		√	
CO 2	√	√	√		√				√	√	√		√	
CO 3	√	√		√							√	√	√	
CO 4	√	√	√	√							√	√		√
CO 5		√	√	√		√						√	√	

**MC5214**

**INTERNET PROGRAMMING LABORATORY**

**L T P C  
0 0 4 2**

**Course Objectives:**

1. To implement the client side of the web application using javascript.
  2. To implement the server side of the web application using Servlets and WebSockets.
  3. To develop a web application using Spring.
  4. To implement a Persistence layer using Hibernate and Spring Data JPA.
  5. To develop a full stack single page application using React, Spring and Hibernate.
1. Create an event registration application using javascript. It should implement different widgets for registration form and registered records view using tabs. It should perform the form validation.
  2. Create a javascript application in an Object Oriented way using Classes and Modules. It should also use browser storage for persistence.
  3. Build a web application using Gradle. The server side of the application should implement RESTful APIs using Servlet and do necessary logging. The client side of the application should be a single page application which consumes the RESTful APIs through AJAX.
  4. Build a chat application using WebSocket.

5. Create a Spring MVC application. The application should handle form validation, file upload, session tracking.

6. Implement a RESTful Spring Boot application using Spring REST, Spring Security and Spring Cache.

7. Design a complex system using JPA and Hibernate. The system should have multiple entities and relationships between the entities. The database schema should be generated through Hibernate. Provide RESTful endpoints for CRUD operations for the defined entities. Also, support pagination and searching using JPA's JPQL and Criteria API.

8. Create a Spring RESTful Application with Spring Data JPA. Support pagination and searching using Specifications.

9. Create a React application with different components and interactions between the components.

10. Develop a full-stack application using React and Spring. Make use of Spring REST, Spring Security, Spring Data JPA, Hibernate, Spring Boot, Gradle and React's higher order component.

**TOTAL : 60 PERIODS**

**Course Outcomes:**

1. To implement client and server side of the web application.
2. To implement a real time application using WebSocket.
3. To use Spring framework in web development.
4. To implement applications using Java Persistence API.
5. To implement applications using the JavaScript framework React.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO 1	√	√	√	√	√	√	√	√	√				√	√
CO 2	√	√	√	√	√	√	√	√	√	√	√		√	√
CO 3	√	√	√	√	√				√			√	√	√
CO 4	√	√	√	√	√				√			√	√	√
CO 5	√	√	√	√	√		√		√	√	√	√	√	√

**OBJECTIVES:**

- To familiarize with the machine learning algorithms and implement in practical situations.
- To involve the students to practice AI algorithms and techniques.
- Learn to use different algorithms for real time data sets.

**List of Experiments :**

1. Write a program to illustrate problem solving as a search.
2. Write a program to illustrate local search algorithms.
3. Write a program to demonstrate logical agents.
4. Evaluate forward chainer and rule base on at least four different databases. Try to create at least one database that demonstrates an interesting feature of the domain, or an interesting feature of forward chaining in general.
5. Demonstrate agent based on propositional logic.
6. Write a program to implement the naïve Bayesian classifier for a sample training data set. Compute the accuracy of the classifier, considering few test data sets.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file.
9. Write a program to implement k-Nearest Neighbor algorithm to classify the data set.
10. Apply the technique of pruning for a noisy data monk2 data, and derive the decision tree from this data. Analyze the results by comparing the structure of pruned and unpruned tree.
11. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets
12. Implement Support Vector Classification for linear kernel.
13. Implement Logistic Regression to classify the problems such as spam detection. Diabetes predictions so on.

**Total: 60 Periods**

**OUTCOMES:**

- Apply the techniques of Problem Solving in Artificial Intelligence.
- Implement Knowledge and Reasoning for real world problems.
- Model the various Learning features of Artificial Intelligence
- Analyze the working model and features of Decision tree
- Apply k-nearest algorithm for appropriate research problem.

<b>Mapping of COs with POs and PSOs</b>														
<b>COs/POs &amp; PSOs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
CO1	√	√	√	√	√	√								
CO2	√	√	√	√	√								√	

CO3	√	√	√	√									√	
CO4	√	√	√	√									√	√
CO5	√	√	√	√									√	√

**MC5216**

**COMMUNICATION SKILLS ENHANCEMENT II**

**L T P C**  
**0 0 2 1**

**OBJECTIVES:**

- To provide opportunities to learners to practice their communication skills to make them become proficient users of English.
- To enable learners to fine-tune their linguistic skills (LSRW) with the help of Technology to communicate globally.
- To enhance the performance of learners at placement interviews and group discussions and other recruitment procedures

**1. SOFT SKILLS**

- People skills
- Interpersonal skills
- Team building skills
- Leadership skills
- Problem solving skills

**2. PRESENTATION SKILLS**

- Preparing slides with animation related to the topic
- Introducing oneself to the audience
- Introducing the topic
- Presenting the visuals effectively – 5 minute presentation

**3. GROUP DISCUSSION SKILLS**

- Participating in group discussions
- Brainstorming the topic
- Activities to improve GD skills.

**4. INTERVIEW SKILLS**

- Interview etiquette – dress code – body language
- Attending job interviews
- Answering questions confidently
- Technical interview – telephone/Skype interview
- Emotional and cultural intelligence
- Stress Interview

**TOTAL: 30 PERIODS**

**REFERENCES / MANUALS / SOFTWARE:** Open Sources / websites

**OUTCOMES:**

**Upon Completion of the course, the students will be able to:**

- Students will be able to make presentations and participate in Group discussions with confidence.
- Students will be able to perform well in the interviews.

- Students will make effective presentations.

Mapping of COs with POs and PSOs														
COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									√	√				
CO2									√	√				
CO3									√	√				
CO4										√				
CO5										√				

**MC5306**

**DATA SCIENCE**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To know the fundamental concepts of data science and analytics.
- To learn fundamental data analysis using R.
- To understand various data modeling techniques.
- To learn the basic and advanced features of open source big data tools and frameworks.
- To study various analytics on stream data.

**UNIT I INTRODUCTION TO DATA SCIENCE AND BIG DATA 9**

Introduction to Data Science – Data Science Process – Exploratory Data analysis – Big data: Definition, Risks of Big Data, Structure of Big Data – Web Data: The Original Big Data – Evolution Of Analytic Scalability – Analytic Processes and Tools – Analysis versus Reporting – Core Analytics versus Advanced Analytics– Modern Data Analytic Tools – Statistical Concepts: Sampling Distributions – Re-Sampling – Statistical Inference – Introduction to Data Visualization.

**UNIT II DATA ANALYSIS USING R 9**

Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis – Bivariate Analysis: Correlation – Regression Modeling: Linear and Logistic Regression – Multivariate Analysis – Graphical representation of Univariate, Bivariate and Multivariate Analysis in R: Bar Plot, Histogram, Box Plot, Line Plot, Scatter Plot, Lattice Plot, Regression Line, Two-Way cross Tabulation.

**UNIT III DATA MODELING 9**

Bayesian Modeling – Support Vector and Kernel Methods – Neuro – Fuzzy Modeling – Principal Component Analysis – Introduction to NoSQL: CAP Theorem, MongoDB: RDBMS VsMongoDB, Mongo DB Database Model, Data Types and Sharding – Data Modeling in HBase: Defining Schema – CRUD Operations

**UNIT IV DATA ANALYTICAL FRAMEWORKS 10**

Introduction to Hadoop: Hadoop Overview – RDBMS versus Hadoop – HDFS (Hadoop Distributed File System): Components and Block Replication – Introduction to MapReduce –

Running Algorithms Using MapReduce – Introduction to HBase: HBase Architecture, HLog and HFile, Data Replication – Introduction to Hive, Spark and Apache Sqoop.

**UNIT V STREAM ANALYTICS**

**8**

Introduction To Streams Concepts – Stream Data Model and Architecture – Stream Computing – Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

On completion of the course, the students will be able to:

1. Convert real world problems to hypothesis and perform statistical testing.
2. Perform data analysis using R.
3. Design efficient modeling of very large data and work with big data platforms..
4. Implement suitable data analysis for stream data.
5. Write efficient MapReduce programs for small problem solving methods.

**REFERENCES:**

1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, First Edition,2013.
2. Umesh R Hodeghatta, UmeshaNayak, "Business Analytics Using R – A Practical Approach", Apress, First Edition,2017.
3. J. Leskowec, AnandRajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, Second Edition,2014.
4. NishantGarg, "HBase Essentials", Packt, First Edition, 2014.
5. Rachel Schutt, Cathy O'Neil, "Doing Data Science", O'Reilly, First Edition,2013
6. Foster Provost, Tom Fawcet, "Data Science for Business", O'Reilly, First Edition,2013.
7. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley, First Edition,2014.
8. <https://www3.cs.stonybrook.edu/~skiena/519/>

Mapping of COs with POs and PSOs														
COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√	√	√	√				√	√			√	√
CO2	√	√	√	√	√				√	√			√	√
CO3	√	√	√	√	√				√	√			√	√
CO4	√	√	√	√	√				√	√			√	√
CO5	√	√	√	√	√				√	√			√	√

**MC5307**

**EMBEDDED SYSTEMS AND INTERNET OF THINGS**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To learn the internal architecture and programming of an embedded processor.



4. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, "IoT Fundamentals, Networking Technologies, Protocols, and Use cases for the Internet of Thing", Cisco Press, First Edition,2017.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1		√	√	√	√				√			√	√	
CO 2		√	√		√						√	√	√	
CO 3	√	√	√										√	√
CO 4	√	√	√			√							√	
CO 5	√	√	√	√					√		√		√	

**MC5308 ACCOUNTING AND FINANCIAL MANAGEMENT FOR APPLICATION DEVELOPMENT**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To understand the basic principles of Double entry system and preparation of balance sheet.
- To understand partnership accounts
- To understand the process of estimating the depreciation of a particular asset.
- To understand single entry accounting

**UNIT I INTRODUCTION TO ACCOUNTING 9**

Meaning and scope of Accounting, Basic Accounting Concepts and Conventions – Objectives of Accounting – Accounting Transactions – Double Entry Book Keeping – Journal, Ledger, Preparation of Trial Balance – Preparation of Cash Book.

**UNIT II FINAL ACCOUNTS 9**

Preparation of Final Accounts of a Sole Trading Concern – Adjustments Receipts and Payments Account, Income & Expenditure Account and Balance Sheet of Non Trading Organizations

**UNIT III PARTNERSHIP ACCOUNTS 9**

Partnership Accounts-Final accounts of partnership firms – Basic concepts of admission, retirement and death of a partner including treatment of goodwill - rearrangement of capitals. (Simple problems on Partnership Accounts).

**UNIT IV DEPRECIATION 9**

Depreciation – Meaning, Causes, Types – Straight Line Method – Written Down Value Method, Insurance Policy Method, Sinking Fund Method & Annuity Method. Insurance claims – Average Clause (Loss of stock & Loss of Profit)

**UNIT V SINGLE ENTRY ACCOUNTING****9**

Single Entry – Meaning, Features, Defects, Differences between Single Entry and Double Entry System – Statement of Affairs Method – Conversion Method

**TOTAL: 45 PERIODS****OUTCOMES:**

- Able to understand the basics of accounting
- Able to understand balance sheet preparation and do analysis
- Able to understand the partnership accounts
- Able to appreciate and depreciate the assets of an organization in accounting
- Able to understand Single Entry Accounting

**REFERENCES:**

1. R.L.Gupta & V.K.Gupta, Advanced Accounting - Sultan Chand & Sons - New Delhi. Fourteenth Revised and Enlarged Edition, 2019
2. Jain & Narang, Financial Accounting - Kalyani Publishers - New Delhi, Twelfth edition - 2014
3. T.S. Reddy & A. Murthy, Financial Accounting - Margham Publications – Chennai-17. 6<sup>th</sup> Edition, 2012
4. Shukla & Grewal, Advanced Accounting – S Chand - New Delhi, 19<sup>th</sup> Edition, 2017
5. Nirmal Gupta, Financial Accounting - Ane Books India – New Delhi. Fifth Edition, 2012

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1				√						√	√	√		
CO 2				√						√	√	√		
CO 3				√						√	√	√		
CO 4				√						√	√	√		
CO 5				√						√	√	√		

**MC5314****DATA SCIENCE LABORATORY****L T P C****0 0 4 2****OBJECTIVES:**

- To provide hands-on cloud and data analytics frameworks and tools.
- To use the Python/R packages for performing analytics.
- To learn using analytical tools for real world problems.
- To familiarize the usage of distributed frameworks for handling voluminous data.
- To write and deploy analytical algorithms as MapReduce tasks.

**EXPERIMENTS:**

Do the following experiments using R/Python:

1. Download, install and explore the features of R/Python for data analytics.
2. Use the Diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
  - a. Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.

- b. Bivariate Analysis: Linear and logistic regression modeling.
  - c. Multiple Regression Analysis
  - d. Also compare the results of the above analysis for the two data sets.
3. Apply Bayesian and SVM techniques on Iris and Diabetes data set.
  4. Apply and explore various plotting functions on UCI data sets.

Implement the following using Hadoop, Map Reduce, HDFS, Hive:

1. Perform setting up and Installing Hadoop in its two operating modes: pseudo-distributed and fully distributed.
2. Implement the following file management tasks in Hadoop: adding files and directories, Retrieving files and Deleting files
3.
  - (i) Performing a MapReduce Job for word search count (look for specific keywords in a file)
  - (ii) Implement stop word elimination problem: Input a large textual file containing one sentence per line and a small file containing a set of stop words (one stop word per line) and save the results in an output textual file containing the same sentences of the large input file without the words appearing in the small file.
4. Implement a MapReduce program that processes a weather data set to:
  - (i) Find average, max and min temperature for each year in National Climate Data Centre data set.
  - (ii) Filter the readings of a set based on value of the measurement. The program must save the line of input files associated with a temperature value greater than 30.0 and store it in a separate file.
5. Install, deploy & configure Apache Spark cluster. Run Apache Spark applications using Scala.
6. Install and run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.
7. Mini projects on the following:
  - (i) Simulate a simple recommender system with Amazon product dataset, Social tweet data set etc. on Hadoop.
  - (ii) Perform a very large text classification run on Hadoop.

**TOTAL: 60 PERIODS**

#### **OUTCOMES:**

On completion of the course, the students will be able to:

1. Install analytical tools and configure distributed file system.
2. Have skills in developing and executing analytical procedures in various distributed frameworks and databases.
3. Develop, implement and deploy simple applications on very large datasets.
4. Implement simple to complex data modeling in NoSQL databases.
5. Develop and deploy simple applications in cloud.

**MC5315**

**INTERNET OF THINGS LABORATORY**

**L T P C  
0 0 4 2**

#### **OBJECTIVES:**

- To learn tools relevant to embedded system and IoT development.

- To write simple assembly programs that uses various features of the processor.
- To design and develop IoT application Arduino/Raspberry pi for real world scenario.

**EXPERIMENTS:**

**PART I:**

1. Implement assembly and Interfacing Programs Using Embedded C.
2. Embedded Application Development
  - (i) Using Arduino and Raspberry Pi
  - (ii) Using Bluemix platform
3. IoT Application Development
  - (i) Using sensors and actuators (temperature sensor, light sensor, infraredsensor)
  - (ii) Interfacing sensors with Arduino/Raspberry Pi/other equivalent boards
  - (iii) Reading data from sensors
4. Explore different communication methods with IoT devices.
5. Collecting and processing data from IoT systems in the cloud using XivelyPaaS.
6. Develop IoT applications using Django Framework and Firebase/ Bluemix platform.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

On completion of the course, the students will be able to:

1. Write and implement simple assembly programs that use various features of the processor.
2. Test and experiment different sensors for application development Arduino/Raspberry Pi/ Equivalent boards.
3. Develop IOT applications with different platform and frameworks.

<b>MC5003</b>	<b>SOFTWARE PROJECT MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To know of how to do project planning for the software process.
- To learn the cost estimation techniques during the analysis of the project.
- To understand the quality concepts for ensuring the functionality of the software

**UNIT I SOFTWARE PROJECT MANAGEMENT CONCEPTS 9**

Introduction to Software Project Management: An Overview of Project Planning: Select Project, Identifying Project scope and objectives, infrastructure, project products and Characteristics. Estimate efforts, Identify activity risks, and allocate resources- TQM, Six Sigma, Software Quality: defining software quality, ISO9126, External Standards.

**UNIT II SOFTWARE EVALUATION AND COSTING 9**

Project Evaluation: Strategic Assessment, Technical Assessment, cost-benefit analysis, Cash flow forecasting, cost-benefit evaluation techniques, Risk Evaluation. Selection of Appropriate Project approach: Choosing technologies, choice of process models, structured methods.

**UNIT III SOFTWARE ESTIMATION TECHNIQUES 9**

Software Effort Estimation: Problems with over and under estimations, Basis of software

Estimation, Software estimation techniques, expert Judgment, Estimating by analogy. Activity Planning: Project schedules, projects and activities, sequencing and scheduling Activities, networks planning models, formulating a network model.

**UNIT IV RISK MANAGEMENT 9**

Risk Management: Nature of Risk, Managing Risk, Risk Identification and Analysis, Reducing the Risk. Resource Allocation: Scheduling resources, Critical Paths, Cost scheduling, Monitoring and Control: Creating Framework, cost monitoring, prioritizing monitoring.

**UNIT V GLOBALIZATION ISSUES IN PROJECT MANAGEMENT 9**

Globalization issues in project management: Evolution of globalization- challenges in building global teams-models for the execution of some effective management techniques for managing global teams. Impact of the internet on project management: Introduction – the effect of internet on project management – managing projects for the internet – effect on project management activities. Comparison of project management software's: dot Project, Launch pad, openProj. Case study: PRINCE2.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Understand the activities during the project scheduling of any software application.
- Learn the risk management activities and the resource allocation for the projects.
- Can apply the software estimation and recent quality standards for evaluation of the software projects
- Acquire knowledge and skills needed for the construction of highly reliable software project
- Able to create reliable, replicable cost estimation that links to the requirements of project planning and managing.

**REFERENCES:**

1. Bob Hughes & Mike Cotterell, "Software Project Management", Tata McGraw- Hill Publications, Fifth Edition 2012
2. Futrell , "Quality Software Project Management", Pearson Education India, 2008
3. Gobalswamy Ramesh, "Managing Global Software Projects", Tata McGraw Hill Publishing Company, 2003
4. Richard H.Thayer "Software Engineering Project Management", IEEE Computer Society
5. S. A. Kelkar," Software Project Management" PHI, New Delhi, Third Edition ,2013
6. [http://en.wikipedia.org/wiki/Comparison\\_of\\_project\\_management\\_software](http://en.wikipedia.org/wiki/Comparison_of_project_management_software)
7. [http://www.ogc.gov.uk/methods\\_prince\\_2.asp](http://www.ogc.gov.uk/methods_prince_2.asp)

**MC5016**

**AGILE METHODOLOGIES**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software.



## REFERENCES

1. David J. Anderson and Eli Schragenheim,, “Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results”, Illustrated Edition, Prentice Hall PTR, 2004
2. Orit Hazza and YaepI Dubinsky, “Agile Software Engineering,: Undergraduate Topics in Computer Science, Springer Verlag, First Edition,2009
3. Craig Larman, “Agile and Iterative Development: A Manager’s Guide”, Pearson Education, Second Impression, 2007
4. Kevin C. Desouza, “Agile Information Systems: Conceptualization, Construction, and Management”, Elsevier, Butterworth-Heinemann, First Edition,2007
5. Ken Schwaber, “Agile Project Management with Scrum”, Illustrated, Revised Edition Microsoft Press, 2004
6. KonnorCluster, “Agile Project Management: Learn How To Manage a Project With Agile Methods, Scrum, Kanban and Extreme Programming”, Independently Published,First Edition,2019

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1		√	√	√	√					√	√		√	
CO 2	√	√		√	√				√		√		√	
CO 3		√				√	√	√						√
CO 4				√	√				√	√				√
CO 5	√			√		√	√		√	√		√		√

**MC5017**

**E- LEARNING**

**LT P C  
3 0 0 3**

### OBJECTIVES:

- To learn the various E-learning approaches and Components.
- To explore Design Thinking.
- To understand the types of design models of E-learning.
- To learn about E-learning Authoring tools.
- To know about evaluation and management of E-learning solutions

### UNIT I INTRODUCTION

**9**

Need for E-Learning – Approaches of E-Learning – Components of E-Learning – synchronous and Asynchronous Modes of Learning – Quality of E-Learning – Blended Learning: Activities, Team and Technology – Work Flow to Produce and Deliver E-Learning Content – Design Thinking: Introduction – Actionable Strategy – Act to Learn – Leading Teams to Win.

### UNIT II DESIGNING E-LEARNINGCOURSECONTENT

**9**

Design Models of E-Learning – Identifying and Organizing E-Learning Course Content: Needs Analysis – Analyzing the Target Audience – Identifying Course Content – Defining Learning Objectives – Defining the Course Sequence – Defining Instructional Methods – Defining Evaluation and Delivery Strategies – Case Study.

**UNIT III CREATING INTERACTIVE CONTENT 9**

Preparing Content: Tips for Content Development and Language Style – Creating Storyboards: Structure of an Interactive E-Lesson – Techniques for Presenting Content – Adding Examples – Integrating Multimedia Elements – Adding Examples – Developing Practice and Assessment Tests – Adding Additional Resources – Courseware Development Authoring Tools – Types of Authoring Tools – Selecting an Authoring Tool.

**UNIT IV LEARNING PLATFORMS 9**

Types of Learning Platforms – Proprietary Vs. Open – Source LMS – LMS Vs LCMS – Internally Handled and Hosted LMS – LMS Solutions – Functional Areas of LMS.

**UNIT V COURSE DELIVERY AND EVALUATION 9**

Components of an Instructor-Led or Facilitated Course – Planning and Documenting Activities – Facilitating Learners Activities – E-Learning Methods and Delivery Formats – Using Communication Tools for E-Learning – Course Evaluation.

**TOTAL: 45 PERIODS**

**OUTCOMES: On completion of course, the students will be able to:**

- Distinguish the phases of activities in models of E-learning.
- Identify appropriate instructional methods and delivery strategies.
- Choose appropriate E-learning Authoring tools.
- Create interactive E-learning courseware.
- Evaluate the E-learning courseware.

**REFERENCE BOOKS:**

1. Clark, R. C., Mayer, R. E., “E-Learning and the Science of Instruction”. Third Edition, 2011.
2. Crews, T. B., Sheth, S. N., Horne, T. M., “Understanding the Learning Personalities of Successful Online Students”, 1<sup>st</sup> Edition, Educause Review, 2014.
3. Johnny Schneider, “Understanding Design Thinking, Lean and Agile”, 1<sup>st</sup> Edition, O’Reilly Media, 2017.
4. Madhuri Dubey, “Effective E-learning Design, Development and Delivery”, 1<sup>st</sup> Edition, University Press, 2011.

Mapping of COs with POs and PSOs														
COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	3										
CO2	1	3	3	2	1								1	
CO3	1	2	3	2									1	
CO4	1	3	1	1									1	
CO5	1	3	1										1	

1 – Slight, 2 – Moderate, 3 – Substantial.

**OBJECTIVES:**

- To know the behavior of the testing techniques and to design test cases to detect the errors in the software
- To get insight into software testing methodologies
- To understand standard emerging areas in testing
- To learn about the software quality models.
- To understand the models and metrics of software quality and reliability.

**UNIT I INTRODUCTION 9**

Basic concepts and Preliminaries – Theory of Program Testing– Unit Testing – Control Flow Testing –Data Flow Testing– System Integration Testing

**UNIT II SOFTWARE TESTING METHODOLOGY 9**

Software Test Plan–Components of Plan - Types of Technical Reviews - Static and Dynamic Testing- – Software Testing in Spiral Manner - Information Gathering - Test Planning - Test Coverage - Test Evaluation -Prepare for Next Spiral - Conduct System Test - Acceptance Test – Summarize Testing Results.

**UNIT III EMERGING SPECIALIZED AREAS IN TESTING 9**

Test Process Assessment – Test Automation Assessment - Test Automation Framework – Nonfunctional Testing – SOA Testing – Agile Testing – Testing Center of Excellence – Onsite/Offshore Model - Modern Software Testing Tools – Software Testing Trends – Methodology to Develop Software Testing Tools.

**UNIT IV SOFTWARE QUALITY MODELS 9**

Software quality –Verification versus Validation– Components of Quality Assurance – SQA Plan – Quality Standards – CMM – PCMM – CMMI – Malcolm Baldrige National Quality Award.

**UNIT V QUALITY THROUGH CONTINUOUS IMPROVEMENT PROCESS 9**

Role of Statistical Methods in Software Quality – Transforming Requirements into Test Cases – Deming’s Quality Principles – Continuous Improvement through Plan Do Check Act (PDCA)

**TOTAL: 45 PERIODS****OUTCOMES:**

Up on completion of the course the students will be able to

- choose the software testing techniques to cater to the need of the project
- identify the components of software quality assurance systems
- apply various software testing strategies
- design and develop software quality models
- make use of statistical methods in software quality.

**REFERENCE BOOKS:**

1. William E.Lewis, “Software Testing and Continuous Quality Improvement”, 3<sup>rd</sup> Edition, Auerbach Publications, 2011
2. Kshirasagar Naik and Priyadarshi Tripathy, “Software Testing and Quality Assurance Theory and Practice”, 2<sup>nd</sup> Edition, John Wiley & Sons Publication, 2011
3. Ron Patton, “Software Testing”, 2<sup>nd</sup> Edition, Pearson Education, 2007

4. Glenford J. Myers, Tom Badgett, Corey Sandler, "The Art of Software Testing", 3rd Edition, John Wiley & Sons Publication, 2012.
5. Paul C. Jorgensen, "Software Testing, A Craftman's Approach", CRC Press Taylor & Francis Group, Fourth Edition, 2018

Mapping of COs with POs and PSOs														
COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		√		√		√								
CO2			√	√										
CO3				√	√									
CO4			√		√									
CO5	√	√	√	√	√								1	

**MC5019**

**ADVANCES IN OPERATING SYSTEMS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To learn the fundamentals of Operating Systems
- To gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols
- To gain insight on to the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols
- To know the components and management aspects of Real time, Mobile operating systems

**UNIT I FUNDAMENTALS OF OPERATING SYSTEMS**

**9**

Overview – Synchronization Mechanisms – Processes and Threads - Process Scheduling – Deadlocks: Detection, Prevention and Recovery – Models of Resources – Memory Management Techniques.

**UNIT II DISTRIBUTED OPERATING SYSTEMS**

**9**

Issues in Distributed Operating System – Architecture – Communication Primitives – Lamport's Logical clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols

**UNIT III DISTRIBUTED RESOURCE MANAGEMENT**

**9**

Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory–Issues in Load Distributing – Scheduling Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault

Tolerance – Two-Phase Commit Protocol – Nonblocking Commit Protocol – Security and Protection

**UNIT IV REAL TIME AND MOBILE OPERATING SYSTEMS 9**

Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems – Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems – Micro Kernel Design - Client Server Resource Access – Processes and Threads - Memory Management - File system.

**UNIT V CASE STUDIES 9**

Linux System: Design Principles - Kernel Modules - Process Management Scheduling - Memory Management - Input-Output Management - File System – Interprocess Communication. iOS and Android: Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon Completion of the course, the students should be able to:

- Discuss the various synchronization, scheduling and memory management issues
- Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system
- Discuss the various resource management techniques for distributed systems
- Identify the different features of real time and mobile operating systems
- Install and use available open source kernel

**REFERENCES:**

1. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, “Operating System Concepts- Essentials”, ninth Edition, John Wiley & Sons, 2013.
2. MukeshSinghal, NiranjanaG. Shivaratri, “Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems”, Tata McGraw-Hill, First Edition, 1994.
3. Love Robert, “Linux Kernel Development”, Pearson Education India, Third Edition, 2018.
4. Neil Smyth, “iPhone/iOS 4 Development Essentials – Xcode”, Fourth Edition, Payload media, 2011.
5. Rajib Mall, “Real-Time Systems: Theory and Practice”, Pearson Education India, First Edition 2006.
6. Daniel P Bovet and Marco Cesati, “Understanding the Linux kernel”, 3rd edition, O’Reilly, 2005.

Mapping of COs with POs and PSOs														
COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		√		√		√						√		
CO2			√	√								√		
CO3				√	√							√		
CO4			√		√							√		

CO5	√	√	√	√	√						√	√	√	√
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**MC5020**

**DIGITAL IMAGE PROCESSING**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- Learn digital image fundamentals.
- Be exposed to simple image processing techniques.
- Learn to represent image enhancement in the spatial and frequency domain..
- Be familiar with image restoration and segmentation techniques.

**UNIT I DIGITAL IMAGE FUNDAMENTALS 9**

Elements of visual perception, Electromagnetic Spectrum-overview, Image Sensing and Image Acquisition Systems, Sampling and Quantization, Image Formation, Image Geometry, Relationship between pixels, Basic concepts of distance transform, Color Image fundamentals-RGB-HIS Models, Different color models-conversion

**UNIT II IMAGE TRANSFORMS 9**

Unitary Image Transforms-1D Discrete Fourier Transform (DFT), Properties of DFT, 2D transforms – 2D DFT, Discrete Cosine Transform, Hadamard, Walsh and PCA.

**UNIT III IMAGE ENHANCEMENT 9**

Spatial Domain: Gray Level transformations, contrast stretching operation, Histogram Equalization and Specifications, Basics of Spatial Filtering-smoothing and sharpening spatial filters. Frequency domain: smoothing and sharpening frequency domain filters, Ideal, Butterworth and Gaussian filters.

**UNIT IV IMAGE RESTORATION 9**

Degradation Models-continuous and discrete form, Estimation of degradation models: Observation, Experimentation, Mathematical Modeling of Noise models, Restoration Techniques: Inverse Filtering, Minimum Mean Square (Wiener) filtering, Constrained Least Square Filter and Adaptive filters.

**UNIT V MORPHOLOGICAL IMAGE PROCESSING AND SEGMENTATION 9**

Basic Morphological operators-erosion, dilation, opening and closing-Basic Morphological Reconstruction Algorithms. Segmentation: point, line, edge detection, Region based segmentation, Region Splitting and Merging Technique, Thresholding Techniques, Applications of image processing.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Up on completion of the course, the students will be able to

- Learn how images are formed, sampled, quantized and represented digitally
- Understand and analyze the different image transform techniques
- Understand how the images are enhanced to improve subjective perception to spatial domain and frequency domain.
- Apply image restoration techniques

- Analyze the fundamental concepts of Morphological Image Processing and Segmentation techniques.

**REFERENCES:**

- Rafael C.Gonzalez and Richard E.Woods, "Digital Image Processing", 4<sup>th</sup> Edition, Pearson Education, New Delhi, 2018
- Jain Anil K., "Fundamentals of Digital Image Processing", 1<sup>st</sup> Edition, Prentice Hall of India, New Delhi, 2002.
- Kenneth R.Castleman, "Digital Image Processing", 1<sup>st</sup> Edition, Prentice Hall of India, New Delhi, 2006.
- John C.Russ, "The Image Processing Handbook", 5<sup>th</sup> Edition, Prentice Hall, New Jersey, 2002.
- William K Pratt, "Digital Image Processing", 3<sup>rd</sup> Edition, John Willey, 2002.
- Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.

Mapping of COs with POs and PSOs														
COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1												
CO2	1	3												
CO3	1	1												
CO4			2	1										
CO5	1	3												

**MC5021**

**COMPILER OPTIMIZATION TECHNIQUES**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To understand the optimization techniques used in compiler design.
- To be aware of the various computer architectures that support parallelism.
- To become familiar with the theoretical background needed for code optimization.
- To understand the techniques used for identifying parallelism in a sequential program.
- To learn the various optimization algorithms.

**UNIT I INTRODUCTION**

**9**

Language Processors - The Structure of a Compiler – The Evolution of Programming Languages - The Science of Building a Compiler – Applications of Compiler Technology  
 Programming Language Basics - The Lexical Analyzer Generator -Parser Generator - Overview of Basic Blocks and Flow Graphs - Optimization of Basic Blocks - Principle Sources of Optimization.

<b>UNIT II</b>	<b>INSTRUCTION-LEVEL PARALLELISM</b>	<b>9</b>
Processor Architectures – Code-Scheduling Constraints – Basic-Block Scheduling –Global Code Scheduling – Software Pipelining.		
<b>UNIT III</b>	<b>OPTIMIZING FOR PARALLELISM AND LOCALITY-THEORY</b>	<b>9</b>
Basic Concepts – Matrix-Multiply: An Example - Iteration Spaces - Affine Array Indexes – Data Reuse Array data dependence Analysis.		
<b>UNIT IV</b>	<b>OPTIMIZING FOR PARALLELISM AND LOCALITY APPLICATION</b>	<b>9</b>
Finding Synchronization - Free Parallelism – Synchronization between Parallel Loops – Pipelining – Locality Optimizations – Other Uses of Affine Transforms.		
<b>UNIT V</b>	<b>INTERPROCEDURAL ANALYSIS</b>	<b>9</b>
Basic Concepts – Need for Interprocedural Analysis – A Logical Representation of Data Flow – A Simple Pointer-Analysis Algorithm – Context Insensitive Interprocedural Analysis - Context - Sensitive Pointer-Analysis - Datalog Implementation by Binary Decision Diagrams.		
<b>TOTAL: 45 PERIODS</b>		

**OUTCOMES:**

On completion of the course the students should be able to:

- Identify the various sources of optimization
- identify the constraints and architectures of parallel execution of instructions
- identify the sources of optimization of parallel execution of instructions
- apply the process of optimization using various techniques
- Implement optimization techniques

**REFERENCES:**

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, “Compilers: Principles, Techniques and Tools”, Second Edition, Pearson Education, 2008.
2. Randy Allen, Ken Kennedy, “Optimizing Compilers for Modern Architectures: A Dependence-based Approach”, Morgan Kaufmann Publishers, First Edition, 2002.
3. Steven S. Muchnick, “Advanced Compiler Design and Implementation”, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint2003.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO 1		√	√	√								√	√	
CO 2		√	√								√	√	√	
CO 3	√	√	√									√	√	√
CO 4	√	√	√									√	√	
CO 5	√	√	√	√	√						√	√	√	

**OBJECTIVES:**

- To learn the technologies of the .NET framework.
- To cover all segments of programming in C# starting from the language basis, followed by the object oriented programming concepts.
- To update and enhance skills in writing Windows applications, ADO.NET and ASP .NET.
- To introduce advanced topics namely data connectivity, WPF, WCF and WPF with C# and .NET 4.5.
- To implement mobile applications using .Net Compact Framework.

**UNIT I C# LANGUAGE BASICS 9**

.Net Architecture – Core C# – Variables – Data Types – Flow control – Objects and Types- Classes and Structs – Inheritance- Generics – Arrays and Tuples – Operators and Casts – Indexers- Assemblies – Shared Assemblies – CLR Hosting – Appdomains.

**UNIT II C# ADVANCED FEATURES 9**

Delegates – Lambdas – Lambda Expressions – Events – Event Publisher – Event Listener – Strings and Regular Expressions – Generics – Collections – Memory Management and Pointers – Errors and Exceptions – Reflection.

**UNIT III BASE CLASS LIBRARIES AND DATA MANIPULATION 9**

Diagnostics Tasks – Threads and Synchronization – Manipulating XML – SAX and DOM – Manipulating files and the Registry – Transactions – Data access with ADO.NET: Introduction, LINQ to Entities and the ADO.NET Entity Framework, Querying a Database with LINQ – Creating the ADO.NET Entity Data Model Class Library, Creating a Windows Forms Project – Data Bindings between Controls and the Entity Data Model – Dynamically Binding Query Results.

**UNIT IV WINDOW AND WEB BASED APPLICATIONS 9**

Window Based Applications – Core ASP.NET – ASP.NET Web Forms – Server Controls, Data Binding – ASP.NET State Management, Tracing, Caching, Error Handling, Security, Deployment, User and Custom Controls – Windows Communication Foundation (WCF) – Introduction to Web Services.

**UNIT V .NET COMPACT FRAMEWORK 9**

Reflection – .Net Remoting-.Net Security – Localization – Peer-to-Peer Networking – Building P2P Applications – .Net Compact Framework – Compact Edition DataStores – Testing and Debugging – Optimizing performance – Packaging and Deployment.

**TOTAL: 45 PERIODS****OUTCOMES:**

Up on completion of the course, the student will be able to:

- Understand the difference between .NET and Java framework.
- Work with the basic and advanced features of C# language.
- Create applications using various data providers.
- Create web application using ASP.NET.
- Create mobile application using .NET compact framework.

**REFERENCES:**

1. Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner, “Professional C# and .NET 4.5”, Wiley, First Edition 2012
2. Andrew Troelsen, “Pro C# 5.0 and the .NET 4.5 Framework”, Apress publication, First Edition 2012
3. Ian Gariffiths, Mathew Adams, Jesse Liberty, “Programming C# 4.0”, O’Reilly, Sixth Edition, 2010
4. Andy Wigley, Daniel Moth, “Peter Foot, —Mobile Development Handbook”, Microsoft Press, 2<sup>nd</sup> Edition, 2011
5. Herbert Schildt, “C# - The Complete Reference”, Tata McGraw Hill, First Edition 2010.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	√	√	√	√	√	√	√	√	√			√	√	√
CO 2	√	√	√	√	√	√	√	√	√	√	√	√	√	√
CO 3	√	√	√	√	√				√			√	√	√
CO 4	√	√	√	√	√				√			√	√	√
CO 5	√	√	√	√	√		√		√	√	√	√	√	√

**MC5023**

**WIRELESS NETWORKING**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

The student should be made:

- To understand the concept about Wireless networks, protocol stack and standards
- To understand and analyse the network layer solutions for Wireless networks
- To study about fundamentals of 3G Services, its protocols and applications
- To learn about evolution of 4G Networks, its architecture and applications
- To explore the architecture of 5G, 5G Modulation Schemes and to analyse the concept of MIMO and other research areas in 5G

**UNIT I WIRELESS LAN**

**9**

Introduction-WLAN technologies: Infrared, UHF narrowband, spread spectrum, IEEE802.11: System architecture, protocol architecture, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, WPAN – IEEE 802.15.4, Wireless USB, Zigbee, 6LoWPAN, WirelessHART- IEEE802.16-WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX

**UNIT II MOBILE NETWORK LAYER**

**9**

Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol - mobile ad-hoc network: Routing: Destination Sequence distance vector, Dynamic source routing, IoT: CoAP. TCP enhancements for wireless protocols



CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√	√		√	√				√			√	√	
CO 2		√	√		√						√	√	√	
CO 3	√	√	√										√	√
CO 4	√	√	√			√							√	
CO 5	√	√	√	√					√		√		√	

**MC5024**

**WEB DESIGN**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To understand the concepts and architecture of the World Wide Web.
- To understand and practice markup languages
- To understand and practice embedded dynamic scripting on client-side Internet
- Programming
- To understand and practice web development techniques on client-side.
- The objective is to enable the students to understand the Organizational Behaviour, and Organizational Change and dynamic of groups.

**UNIT I INTRODUCTION TO WWW**

**9**

Understanding the working of Internet-Web Application Architecture-Brief history of Internet-Web Standards – W3C-Technologies involved in Web development – Protocols-Basic Principles involved in developing a website-Five Golden Rules of Web Designing.

**UNIT II UI DESIGN**

**9**

HTML Documents-Understanding markup languages-Structure of HTML Documents-Markup Tags-Basic markup tags-Working with Text-Working with Images-Hyperlinks -Images-Tables-List-SVG-Advanced HTML- Iframes-HTML5 Video and Audio tags  
Cascading Style Sheet: Need for CSS - Importance of separating document structuring and styling-Basic CSS selectors and properties-CSS properties for text (Color, font, weight, align, etc.) and working with colors-Selecting with classes, IDs, tags-CSS Specificity-Ways of linking CSS to HTML-CSS Pseudo selectors-Understanding the box model - Margins, padding and border – Inline and block elements -Structuring pages using Semantic Tags

**UNIT III WEB PAGE LAYOUTS WITH CSS3**

**9**

Positioning with CSS – Positions, Floats, z-index-Layouts with Flexbox –Responsive web design with media queries-Advanced CSS Effects – Gradients, opacity, box-shadow-CSS3 Animations – Transforms and Transitions-CSS Frameworks – Bootstrap

**UNIT IV JAVA SCRIPT**

**9**

Basic JavaScript syntax-JavaScript Objects and JSON-Understanding the DOM-JavaScript Events and Input validation-Modifying CSS of elements using JavaScript-JavaScript Local Storage and Session Storage-Cross domain data transfer with AJAX-Using JQuery to add interactivity-JQuery Selectors-JQuery Events-Modifying CSS with JQuery -Adding and removing elements with JQuery-AJAX with JQuery-Animations with JQuery (hide, show, animate, fade methods, Slide Method)

**UNIT V SERVER-SIDE PROGRAMMING WITH PHP****9**

PHP basic syntax-PHP Variables and basic data structures-Using PHP to manage form submissions-File Handling -Cookies and Sessions with PHP-Working with WAMP and PHPMYADMIN-Establishing connectivity with MySQL using PHP

**.TOTAL: 45 PERIODS****OUTCOMES:**

- Create a basic website using HTML and Cascading Style Sheets.
- Create websites with complex layouts
- Add interactivity to websites using simple scripts
- Design rich client presentation using AJAX.
- Add business logic to websites using PHP and databases

**REFERENCES:**

1. David Flanagan, “JavaScript: The Definitive Guide”, 7th Edition, O’Reilly Publications,2020
2. Danny Goodman, “Dynamic HTML: The Definitive Reference: A Comprehensive Resource for XHTML, CSS, DOM, JavaScript” , O’Reilly Publications, 3<sup>rd</sup> Edition,2007
3. Robin Nixon; “Learning PHP, MySQL, JavaScript & CSS: A Step-by-Step Guide to Creating Dynamic Websites”, O’Reilly Publications, 2<sup>nd</sup> Edition,2018
4. Keith J Grant; “CSS in Depth”, Manning Publications. 1st edition,2018
5. Elizabeth Castrol, “HTML5 & CSS3 Visual Quick start Guide”, Peachpit Press, 7<sup>th</sup> Edition, 2012.
6. Harvey & Paul Deitel& Associates, Harvey Deitel and Abbey Deitel, “Internet and World Wide Web - How to Program”, Fifth Edition, Pearson Education, 2012
7. <https://developer.mozilla.org/en-US/>
8. <https://learn.shayhowe.com/>

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√				√									√
CO 2		√	√	√									√	
CO 3						√	√							√
CO 4				√	√								√	
CO 5							√				√			

**MC5025****NETWORK PROGRAMMING AND SECURITY****L T P C****3 0 0 3****OBJECTIVES:**

- To understand the basics of Network Programming
- To be familiar with building network applications
- To design and implement client server Applications using TCP and UDP Sockets
- To expose with various socket options
- To get aware of Network security for Network Programming

**UNIT I INTRODUCTION 9**  
TCP/IP Layer Model – Multicast, broadcast and Any cast - Socket address Structures – Byte ordering functions – address conversion functions – Elementary TCP Sockets – socket, connect, bind, listen, accept, read, write , close functions – Iterative Server – Concurrent Server

**UNIT II ELEMENTARY TCP SOCKETS 9**  
TCP Echo Server – TCP Echo Client – Posix Signal handling – Server with multiple clients – boundary conditions: Server process Crashes, Server host Crashes, Server Crashes and reboots, Server Shutdown

**UNIT III SOCKET OPTIONS AND MULTIPLEXING 9**  
Socket options – getsocket and setsocket functions – generic socket options – IP socket options – ICMP socket options – TCP socket options I/O multiplexing – I/O Models – select function – shutdown function – TCP echo Server (with multiplexing) – poll function – TCP echo Client (with Multiplexing)

**UNIT IV ELEMENTARY UDP SOCKETS 9**  
UDP echo Server – UDP echo Client – Multiplexing TCP and UDP sockets – Domain name system – gethostbyname function – Ipv6 support in DNS – gethostbyadr function – getservbyname and getservbyport functions.

**UNIT V NETWORK SECURITY 9**  
SSL - SSL Architecture, SSL Protocols, SSL Message , Secure Electronic Transaction (SET). TLS –TLS Protocols,DTLS Protocols, PKI – Fundamentals, Standards and Applications

**TOTAL: 45 PERIODS**

**REFERENCE BOOKS:**

1. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff ,”Unix Network Programming, Volume 1: The Sockets Networking API”, Third Edition, ISBN:0-13-141155-1, Addison Wesley Pearson Education,2004
2. Behrouz A Forouzan,DebdeepMukhopadhyay “Cryptography and Network Security” ,Second Edition, ISBN -13:978-0-07—070208-0 Tata McGraw Hill Education Private Limited 2010
3. William Stallings, “Cryptographic and network security Principles and Practices”,Fourth Edition, Publisher Prentice Hall, November 2005
4. Andre Perez, ”Network Security”, First Edition, Publisher John Wiley & Sons, 2014
5. Gary R. Wright , W. Richard Stevens, ”TCP/IP Illustrated: The Implementation” , ISBN 0-201-63354-X , Vol. 2, 1st Edition , Addison Wesley Professional, January 2008
6. Michael J. Donahoo, Kenneth L. Calvert “TCP/IP Sockets in C: Practical Guide for Programmers “, Morgan Kaufmann Publishers 2<sup>nd</sup>Edition. 2009
7. Lewis Van Winkle ,”Hands-On Network Programming with C: Learn socket programming in C and write secure and optimized network code” ,ISBN -978-1-78934-986-3, Packt Publishing 2019 First Edition.

**OUTCOMES:**

Upon completion of the course, the student will be able to

- Design and implement the client/server programs using variety of protocols
- Understand the key protocols which support Internet
- Demonstrate advanced knowledge of programming interfaces for network communication

- Use the basic tools for design and testing of network programs in Unix environment.
- Identify some of the factors driving the need for network security
- 

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√	√	√	√				√	√			√	√	√
CO 2	√	√					√					√	√	
CO 3	√	√	√	√		√				√	√	√	√	√
CO 4	√	√	√		√						√	√	√	√
CO 5	√		√		√	√	√	√	√	√			√	√

**MC5026**

**MICROSERVICES AND DEVOPS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To introduce Microservices and Containers. .
- To understand the key concepts and principles of DevOps
- To be familiar with most common DevOps tools
- To explain the business benefits of DevOps and continuous delivery.
- To recall specific DevOps methodologies and frameworks

**UNIT I INTRODUCTION TO MICROSERVICES 9**

Definition of Microservices – Characteristics - Microservices and Containers – Interacting with Other Services – Monitoring and Securing the Services – Containerized Services – Deploying on Cloud

**UNIT II MICROSERVICES ARCHITECTURE 9**

Monolithic architecture- Microservice architectural style- Benefits - Drawbacks of Microservice architectural style - decomposing monolithic applications into Microservices.

**UNIT III BASICS OF DEVOPS 9**

History of DevOps- DevOps and software development life cycle- water fall model – agile model –DevOps life cycle – DevOps tools: distributed version control tool –**Git**- automation testing tools – **Selenium** - reports generation – **TestNG** - User Acceptance Testing – **Jenkins**.

**UNIT IV MICROSERVICES IN DEVOPS ENVIRONMENT 9**

Evolution of Microservices and DevOps – Benefits of combining DevOps and Microservices- working of DevOps and Microservices in Cloud environment - DevOps Pipeline representation for a NodeJS based Microservices

**UNIT V VELOCITYAND CONTINUOUS DELIVERY 9**

Velocity - Delivery Pipeline- test stack - Small/Unit Test – medium /integration testing – system testing- Job of Development and DevOps - Job of Test and DevOps – Job of Op and Devops- Infrastructure and the job of Ops.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

At the end of this course, the students will be able to:

- Understand the Microservices and containers.

- apply Microservices in DevOps
- Understand about DevOps and the common tools used in DevOps.
- Develop and integrate projects using DevOps
- Deploy and monitor projects using DevOps.

**REFERENCES:**

1. NamitTanasseri, RahulRai, Microservices with Azure, 1<sup>st</sup> Edition, Packt Publishing, UK, 2017
2. Eberhard Wolff, Microservices: Flexible Software Architecture, 1<sup>st</sup> Edition, Pearson Education, 2017
3. James A Scott, A Practical Guide to Microservices and Containers, MapR Data Technologies e – book. <https://mapr.com/ebook/microservices-and-containers/assets/microservices-and-containers.pdf>
4. Joyner Joseph, Devops for Beginners, First Edition, MihailsKonoplovs publisher, 2015.
5. Gene Kim, Kevin Behr, George Spafford, The Phoenix Project, A Novel about IT, DevOps, 5<sup>th</sup> Edition, IT Revolution Press, 2018 .
6. Michael Hüttermann, DevOps for Developers, 1<sup>st</sup> Edition, APress, e-book, 2012.

Mapping of COs with POs and PSOs														
COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√												
CO2	√	√												
CO3	√	√												
CO4			√	√										
CO5	√	√												

**MC5027**

**SOCIAL NETWORK ANALYTICS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To gain knowledge about social networks, its structure and their data sources.
- To study about the knowledge representation technologies for social network analysis.
- To analyse the data left behind in social networks.
- To gain knowledge about the community maintained social media resources.
- To learn about the visualization of social networks.

**UNIT I INTRODUCTION TO SEMANTIC WEB**

**9**

The development of Semantic Web – Emergence of the Social Web – The Development of Social Network Analysis – Basic Graph Theoretical Concepts of Social Network Analysis – Electronic Sources for Network Analysis – Electronic Discussion Networks, Blogs and Online Communities, Web-based Networks.

**UNIT II KNOWLEDGE REPRESENTATION ON THE SEMANTIC WEB 9**

Ontology-based knowledge Representation – Ontology languages for the Semantic Web: RDF and OWL–Modeling Social Network Data – Network Data Representation, Ontological Representation of Social Individuals and Relationships –Aggregating and Reasoning with Social Network Data.

**UNIT III SOCIAL NETWORK MINING 9**

Detecting Communities in Social Network – Evaluating Communities –Methods for Community Detection – Applications of Community Mining Algorithms – Tools for detecting communities – Application: Mining Facebook - Exploring Facebook’s social Graph API – Analyzing social graph connections

**UNIT IV COMMUNITY MAINTAINED SOCIAL MEDIA RESOURCES 9**

Community Maintained Resources – Supporting technologies for community maintained resources– User motivations-Location based social interaction – location technology– mobile location sharing – Social Information Sharing and social filtering – Automated recommender system.

**UNIT V VISUALIZATION OF SOCIAL NETWORKS 9**

Visualization of Social Networks - Node-Edge Diagrams – Random Layout – Force-Directed Layout – Tree Layout – Matrix Representations –Matrix and Node-Link Diagrams – Hybrid Representations – Visualizing Online Social Networks.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Up on completion of the course, the students will be able to:

- Explain the basic principles behind network analysis algorithms.
- Model and represent knowledge for social semantic Web.
- Use extraction and mining tools for analyzing Social networks.
- Discuss about community maintained social media resources.
- Develop personalized visualization for Social networks.

**REFERENCES:**

1. Matthew A. Russell,“Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, Githuband more”, O’REILLY, Third Edition, 2018.
2. CharuAggarwal, "Social Network Data Analytics," Springer, First Edition, 2014
3. Jennifer Golbeck, "Analyzing the social web", Waltham, MA: Morgan Kaufmann (Elsevier), First Edition, 2013.
4. BorkoFurht, “Handbook of Social Network Technologies and Applications”, Springer, First Edition, 2010
5. Peter Mika, “Social Networks and the Semantic Web”, Springer, First Edition, 2007
6. Stanley Wasserman and Katherine Faust, “Social network analysis: methods and applications”, Cambridge University Press, First Edition, 1999.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√												√	
CO 2	√	√		√										√

CO 3	√	√		√										√
CO 4			√				√		√	√	√		√	
CO 5	√	√		√	√	√	√			√		√		√

**MC5028**

**BIO INSPIRED COMPUTING**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To Learn bio-inspired theorem and algorithms
- To Understand random walk and simulated annealing
- To Learn genetic algorithm and differential evolution
- To Learn swarm optimization and ant colony for feature selection
- To understand bio-inspired application in various fields

**UNIT I INTRODUCTION**

**9**

Introduction to algorithm - Newton ' s method - optimization algorithm - No-Free-Lunch Theorems - Nature-Inspired Metaheuristics -Analysis of Algorithms -Nature Inspires Algorithms -Parameter tuning and parameter control.

**UNIT II RANDOM WALK AND ANEALING**

**9**

Random variables - Isotropic random walks - Levy distribution and flights - Markov chains - step sizes and search efficiency - Modality and intermittent search strategy - importance of randomization- Eagle strategy-Annealing and Boltzmann Distribution - parameters -SA algorithm - Stochastic Tunneling.

**UNIT III GENETIC ALGORITHM AND DIFFERENTIAL EVOLUTION**

**9**

Introduction to genetic algorithms and - role of genetic operators - choice of parameters - GA variants - schema theorem - convergence analysis - introduction to differential evolution - variants - choice of parameters - convergence analysis - implementation.

**UNIT IV SWARM OPTIMIZATION AND FIREFLY ALGORITHM**

**9**

Swarm intelligence - PSO algorithm - accelerated PSO - implementation - convergence analysis - binary PSO - The Firefly algorithm - algorithm analysis - implementation - variants- Ant colony optimization toward feature selection.

**UNIT V APPLICATIONS OF BIO INSPIRED COMPUTING**

**9**

Improved Weighted Thresholded Histogram Equalization Algorithm for Digital Image Contrast Enhancement Using Bat Algorithm - Ground Glass Opacity Nodules Detection and Segmentation using Snake Model - Mobile Object Tracking Using Cuckoo Search- Bio inspired algorithms in cloud computing- Wireless Sensor Networks using Bio inspired Algorithms

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon completion of the course, the students should be able to

- Implement and apply bio-inspired algorithms
- Explain random walk and simulated annealing
- Implement and apply genetic algorithms

- Explain swarm intelligence and ant colony for feature selection
- Apply bio-inspired techniques in various fields.

**REFERENCES:**

1. Eiben,A.E.Smith,James E, "Introduction to Evolutionary Computing", Springer 2<sup>nd</sup>Edition2015.
2. Helio J.C. Barbosa, "Ant Colony Optimization - Techniques and Applications", IntechFirst Edition,2013
3. Xin-She Yang , Jaao Paulo papa, "Bio-Inspired Computing and Applications in Image Processing",Elsevier First Edition, 2016
4. Xin-She Yang, "Nature Inspired Optimization Algorithm",Elsevier First Edition 2014
5. Yang ,Cui,Xlao,Gandomi,Karamanoglu,"Swarm Intelligence and Bio-Inspired Computing", Elsevier First Edition 2013

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	√	√	√	√	√				√			√	√	√
CO 2	√	√	√	√	√				√			√		√
CO 3	√	√	√	√	√				√			√		√
CO 4	√	√	√	√	√		√		√	√	√	√	√	√
CO 5	√	√	√	√	√	√	√		√	√		√		√

**MC5029**

**INFORMATION RETRIEVAL TECHNIQUES**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To understand the basics of information retrieval with pertinence to modeling, query operations and indexing
- To get an understanding of machine learning techniques for text classification and clustering.
- To understand the various applications of information retrieval giving emphasis to multimedia IR, web search
- To understand the concepts of digital libraries

**UNIT I INTRODUCTION: MOTIVATION**

**9**

Basic Concepts – Practical Issues - Retrieval Process – Architecture - Boolean Retrieval – Retrieval Evaluation – Open Source IR Systems–History of Web Search – Web Characteristics– The impact of the web on IR —IR Versus Web Search–Components of a Search engine

**UNIT II MODELING**

**9**

Taxonomy and Characterization of IR Models – Boolean Model – Vector Model - Term Weighting – Scoring and Ranking –Language Models – Set Theoretic Models - Probabilistic Models – Algebraic Models – Structured Text Retrieval Models – Models for Browsing

**UNIT III INDEXING 9**

Static and Dynamic Inverted Indices – Index Construction and Index Compression. Searching-Sequential Searching and Pattern Matching. Query Operations -Query Languages – Query Processing - Relevance Feedback and Query Expansion - Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency

**UNIT IV CLASSIFICATION AND CLUSTERING 9**

Text Classification and Naïve Bayes – Vector Space Classification – Support vector machines and Machine learning on documents. Flat Clustering – Hierarchical Clustering – Matrix decompositions and latent semantic indexing – Fusion and Meta learning

**UNIT V SEARCHING THE WEB 9**

Searching the Web –Structure of the Web –IR and web search – Static and Dynamic Ranking – Web Crawling and Indexing – Link Analysis - XML Retrieval Multimedia IR: Models and Languages – Indexing and Searching Parallel and Distributed IR – Digital Libraries

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon completion of this course, the students should be able to:

- Build an Information Retrieval system using the available tools.
- Identify and design the various components of an Information Retrieval system.
- Model an information retrieval system
- Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval.
- Design an efficient search engine and analyze the Web content structure.

**REFERENCES:**

1. Implementing and Evaluating Search EnginesII, The MIT Press, Cambridge, Massachusetts London, England, First Edition2010
2. Ricardo Baeza – Yates, BerthierRibeiro – Neto, —Modern Information Retrieval: The concepts and Technology behind SearchII (ACM Press Books), Second Edition, 2011.
3. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, —Information RetrievalFirst Edition 2010
4. Manning Christopher D., Raghavan Prabhakar & SchutzeHinrich, “ Introduction to Information Retrieval”, Cambridge University Press, Online Edition,2009

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	√	√	√	√	√				√			√	√	√
CO 2	√	√	√	√	√				√			√	√	√
CO 3	√	√	√	√	√				√			√	√	√
CO 4	√	√	√	√	√		√		√	√	√	√	√	√
CO 5	√	√	√	√	√				√	√		√	√	√

**OBJECTIVES:**

- Understand software architectural requirements and drivers
- Be exposed to architectural styles and views
- Be familiar with architectures for emerging technologies

**UNIT I INTRODUCTION AND ARCHITECTURAL DRIVERS 9**

Introduction – Software architecture - Architectural structures – Influence of software architecture on organization - both business and technical – Architecture Business Cycle- Functional requirements – Technical constraints – Quality Attributes.

**UNIT II QUALITY ATTRIBUTE WORKSHOP 9**

Quality Attribute Workshop – Documenting Quality Attributes – Six part scenarios – Case studies.

**UNIT III ARCHITECTURAL VIEWS 9**

Introduction – Standard Definitions for views – Structures and views – Representing views-available notations – Standard views – 4+1 view of RUP, Siemens 4 views, SEI's perspectives and views – Case studies

**UNIT IV ARCHITECTURAL STYLES 9**

Introduction – Data flow styles – Call-return styles – Shared Information styles – Event styles – Case studies for each style.

**UNIT V DOCUMENTING THE ARCHITECTURE 9**

Good practices – Documenting the Views using UML – Merits and Demerits of using visual languages – Need for formal languages – Architectural Description Languages – ACME – Case studies. Special topics: SOA and Web services – Cloud Computing – Adaptive structures

**TOTAL: 45 PERIODS****OUTCOMES:**

Upon Completion of the course, the students will be able to

- Explain influence of software architecture on business and technical activities
- Summarize quality attribute workshop
- Identify key architectural structures
- Use styles and views to specify architecture
- Design document for a given architecture

**REFERENCES:**

1. Len Bass, Paul Clements, and Rick Kazman, "Software Architectures Principles and Practices", 2n Edition, Addison-Wesley, 2003.
2. Anthony J Lattanze, "Architecting Software Intensive System. A Practitioner's Guide", 1<sup>st</sup> Edition, Auerbach Publications, 2010.
3. Paul Clements, Felix Bachmann, Len Bass, David Garlan, James Ivers, Reed Little, Paulo Merson, Robert Nord, and Judith Stafford, "Documenting Software Architectures. Views and Beyond", 2<sup>nd</sup> Edition, Addison-Wesley, 2010
4. Paul Clements, Rick Kazman, and Mark Klein, "Evaluating software architectures: Methods and case studies.", 1<sup>st</sup> Edition, Addison-Wesley, 2001.
5. Mark Hansen, "SOA Using Java Web Services", 1<sup>st</sup> Edition, Prentice Hall, 2007
6. David Garlan, Bradley Schmerl, and Shang-Wen Cheng, "Software Architecture-Based Self-Adaptation," 31-56. Mieso K Denko, Laurence Tianruo Yang, and Yan

Mapping of COs with POs and PSOs														
COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		√	√											
CO2	√	√												
CO3	√	√												
CO4	√	√												
CO5	√	√	√											

**MC5031**

**DIGITAL FORENSICS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To learn the security issues network layer and transport layer.
- To be exposed to security issues of the application layer.
- To be familiar with forensics tools.
- To analyze and validate forensics data.
- To perform digital forensic analysis based on the investigator's position.

**UNIT I INTRODUCTION**

**9**

Digital Forensics – Uses- Digital Forensics Process – Locard’s Exchange Principle – Scientific Method – Role of Forensic examiner in Judicial System – Key technical concepts – Bits, bytes and numbering schemes- File extension and file signatures – Storage and memory- computing environment

**UNIT II ANTI-FORENSICS & LEGAL**

**9**

Introduction – Hiding data – Password attacks – Additional resources – Steganography – Data destruction. Legal: Fourth Amendment – Criminal law-searches without a warrant – searching with a warrant- Electronic discovery-Expert testimony.

**UNIT III EVIDENCE COLLECTION**

**9**

Evidence Collection – Collection option – Obstacles – Types of Evidence – The rules of Evidence – General Procedure – Collection and archiving – Methods of collection – Artifacts – Collection steps – Controlling Contamination: The Chain of Custody Duplication and Preservation of Digital Evidence: Preserving the digital Crime Scene – Computer Evidence processing steps - Legal Aspects of Collecting and Preserving Computer Forensic Evidence - Computer Image Verification and Authentication.

**UNIT IV COMPUTER FORENSICS**

**9**

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud.Types of CF techniques – Incident and incident response methodology – Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. – Forensics Technology and Systems – Understanding Computer Investigation – Data Acquisition.

**UNIT V NETWORK FORENSICS & MOBILE DEVICE FORENSICS 9**

Introduction – Network fundamentals – Network Security tools – Network evidence and investigations. Mobile device forensics: Cellular Network – Cell phone evidence – Cell phone forensic tools- Global Positioning systems.

**TOTAL: 45 PERIODS**

**OUTCOME:**

Upon Completion of the course, the students will be able to

- Explain digital forensic process and role of forensic examiner.
- Explore Legal amendments.
- Demonstrate evidence collection
- Explore computer forensics, network forensics and mobile device forensics.
- Make Use forensics tools.

**REFERENCES:**

1. John Sammons, The Basics of Digital Forensics The Primer for Getting Started in Digital Forensics, Second Edition, Syngress, 2015.
2. Cory Altheide and Harlan Carvey, —Digital Forensics with Open Source Tools, 1<sup>st</sup> Edition, Elsevier publication, April 2011.
3. Nihad A. Hassan, Digital Forensics Basics: A Practical Guide Using Windows OS, 1<sup>st</sup> Edition, A Press, 2019
4. ThmasJ.Holt, Adam M.Bossler, K.C.Seigfried – Spellar, Cybercrime and Digital Forensics An Introduction, 1<sup>st</sup> Edition, Taylor and Francis,New York, 2015.
5. Darren R. Hayes, A Practical Guide to Digital Forensics Investigations, 2<sup>nd</sup> Edition , Pearson Education, 2020.

Mapping of COs with POs and PSOs														
COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√						√						
CO2	√	√						√						
CO3	√	√			√									
CO4	√	√	√	√										
CO5	√	√						√						

**MC5032 DATA MINING AND DATA WAREHOUSING TECHNIQUES L T P C 3 0 0 3**

**OBJECTIVES:**

- To gain knowledge on data mining and the need for pre-processing.
- To characterize the kinds of patterns that can be discovered by association rule mining.
- To implement classification techniques on large datasets.
- To analyze various clustering techniques in real world applications.

- To get exposed to the concepts of data warehousing architecture and implementation.

**UNIT I DATA MINING & DATA PREPROCESSING 9**

Data Mining–Concepts , DBMS versus Data mining , kinds of Data, Applications, Issues and Challenges–Need for Data Pre-processing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation.

**UNIT II ASSOCIATION RULE MINING AND CLASSIFICATION BASICS 9**

Introduction to Association rules – Association Rule Mining – Mining Frequent Itemsets with and without Candidate Generation – Mining Various Kinds of Association Rules - Classification versus Prediction – Data Preparation for Classification and Prediction.

**UNIT III CLASSIFICATION AND PREDICTION TECHNIQUES 9**

Classification by Decision Tree – Bayesian Classification – Rule Based Classification – Bayesian Belief Networks – Classification by Back Propagation – Support Vector Machines – K-Nearest Neighbor Algorithm –Linear Regression, Nonlinear Regression, Other Regression-Based Methods

**UNIT IV CLUSTERING TECHNIQUES 9**

Cluster Analysis – Partitioning Methods: k-Means and k- Mediods – Hierarchical Methods: Agglomerative and Divisive – Density–Based Method: DBSCAN –Model Based Clustering Methods: Fuzzy clusters and Expectation-Maximization Algorithm – Clustering High-Dimensional Data: Biclustering – Outlier Analysis.

**UNIT V DATA WAREHOUSE 9**

Need for Data Warehouse – Database versus Data Warehouse – Multidimensional Data Model – Schemas for Multidimensional Databases – OLAP operations – OLAP versus OLTP – Data Warehouse Architecture – Extraction, Transformation and Loading (ETL).

**TOTAL: 45 PERIODS**

**OUTCOMES:**

On completion of the course, the students will be able to:

1. Identify data mining techniques in building intelligent model.
2. Illustrate association mining techniques on transactional databases.
3. Apply classification and clustering techniques in real world applications.
4. Evaluate various mining techniques on complex data objects.
5. Design, create and maintain data warehouses.

**REFERENCES:**

1. Daniel T. Larose, Chantal D. Larose, "Data mining and Predictive analytics," Second Edition, Wiley Publication, 2015
2. G. K. Gupta, "Introduction to Data Mining with Case Studies", Eastern Economy Edition, Prentice Hall of India, Third Edition, 2014

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√	√											√	
CO 2		√											√	
CO 3	√	√	√		√	√			√					√

CO 4	√	√		√	√				√					√
CO 5	√	√			√	√	√		√	√	√	√		√

**MC5033**

**DATA VISUALIZATION TECHNIQUES**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To understand the categories of data quality principles.
- To describe data through visual representation.
- To provide basic knowledge about how large datasets are represented into visual graphics and easily understand about the complex relationships within the data.
- To design effective visualization techniques for any different problems.

**UNIT I INTRODUCTION**

**9**

Visualization – visualization process – role of cognition – Pseudocode conventions – Scatter plot - Data foundation : Types of data - Structure within and between records - Data preprocessing – Human perceptions and information processing.

**UNIT II VISUALIZATION FOUNDATIONS**

**9**

Semiology of graphical Symbols – Eight Visual Variables – Historical Perspective- Visualization Techniques for spatial data – One-dimensional data- two dimensional data – Three dimensional data- dynamic data – combining techniques- Visualization of Geospatial data – Visualization of Point, line, area data.

**UNIT III DESIGNING EFFECTIVE VISUALIZATION**

**9**

Steps in Designing Visualization – problems in Designing Effective Visualization – Comparing and evaluating visualization techniques – Visualization Systems.

**UNIT IV INFORMATION DASHBOARD DESIGN**

**9**

Characteristics of dashboards – Key goals in visual design process – Dashboard display media – Designing dashboards for usability – Meaningful organization – Maintaining consistency – Aesthetics of dashboards – Testing for usability – Case Studies: Sales dashboard, Marketing analysis dashboard.

**UNIT V VISUALIZATION SYSTEMS**

**9**

Systems based on Data type-systems based on Analysis type – Text analysis and visualization – Modern integrated visualization systems – toolkit-Research directions in visualization – issues of cognition, perception and reasoning –issues of evaluation - issues of Hardware.

**TOTAL: 45 PERIODS**

**OUTCOME:**

**On completion of the course the student should be able to:**

- Describe principles of visual perception
- Apply visualization techniques for various data analysis tasks – numerical data
- Apply visualization techniques for various data analysis tasks – Non numerical data
- Design effective visualization techniques for different problems
- Design information dashboard.



**UNIT IV QUEUEING MODELS 9**  
 Characteristics of Queueing Models–Poisson Queues-(M /M/1):(FIFO/∞/∞), (M / M / 1) : (FIFO / N / ∞), (M / M / C) : (FIFO / ∞ / ∞), (M / M / C) : (FIFO / N / ∞)models.

**UNIT V GAME THEORY 9**  
 Competitive game, rectangular game, saddle point, minimax (maximin) method of optimal strategies- value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2 X 2 games.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon Completion of the course, the students will be able to

- Understand and apply linear programming to solve operational problem with constraints
- Apply transportation and assignment models to find optimal solution
- To prepare project scheduling using PERT andCPM
- Identify and analyze appropriate queuing model to reduce the waiting time in queue.
- To choose the best strategy using decision making methods under game theory.

**REFERENCES:**

1. Taha H.A., “Operations Research: An Introduction”, 10th Edition, Prentice Hall of India, New Delhi, 2017
2. KantiSwarup, P.K. Gupta, Man Mohan, “Operations Research”, 15th Revised Edition, S. Chand& Sons Education Publications, New Delhi, 2017
3. Ronald L Rardin, Optimization In Operations Research, 2nd Edition, Pearson Education, India, 2018
4. Jatinder Kumar, Optimization Techniques in Operations Research, LAP LAMBERT Academic Publishing, 2015
5. D.S.Hira and P.K.Gupta, Operations Research, 5th Edition, S.Chand& Sons, 2015.

**Mapping of COs with POs and PSOs**

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√	√	√										
CO2	√	√	√	√	√									
CO3	√	√	√	√										
CO4	√	√	√	√		√								
CO5	√	√	√	√										

**MC5035**

**PROFESSIONAL ETHICS IN IT**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To understand the concepts of computer ethics in work environment.
- To understand the threats in computing environment
- To Understand the intricacies of accessibility issues

- To ensure safe exits when designing the software projects

**UNIT I INTRODUCTION TO ETHICS 9**

Definition of Ethics- Right, Good, Just- The Rational Basis of Ethics -Theories of Right: Intuitionist vs. End-Based vs. Duty-Based -Rights, Duties, Obligations -Theory of Value - Conflicting Principles and Priorities -The Importance of Integrity -The Difference Between Morals, Ethics, and Laws -Ethics in the Business World - Corporate Social Responsibility - Creating an Ethical Work Environment -Including Ethical Considerations in Decision Making

**UNIT II ETHICS IN INFORMATION TECHNOLOGY, INTERNET CRIME 9**

IT Professionals - Are IT Workers Professionals- Professional Relationships That Must Be Managed -Professional Codes of Ethics - Professional Organizations - Certification - IT Professional Ethics, Three Codes of Ethics, Management Conflicts. The RevetonRansomware Attacks -IT Security Incidents: A Major Concern - Why Computer Incidents Are So Prevalent -Types of Exploits -Types of Perpetrators-Federal Laws for Prosecuting Computer Attacks-Implementing Trustworthy Computing -Risk Assessment - Establishing a Security Policy -Educating Employees and Contract Workers

**UNIT III FREEDOM OF EXPRESSION, PRIVACY 9**

First Amendment Rights -Obscene Speech-Defamation -Freedom of Expression: Key Issues -Controlling Access to Information on the Internet -Strategic Lawsuit Against Public Participation (SLAPP)-Anonymity on the Internet-Hate Speech- Privacy Protection and the Law- Information Privacy- Privacy Laws, Applications, and Court Rulings-Key Privacy and Anonymity Issues- Data Breaches -Electronic Discovery-Consumer Profiling- Workplace Monitoring -Advanced Surveillance Technology

**UNIT IV FREEDOM OF EXPRESSION, INTELLECTUAL PROPERTY RIGHTS 9**

Intellectual Property Rights-Copyrights-Copyright Term - Eligible Works -Fair Use Doctrine - Software Copyright Protection -Copyright Laws and the internet-Copyright and Piracy- Patents- -Software Patents -Cross-Licensing Agreements -Trade Secrets-Trade Secret Laws -Employees and Trade Secrets-Key Intellectual Property Issues-Plagiarism -Reverse Engineering-Open Source Code- Competitive Intelligence -Trademark Infringement -Cyber squatting

**UNIT V SOCIAL NETWORKING ETHICS AND ETIQUETTES 9**

Social Networking Web Site- Business Applications of Online Social Networking-Social Network Advertising-The Use of Social Networks in the Hiring Process-Social Networking Ethical Issues -Cyber bullying- Online Virtual Worlds-Crime in Virtual Worlds-Educational and Business Uses of Virtual Worlds

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon Completion of the course, the students will be able to

- Helps to examine situations and to internalize the need for applying ethical principles, values to tackle with various situations.
- Develop a responsible attitude towards the use of computer as well as the technology.

- Able to envision the societal impact on the products/ projects they develop in their career
- Understanding the code of ethics and standards of computer professionals.
- Analyze the professional responsibility and empowering access to information in the work place.

**REFERENCES:**

1. Caroline Whitback, "Ethics in Engineering Practice and Research ", Cambridge University Press, 2<sup>nd</sup>Edition2011.
2. George Reynolds, "Ethics in Information Technology", Cengage Learning, 6<sup>th</sup>Edition2018.
3. Barger, Robert. (2008). Computer ethics: A case-based approach.Cambridge University Press 1<sup>st</sup>Edition.
4. John Weckert and Douglas Adeney, Computer and Information Ethics, Greenwood Press,FirstEdition1997.
5. Penny Duquenoy, Simon Jones and Barry G Blundell, "Ethical, legal and professional issues in computing", Middlesex University Press, First Edition2008.
6. Sara Baase, "A Gift of Fire: Social, Legal, and Ethical Issues for Computing and the Internet", 3rd Edition, Prentice Hall, 2008.
7. [http://www.infosectoday.com/Articles/Intro\\_Computer\\_Ethics.html](http://www.infosectoday.com/Articles/Intro_Computer_Ethics.html)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1						√		√	√	√				√
CO 2						√		√	√	√				
CO 3						√		√	√	√				
CO 4						√		√	√	√				√
CO 5						√		√	√	√				

**MC5036**

**MARKETING MANAGEMENT**

**L T P C**

**3 0 0 3**

**OBJECTIVE:**

- To provide basic knowledge of concepts, principles, tools and techniques of Marketing.
- To provide an exposure to the students pertaining to marketing strategies, which they are expected to possess when they enter the industry as practitioners.
- To give them an understanding of the various marketing Strategies used in consumer and industrial marketing.

**UNIT I INTRODUCTION TO MARKETING MANAGEMENT**

**9**

Introduction - Market and Marketing - the Exchange Process- Core Concepts of Marketing - Functions of Marketing - Importance of Marketing - Marketing Orientations -Marketing Mix-The Traditional 4Ps - The Modern Components of the Mix - The Additional 3Ps - Developing an Effective Marketing Mix.



CO 2				√	√								√	
CO 3									√	√	√			
CO 4	√	√	√								√		√	√
CO 5	√					√								

**MC5037**

**ORGANIZATIONAL BEHAVIOR**

**L T P C**

**3 0 0 3**

**OBJECTIVE:**

- The objective is to enable the students to understand the Organizational Behavior, and Organizational Change and dynamic of groups.

**UNIT I ORGANISATIONAL BEHAVIOUR**

**9**

Organization Behaviour – Definition – Scope and Application in Management – Contributions of Other Disciplines to OB. Emerging Issues in Organizational Behaviour- Organizational behaviour models

**UNIT II INDIVIDUAL PROCESSES**

**9**

Personality – types – Factors influencing personality– Theories. Emotions - Theories – Emotional Intelligence- Learning – Types of learners – The learning process – Learning theories.

Perceptions – Importance – Factors influencing perception- Attitudes – Nature of Attitudes Components of Attitudes Formation of Attitude Benefits of Positive Attitude Functions of Attitudes– Measurement-Motivation – Importance – Types – Theories.

**UNIT III LEADERSHIP AND POWER**

**9**

Meaning – Importance – Leadership styles – Theories – Leaders Vs Managers – Sources of power – Power centers – Power and Politics.

**UNIT IV GROUP DYNAMICS**

**9**

Meaning – Types of Groups – Functions of Small Groups – Group Size Status – Managerial Implications – Group Behaviour – Group Norms – Cohesiveness – Group Thinking

**UNIT V ORGANISATIONAL CHANGE AND DEVELOPMENT**

**9**

Organizational Change: Meaning – Nature of Work Change – Need for Change – Change Process – Types of Change – Factors Influencing Change – Resistance to Change – Overcoming Resistance – Organizational Development: Meaning and Different Types of OD Interventions.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

On completion of the course should be able to:

- Students will have a better understanding of human behavior in organization.
- They will know the framework for managing individual and group performance.
- Characteristics of attitudes and components of attitudes — A brief discussion

- List the determinants of personality
- List the characteristics of various leadership styles.

**REFERENCES:**

1. K. Aswathappa, “Organizational behaviour”, Himalaya Publishing House Pvt. Ltd. 11<sup>th</sup>Edition.
2. Stephen P. Robins, “Organizational Behavior”, PHI Learning / Pearson Education, Edition 17, 2016 (Global edition)
3. Fred Luthans, “Organizational Behavior”, McGraw Hill, 12<sup>th</sup> Edition
4. Nelson, Quick, Khandelwal. “ORGB – An innovative approach to learning and teaching”. Cengage, 2<sup>nd</sup> edition 2012
5. Ivancevich, Konopaske&Maheson, “Organizational Behaviour& Management”, Tata McGraw Hill, 7<sup>th</sup> edition, 2008
6. Robert Kreitner and Angelo Kinicki, “Organizational Behaviour”, Tata McGraw Hill, 10<sup>th</sup> Edition, 2016

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1			√	√			√							
CO 2		√		√									√	
CO 3								√				√		√
CO 4							√			√				√
CO 5									√		√		√	

**MC5038**

**BUSINESS DATA ANALYTICS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To understand the basics of business analytics and its life cycle.
- To gain knowledge about fundamental business analytics.
- To learn modeling for uncertainty and statistical inference.
- To understand analytics using Hadoop and Map Reduce frameworks.
- To acquire insight on other analytical frameworks.

**UNIT I OVERVIEW OF BUSINESS ANALYTICS 9**

Introduction – Drivers for Business Analytics – Applications of Business Analytics: Marketing and Sales, Human Resource, Healthcare, Product Design, Service Design, Customer Service and Support – Skills Required for a Business Analyst – Framework for Business Analytics Life Cycle for Business Analytics Process.

**UNIT II ESSENTIALS OF BUSINESS ANALYTICS 9**

Descriptive Statistics – Using Data – Types of Data – Data Distribution Metrics: Frequency, Mean, Median, Mode, Range, Variance, Standard Deviation, Percentile, Quartile, z-Score, Covariance, Correlation – Data Visualization: Tables, Charts, Line Charts, Bar and Column Chart, Bubble Chart, Heat Map – Data Dashboards.

**UNIT III      MODELING UNCERTAINTY AND STATISTICAL INFERENCE      9**

Modeling Uncertainty: Events and Probabilities – Conditional Probability – Random Variables – Discrete Probability Distributions – Continuous Probability Distribution – Statistical Inference: Data Sampling – Selecting a Sample – Point Estimation – Sampling Distributions – Interval Estimation – Hypothesis Testing.

**UNIT IV      ANALYTICS USING HADOOP AND MAPREDUCE FRAMEWORK      9**

Introducing Hadoop – RDBMS versus Hadoop – Hadoop Overview – HDFS (Hadoop Distributed File System) – Processing Data with Hadoop – Introduction to MapReduce – Features of MapReduce – Algorithms Using Map-Reduce: Matrix-Vector Multiplication, Relational Algebra Operations, Grouping and Aggregation – Extensions to MapReduce

**UNIT V      OTHER DATA ANALYTICAL FRAMEWORKS      9**

Overview of Application development Languages for Hadoop – PigLatin – Hive – Hive Query Language (HQL) – Introduction to Pentaho, JAQL – Introduction to Apache: Sqoop, Drill and Spark, Cloudera Impala – Introduction to NoSQL Databases – Hbase and MongoDB.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

On completion of the course, the student will be able to:

- Identify the real world business problems and model with analytical solutions.
- Solve analytical problem with relevant mathematics background knowledge.
- Convert any real world decision making problem to hypothesis and apply suitable statistical testing.
- Write and Demonstrate simple applications involving analytics using Hadoop and MapReduce
- Use open source frameworks for modeling and storing data.

**REFERENCES:**

1. U. Dinesh Kumar, “Business Analytics: The Science of Data-Driven Decision Making”, Wiley, First Edition, 2017.
2. Umesh R Hodeghatta, UmeshaNayak, “Business Analytics Using R – A Practical Approach”, Apress, First Edition 2017.
3. Jeffrey D. Camm, James J. Cochran, Michael J. Fry, Jeffrey W. Ohlmann, David R. Anderson, “Essentials of Business Analytics”, Cengage Learning, second Edition, 2016.
4. Rui Miguel Forte, “Mastering Predictive Analytics with R”, Packt Publication, First Edition 2015.
5. VigneshPrajapati, “Big Data Analytics with R and Hadoop”, Packt Publishing, First Edition 2013.
6. AnandRajaraman, Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, First Edition 2012.
7. A. Ohri, “R for Business Analytics”, Springer, First Edition, 2012

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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CO 1	√	√	√	√	√				√	√		√	√	√
CO 2	√	√	√	√	√				√	√		√	√	√
CO 3	√	√	√	√	√				√	√		√	√	√
CO 4	√	√	√	√	√				√	√		√	√	√
CO 5	√	√	√	√	√				√	√	√	√	√	√

**MC5039      CRYPTOCURRENCY AND BLOCK CHAIN TECHNOLOGIES      L T P C**  
**3 0 0 3**

**Objectives:**

- To understand the basics of Blockchain
- To understand the basics of Cryptocurrency
- To understand the working of digital tokens and wallets
- To understand the working of contracts
- To understand the working of block chain platforms

**UNIT I      OVERVIEW OF BLOCKCHAIN:      9**

Why Blockchain - The Structure of Blockchain - Data Structure of Blockchain - Data Distribution in Blockchain - Block Validation. **Block Validators:** Proof of Work – Proof of Stake - Proof of Activity - Proof of Elapsed Time - Proof of Burn.

**UNIT II      CRYPTOCURRENCY      9**

Overview. **Bitcoin:** Bitcoin Working - Bitcoin Transactions - Bitcoin Mining - Value of Bitcoin - Community, Politics and Regulations – Advantages – Disadvantages. **Ethereum:** Overview – Decentralized Application. **Components of Ethereum:** Smart contracts – Ether - Ethereum Clients - Ethereum Virtual Machine – Etherscripter.

**UNIT III      HYPERLEDGER      9**

Introduction. **Digital Tokens:** Overview - Initial Coin Offering – OmiseGO – EOS – Tether. **MetaMask:** Wallet Seed - MetaMask Transactions. **Mist:** Overview - Mist wallet. **Truffle:** Features of Truffle – Development Truffle boxes - Community truffle box.

**UNIT IV      SOLIDITY      9**

Smart Contracts - Contract and Interfaces - **Hyperledger Fabric:** Introduction - Fabric v/s Ethereum - Hyperledger Iroha - Features of Iroha. **Hyperledger Sawtooth:** Components of sawtooth - Proof of Elapsed time.

**UNIT V      BLOCKCHAIN PLATFORMS      9**

Multichain - HydraChain. **Future Blockchain:** IOTA – Corda - Chain Core. **Blockchain Framework:** CoCo Framework – Tierion – BigchainDB.

**TOTAL:45 PERIODS**

## OUTCOME:

Upon Completion of the course, the students will be able to

- describe the Basics of Block chain Technology concepts and its applications
- know about the implementation of Crypto currency
- identify the different ways to achieve Block chain Technology
- Illustrate how to design and build smart contracts using various platforms
- understand about the future of Block chain technology

## REFERENCES:

1. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 1<sup>st</sup> Edition, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. 1<sup>st</sup> Edition, Princeton University Press, 2016.
3. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 1<sup>st</sup> Edition, 2015.
- 4 <https://www.blockchainexpert.uk/book/blockchain-book.pdf>

MOOC Website references (Example website references are only given; it's not an exhaustive list)

1. [www.coursera.org](http://www.coursera.org)
  - a. Blockchain
  - b. Blockchain and cryptocurrency explained
  - c. Blockchain revolution
  - d. Bitcoin and Cryptocurrency technologies
  - e. Blockchain basics
  - f. Introduction to Blockchain
  - g. Introduction to Blockchain technologies
  - h. Blockchain foundations and use cases
2. [www.udemy.com](http://www.udemy.com)
  - a. Build a blockchain and cryptocurrency from scratch
  - b. The Basics of Blockchain
  - c. Blockchain advanced level
  - d. Learn Blockchain technology and cryptocurrency in Java
  - e. Full Cryptocurrency courses: Ethereum, bitcoin and blockchain

### Mapping of COs with POs and PSOs

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√												
CO2	√	√												
CO3	√	√												
CO4	√	√												
CO5	√	√												

**OBJECTIVES:**

The student should be made:

- To understand the theme underlying IPv6 Structure and addressing methods
- To understand and analyse the protocols for IPv6 Implementation
- To identify and provide solutions for QoS and Security Issues with IPv6
- To learn about Software Defined concepts, architectures, protocols and applications
- To explore the significance of Network Function Virtualization

**UNIT I IPv6 STRUCTURE AND ADDRESSING 9**

IPv4 Address Depletion- IPv6 Transition Issues-IPv6 Structure: IPv6 Header, Extension Headers: Hop-by-Hop Options Header, Destination Options Header, Routing Header, Fragment Header, AH, ESP- IPv6 Addresses: Unicast, Anycast, Multicast – Address Autoconfiguration

**UNIT II IPv6 NETWORKING 9**

IPv6 Internet Control Message Protocol (ICMPv6): ICMPv6 Messages, Fragmentation and Path MTU- IPv6 Neighbor Discovery- IPv6 Routing: RIPng, EIGRP for IPv6, OSPFv3 - Mobile IPv6

**UNIT III QoS, PROVISIONING AND SECURITY WITH IPv6 9**

QoS in IPv6 Protocols: Differentiated Services and IPv6, IPv6 Flows, Explicit Congestion Notification in IPv6 –Provisioning: Stateless DHCPv6, Stateful DHCPv6, DNS Extensions for IPv6- Security with IPv6: IP Security Protocol (IPsec) Basics, IPv6 Security Elements, Interaction of IPsec with IPv6 Elements

**UNIT IV SOFTWARE DEFINED NETWORKING 9**

Genesis of SDN – Separation of Control Plane and Data Plane – Distributed Control Plane – IP and MPLS – Characteristics of SDN – Operation – Devices – Controller – OpenFlow Specification

**UNIT V NETWORK FUNCTION VIRTUALIZATION 9**

Building SDN Framework – Network Functions Virtualization – Introduction –Virtualization and Data Plane I/O – Service Locations and Chaining – Applications – Use Cases of SDNs: Data Centers, Overlays, Big Data and Network Function Virtualization

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Understand the fundamentals of IPv6 and IPv6 Protocols
- Analyze the need for separation of data and control plane
- Understand the functionality of NFV
- Be Conversant with the latest networks and its architecture
- Gain an in-depth coverage of various networking technologies

**REFERENCES:**

1. Rick Graziani, "IPv6 Fundamentals: A Straightforward Approach to Understanding IPv6" Second Edition, Cisco Press, 2017
2. Peter Loshin, "IPv6: Theory, Protocol and Practice" Second Edition, Morgan Kaufmann Publishers, 2004
3. William Stallings, "Foundations of Modern Networking – SDN, NFC, QoE, IoT and Cloud" Third Edition, Pearson Publications, 2019.
4. Oswald Coker, Siamak Azodolmolky, "Software-Defined Networking with OpenFlow", Second Edition, Packt Publishing, 2017.
5. Paul Goransson, Chuck Black, "Software Defined Networks: A Comprehensive Approach", Morgan Kaufmann Publisher, First Edition 2014.
6. Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks, an Authoritative Review of Network Programmability Technologies", O'Reilly Media, First Edition August 2013.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√	√				√							√	
CO 2	√	√	√	√		√						√	√	
CO 3	√	√				√				√		√	√	√
CO 4	√	√	√			√						√	√	
CO 5	√	√	√	√	√	√	√			√		√	√	

**MC5041**

**SOFT COMPUTING TECHNIQUES**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To gain knowledge of soft computing theories and its fundamentals.
- To design a soft computing system required to address a computational task.
- To learn and apply artificial neural networks, fuzzy sets and fuzzy logic and genetic algorithms in problem solving and use of heuristics based on human experience.
- To introduce the ideas of fuzzy sets, fuzzy logic and to become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems.
- To familiarize with genetic algorithms and other random search procedures while seeking global optimum in self – learning situations.

**UNIT I FUZZY COMPUTING**

**9**

Basic Concepts of Fuzzy Logic, Fuzzy Sets and Crisp Sets, Fuzzy Set Theory and Operations, Properties of Fuzzy Sets, Fuzzy and Crisp Relations, Fuzzy to Crisp Conversion Membership Functions, Inference in Fuzzy Logic, Fuzzy If – Then Rules, Fuzzy Implications and Fuzzy Algorithms, Fuzzifications and Defuzzifications, Fuzzy Controller, Industrial Applications.

<b>UNIT II</b>	<b>FUNDAMENTALS OF NEURAL NETWORKS</b>	<b>9</b>
Neuron, Nerve Structure and Synapse, Artificial Neuron and its Model, Activation Functions, Neural Network Architecture: Single Layer and Multilayer Feed Forward Networks, Recurrent Networks. Various Learning Techniques; Perception and Convergence Rule, Auto-Associative and Hetero-Associative Memory.		
<b>UNIT III</b>	<b>BACKPROPAGATION NETWORKS</b>	<b>9</b>
Back Propagation Networks) Architecture: Perceptron Model, Solution, Single Layer Artificial Neural Network, Multilayer Perception Model; Back Propagation Learning Methods, Effect of Learning Rule Co – Efficient ;Back Propagation Algorithm, Factors Affecting Back Propagation Training, Applications.		
<b>UNIT IV</b>	<b>COMPETITIVE NEURAL NETWORKS</b>	<b>9</b>
Kohonen's Self Organizing Map – SOM Architecture, learning procedure – Application; Learning Vector Quantization – learning by LVQ; Adaptive Resonance Theory – Learning procedure – Applications.		
<b>UNIT V</b>	<b>GENETIC ALGORITHM</b>	<b>9</b>
Basic Concepts, Working Principle, Procedures of GA, Flow Chart of GA, Genetic Representations, (Encoding) Initialization and Selection, Genetic Operators, Mutation, Generational Cycle, Applications.		

**TOTAL: 45 PERIODS**

**OUTCOMES:**

On completion of the course, the students will be able to:

- Identify and describe soft computing techniques and their roles in building intelligent machines.
- Recognize the feasibility of applying a soft computing methodology for a particular problem.
- Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
- Apply genetic algorithms to optimization problems.
- Design neural networks to pattern classification and regression problems using soft computing approach.

**REFERENCES:**

1. S. Rajasekaran and G.A. VijayalakshmiPai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications", Prentice Hall of India, 2003.
2. J.S.R. Jang, C.T. Sun and E. Mizutani, "Neuro – Fuzzy and Soft Computing", Pearson Education, ,2004
3. S. N. Sivanandam, S. N. Deepa, "Principles of Soft Computing", Second Edition, Wiley, 2007.
4. SimonHaykin, "Neural Networks", Prentice Hall, 2<sup>nd</sup>Edition,1999.
5. Timothy Ross, "Fuzzy Logic with Engineering Applications", Wiley Publications,4<sup>th</sup>Edition 2016.
6. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Pearson Education, First Edition,2008.

Mapping of COs with POs and PSOs														
COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PSOCO1	2	1											1	
CO2	3	2	1										2	
CO3	3	2											2	
CO4	3	2											2	
CO5	3	2											2	

**MC5042**

**DEEP LEARNING**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To understand how to represent the high-dimensional data, such as images, text and data.
- To explain convolution neural network
- To introduce major deep learning algorithms and their applications to solve real world problems.
- To explore about optimization and generalization in Deep learning
- To understand about deep reinforcement learning

**UNIT I NEURAL NETWORK**

**9**

Building Intelligence Machine-Expressing Linear Perceptron as Neurons-Feed Forward Neural Networks - Activation function. Supervised and Unsupervised Learning:Single Layer Perceptron – Perceptron Learning Algorithm – Least Mean Square Learning Algorithm - Multilayer Perceptron – Back Propagation Algorithm – XOR problem – Limitations of Back Propagation Algorithm- Implementing Neural Networks in TensorFlow.

**UNIT II CONVOLUTION NEURAL NETWORK**

**9**

Introduction-Filter and Feature Maps-Full Description of CNN-Max Pooling- Full Architectural Description of CNN-Image Preprocessing Pipeline Enable More Robust Models-Accelerating Training with Batch Normalization-Visualizing Learning with Convolution Network-Leveraging and Learning Convolution Filters - Predefined Convolutional Filters Network (PCFNet)- Transfer Learning with Convolutional Neural Networks.

**UNIT III DEEP NETWORKS**

**9**

History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks - Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning

**UNIT IV OPTIMIZATION AND GENERALIZATION**

**9**

Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning.

**UNIT V DEEP REINFORCEMENT LEARNING****9**

Markov Decision Processes-Explore versus Exploit-Policy versus Value Learning-Pole-Cart with Policy Gradients-Q Learning and Deep Q Networks-Improving and Moving Beyond DQN

**TOTAL: 45 PERIODS****OUTCOME:**

On completion of the course, the students will be able to

- Describe the fundamental concepts of Neural Networks
- Apply Convolution Neural Network techniques to solve problems in image processing
- Summarize the characteristics of deep Learning
- Comprehend the Optimization and Generalization in Deep Learning
- Interpret the concepts of Deep Reinforcement Learning to solve real world problems.

**REFERENCES**

1. Nikhil Buduma, Nicholas Locascio, “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms”, First Edition, O’ReillyMedia, 2017.
2. SudharsanRavichandiran, Hands on Deep Learning Algorithms with Python, FirstEdition, Packt Publishing Limited, 2019.
3. François Chollet, Deep Learning with Python, First Edition,Manning Publications Company, 2017.
4. Ian Goodfellow, YoshuaBengio and Aaron Courville, Deep Learning, First editionMIT Press, London, 2016

**Mapping of COs with POs and PSOs**

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PSOCO1	2	1											1	
CO2	3	2	1										2	
CO3	3	2											2	
CO4	3	2											2	
CO5	3	2											2	

**MC5043****BIG DATA PROCESSING****L T P C  
3 0 0 3****OBJECTIVES:**

- To know the fundamental concepts of big data and analytics.
- To explore tools and practices for working with big data
- To learn about stream computing.
- To know about the research that requires the integration of large amounts of data.

**UNIT I INTRODUCTION TO BIG DATA****9**

Evolution of Big data – Best Practices for Big data Analytics – Big data characteristics – Validating – The Promotion of the Value of Big Data – Big Data Use Cases- Characteristics of Big Data Applications – Perception and Quantification of Value -Understanding Big Data

Storage – A General Overview of High-Performance Architecture – HDFS – MapReduce and YARN – Map Reduce Programming Model

**UNIT II CLUSTERING AND CLASSIFICATION 9**

Advanced Analytical Theory and Methods: Overview of Clustering – K-means – Use Cases – Overview of the Method – Determining the Number of Clusters – Diagnostics – Reasons to Choose and Cautions .- Classification: Decision Trees – Overview of a Decision Tree – The General Algorithm – Decision Tree Algorithms – Evaluating a Decision Tree – Decision Trees in R – Naïve Bayes – Bayes' Theorem – Naïve Bayes Classifier.

**UNIT III ASSOCIATION AND RECOMMENDATION SYSTEM 9**

Advanced Analytical Theory and Methods: Association Rules – Overview – Apriori Algorithm – Evaluation of Candidate Rules – Applications of Association Rules – Finding Association & finding similarity – Recommendation System: Collaborative Recommendation- Content Based Recommendation – Knowledge Based Recommendation- Hybrid Recommendation Approaches.

**UNIT IV STREAM MEMORY 9**

Introduction to Streams Concepts – Stream Data Model and Architecture – Stream Computing, Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating moments – Counting oneness in a Window – Decaying Window – Real time Analytics Platform(RTAP) applications – Case Studies – Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics

**UNIT V NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION 9**

NoSQL Databases : Schema-less Models: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores – Tabular Stores – Object Data Stores – Graph Databases Hive – Sharding --Hbase – Analyzing big data with twitter – Big data for E-Commerce Big data for blogs – Review of Basic Data Analytic Methods using R.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon completion of the course, the students will be able to:

- Work with big data tools and its analysis techniques
- Analyze data by utilizing clustering and classification algorithms
- Learn and apply different mining algorithms and recommendation systems for large volumes of data
- Perform analytics on data streams
- Learn NoSQL databases and management.

**REFERENCES:**

1. Jure Leskovec Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2<sup>nd</sup> Edition 2016.
2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/Elsevier Publishers, First Edition 2013.

- EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, First Edition, 2015.
- Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, First Edition 2014.
- Dietmar Jannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, First Edition 2010.
- Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers" CRC Press, First Edition 2015.

**MOOC REFERENCES:**

- [www.swayam.gov.in](http://www.swayam.gov.in): Big Data Computing
- [www.coursera.org](http://www.coursera.org): Big Data Essentials: HDFS, MapReduce and Spark RDD
- [www.udemy.com](http://www.udemy.com): Big Data and Hadoop: Interactive Intense Course
- [www.edx.org](http://www.edx.org): Big Data Fundamentals, Processing Big Data with Hadoop in Azure HDInsight

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	√	√	√	√	√				√	√		√	√	√
CO 2	√	√	√	√	√				√	√		√	√	√
CO 3	√	√	√	√	√				√	√		√	√	√
CO 4	√	√	√	√	√				√	√		√	√	√
CO 5	√	√	√	√	√				√	√	√	√	√	√

**MC5044**

**NATURAL LANGUAGE PROCESSING**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To learn the fundamentals of natural language processing
- To understand word level and syntactic analysis.
- To understand the role of semantics of sentences and pragmatics
- To get knowledge about the machine translation.

**UNIT I INTRODUCTION OF BASIC TEXT PROCESSING 9**

Overview: NLP-Language - Basics of Text Processing – Spelling Correction – Weight Edit Distance- other Variations – Noisy Channel Model for spelling correction –N-Gram Language Models – Evaluation of Language models- Basic Smoothing.

**UNIT II LANGUAGE MODELLING AND SMOOTHING 9**

Language modeling – smoothing models – Computational Morphology – Finite state Methods for morphology – Introduction to POS tagging – Hidden Markov model for POS tagging – Models for sequential parsing – MaxEnt- CRF.

**UNIT III SYNTAX, PARSING, SEMANTICS 9**

Syntax – Parsing – CKY-PCFGs – Inside and outside probabilities - Dependency grammar and parsing – Transition based Parsing – Formulation – Learning. MST Based Parsing -

Distributional model for semantics – Word Embeddings - Lexical Semantics-wordNet – Word Sense Disambiguation – Novel word sense detection.

**UNIT IV TOPIC MODELS AND INFORMATION EXTRACTION 9**

Topic Model- Latent Dirichlet Allocation – Gibbs sampling for LDA – Formulation and Application – LDA Variants- Entity Linking - Information extraction – Relation extraction- Distant Supervision

**UNIT V TEXT SUMMARIZATION & TEXT CLASSIFICATION 9**

Optimization Based models for summarization – Evaluation- Text classification – sentiment analysis - Affective lexicon -Learning affective lexicons - computing with affective lexicons

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon completion of the course, the students will be able to:

- To tag a given text with basic Language features
- To design an innovative application using NLP components
- To implement a rule based system to tackle morphology/syntax of a language
- To design a tag set to be used for statistical processing for real-time applications
- To apply NLG and machine translation

**REFERENCES:**

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 3<sup>rd</sup> Edition, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, OReilly Media, 2009.
3. Breck Baldwin, Language Processing with Java and LingPipe Cookbook, 1<sup>st</sup> Edition, Atlantic Publisher, 2015.
4. Richard M Reese, Natural Language Processing with Java, 2<sup>rd</sup> Edition, OReilly Media, 2015.
5. NitinIndurkha and Fred J. Damerau, —Handbook of Natural Language Processing, 2<sup>rd</sup> Edition, Chapman and Hall/CRC Press, 2010.

**Mapping of COs with POs and PSOs**

COs/POs & PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PSOCO1	2	1											2	
CO2	2	1											2	
CO3	2	1											2	
CO4	2	1											2	
CO5	2	1											2	

**OBJECTIVES:**

- To introduce Mathematical Logic and their rules for validating arguments and programmes.
- To introduce counting principles for solving combinatorial problems.
- To give exposure to Graph models and their utility in connectivity problems.
- To introduce abstract notion of Algebraic structures for studying cryptographic and its related areas.
- To introduce Boolean algebra as a special algebraic structure for understanding logical circuit problems.

**UNIT I      LOGIC AND PROOFS      9**

Propositional Logic – Propositional Equivalences – Predicates and Quantifiers – Nested Quantifiers – Rules of Inference – Introduction to Proofs – Proof Methods and Strategy.

**UNIT II      COMBINATORICS      9**

Mathematical Induction – Strong Induction and Well Ordering – The Basics of Counting - The Pigeonhole Principle – Permutations and Combinations – Recurrence Relations Solving Linear Recurrence Relations Using Generating Functions – Inclusion – Exclusion – Principle and Its Applications.

**UNIT III      GRAPHS      9**

Graphs and Graph Models – Graph Terminology and Special Types of Graphs – Matrix Representation of Graphs and Graph Isomorphism – Connectivity – Euler and Hamilton Paths.

**UNIT IV      ALGEBRAIC STRUCTURES      9**

Groups – Subgroups – Homomorphisms – Normal Subgroup and Coset – Lagrange's Theorem – Definitions and Examples of Rings and Fields.

**UNIT V      LATTICES AND BOOLEAN ALGEBRA      9**

Partial Ordering – Posets – Lattices as Posets – Properties of Lattices – Lattices as Algebraic Systems – Sub Lattices – Direct Product And Homomorphism – Some Special Lattices – Boolean Algebra.

**TOTAL: 45 PERIODS**

**REFERENCE BOOKS:**

1. Kenneth H.Rosen, "Discrete Mathematics and its Applications", Tata Mc Graw Hill Pub. Co.Ltd., Seventh Edition, Special Indian Edition, New Delhi, 2011.
2. Tremblay J.P. and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, 30<sup>th</sup> Reprint, New Delhi, 2011.
3. Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Pearson Education, 3<sup>rd</sup> Edition, New Delhi, 2014.
4. ThomasKoshy, "Discrete Mathematics with Applications", 2<sup>nd</sup> Edition, Elsevier Publications, Boston, 2006.
5. SeymourLipschutz and Mark Lipson,"Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., Third Edition, New Delhi, 2013.

**OUTCOMES:**

Upon completion of the module the student should able to:

- Apply Mathematical Logic to validate logical arguments and programmes.

- Apply combinatorial counting principles to solve application problems.
- Apply graph model and graph techniques for solving network other connectivity related problems.
- Apply algebraic ideas in developing cryptograph techniques for solving network security problems.
- Apply Boolean laws in developing and simplifying logical circuits.

**BX5001                      PROBLEM SOLVING AND PROGRAMMING IN C                      L T P C**  
**3 0 2 4**

**OBJECTIVES:**

- To understand the basic concepts of problem solving approaches and to develop the algorithms
- Apply the techniques of structured (functional) decomposition to break a program into smaller pieces and describe the mechanics of parameter passing.
- To design, implements, test, and apply the basic C programming concepts.

**UNIT I                      INTRODUCTION TO COMPUTER PROBLEM SOLVING                      15**

Introduction – The Problem Solving aspect – Top down design – Implementation of algorithm – Program Verification – The efficiency of algorithms – The analysis of algorithms – Fundamental Algorithms

**UNIT II                      PROGRAMMING AND ALGORITHMS                      15**

Programs and Programming – building blocks for simple programs -pseudo code representation – flow charts - Programming Languages - compiler –Interpreter, Loader and Linker - Program execution – Classification of Programming Language - Structured Programming Concept – Illustrated Problems: Algorithm to check whether a given number is Armstrong number or not- Find factorial of a number.

**UNIT III                      BASICS OF 'C', INPUT / OUTPUT & CONTROL STATEMENTS                      15**

Introduction- Identifier – Keywords - Variables – Constants – I/O Statements - Operators - Initialization –Expressions – Expression Evaluation – Lvalues and Rvalues – Type Conversion in C –Formatted input and output functions - Specifying Test Condition for Selection and Iteration- Conditional Execution - and Selection – Iteration and Repetitive Execution- go to Statement – Nested Loops- Continue and break statements. Programs to be implemented:

1. Write a program to find whether the given year is leap year or Not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
2. Write a program to perform the Calculator operations, namely, addition, subtraction, multiplication, division and square of a number.

**UNIT IV                      ARRAYS, STRINGS, FUNCTIONS AND POINTERS                      15**

Array – One dimensional Character Arrays- Multidimensional Arrays- Arrays of Strings – Two dimensional character array – functions - parameter passing mechanism scope – storage classes – recursion - comparing iteration and recursion- pointers – pointer operators - uses of pointers- arrays and pointers – pointers and strings - pointer indirection pointers to functions - Dynamic memory allocation.

1. Write a program in C to get the largest element of an array using the function.
2. Display all prime numbers between two intervals using functions.
3. Reverse a sentence using recursion.

4. Write a C program to concatenate two strings.
5. Find the frequency of a character in a string.

#### **UNIT V USER-DEFINED DATATYPES & FILES**

**15**

Structures – initialization - nested structures – structures and arrays – structures and pointers - union– type def and enumeration types - bit fields - File Management in C – Files and Streams – File handling functions – Sequential access file- Random access file – Command line arguments.

1. Write a C program to Store Student Information in Structure and Display it.
2. The annual examination is conducted for 10 students for five subjects.
3. Write a program to read the data and determine the following:
  - (a) Total marks obtained by each student.
  - (b) The highest marks in each subject and the marks of the student who secured it.
  - (c) The student who obtained the highest total marks.

**TOTAL: 75PERIODS**

#### **OUTCOMES:**

- Able to design a computational solution for a given problem.
- Able to break a problem into logical modules that can be solved (programmed).
- Able to transform a problem solution into programs involving programming constructs.
- To write programs using structures, strings, arrays, pointer and files for solving complex computational problem.
- Able to introduce modularity using functions and pointers which permit ad hoc runtime polymorphism.

#### **REFERENCES:**

1. Deitel and Deitel, “C How to Program”, Pearson Education. 2013, 7<sup>th</sup> Edition
2. Byron S Gottfried, —Programming with C, Schaums Outlines, Second Edition, Tata McGraw-Hill, 2006.
3. Brian W. Kernighan and Dennis M. Ritchie, “The C programming Language”, Edition? 2<sup>nd</sup> edition 2015, Pearson Education India
4. How to solve it by Computer, R. G. Dromey, Pearson education, Fifth Edition, 2007.
5. Kamthane, A.N., “Programming with ANSI and Turbo C”, Pearson Education, Delhi, 3<sup>rd</sup> Edition, 2015.
6. Mastering C- by K R Venugopal, Sudeep R Prasad McGraw Hill Education (India) Private Limited; Second edition 2015.
7. PradipDey, ManasGhosh, —Computer Fundamentals and Programming in C, Second Edition, Oxford University Press, 2013.

#### **BX5002 DIGITAL LOGIC AND COMPUTER ORGANISATION**

**L T P C  
3 0 0 3**

#### **OBJECTIVES:**

- To become familiar with Boolean algebra
- To study the different types of combinational and sequential circuits
- To comprehend the basis operations that happen in a CPU
- To learn the data path and control path implementation
- To become familiar with the memory hierarchy design and I/O design

#### **UNIT I DIGITAL FUNDAMENTALS**

**8**

Number Systems and Conversions – Boolean Algebra and Simplifications – Minimization of Boolean Functions – Karnaugh Map, QuineMcClusky Method. Logic Gates – NAND NOR implementation.

**UNIT II COMBINATIONAL AND SEQUENTIAL CIRCUITS 10**

Design of Circuits – Adder /Subtractor – Encoder – Decoder – MUX /DEMUX – Comparators, Flip flops – Triggering – Master – Slave Flip Flop – State Diagram and Minimization – Counters - Registers

**UNIT III BASIC STRUCTURE OF COMPUTER 9**

Functional Units - Basic Operational Concepts – Bus structures – Performance and Metrics – instruction and instruction sequencing – Hardware Software Interface – Addressing modes – Instruction Sets – RISC and CISC – ALU Design – Fixed point and Floating point operations

**UNIT IV PROCESSOR DESIGN 9**

Processor basics – CPU Organization – Data Path Design – Control Design – Basic concepts – Hardwired control – Micro Programmed control – Pipe control – Hazards super scale operations

**UNIT V MEMORY AND I/O SYSTEMS 9**

Memory technology – Memory Systems- Virtual Memory – Caches – Design Methods – Associative memories – Input /output system – Programmed I/O – DMA and interrupts – I/O devices and Interfaces

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon Completion of the course, the students will be able to

- Simplify using laws of Boolean algebra and Karnaugh map method
- Design various combinational and sequential circuits
- Differentiate between various addressing modes
- Differentiate between the various mapping policies used in cache memories
- Discuss the various types of I/O transfers

**REFERENCES:**

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, “Computer Organization and Embedded Systems”, 6<sup>th</sup> Edition, Tata McGraw Hill, 2012.
2. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, fifth edition, “Computer Organisation” 5<sup>th</sup> Edition, Tata McGraw Hill, 2002.
3. Charles H. Roth, Jr., “Fundamentals of Logic Design”, Jaico Publishing House, Mumbai, 4<sup>th</sup> Edition 1992.
4. David A. Patterson and John L. Hennessy, “Computer Organization and Design: The Hardware/Software Interface”, 2<sup>nd</sup> Edition, Morgan Kaufmann, 2002. Morris Mano “Digital Design”, Prentice Hall of India 1997
5. John P. Hayes, “Computer Architecture and Organization”, 3<sup>rd</sup> Edition, Tata McGraw Hill, 1998
6. William Stallings, “Computer Organization & Architecture – Designing for Performance” 6<sup>th</sup> Edition, Pearson Education, 2003.

**OBJECTIVES**

- To be familiar with the basic concepts and functions of Operating Systems
- To understand Processes and Threads
- To analyze Scheduling algorithms
- To gain expertise in various Memory Management schemes
- To expose with various I/O Management and File systems

**UNIT I OS OVERVIEW 9**

Instruction Execution-Memory Hierarchy-Direct Memory Access- Types of Operating Systems- Operating Systems Services-Operation on Processes-Co-operating processes-System Calls-System Programs-Evolution of OS-OS Structure.

**UNIT II PROCESS SYNCHRONIZATION 9**

Processes-Process Concept-Process Synchronization-Critical Regions - Critical Section Problem – InterProcess Communication-Synchronization Hardware-Mutex Locks – Semaphores-Classical problems of Synchronization – Monitors – Threads – Overview-Multithreading Models-Threading Issues.

**UNIT III PROCESS SCHEDULING 9**

Process Scheduling-Scheduling mechanisms-Strategy selection-Pre emptive and Non pre emptive strategies-Scheduling criteria-Scheduling Algorithms-Multiprocessor Scheduling.

**UNIT IV STORAGE MANAGEMENT 9**

Main Memory – Background-Mapping Address space to Memory space – Swapping-Contiguous Memory allocation-Memory Allocation Strategies – Paging – Segmentation-Virtual Memory-Page Replacement – Thrashing.

**UNIT V FILE SYSTEMS AND I/O SYSTEMS 9**

Disk structures-Disk Scheduling and Management-File System Interface-File Concepts-Access Methods-Directory Structures-Directory Organization–Filesystem Mounting–Filesharing and Protection–Filesystem Implementation-Allocation Methods-Free space Management-Efficiency and Performance – Recovery.

**TOTAL:45 PERIODS****OUTCOMES:**

Upon completion of the course, the student will be able to

- Deliver the main concepts, structure and functions of Operating Systems
- Implement the algorithms in Process management and solving the issues of IPC
- Analyze various Scheduling Algorithms
- Demonstrate the mapping between Physical memory and Virtual memory
- Understand the functionality of File systems in OS perspective

**REFERENCE BOOKS:**

1. Abraham Silberschatz Peter B Galvin&G.Gagne, "Operating Systems Concepts", Ninth Edition, Addison Wesley Publishing Co.,2012.
2. Andrew S.Tanenbaum, "Modern operating Systems", Fourth Edition, Pearson Education, 2016.
3. William Stallings, "Operating Systems: Internals and Design Principles",Seventh Edition, PrenticeHall, 2011.



**REFERENCES:**

1. A.K. Sharma, "Data Structures using C", 2<sup>nd</sup> Edition, Pearson Education Asia, 2013
2. AnanyLevitin "Introduction to the Design and Analysis of Algorithms" 3<sup>rd</sup> Edition, Pearson Education 2012
3. E. Horowitz, Anderson-Freed and S.Sahni, "Fundamentals of Data structures in C", 2<sup>nd</sup> Edition, University Press, 2007
4. E.Balagursamy," Data Structures using C", Tata McGraw Hill 2015 Reprint
5. M. A. Weiss, "Data Structures and Algorithm Analysis in C", 3<sup>rd</sup> Edition, Pearson Education Asia, 2013.

**BX5005          PROGRAMMING AND DATA STRUCTURES USING C LABORATORY****L T P C****0 0 4 2****OBJECTIVES:**

To develop skills in design and implementation of data structures and their applications

- To learn and implement linear, non linear and tree data structures
- To study, implement and analyze the sorting technique.

**LIST OF EXPERIMENTS**

1. Array- Insertion and Deletion
2. Application using array of structures
3. Array Implementation of Stack
4. Array Implementation of Queue
5. Infix to postfix conversion
6. Singly Linked List operations
7. Polynomial manipulation- addition, subtraction
8. Binary Tree Traversal
9. Quick Sort
10. Binary Search

**TOTAL: 60 PERIODS****OUTCOMES:**

Upon Completion of the course, the students will be able to:

- Work with basic data structures that are suitable for the problems to be solved efficiently.
- Implement stack & queue techniques for related problems
- Implement prefix and post fix conversion
- Design and implement linear, and tree and its applications
- Design sorting technique, its algorithm design and analysis.

**BX5006          DATABASE MANAGEMENT SYSTEMS****L T P C****3 0 0 3****OBJECTIVES:**

- To understand the fundamentals of data models and conceptualize and depict a database system using ER diagram.
- To make a study of SQL and relational database design.

- To know about data storage techniques and query processing.
- To impart knowledge in transaction processing, concurrency control techniques and recovery procedures.

**UNIT I INTRODUCTION 9**

File systems versus Database systems – Data Models – DBMS Architecture – Data Independence – Data Modeling using Entity – Relationship Model – Enhanced E-R Modeling.

**UNIT II RELATIONAL MODEL AND QUERY EVALUATION 9**

Relational Model Concepts – Relational Algebra – SQL – Basic Queries – Complex SQL Queries – Views – Constraints – Relational Calculus – Tuple Relational Calculus – Domain Relational Calculus

**UNIT III DATABASE DESIGN & APPLICATION DEVELOPMENT 9**

Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

**UNIT IV TRANSACTION PROCESSING 9**

Transaction Processing – Properties of Transactions - Serializability – Transaction support in SQL - Locking Techniques – Time Stamp ordering – Validation Techniques – Granularity of Data Items – Recovery concepts – Shadow paging – Log Based Recovery.

**UNIT V FILES AND INDEXING 9**

File operations – Hashing Techniques – Indexing – Single level and Multi-level Indexes – B+ tree – Static Hashing - Indexes on Multiple Keys.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Understand the basic concepts of the database and data models.
- Design a database using ER diagrams and map ER into Relations and normalize the relations
- Acquire the knowledge of query evaluation to monitor the performance of the DBMS.
- Develop a simple database applications using normalization.
- Acquire the knowledge about different special purpose databases and to critique how they differ from traditional database systems.

**REFERENCES:**

1. Abraham Silberschatz, Henry F.Korth and S.Sundarshan “Database System Concepts”, Seventh Edition, McGraw Hill, 2017.
2. RamezElamassri and ShankantBNavathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education Delhi, 2017.
3. RaghuRamakrishnan, —Database Management SystemsII, Fourth Edition, McGrawHill College Publications, 2015.
4. Lee Chao, “Database Development and Management”, Auerbach Publications, 1<sup>st</sup> edition, 2010
5. Carlos Coronel, Peter Rob, and Stephen Morris, “Database Principles Fundamentals of Design, Implementation, and Management –10th Edition”, Course Technology, Cengage Learning, 2013.
6. C.J. Date, “An Introduction to Database Systems”, Eighth Edition, Pearson Education Delhi, 2003.



3. Use the frameworks JSP, Hibernate, Spring
4. Design and implement server side programs using Servlets and JSP
5. Make use of networking concepts in Java

**REFERENCES:**

1. R. Nageswara Rao, “Core Java: An **Integrated Approach**”, DreamTech Press, Edition 2016
2. Amritendu De, “Spring 4 and Hibernate 4: Agile Java Design and Development”, McGraw-Hill Education, Illustrated Edition, 2015
3. Herbert Schildt, The Complete Reference – Java 2, Ninth Edition, Tata McGrawHill, 2014
4. Joyce Farrell, “Java Programming”, Cengage Learning, Seventh Edition, 2014
5. John Dean, Raymond Dean, “Introduction to Programming with JAVA – A Problem Solving Approach”, Tata Mc Graw Hill, Second Edition, 2014.
6. Mahesh P. Matha, “Core Java A Comprehensive Study”, Prentice Hall of India, First Edition, 2011

**BX5008**

**SOFTWARE ENGINEERING**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To provide an insight into software life cycle and various software process models
- To estimate the resources for developing the application and to prepare the schedule
- .To know the various designing concepts and notations for modeling the software.
- To prepare the test cases for the project, apply various testing techniques, strategies and metrics to evaluate the software.
- To construct software with high quality and reliability.

**UNIT I INTRODUCTION 9**

Software Engineering Paradigms – Waterfall Life Cycle Model – Spiral Model – Prototype Model – Agile Process Model – Unified Process Model - Planning – Software Project Scheduling – SRS - Case Study: Project Plan and SRS

**UNIT II SOFTWARE DESIGN 9**

Designing Concepts - Abstraction – Modularity – Software Architecture – Cohesion – Coupling – Dataflow Oriented Design - Jackson System Development - Real time and Distributed System Design – Designing for Reuse — Case Study : Design for any Application Oriented Project.

**UNIT III SOFTWARE TESTING AND MAINTENANCE 9**

Software Testing Fundamentals – Software Testing Strategies – Black Box Testing – White Box Testing – System Testing – Object Orientation Testing – State Based Testing - Testing Tools – Test Case Management – Types of Maintenance – Case Study: Testing Techniques.

**UNIT IV SOFTWARE METRICS 9**

Scope – Classification of metrics – Measuring Process and Product attributes – Direct and Indirect measures – Cost Estimation - Reliability – Software Quality Assurance – Standards – Case Study for COCOMO model.

**UNIT V SCM & WEB ENGINEERING 9**

Need for SCM – Version Control – SCM process – Software Configuration Items – Taxonomy – Re Engineering – Reverse Engineering - Web Engineering - CASE Repository – Features.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Able to understand the problem domain to choose process models and to develop SRS
- Able to model software projects using appropriate design notations
- Able to measure the product and process performance using various metrics
- Able to evaluate the system with various testing techniques and strategies
- Able to analyze, design, verify, validate, implement, and maintain software systems.

**REFERENCES**

1. Roger S. Pressman, “Software Engineering: A Practitioner Approach”, Seventh Edition, Tata McGraw – Hill International Edition, 2010
2. Richard Fairley, “Software Engineering Concepts”, Tata McGraw Hill Edition, 2008
3. Ali Behforrooz, Frederick J.Hudson, “Software Engineering Fundamentals”, Oxford Indian Reprint, First Edition, 2012.
4. Sommerville, “Software Engineering”, Tenth Edition, Pearson, 2016.
5. PankajJalote, “An Integrated approach to Software Engineering”, Third Edition, NarosaPublications, 2011.

**BX5009 BASICS OF COMPUTER NETWORKS L T P C  
3 0 0 3**

**OBJECTIVES:**

- To understand networking concepts and basic communication model
- To understand network architectures and components required for data communication.
- To analyze the function and design strategy of physical, data link, network layer and transport layer
- To acquire basic knowledge of various application protocol for internet security issues and services.

**UNIT I NETWORK FUNDAMENTALS 9**

Uses of Networks – Categories of Networks -Communication model –Data transmission concepts and terminology – Protocol architecture – Protocols – OSI – TCP/IP – LAN Topology - Transmission media .

**UNIT II DATA LINK LAYER 9**

Data link control - Flow Control – Error Detection and Error Correction - MAC – Ethernet, Token ring, Wireless LAN MAC – Blue Tooth – Bridges.

**UNIT III NETWORK LAYER 9**

Network layer – Switching concepts – Circuit switching – Packet switching –IP — Datagrams —IP addresses- IPV6– ICMP – Routing Protocols – Distance Vector – Link State- BGP.

**UNIT IV TRANSPORT LAYER 9**

Transport layer –service –Connection establishment – Flow control – Transmission control protocol – Congestion control and avoidance – User datagram protocol. -Transport for Real Time Applications (RTP).

**UNIT V APPLICATIONS AND SECURITY 9**

Applications - DNS- SMTP – WWW –SNMP- Security –threats and services - DES- RSA.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Able to trace the flow of information from one node to another node in the network
- Able to Identify the components required to build different types of networks
- Able to understand the functionalities needed for data communication into layers
- Able to choose the required functionality at each layer for given application
- Able to understand the working principles of various application protocols and fundamentals of security issues and services available.

**REFERENCES:**

1. Larry L. Peterson & Bruce S. Davie, “Computer Networks – A systems Approach”, Fifth Edition, Morgan Kaufmann, 2012.
2. James F. Kurose, Keith W. Ross, “Computer Networking: A Top-down Approach, Pearson Education, Limited, sixth edition, 2012.
3. AndrewS.Tannenbaum, David J. Wetherall, “Computer Networks” Fifth Edition, Pearson Education 2011.
4. Forouzan, “Data Communication and Networking”, Fifth Edition , TMH 2012.
5. William Stallings, —Data and Computer Communicationsll, Tenth Edition, Pearson Education, 2013.

**BX5010 JAVA PROGRAMMING LABORATORY**

**L T P C**

**0 0 4 2**

**OBJECTIVES:**

To develop skills in design and implementation of object oriented concepts and networking applications

- To learn and implement class, interface and package
- To study, implement and analyze the client server and remote programming.

**LIST OF EXPERIMENTS**

1. Write Java programs by making use of class, interface, package, etc for the following  
Different types of inheritance study  
# Uses of 'this' keyword  
# Polymorphism  
# Creation of user specific packages  
# Creation of jar files and using them  
# User specific exception handling
2. Writing window based GUI applications using frames and applets such as Calculator application, Fahrenheit to Centigrade conversion etc.
3. Application of threads examples
4. Create an Application to search Phone Number using contact Name Using Hash Map.
5. Create an Application which finds the Duplicates in E-mail using Set Interface.
6. Writing an RMI application to access a remote method
7. Writing a Servlet program with database connectivity for a web based application such as students result status checking, PNR number enquiry etc.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

Upon Completion of the course, the students will be able to:

- Work with basic Object Oriented programming concepts that are suitable for the problems to be solved efficiently.
- Implement frames and applets for related problems
- Implement prefix and post fix conversion
- Design and implement Threads in Java
- Design Remote method invocation

**BX5011**

**DATABASE PROGRAMMING LABORATORY**

**L T P C**

**0 0 4 2**

**OBJECTIVES:**

- To understand the concepts of DBMS.
- To familiarize with SQL queries.
- To write stored procedures in DBMS.
- To learn front end tools to integrate with databases.

**LIST OF EXPERIMENTS:**

1. Creation of base tables and views

2. Data Manipulation INSERT, DELETE and UPDATE in Tables. SELECT, Sub Queries
3. Data Control Commands
4. High level language extensions – PL/SQL Or Transact SQL – Packages
5. Use of Cursors, Procedures and Functions
6. Embedded SQL or Database Connectivity
7. Oracle or SQL Server Triggers – Block Level – Form Level Triggers
8. Working with Forms, Menus and ReportWriters for a application project in any domain
9. Develop a database application using Java/ Django/PHP/.NET as Front end

**TOTAL: 60 PERIODS**

Upon Completion of the course, the students will be able to:

- Design and Implement databases
- Formulate complex queries using SQL
- Implement procedures, Cursors and Function
- Implement Triggers
- Design and Implement applications that have GUI and access databases for backend connectivity

**ANNA UNIVERSITY, CHENNAI**  
**AFFILIATED COLLEGES**  
**REGULATIONS - 2017**  
**M.E. AERONAUTICAL ENGINEERING**  
**CHOICE BASED CREDIT SYSTEM**

**PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):**

- I. **PEO 1:** Successful Moulding of Graduate into Aeronautical Engineering Professional:  
Graduates of the programme will acquire adequate knowledge both in practical and theoretical domains in the field of Aeronautical Engineering through rigorous post graduate education.
- II. **PEO 2:** Successful Career Development:  
Graduates of the programme will have successful technical and managerial career in Aeronautical Engineering industries and the allied management.
- III. **PEO 3:** Contribution to Aeronautical Engineering Field:  
Graduates of the programme will have innovative ideas and potential to contribute for the development and current needs of the Aviation industries.
- IV. **PEO 4:** Sustainable interest for Lifelong learning:  
Graduates of the programme will have sustained interest to learn and adapt new Technology developments to meet the changing industrial scenarios.

**PROGRAMME OUTCOMES (POs)**

On successful completion of the programme,

1. Post Graduate will acquire the ability to design and conduct experiments, as well as to analyze and interpret data in the field of Aeronautical Engineering.
2. Post Graduate will have the ability to design a system or a component to meet the design requirements with constraints exclusively meant for Aeronautical Engineering.
3. Post Graduate will become familiar with modern engineering tools and analyze problems within the domains of Aeronautical Engineering
4. Post Graduate will acquire an understanding of professional and ethical responsibility with reference to their career in the field of Aeronautical Engineering and other allied professional fields.
5. Post Graduate will be able to communicate effectively both in verbal and nonverbal forms.
6. Post Graduate will be trained towards developing and understanding the importance of design and development of Airplanes from system integration point of view.
7. Post Graduate will be capable of understanding the value of lifelong learning.
8. Post Graduate will exhibit the awareness of contemporary issues focusing on the necessity to develop new materials, design and testing methods for the solution of problems related to aircraft industry.
9. Post Graduate will have a firm scientific, technological and communication base that helps him to find a placement in the aircraft industry and Research & Development organizations related to Aeronautical Engineering and other professional fields.
10. Post Graduate will be capable of doing doctoral studies and research in inter and multidisciplinary areas.

### Mapping of PEOs with Pos

Programme Educational Objectives	Programme Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
I	✓	✓	✓	✓				✓		✓
II				✓	✓	✓		✓	✓	
III		✓		✓		✓		✓	✓	
IV			✓				✓	✓		✓

### MAPPING OF POS WITH SUBJECTS

YEAR	SEM	COURSE TITLE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10		
YEAR I	SEM I	Advanced Mathematical Methods	✓		✓				✓		✓	✓		
		Aerodynamics	✓	✓	✓	✓		✓	✓		✓	✓		
		Aircraft Structural Mechanics	✓	✓	✓	✓		✓	✓		✓	✓		
		Aerospace Propulsion	✓	✓	✓	✓		✓	✓		✓	✓		
		Theory of Vibrations	✓	✓	✓			✓			✓	✓		
		Professional Elective I												
		<b>Practical</b>												
		Aerodynamics Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	Technical Seminar - I			✓	✓	✓		✓						
	SEM II	Flight Mechanics	✓	✓					✓	✓	✓		✓	
		Finite Element Methods	✓	✓	✓	✓			✓	✓			✓	
		Computational Fluid Dynamics for Aerospace Applications	✓	✓	✓	✓			✓	✓			✓	
		Composite Materials and Structures	✓	✓					✓	✓	✓		✓	
		Professional Elective II												
		Professional Elective III												
		<b>Practical</b>												
Structures Laboratory		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
CFD/FEA Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
YEAR II	SEM III	Professional Elective IV												
		Professional Elective V												
		<b>Practical</b>												
	Project Work Phase I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
	Technical Seminar II			✓	✓	✓		✓		✓				
	SEM IV	Project Work Phase II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		

**List of Electives**  
**MAPPING OF POS WITH SUBJECTS**  
**Semester: I Electives**

S.No.	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
1	Boundary Layer Theory	✓		✓			✓		✓		
2	Aircraft Design	✓	✓	✓	✓		✓	✓	✓	✓	✓
3	Theory of Elasticity	✓	✓				✓		✓		
4	Rocketry and Space Mechanics	✓	✓		✓		✓			✓	✓
5	Experimental Stress Analysis	✓	✓	✓			✓	✓	✓	✓	✓

**Semester: II Electives**

S.No	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
1	Theory of Plates and Shell	✓	✓				✓		✓		✓
2	High Temperature Problems in Structures		✓	✓			✓		✓	✓	
3	Fatigue and Fracture Mechanics	✓	✓	✓			✓		✓		✓
4	Industrial Aerodynamics	✓	✓		✓		✓	✓	✓	✓	
5	Hypersonic Aerodynamics		✓	✓			✓		✓		✓
6	Computational Heat Transfer		✓	✓			✓		✓		✓
7	Wind power Engineering	✓	✓	✓	✓		✓		✓		
8	Advanced Propulsion System	✓	✓	✓			✓				✓
9	Data Analytics	✓	✓	✓			✓			✓	✓

**Semester: III Electives**

S.No	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
1	Aero Elasticity		✓				✓				
2	Design and Analysis of Turbo Machines	✓	✓	✓			✓				
3	Helicopter Aerodynamics		✓				✓				
4	Experimental Aerodynamics	✓	✓				✓	✓	✓	✓	
5	High Temperature Gas Dynamics		✓	✓							✓
6	High Speed Jet Flows		✓	✓							
7	Combustion in Jet and Rocket Engines		✓							✓	
8	Propeller Aerodynamics		✓	✓							✓
9	Aircraft Guidance and Control	✓	✓	✓			✓				✓
10	Avionics	✓	✓	✓			✓			✓	

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**REGULATIONS 2017**  
**M.E. AERONAUTICAL ENGINEERING**  
**CHOICE BASED CREDIT SYSTEMS**  
**I TO IV SEMESTERS (FULL TIME) CURRICULUM AND SYLLABUS**

**SEMESTER I**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIOD	L	T	P	C
<b>THEORY</b>								
1.	MA5151	Advanced Mathematical Methods	FC	4	4	0	0	4
2.	AO5151	Aerodynamics	PC	3	3	0	0	3
3.	AO5101	Aircraft Structural Mechanics	PC	5	3	2	0	4
4.	AO5102	Aerospace Propulsion	FC	5	3	2	0	4
5.	AO5103	Theory of Vibrations	PC	3	3	0	0	3
6.		Professional Elective I	PE	3	3	0	0	3
<b>PRACTICAL</b>								
7.	AO5161	Aerodynamics Laboratory	PC	4	0	0	4	2
8.	AO5111	Technical Seminar – I	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>29</b>	<b>19</b>	<b>4</b>	<b>6</b>	<b>24</b>

**SEMESTER II**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIOD	L	T	P	C
<b>THEORY</b>								
1.	AO5251	Flight Mechanics	PC	3	3	0	0	3
2.	AO5252	Finite Element Methods	PC	5	3	2	0	4
3.	AO5253	Computational Fluid Dynamics for Aerospace Applications	PC	3	3	0	0	3
4.	AO5254	Composite Materials and Structures	PC	3	3	0	0	3
5.		Professional Elective II	PE	3	3	0	0	3
6.		Professional Elective III	PE	3	3	0	0	3
<b>PRACTICAL</b>								
7	AO5261	Structures Laboratory	PC	4	0	0	4	2
8	AO5211	CFD/FEA Laboratory	EEC	4	0	0	4	2
<b>TOTAL</b>				<b>28</b>	<b>18</b>	<b>2</b>	<b>8</b>	<b>23</b>

**SEMESTER III**

<b>SL. NO</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>CONTACT PERIOD</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>								
1.		Professional Elective IV	PE	3	3	0	0	3
2.		Professional Elective V	PE	3	3	0	0	3
<b>PRACTICAL</b>								
3.	AO5312	Project Work Phase I	EEC	12	0	0	12	6
4.	AO5311	Technical Seminar - II	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>20</b>	<b>6</b>	<b>0</b>	<b>14</b>	<b>13</b>

**SEMESTER IV**

<b>SL. NO</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>CONTACT PERIOD</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>PRACTICAL</b>								
1.	AO5411	Project Work Phase II	EEC	24	0	0	24	12
<b>TOTAL</b>				<b>24</b>	<b>0</b>	<b>0</b>	<b>24</b>	<b>12</b>

**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 72**

**FOUNDATION COURSES (FC)**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MA5151	Advanced Mathematical Methods	FC	4	4	0	0	4
2.	AO5102	Aerospace Propulsion	FC	5	3	2	0	4

**PROFESSIONAL CORE (PC)**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	AO5151	Aerodynamics	PC	5	3	2	0	4
2.	AO5101	Aircraft Structural Mechanics	PC	5	3	0	0	3
3.	AO5103	Theory of Vibrations	PC	3	3	0	0	3
4.	AO5161	Aerodynamics Laboratory	PC	4	0	0	4	2
5.	AO5251	Flight Mechanics	PC	5	3	0	0	3
6.	AO5252	Finite Element Methods	PC	5	3	2	0	4
7.	AO5253	Computational Fluid Dynamics for Aerospace Applications	PC	3	3	0	0	3
8.	AO5254	Composite Materials and Structures	PC	3	3	0	0	3
9.	AO5261	Structures Laboratory	PC	4	0	0	4	2

**LIST OF ELECTIVES FOR M.E. AERONAUTICAL ENGINEERING**  
**SEMESTER I (Elective I)**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIOD	L	T	P	C
1	AO5001	Boundary Layer Theory	PE	3	3	0	0	3
2	AO5002	Aircraft Design	PE	3	3	0	0	3
3	AO5003	Theory of Elasticity	PE	3	3	0	0	3
4	AO5071	Rocketry and Space Mechanics	PE	3	3	0	0	3
5	AO5004	Experimental Stress Analysis	PE	3	3	0	0	3

**SEMESTER II (Elective II & III)**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIOD	L	T	P	C
1	AO5005	Theory of Plates and Shells	PE	3	3	0	0	3
2	AO5006	High Temperature Problems in Structures	PE	3	3	0	0	3
3	AO5074	Fatigue and Fracture Mechanics	PE	3	3	0	0	3
4	AO5007	Industrial Aerodynamics	PE	3	3	0	0	3
5	AO5091	Hypersonic Aerodynamics	PE	3	3	0	0	3
6	AO5072	Computational Heat Transfer	PE	3	3	0	0	3
7	AO5008	Wind Power Engineering	PE	3	3	0	0	3
8	AO5073	Advanced Propulsion Systems	PE	3	3	0	0	3
9	IL5091	Data Analytics	PE	3	3	0	0	3

**SEMESTER III (Elective IV & V)**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIOD	L	T	P	C
1	AO5010	Aero Elasticity	PE	3	3	0	0	3
2	EY5092	Design and Analysis of Turbomachines	PE	3	3	0	0	3
3	AO5011	Helicopter Aerodynamics	PE	3	3	0	0	3
4	AO5012	Experimental Aerodynamics	PE	3	3	0	0	3
5	AO5013	High Temperature Gas Dynamics	PE	3	3	0	0	3
6	AO5075	High Speed Jet Flows	PE	3	3	0	0	3
7	AO5014	Combustion in Jet and Rocket Engines	PE	3	3	0	0	3
8	AO5015	Propeller Aerodynamics	PE	3	3	0	0	3
9	AO5009	Aircraft Guidance and Control	PE	3	3	0	0	3
10	AO5092	Avionics	PE	3	3	0	0	3

**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	AO5211	CFD/FEA Laboratory	EEC	4	0	0	4	2
2.	AO5312	Project Work Phase I	EEC	12	0	0	12	6
3.	AO5311	Technical Seminar - II	EEC	2	0	0	2	1
4.	AO5411	Project Work Phase II	EEC	24	0	0	24	12

**OBJECTIVES :**

The main objective of this course is to provide the student with a repertoire of mathematical methods that are essential to the solution of advanced problems encountered in the fields of applied physics and engineering. This course covers a broad spectrum of mathematical techniques such as Laplace Transform, Fourier Transform, Calculus of Variations, Conformal Mapping and Tensor Analysis. Application of these topics to the solution of problems in physics and engineering is stressed.

**UNIT I LAPLACE TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS 12**

Laplace transform : Definitions – Properties – Transform error function – Bessel's function - Dirac delta function – Unit step functions – Convolution theorem – Inverse Laplace transform : Complex inversion formula – Solutions to partial differential equations : Heat equation – Wave equation.

**UNIT II FOURIER TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS 12**

Fourier transform : Definitions – Properties – Transform of elementary functions – Dirac delta function – Convolution theorem – Parseval's identity – Solutions to partial differential equations : Heat equation – Wave equation – Laplace and Poisson's equations.

**UNIT III CALCULUS OF VARIATIONS 12**

Concept of variation and its properties – Euler's equation – Functional dependant on first and higher order derivatives – Functionals dependant on functions of several independent variables – Variational problems with moving boundaries – Isoperimetric problems – Direct methods – Ritz and Kantorovich methods.

**UNIT IV CONFORMAL MAPPING AND APPLICATIONS 12**

Introduction to conformal mappings and bilinear transformations – Schwarz Christoffel transformation – Transformation of boundaries in parametric form – Physical applications : Fluid flow and heat flow problems.

**UNIT V TENSOR ANALYSIS 12**

Summation convention – Contravariant and covariant vectors – Contraction of tensors – Inner product – Quotient law – Metric tensor – Christoffel symbols – Covariant differentiation – Gradient - Divergence and curl.

**TOTAL : 60 PERIODS**

**OUTCOMES :**

After completing this course, students should demonstrate competency in the following skills:

- Application of Laplace and Fourier transforms to initial value, initial–boundary value and boundary value problems in Partial Differential Equations.
- Maximizing and minimizing the functional that occur in various branches of Engineering Disciplines.
- Construct conformal mappings between various domains and use of conformal mapping in studying problems in physics and engineering particularly to fluid flow and heat flow problems.
- Understand tensor algebra and its applications in applied sciences and engineering and develops ability to solve mathematical problems involving tensors.
- Competently use tensor analysis as a tool in the field of applied sciences and related fields.

## REFERENCES :

1. Andrews L.C. and Shivamoggi, B., "Integral Transforms for Engineers", Prentice Hall of India Pvt. Ltd., New Delhi, 2003.
2. Elsgolc, L.D., "Calculus of Variations", Dover Publications Inc., New York, 2007.
3. Mathews, J. H., and Howell, R.W., "Complex Analysis for Mathematics and Engineering", 5<sup>th</sup> Edition, Jones and Bartlett Publishers, 2006.
4. Kay, D. C., "Tensor Calculus", Schaum's Outline Series, Tata McGraw Hill Edition, 2014.
5. Naveen Kumar, "An Elementary Course on Variational Problems in Calculus ", Narosa Publishing House, 2005.
6. Saff, E.B and Snider, A.D, "Fundamentals of Complex Analysis with Applications in Engineering, Science and Mathematics", 3<sup>rd</sup> Edition, Pearson Education, New Delhi, 2014.
7. Sankara Rao, K., "Introduction to Partial Differential Equations", Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
8. Spiegel, M.R., "Theory and Problems of Complex Variables and its Applications", Schaum's Outline Series, McGraw Hill Book Co., 1981.
9. Ramaniah. G. "Tensor Analysis", S. Viswanathan Pvt. Ltd., 1990.

AO5151

AERODYNAMICS

L T P C  
3 0 0 3

## OBJECTIVES

- To introduce the students the fundamental concepts and topic related to aerodynamics of flight vehicles like fundamental forms of flow, aerodynamic coefficient, incompressible and compressible flow theories, viscous flow measurements and various configuration of aircraft and wings.

### UNIT I INTRODUCTION TO AERODYNAMICS 9

Hot air balloon and aircrafts, Various types of airplanes, Wings and airfoils, lift and Drag, Centre of pressure and aerodynamic centre, Coefficient of pressure, moment coefficient, Continuity and Momentum equations, Point source and sink, doublet, Free and Forced Vortex, Uniform parallel flow, combination of basic flows, Pressure and Velocity distributions on bodies with and without circulation in ideal and real fluid flows, Magnus effect

### UNIT II INCOMPRESSIBLE FLOW THEORY 9

Conformal Transformation, Kutta condition, Karman – Trefftz profiles, Thin aerofoil Theory and its applications. Vortex line, Horse shoe vortex, Biot - Savart law, lifting line theory

### UNIT III COMPRESSIBLE FLOW THEORY 9

Compressibility, Isentropic flow through nozzles, shocks and expansion waves, Rayleigh and Fanno Flow, Potential equation for compressible flow, small perturbation theory, Prandtl- Glauert Rule, Linearised supersonic flow, Method of characteristics

### UNIT IV AIRFOILS, WINGS AND AIRPLANE CONFIGURATION IN HIGH SPEED FLOWS 9

Critical Mach number, Drag divergence Mach number, Shock stall, super critical airfoils, Transonic area rule, Swept wings (ASW and FSW), supersonic airfoils, wave drag, delta wings, Design considerations for supersonic airplanes

### UNIT V VISCOUS FLOW AND FLOW MEASUREMENTS 9

Basics of viscous flow theory – Boundary Layer – Displacement, momentum and Energy Thickness – Laminar and Turbulent boundary layers – Boundary layer over flat plate – Blasius Solution Introduction to wind tunnel, Types of wind tunnel, Scale model, Important testing parameters, Calibration of test section, Measurement of force, moment and pressure, scale effect, Flow visualization techniques

**TOTAL : 45 PERIODS**

**OUTCOME:**

Upon completion of the course, students will understand the behaviour of airflow over bodies with particular emphasis on airfoil sections in the incompressible flow regime.

**REFERENCES**

1. E.L. Houghton and N.B. Caruthers, Aerodynamics for Engineering Students, Edward Arnold Publishers Ltd., London (First Indian Edition), 1988
2. J.D. Anderson, "Fundamentals of Aerodynamics", McGraw-Hill Book Co., New York, 1985.
3. Rathakrishnan.E., Gas Dynamics, Prentice Hall of India, 1995.
4. Shapiro, A.H., Dynamics & Thermodynamics of Compressible Fluid Flow, Ronald Press, 1982.
5. W.H. Rae and A. Pope, "Low speed Wind Tunnel Testing", John Wiley Publications, 1984.
6. Zucrow, M.J., and Anderson, J.D., Elements of gas dynamics McGraw-Hill Book Co., New York, 1989.

**AO5101****AIRCRAFT STRUCTURAL MECHANICS****L T P C**  
**3 2 0 4****OBJECTIVE**

- To make students learn important technical aspects on theory of bending, shear flow in open and closed sections, stability problems in structures with various modes of loading and also impart knowledge on how to analyze aircraft structural components under various forms of loading.

**UNIT I BENDING OF BEAMS 12**

Elementary theory of bending – Introduction to semi-monocoque structures - Stresses in beams of symmetrical and unsymmetrical sections -Box beams – General formula for bending stresses-principal axes method – Neutral axis method.

**UNIT II SHEAR FLOW IN OPEN SECTIONS 9**

Shear stresses in beams – Shear flow in stiffened panels - Shear flow in thin walled open tubes – Shear centre – Shear flow in open sections with stiffeners.

**UNIT III SHEAR FLOW IN CLOSED SECTIONS 15**

Shear flow in closed sections with stiffeners– Angle of twist - Shear flow in two flange and three flange box beams – Shear centre - Shear flow in thin walled closed tubes - Bredt-Batho theory - Torsional shear flow in multi cell tubes - Flexural shear flow in multi cell stiffened structures.

**UNIT IV STABILITY PROBLEMS 12**

Stability problems of thin walled structures– Buckling of sheets under compression, shear, bending and combined loads - Crippling stresses by Needham's and Gerard's methods–Sheet stiffener panels-Effective width, Inter rivet and sheet wrinkling failures-Tension field web beams(Wagner's).

**UNIT V ANALYSIS OF AIRCRAFT STRUCTURAL COMPONENTS 12**

Loads on Wings – Schrenk's curve - Shear force, bending moment and torque distribution along the span of the Wing. Loads on fuselage - Shear and bending moment distribution along the length of the fuselage. Analysis of rings and frames.

**TOTAL: 60 PERIODS****OUTCOME:**

Upon completion of the course, students will get knowledge on different types of beams and columns subjected to various types of loading and support conditions with particular emphasis on aircraft structural components.



## REFERENCES

1. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H, Gas Turbine Theory, Longman, 1989
2. G.C. Oates, "Aerothermodynamics of Aircraft Engine Components", AIAA Education Series, 1985.
3. G.P. Sutton, "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 5<sup>th</sup> Edition, 1986.
4. Hill, P.G. and Peterson, C.R. Mechanics and Thermodynamics of Propulsion, Addison – Wesley Longman Inc. 1999
5. W.P. Gill, H.J. Smith & J.E. Ziurys, "Fundamentals of Internal Combustion Engines as applied to Reciprocating, Gas turbine & Jet Propulsion Power Plants", Oxford & IBH Publishing Co., 1980.

**AO5103**

**THEORY OF VIBRATIONS**

**L T P C**  
**3 0 0 3**

### OBJECTIVE:

- To study the effect of time dependent forces on mechanical systems and to get the natural characteristics of system with more degree of freedom systems.
- To study the aeroelastic effects of aircraft wing.

### **UNIT I SINGLE DEGREE OF FREEDOM SYSTEMS 10**

Simple harmonic motion, definition of terminologies, Newton's Laws, D'Alembert's principle, Energy methods. Free and forced vibrations with and without damping, base excitation, and vibration measuring instruments.

### **UNIT II MULTI-DEGREES OF FREEDOM SYSTEMS 12**

Two degrees of freedom systems, Static and dynamic couplings, eigen values, eigen vectors and orthogonality conditions of eigen vectors, Vibration absorber, Principal coordinates, Principal modes. Hamilton's Principle, Lagrange's equation and its applications.

### **UNIT III VIBRATION OF ELASTIC BODIES 10**

Transverse vibrations of strings, Longitudinal, Lateral and Torsional vibrations. Approximate methods for calculating natural frequencies.

### **UNIT IV EIGEN VALUE PROBLEMS & DYNAMIC RESPONSE OF LARGE SYSTEMS 8**

Eigen value extraction methods – Subspace hydration method, Lanczos method – Eigen value reduction method – Dynamic response of large systems – Implicit and explicit methods.

### **UNIT V ELEMENTS OF AEROELASTICITY 5**

Aeroelastic problems – Collar's triangle of forces – Wing divergence – Aileron control reversal – Flutter.

**TOTAL : 45 PERIODS**

### OUTCOME:

Upon completion of the course, students will learn the dynamic behaviour of different aircraft components and the interaction among the aerodynamic, elastic and inertia forces

## REFERENCES

1. F.S. Tse., I.F. Morse and R.T. Hinkle, "Mechanical Vibrations", Prentice-Hall of India, 1985.
2. Fung, Y.C., "An Introduction to the Theory of Aeroelasticity", John Wiley & Sons Inc., New York, 1985.
3. Kenneth G. McConnell, Paulo S. Varoto Vibration Testing: Theory and Practice 2nd Edition, 2008
4. Meirovitch, L. "Elements of Vibration Analysis", McGraw-Hill Inc., 1986.

5. Rao.J.S. and Gupta.K. "Theory and Practice of Mechanical Vibrations", Wiley Eastern Ltd., New Delhi, 1999.
6. Thomson W.T, Marie Dillon Dahleh, "Theory of Vibrations with Applications", Prentice Hall, 1997
7. Timoshenko, S. "Vibration Problems in Engineering", John Wiley & Sons, Inc., 1987.

**AO5161**

**AERODYNAMICS LABORATORY**

**L T P C**  
**0 0 4 2**

**LIST OF EXPERIMENTS**

1. Calibration of subsonic wind tunnel
2. Pressure distribution over a smooth and rough cylinders
3. Pressure distribution over a symmetric aerofoil section
4. Pressure distribution over a cambered aerofoil section
5. Force and moment measurements using wind tunnel balance
6. Pressure distribution over a wing of symmetric aerofoil section
7. Pressure distribution over a wing of cambered aerofoil section
8. Flow visualization studies in incompressible flows
9. Calibration of supersonic wind tunnel
10. Supersonic flow visualization studies

**TOTAL: 60 PERIODS**

**LABORATORY EQUIPMENTS REQUIREMENTS**

1. Subsonic wind tunnel
2. Rough and smooth cylinder
3. Symmetrical Cambered aerofoil
4. Wind tunnel balance
5. Schlieren system
6. Pressure Transducers
7. Supersonic wind tunnel

**OUTCOME:**

Upon completion of the course, students will be in a position to use wind tunnel for pressure and force measurements on various models

**AO5251**

**FLIGHT MECHANICS**

**L T P C**  
**3 0 0 3**

**OBJECTIVE**

- To impart knowledge to students on aircraft performance in level, climbing, gliding and accelerated flight modes and also various aspects of stability and control in longitudinal, lateral and directional modes.

**UNIT I PRINCIPLES OF FLIGHT**

**9**

Physical properties and structure of the atmosphere, International Standard Atmosphere, Temperature, pressure and altitude relationship, Measurement of speed – True, Indicated and Equivalent air speed, Streamlined and bluff bodies, Various Types of drag in airplanes, Drag polar, Methods of drag reduction of airplanes.

**UNIT II AIRCRAFT PERFORMANCE IN LEVEL, CLIMBING AND GLIDING FLIGHTS**

**8**

Straight and level flight, Thrust required and available, Power required and available, Effect of altitude on thrust and power, Conditions for minimum drag and minimum power required, Gliding and Climbing flight, Range and Endurance

**UNIT III ACCELERATED FLIGHT****9**

Take off and landing performance, Turning performance, horizontal and vertical turn, Pull up and pull down, maximum turn rate, V-n diagram with FAR regulations.

**UNIT IV LONGITUDINAL STABILITY AND CONTROL****10**

Degrees of freedom of a system, static and dynamic stability, static longitudinal stability, Contribution of individual components, neutral point, static margin, Hinge moment, Elevator control effectiveness, Power effects, elevator angle to trim, elevator angle per g, maneuver point, stick force gradient, aerodynamic balancing, Aircraft equations of motion, stability derivatives, stability quartic, Phugoid motion

**UNIT V LATERAL, DIRECTIONAL STABILITY AND CONTROL****9**

Yaw and side slip, Dihedral effect, contribution of various components, lateral control, aileron control power, strip theory, aileron reversal, weather cock stability, directional control, rudder requirements, dorsal fin, One engine inoperative condition, Dutch roll, spiral and directional divergence, autorotation and spin

**TOTAL: 45 PERIODS****OUTCOME:**

Upon completion of the course, students will understand the static, dynamic longitudinal, directional and lateral stability and control of airplane, effect of maneuvers.

**REFERENCES**

1. Babister, A.W. Aircraft stability and response, Pergamon Press, 1980.
2. Clancey, L.J. Aerodynamics, Pitman, 1986.
3. Houghton, E.L., and Caruthers, N.B., Aerodynamics for engineering students, Edward Arnold Publishers, 1988.
4. Kuethe, A.M., and Chow, C.Y., Foundations of Aerodynamics, John Wiley & Sons, 1982.
5. McCormic, B.W., Aerodynamics, Aeronautics & Flight Mechanics John Wiley, 1995.
6. Nelson, R.C. Flight Stability & Automatic Control, McGraw-Hill, 1989.
7. Perkins C.D., & Hage, R.E. Airplane performance, stability and control, Wiley Toppan, 1974.

**AO5252****FINITE ELEMENT METHODS****L T P C  
3 2 0 4****OBJECTIVES:**

- To make students learn using Finite element techniques to solve problems related to discrete, continuum and isoparametric elements. And also to introduce solution schemes for static, dynamic and stability problems.

**UNIT I INTRODUCTION****12**

Review of various approximate methods – Rayleigh-Ritz, Galerkin and Finite Difference Methods - Stiffness and flexibility matrices for simple cases - Basic concepts of finite element method - Formulation of governing equations and convergence criteria.

**UNIT II DISCRETE ELEMENTS****14**

Structural analysis of bar and beam elements for static and dynamic loadings. Bar of varying section – Temperature effects  
Program Development and use of software package for application of bar and beam elements for static, dynamic and stability analysis.

**UNIT III CONTINUUM ELEMENTS****14**

Plane stress, Plane strain and Axisymmetric problems – CST Element – LST Element. Consistent and lumped load vectors. Use of local co-ordinates. Numerical integration. Application to heat transfer problems.  
Solution for 2-D problems (static analysis and heat transfer) using software packages.

**UNIT IV ISOPARAMETRIC ELEMENTS 12**  
 Definition and use of different forms of 2-D and 3-D elements. - Formulation of element stiffness matrix and load vector.  
 Solution for 2-D problems (static analysis and heat transfer) using software packages.

**UNIT V SOLUTION SCHEMES 8**  
 Different methods of solution of simultaneous equations governing static, dynamics and stability problems. General purpose Software packages.

**TOTAL: 60 PERIODS**

**OUTCOME:**  
 Upon completion of the course, students will learn the concept of numerical analysis of structural components

**REFERENCES**

1. C.S. Krishnamurthy, "Finite Elements Analysis", Tata McGraw-Hill, 1987.
2. K.J. Bathe and E.L. Wilson, "Numerical Methods in Finite Elements Analysis", Prentice Hall of India Ltd., 1983.
3. Robert D. Cook, David S. Malkus, Michael E. Plesha and Robert J. Witt "Concepts and Applications of Finite Element Analysis", 4<sup>th</sup> Edition, John Wiley & Sons, 2002.
4. S.S.Rao, "Finite Element Method in Engineering", Butterworth, Heinemann Publishing, 3<sup>rd</sup> Edition, 1998
5. Segerlind, L.J. "Applied Finite Element Analysis", Second Edition, John Wiley and Sons Inc., New York, 1984.
6. Tirupathi R. Chandrupatla and Ashok D. Belegundu, Introduction to Finite Elements in Engineering, Prentice Hall, 2002

**AO5253 COMPUTATIONAL FLUID DYNAMICS FOR AEROSPACE APPLICATIONS L T P C 3 0 0 3**

**OBJECTIVES:**

- To introduce to the students various numerical solution methods pertaining to grid generation, time dependant and panel methods and also techniques pertaining to transonic small perturbation force.

**UNIT I NUMERICAL SOLUTIONS OF SOME FLUID DYNAMICAL PROBLEMS 9**  
 Basic fluid dynamics equations, Equations in general orthogonal coordinate system, Body fitted coordinate systems, Stability analysis of linear system. Finding solution of a simple gas dynamic problem, Local similar solutions of boundary layer equations, Numerical integration and shooting technique.  
 Numerical solution for CD nozzle isentropic flows and local similar solutions of boundary layer equations.

**UNIT II GRID GENERATION 9**  
 Need for grid generation – Various grid generation techniques – Algebraic, conformal and numerical grid generation – importance of grid control functions – boundary point control – orthogonality of grid lines at boundaries.  
 Elliptic grid generation using Laplace's equations for geometries like airfoil and CD nozzle.

**UNIT III TRANSONIC RELAXATION TECHNIQUES 9**  
 Small perturbation flows, Transonic small perturbation (TSP) equations, Central and backward difference schemes, conservation equations and shockpoint operator, Line relaxation techniques, Acceleration of convergence rate, Jameson's rotated difference scheme -stretching of coordinates, shock fitting techniques Flow in body fitted coordinate system.

Numerical solution of 1-D conduction- convection energy equation using time dependent methods using both implicit and explicit schemes – application of time split method for the above equation and comparison of the results.

**UNIT IV TIME DEPENDENT METHODS 9**

Stability of solution, Explicit methods, Time split methods, Approximate factorization scheme, Unsteady transonic flow around airfoils. Some time dependent solutions of gas dynamic problems. Numerical solution of unsteady 2-D heat conduction problems using SLOR methods

**UNIT V PANEL METHODS 9**

Elements of two and three dimensional panels, panel singularities. Application of panel methods to incompressible, compressible, subsonic and supersonic flows. Numerical solution of flow over a cylinder using 2-D panel methods using both vertex and source panel methods for lifting and non lifting cases respectively.

**TOTAL: 45 PERIODS**

**OUTCOME:**

Upon completion of the course, students will learn the flow of dynamic fluids by computational methods.

**REFERENCES**

1. A.A. Hirsch, 'Introduction to Computational Fluid Dynamics', McGraw-Hill, 1989.
2. C.Y. Chow, "Introduction to Computational Fluid Dynamics", John Wiley, 1979.
3. H.J. Wirz and J.J. Smeldern "Numerical Methods in Fluid Dynamics", McGraw-Hill & Co., 1978.
4. John D. Anderson, JR" Computational Fluid Dynamics", McGraw-Hill Book Co., Inc., New York, 1995.
5. T.J. Chung, Computational Fluid Dynamics, Cambridge University Press, 2002
6. T.K. Bose, "Computation Fluid Dynamics" Wiley Eastern Ltd., 1988.

**AO5254 COMPOSITE MATERIALS AND STRUCTURES L T P C  
3 0 0 3**

**OBJECTIVE:**

- To impart knowledge to the students on the macro mechanics of composite materials, analysis and manufacturing methods of composite materials and introduce failure theories of composites.

**UNIT I INTRODUCTION 10**

Classification and characteristics of composite materials - Types of fiber and resin materials, functions and their properties – Application of composite to aircraft structures-Micromechanics-Mechanics of materials, Elasticity approaches-Mass and volume fraction of fibers and resins-Effect of voids, Effect of temperature and moisture.

**UNIT II MACROMECHANICS 10**

Hooke's law for orthotropic and anisotropic materials-Lamina stress-strain relations referred to natural axes and arbitrary axes.

**UNIT III ANALYSIS OF LAMINATED COMPOSITES 10**

Governing equations for anisotropic and orthotropic plates- Angle-ply and cross ply laminates- Analysis for simpler cases of composite plates and beams - Interlaminar stresses- Netting analysis.

**UNIT IV MANUFACTURING & FABRICATION PROCESSES 8**

Manufacture of glass, boron and carbon fibers-Manufacture of FRP components- Open mould and closed mould processes. Properties and functions of resins.

**UNIT V FAILURE THEORY AND NDE****7**

Failure criteria-Flexural rigidity of Sandwich beams and plates – composite repair- Ultra Sonic Technique - AE technique.

**TOTAL: 45 PERIODS****OUTCOME:**

Upon completion of the course, students will understand the fabrication, analysis and design of composite materials & structures.

**REFERENCES**

1. Autar K. Kaw, Mechanics of Composite Materials, CRC Press LLC, 1997
2. B.D. Agarwal and L.J. Broutman, "Analysis and Performance of fiber composites", John-Wiley and Sons, 1990.
3. G.Lubin, "Hand Book on Fibre glass and advanced plastic composites", Van Nostrand Co., New York, 1989.
4. J Prasad & CGK Nair Non-Destructive Testing and Evaluation of Material, Second Edition Paperback –ISBN-13: 978-0070707030,Amazon,2011
5. L.R. Calcote, "Analysis of laminated structures", Van Nostrand Reinhold Co.,1989.
6. Michael Chun-Yung Niu Composite Airframe Structures Third Edition Conmilit Publishers 1997
7. P. Fordham, "Non-Destructive Testing Techniques" Business Publications, London, 1988.
8. R.M. Jones, "Mechanics of Composite Materials", 2<sup>nd</sup> Edition, Taylor & Francis, 1999

**AO5261****STRUCTURES LABORATORY****L T P C  
0 0 4 2****OBJECTIVES:**

- To impart practical knowledge to the students on calibration of photoelastic materials determination of elastic constant for composite lamina, unsymmetrical bending of beams, determination of shear centre locations for closed and open sections and experimental studies.

**LIST OF EXPERIMENTS**

1. Constant strength Beams
2. Buckling of columns
3. Unsymmetrical Bending of Beams
4. Shear Centre Location for Open Section
5. Shear Centre Location for Closed Section
6. Flexibility Matrix for Cantilever Beam
7. Combined Loading
8. Calibration of Photo Elastic Materials
9. Stresses in Circular Disc Under Diametrical Compression – Photo Elastic Method
10. Vibration of Beams with Different Support Conditions
11. Fabrication and Determination of elastic constants of a composite laminate.
12. Wagner beam

**NOTE:** Any TEN experiments will be conducted out of 12.

**TOTAL: 60 PERIODS****LABORATORY EQUIPMENTS REQUIREMENTS**

1. Constant strength beam setup
2. Column setup
3. Unsymmetrical Bending setup
4. Experimental setup for location of shear centre (open & close section)
5. Cantilever beam setup
6. Experimental setup for bending and torsional loads
7. Diffuser transmission type polariscope with accessories

8. Experimental setup for vibration of beams
9. Universal Testing Machine
10. Wagner beam setup

**OUTCOME:**

Upon completion of the course, students will acquire experimental knowledge on the unsymmetrical bending of beams, finding the location of shear centre, obtaining the stresses in circular discs and beams using photoelastic techniques, calibration of photo – elastic materials.

**A05211**

**CFD / FEA LABORATORY**

**L T P C**  
**0 0 4 2**

**OUTCOME:**

Upon completion of the course, students will be in a position to use Computational fluid dynamics software and Finite Element Analysis software for solving various aeronautical problems.

**LIST OF EXPERIMENTS**

1. Fatigue analysis of aircraft landing gear using FEM Software.
2. Rotor dynamic analysis of jet engine compressor blade using FEM Software
3. Rotor dynamic analysis of jet engine Turbine blade using FEM Software
4. Fracture Mechanics analysis of aircraft skin structure using FEM Software.
5. Random Vibration analysis of Aircraft Wing Structure.
6. Weight Optimization of Aircraft fuselage frame structure using FEM Software.
7. Stress Optimization of Aircraft fuselage frame structure using FEM Software.
8. Heat transfer analysis of Turbine blade using FEM Software.
9. Heat transfer analysis of rocket thrust chamber using FEM Software.
10. Prediction of Drag and lift on typical aircraft using CFD Software
11. Prediction of Drag and lift typical automobile using CFD Software
12. Flow simulation of propeller using CFD Software
13. Flow simulation of wind Turbine blade using CFD Software
14. Combustion simulation of mini jet engine using CFD Software
15. Combustion simulation of pulse jet engine using CFD Software
16. Acoustic study of jet engine using CFD Software.

**NOTE:** Any TEN experiments will be conducted out of 16.

**TOTAL: 60 PERIODS**

**LABORATORY EQUIPMENTS REQUIREMENTS**

1. Internal Server or Workstation
2. Computers
3. CAD Modelling Software
4. FEA Analysis Software
5. CFD Analysis Software

**A05001**

**BOUNDARY LAYER THEORY**

**L T P C**  
**3 0 0 3**

**OUTCOME:**

Upon completion of the course, students will acquire knowledge on viscous fluid flow, development of boundary layer for 2D flows.

**UNIT I VISCIOUS FLOW EQUATIONS**

**9**

Navier-Stokes Equations, Creeping motion, Couette flow, Poiseuille flow through ducts, Ekman drift.

**UNIT II LAMINAR BOUNDARY LAYER 9**  
 Development of boundary layer – Estimation of boundary layer thickness, Displacement thickness - Momentum and energy thicknesses for two dimensional flow – Two dimensional boundary layer equations – Similarity solutions - Blasius solution.

**UNIT III TURBULENT BOUNDARY LAYER 9**  
 Physical and mathematical description of turbulence, two-dimensional turbulent boundary layer equations, Velocity profiles – Inner, outer and overlap layers, Transition from laminar to turbulent boundary layers, turbulent boundary layer on a flat plate, mixing length hypothesis.

**UNIT IV APPROXIMATE SOLUTION TO BOUNDARY LAYER EQUATIONS 9**  
 Approximate integral methods, digital computer solutions – Von Karman – Polhausen method.

**UNIT V THERMAL BOUNDARY LAYER 9**  
 Introduction to thermal boundary layer – Heat transfer in boundary layer - Convective heat transfer, importance of non dimensional numbers – Prandtl number, Nusselt number, Lewis number etc.

**TOTAL: 45 PERIODS**

**REFERENCES**

1. A.J. Reynolds, "Turbulent flows in Engineering", John Wiley & Sons, 1980.
2. Frank White – Viscous Fluid flow – McGraw Hill, 1998
3. H. Schlichting, "Boundary Layer Theory", McGraw-Hill, New York, 1979.
4. Ronald L., Panton, "Incompressible fluid flow", John Wiley & Sons, 1984.
5. Tuncer Cebeci and Peter Bradshaw, "Momentum transfer in boundary layers", Hemisphere Publishing Corporation, 1977.

**AO5002 AIRCRAFT DESIGN L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To impart knowledge to the students on various types of power plant types and also to expose them principles of aerodynamics and structural design aspects.

**UNIT I REVIEW OF DEVELOPMENTS IN AVIATION 9**  
 Categories and types of aircrafts – various configurations – Layouts and their relative merits – strength, stiffness, fail safe and fatigue requirements – Manoeuvring load factors – Gust and manoeuvrability envelopes – Balancing and maneuvering loads on tail planes.

**UNIT II POWER PLANT TYPES AND CHARACTERISTICS 9**  
 Characteristics of different types of power plants – Propeller characteristics and selection – Relative merits of location of power plant.

**UNIT III PRELIMINARY DESIGN 9**  
 Selection of geometric and aerodynamic parameters – Weight estimation and balance diagram – Drag estimation of complete aircraft – Level flight, climb, takeoff and landing calculations – range and endurance – static and dynamic stability estimates – control requirements.

**UNIT IV SPECIAL PROBLEMS 9**  
 Layout peculiarities of subsonic and supersonic aircraft – optimization of wing loading to achieve desired performance – loads on undercarriages and design requirements.

**UNIT V STRUCTURAL DESIGN 9**  
 Estimation of loads on complete aircraft and components – Structural design of fuselage, wings and undercarriages, controls, connections and joints. Materials for modern aircraft – Methods of analysis, testing and fabrication.

## PRACTICALS

Conceptual design of an aircraft for given specifications.

**TOTAL: 45 PERIODS**

## OUTCOME:

Upon completion of the course, students will get the basic concept of aircraft design.

## REFERENCES

1. A.A. Lebedenski, "Notes on airplane design", Part-I, I.I.Sc., Bangalore, 1971.
2. D.P. Raymer, "Aircraft conceptual design", AIAA Series, 1988.
3. E. Torenbeek, "Synthesis of Subsonic Airplane Design", Delft University Press, London, 1976.
4. E.F. Bruhn, "Analysis and Design of Flight Vehicle Structures", Tristate Offset Co., U.S.A., 1980.
5. G. Corning, "Supersonic & Subsonic Airplane Design", II Edition, Edwards Brothers Inc., Michigan, 1953.
6. H.N.Kota, "Integrated design approach to Design fly by wire" Lecture notes Interline Pub. Bangalore, 1992.
7. Michael Niu, Michael C.Y. Niu, "Airframe Stress Analysis & Sizing 1st Edition 1997"

**AO5003**

## THEORY OF ELASTICITY

**L T P C**  
**3 0 0 3**

## OBJECTIVE:

- To impart knowledge to students on basic governing equations of elasticity, solving of 2D problems in Cartesian and polar coordinates and also to introduce various theories and methods to solve torsion related problems.

### UNIT I INTRODUCTION

**6**

Definition, notations and sign conventions for stress and strain – Stress - strain relations, Strain-displacement relations- Elastic constants.

### UNIT II BASIC EQUATIONS OF ELASTICITY

**10**

Equations of equilibrium – Compatibility equations in strains and stresses –Boundary Conditions - Saint-Venant's principle - Stress ellipsoid – Stress invariants – Principal stresses in 2-D and 3-D.

### UNIT III 2 - D PROBLEMS IN CARTESIAN COORDINATES

**9**

Plane stress and plain strain problems - Airy's stress function – Biharmonic equations – 2-D problems – Cantilever and simply supported beams.

### UNIT IV 2 - D PROBLEMS IN POLAR COORDINATES

**12**

Equations of equilibrium – Strain – displacement relations – Stress – strain relations – Airy's stress function – Use of Dunder's table. - Axisymmetric problems - Bending of Curved Bars - Circular Discs and Cylinders – Rotating Discs and Cylinders - Kirsch, Boussinasque's and Michell's problems.

### UNIT V TORSION

**8**

Coulomb's theory-Navier's theory-Saint Venant's Semi-Inverse method – Torsion of Circular, Elliptical and Triangular sections - Prandtl's theory-Membrane analogy.

**TOTAL: 45 PERIODS**

## OUTCOME:

Upon completion of the course, students will understand the theoretical concepts of material behaviour with particular emphasis on their elasticity property.

## REFERENCES

1. E. Sechler, "Elasticity in Engineering" John Wiley & Sons Inc., New York, 1980.
2. Enrico Volterra and Caines, J.H, "Advanced strength of Materials, Prentice Hall, 1991."



**OBJECTIVE:**

- To make the students learn basic principles of operation, electrical resistance strain gauges, photoelasticity and interferometric techniques and non destructive methods.

**UNIT I INTRODUCTION****8**

Principle of measurements-Accuracy, sensitivity and range- Mechanical, Optical, Acoustical and Electrical extensometers.

**UNIT II ELECTRICAL RESISTANCE STRAIN GAUGES****12**

Principle of operation and requirements-Types and their uses-Materials for strain gauge-Calibration and temperature compensation-Cross sensitivity-Rosette analysis-Wheatstone bridge-Potentiometer circuits for static and dynamic strain measurements-Strain indicators- Application of strain gauges to wind tunnel balance.

**UNIT III PRINCIPLES OF PHOTOELASTICITY****9**

Two dimensional photo elasticity-Concepts of photoelastic effects-Photoelastic materials-Stress optic law-Plane polariscope-Circular polariscope-Transmission and Reflection type-Effect of stressed model in Plane and Circular polariscope. Interpretation of fringe pattern Isoclinics and Isochromatics.-Fringe sharpening and Fringe multiplication techniques-Compensation and separation techniques-Introduction to three dimensional photoelasticity.

**UNIT IV PHOTOELASTICITY AND INTERFEROMETRY TECHNIQUES****9**

Fringe sharpening and Fringe multiplication techniques-Compensation and separation techniques-Calibration methods -Photo elastic materials. Introduction to three dimensional photoelasticity. Moire fringes – Laser holography – Grid methods-Stress coat

**UNIT V NON DESTRUCTIVE TECHNIQUES****7**

Radiography- Ultrasonics- Magnetic particle inspection- Fluorescent penetrant technique-Eddy current testing– thermography– MICRO FOCUS CT scan.

**TOTAL: 45 PERIODS****OUTCOME:**

Upon completion of the course, students will be able to appreciate use of strain gauges and its principles, principle of photoelasticity and its use, NDT techniques.

**REFERENCES**

- A.J. Durelli and V.J. Parks, "Moire Analysis of Strain", Prentice Hall Inc., Englewood Cliffs, New Jersey, 1980.
- G.S. Holister, "Experimental Stress Analysis, Principles and Methods", Cambridge University Press, 1987.
- J Prasad & CGK Nair Non-Destructive Testing and Evaluation of Material, Second Edition Paperback –ISBN-13: 978-0070707030,Amazon,2011
- J.W. Dally and M.F. Riley, "Experimental Stress Analysis", McGraw-Hill Book Co., New York, 1988.
- M. Hetenyi, "Handbook of Experimental Stress Analysis", John Wiley & Sons Inc., New York, 1980.
- P. Fordham, "Non-Destructive Testing Techniques" Business Publications, London, 1988.
- Srinath,L.S., Raghava,M.R., Lingaiah,K. Gargesha,G.,Pant B. and Ramachandra,K. – Experimental Stress Analysis, Tata McGraw Hill, New Delhi, 1984
- U. C. Jindal Experimental Stress Analysis, Pearson India, ISBN: 9789332503533, 2012

<b>AO5005</b>	<b>THEORY OF PLATES AND SHELLS</b>	<b>L T P C</b> <b>3 0 0 3</b>
<b>UNIT I</b>	<b>CLASSICAL PLATE THEORY</b>	<b>8</b>
Classical Plate Theory – Assumptions – Differential Equations – Boundary Conditions.		
<b>UNIT II</b>	<b>PLATES OF VARIOUS SHAPES</b>	<b>10</b>
Navier’s Method of Solution for Simply Supported Rectangular Plates – Levy’s Method of Solution for Rectangular Plates under Different Boundary Conditions – Circular plates.		
<b>UNIT III</b>	<b>EIGEN VALUE ANALYSIS</b>	<b>8</b>
Stability and Free Vibration Analysis of Rectangular Plates with various end conditions.		
<b>UNIT IV</b>	<b>APPROXIMATE METHODS</b>	<b>10</b>
Rayleigh – Ritz, Galerkin Methods– Finite Difference Method – Application to Rectangular Plates for Static, Free Vibration and Stability Analysis.		
<b>UNIT V</b>	<b>SHELLS</b>	<b>9</b>
Basic Concepts of Shell Type of Structures – Membrane and Bending Theories for Circular Cylindrical Shells.		
		<b>TOTAL: 45 PERIODS</b>

**OUTCOME:**

Upon completion of the course, students will get knowledge on the behaviour of plates and shells with different geometry under various types of loads

**REFERENCES**

1. Flugge, W. Stresses in Shells, Springer – Verlag, 1985.
2. Harry Kraus, ‘Thin Elastic Shells’, John Wiley and Sons, 1987.
3. T.K.Varadan & K. Bhaskar, “Analysis of plates – Theory and problems”, Narosha Publishing Co., 1999.
4. Timoshenko, S.P. and Gere, J.M., Theory of Elastic Stability, McGraw Hill Book Co. 1986.
5. Timoshenko, S.P. Winowsky. S., and Kreger, Theory of Plates and Shells, McGraw Hill Book Co., 1990.

<b>AO5006</b>	<b>HIGH TEMPERATURE PROBLEMS IN STRUCTURES</b>	<b>L T P C</b> <b>3 0 0 3</b>
<b>UNIT I</b>	<b>TEMPERATURE EQUATIONS &amp; AERODYNAMIC HEATING</b>	<b>9</b>
Basics of conduction, radiation and convection – Fourier’s equation – Boundary and initial conditions – One-dimensional problem formulations – Methods and Solutions. Heat balance equation for idealised structures – Adiabatic temperature – Variations – Evaluation of transient temperature.		
<b>UNIT II</b>	<b>THERMAL STRESS ANALYSIS</b>	<b>9</b>
Thermal stresses and strains – Equations of equilibrium – Boundary conditions – Thermoelasticity – Two dimensional problems and solutions – Airy stress function and applications.		
<b>UNIT III</b>	<b>THERMAL STRESS IN BEAMS, TRUSSES AND THIN CYLINDERS</b>	<b>9</b>
Analysis of bar, plane truss and beam under mechanical loads and temperature. Thermal stress analysis of thin cylinder.		
<b>UNIT IV</b>	<b>THERMAL STRESSES IN PLATES</b>	<b>9</b>
Membrane thermal stresses –Rectangular plates – Circular plates – Thick plates with temperature varying along thickness.		

**UNIT V SPECIAL TOPICS & MATERIALS****9**

Thermal bucking – Analysis including material properties variation with temperature.

**TOTAL: 45 PERIODS****OUTCOME:**

Upon completion of the course, students will learn the analysis of bar, plane truss and beam under mechanical and thermal loads.

**REFERENCES**

1. A.B. Bruno and H.W. Jerome, "Theory of Thermal Stresses", John Wiley & Sons Inc., New York, 1980.
2. D.J. Johns, "Thermal Stress Analysis", Pergamon Press, Oxford, 1985.
3. N.J. Hoff, "High Temperature effects in Aircraft Structures", John Wiley & Sons Inc., London, 1986.

**AO5074****FATIGUE AND FRACTURE MECHANICS****L T P C  
3 0 0 3****OBJECTIVE:**

- To make the students learn about fundamentals of fatigue & fracture mechanics, statistical aspects of fatigue behaviour & fatigue design and testing of aerospace structures.

**UNIT I FATIGUE OF STRUCTURES****10**

S.N. curves – Endurance limit – Effect of mean stress – Goodman, Gerber and Soderberg relations and diagrams – Notches and stress concentrations – Neuber's stress concentration factors – plastic stress concentration factors – Notched S-N curves.

**UNIT II STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR****8**

Low cycle and high cycle fatigue – Coffin-Manson's relation – Transition life – Cyclic Strain hardening and softening – Analysis of load histories – Cycle counting techniques – Cumulative damage – Miner's theory – other theories.

**UNIT III PHYSICAL ASPECTS OF FATIGUE****5**

Phase in fatigue life – Crack initiation – Crack growth – Final fracture – Dislocations – Fatigue fracture surfaces.

**UNIT IV FRACTURE MECHANICS****15**

Strength of cracked bodies – potential energy and surface energy – Griffith's theory – Irwin – Orwin extension of Griffith's theory to ductile materials – Stress analysis of cracked bodies – Effect of thickness on fracture toughness – Stress intensity factors for typical geometries.

**UNIT V FATIGUE DESIGN AND TESTING****7**

Safe life and fail safe design philosophies – Importance of Fracture Mechanics in aerospace structure – Application to composite materials and structures.

**TOTAL: 45 PERIODS****OUTCOME:**

Upon completion of the course, students will learn about fracture behaviour, fatigue design and testing of structures.

**REFERENCES**

1. C.G.Sih, "Mechanics of Fracture", Vol.1 Sijthoff and Noordhoff International Publishing Co., Netherland, 1989.
2. D.Brock, "Elementary Engineering Fracture Mechanics", Noordhoff International Publishing Co., London, 1994.
3. J.F.Knott, "Fundamentals of Fracture Mechanics", Butterworth & Co., (Publishers) Ltd., London, 1983.
4. W.Barrois and L.Ripley, "Fatigue of Aircraft Structures", Pergamon Press, Oxford, 1983.



**UNIT III APPROXIMATE METHODS FOR INVISCID HYPERSONIC FLOWS` 9**  
 Approximate methods hypersonic small disturbance equation and theory – thin shock layer theory – blast wave theory - entropy effects - rotational method of characteristics - hypersonic shock wave shapes and correlations.

**UNIT IV VISCOUS HYPERSONIC FLOW THEORY 10**  
 Navier–Stokes equations – boundary layer equations for hypersonic flow – hypersonic boundary layer – hypersonic boundary layer theory and non similar hypersonic boundary layers – hypersonic aerodynamic heating and entropy layers effects on aerodynamic heating – heat flux estimation.

**UNIT V VISCOUS INTERACTIONS IN HYPERSONIC FLOWS 9**  
 Strong and weak viscous interactions – hypersonic shockwaves and boundary layer interactions – Estimation of hypersonic boundary layer transition- Role of similarity parameter for laminar viscous interactions in hypersonic viscous flow.

**TOTAL: 45 PERIODS**

**OUTCOME:**  
 Upon completion of the course, students will learn basics of hypersonic flow, shock wave - boundary layer interaction and hypersonic aerodynamic heating.

**REFERENCES**

1. John D. Anderson, Jr, Hypersonic and High Temperature Gas Dynamics, McGraw-Hill Series, New York, 1996.
2. John T. Bertin, Hypersonic Aerothermodynamics, 1994 AIAA Inc., Washington D.
3. John.D.Anderson, Jr., Modern Compressible Flow with Historical perspective Hypersonic Series.
4. William H. Heiser and David T. Pratt, Hypersonic Air Breathing propulsion, AIAA Education Series.

**AO5072 COMPUTATIONAL HEAT TRANSFER L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To make the students learn to solve conductive, transient conductive, convective, radiative heat transfer problems using computational methods.

**UNIT I INTRODUCTION 9**  
 Finite Difference Method-Introduction-Taylor’s series expansion - Discretisation Methods Forward, backward and central differencing scheme for 1<sup>st</sup> order and second order Derivatives – Types of partial differential equations-Types of errors. Solution to algebraic equation-Direct Method and Indirect Method-Types of boundary condition.  
 FDM - FEM - FVM.

**UNIT II CONDUCTIVE HEAT TRANSFER 9**  
 General 3D-heat conduction equation in Cartesian, cylindrical and spherical coordinates.  
 Computation (FDM) of One – dimensional steady state heat conduction –with Heat generation-without Heat generation- 2D-heat conduction problem with different boundary conditions- Numerical treatment for extended surfaces. Numerical treatment for 3D- Heat conduction.  
 Numerical treatment to 1D-steady heat conduction using FEM.

**UNIT III TRANSIENT HEAT CONDUCTION 9**  
 Introduction to Implicit, explicit Schemes and crank-Nicolson Schemes Computation(FDM) of One –dimensional un-steady heat conduction –with heat Generation-without Heat generation - 2D-transient heat conduction problem with different boundary conditions using Implicit, explicit Schemes. Importance of Courant number. Analysis for 1-D,2-D transient heat Conduction problems.

**UNIT IV CONVECTIVE HEAT TRANSFER 9**  
 Convection- Numerical treatment(FDM) of steady and unsteady 1-D and 2-d heat convection-diffusion steady-unsteady problems- Computation of thermal and Velocity boundary layer flows. Upwind scheme. Stream function-vorticity approach-Creeping flow.

**UNIT V RADIATIVE HEAT TRANSFER 9**  
 Radiation fundamentals-Shape factor calculation-Radiosity method- Absorption Method-Montacalro method-Introduction to Finite Volume Method- Numerical treatment of radiation enclosures using finite Volume method. Developing a numerical code for 1D, 2D heat transfer problems.

**TOTAL: 45 PERIODS**

**OUTCOME:**

Upon completion of the course, students will learn the concepts of computation applicable to heat transfer for practical applications.

**REFERENCES**

1. C.Y.Chow, "Introduction to Computational Fluid Dynamics", John Wiley, 1979.
2. J.P. Holman, "Heat Transfer", McGraw-Hill Book Co., Inc., New York, 6<sup>th</sup> Edition, 1991.
3. John D. Anderson, JR" Computational Fluid Dynamics", McGraw-Hill Book Co., Inc., New York, 1995.
4. John H. Lienhard, "A Heat Transfer Text Book", Prentice Hall Inc., 1981.
5. Pletcher and Tannahils " Computational Heat Trasnrfer".....
6. S.C. Sachdeva, "Fundamentals of Engineering Heat & Mass Transfer", Wiley Eastern Ltd., New Delhi, 1981.
7. T.J. Chung, Computational Fluid Dynamics, Cambridge University Press, 2002
8. Yunus A. Cengel, Heat Transfer – A Practical Approach Tata McGraw Hill Edition, 2003.

**AO5008 WIND POWER ENGINEERING L T P C**  
**3 0 0 3**

**UNIT I INTRODUCTION TO WIND ENERGY 8**  
 Background,Motivations, and Constraints, Historical perspective, Modern wind turbines, Components and geometry, Power characteristics.

**UNIT II WIND CHARACTERISTICS AND RESOURCES 8**  
 General characteristics of the wind resource, Atmospheric boundarylayer characteristics, Wind data analysis and resource estimation, Wind turbine energy production estimates using statistical techniques

**UNIT III AERODYNAMICS OF WIND TURBINES 12**  
 Overview , 1-D Momentum theory,Ideal horizontal axis wind turbine with wake rotation, Airfoils and aerodynamic concepts -Momentum theory and blade element theory General rotor blade shape performance prediction - Wind turbine rotor dynamics

**UNIT IV WIND TURBINE DESIGN & CONTROL 9**  
 Brief design overview – Introduction -Wind turbine control systems -Typical grid-connected turbine operation -Basic concepts of electricpower- Power transformers -Electrical machines

**UNIT V ENVIRONMENTAL AND SITE ASPECTS 8**  
 Overview- Wind turbine siting - Installation and operation- Wind farms- Overview of wind energy economics-Electromagnetic interference-noise-Land use impacts - Safety

**TOTAL: 45 PERIODS**

**OUTCOME:**

Upon completion of the course, students will learn about aerodynamics, design and control of wind turbines.

**REFERENCES:**

1. Emil Simiu & Robert H Scanlan, Wind effects on structures - fundamentals and applications to design, John Wiley & Sons Inc New York, 1996.
2. IS: 875 (1987) Part III Wind loads, Indian Standards for Building codes.
3. N J Cook, Design Guides to wind loading of buildings structures Part I & II, Butterworths, London, 1985
4. Tom Lawson Building Aerodynamics Imperial College Press London, 2001

**AO5073****ADVANCED PROPULSION SYSTEMS****L T P C**  
**3 0 0 3****OBJECTIVES:**

- To familiarize the students on advanced air breathing propulsion systems like air augmented rockets, scramjets and also to introduce the students various technical details and operating principles of nuclear and electric propulsion.

**UNIT I THERMODYNAMIC CYCLE ANALYSIS OF AIR-BREATHING PROPULSION SYSTEMS****8**

Air breathing propulsion systems like Turbojet, turboprop, ducted fan, Ramjet and Air augmented rockets – Thermodynamic cycles – Pulse propulsion – Combustion process in pulse jet engines – inlet charging process – Subcritical, Critical and Supercritical charging.

**UNIT II RAMJETS AND AIR AUGMENTED ROCKETS****8**

Preliminary performance calculations – Diffuser design with and without spike, Supersonic inlets – combustor and nozzle design – integral Ram rocket.

**UNIT III SCRAMJET PROPULSION SYSTEM****12**

Fundamental considerations of hypersonic air breathing vehicles – Preliminary concepts in engine airframe integration – calculation of propulsion flow path – flowpath integration – Various types of supersonic combustors – fundamental requirements of supersonic combustors – Mixing of fuel jets in supersonic cross flow – performance estimation of supersonic combustors.

**UNIT IV NUCLEAR PROPULSION****9**

Nuclear rocket engine design and performance – nuclear rocket reactors – nuclear rocket nozzles – nuclear rocket engine control – radioisotope propulsion – basic thruster configurations – thruster technology – heat source development – nozzle development – nozzle performance of radioisotope propulsion systems.

**UNIT V ELECTRIC AND ION PROPULSION****8**

Basic concepts in electric propulsion – power requirements and rocket efficiency – classification of thrusters – electrostatic thrusters – plasma thruster of the art and future trends – Fundamentals of ion propulsion – performance analysis – ion rocket engine.

**TOTAL: 45 PERIODS****OUTCOME:**

Upon completion of the course, students will learn in detail about gas turbines, ramjet, fundamentals of rocket propulsion and chemical rockets.

## REFERENCES

1. Cumpsty, Jet propulsion, Cambridge University Press, 2003.
2. Fortescue and Stark, Spacecraft Systems Engineering, 1999.
3. G.P. Sutton, "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 1998.
4. William H. Heiser and David T. Pratt, Hypersonic Airbreathing propulsion, AIAA Education Series, 2001.

IL5091

DATA ANALYTICS

L T P C  
3 0 0 3

### OBJECTIVES:

The Student should be made to:

- Be exposed to big data
- Learn the different ways of Data Analysis
- Be familiar with data streams
- Learn the mining and clustering
- Be familiar with the visualization

### UNIT I INTRODUCTION TO BIG DATA

8

Introduction to Big Data Platform – Challenges of conventional systems - Web data – Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting - Modern data analytic tools, Stastical concepts: Sampling distributions, resampling, statistical inference, prediction error.

### UNIT II DATA ANALYSIS

12

Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and kernel methods, Analysis of time series: linear systems analysis, nonlinear dynamics - Rule induction - Neural networks: learning and generalization, competitive learning, principal component analysis and neural networks; Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods.

### UNIT III MINING DATA STREAMS

8

Introduction to Streams Concepts – Stream data model and architecture - Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window - Realtime Analytics Platform(RTAP) applications - case studies - real time sentiment analysis, stock market predictions.

### UNIT IV FREQUENT ITEMSETS AND CLUSTERING

9

Mining Frequent itemsets - Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream – Clustering Techniques – Hierarchical – K- Means – Clustering high dimensional data – CLIQUE and PROCLUS – Frequent pattern based clustering methods – Clustering in non-euclidean space – Clustering for streams and Parallelism.

### UNIT V FRAMEWORKS AND VISUALIZATION

8

MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed file systems – Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications:

**TOTAL : 45 PERIODS**

## OUTCOMES:

### The student should be made to:

- Apply the statistical analysis methods.
- Compare and contrast various soft computing frameworks.
- Design distributed file systems.
- Apply Stream data model.
- Use Visualisation techniques

## REFERENCES:

1. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012.
2. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analytics, John Wiley & sons, 2012.
3. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O'Reilly, 2011.
4. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.
5. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.

AO5010

AERO ELASTICITY

L T P C  
3 0 0 3

## OBJECTIVES:

- To make the students understand aero elastic phenomena, flutter and to make them to solve steady state aero elastic problems.

### UNIT I AEROELASTIC PHENOMENA

6

Stability versus response problems – The aero-elastic triangle of forces – Aeroelasticity in Aircraft Design – Prevention of aeroelastic instabilities. Influence and stiffness co-efficients. Flexure – torsional oscillations of beam – Differential equation of motion of beam.

### UNIT II DIVERGENCE OF A LIFTING SURFACE

10

Simple two dimensional idealisations-Strip theory – Integral equation of the second kind – Exact solutions for simple rectangular wings – 'Semirigid' assumption and approximate solutions – Generalised coordinates – Successive approximations – Numerical approximations using matrix equations.

### UNIT III STEADY STATE AEROLASTIC PROBLEMS

9

Loss and reversal of aileron control – Critical aileron reversal speed – Aileron efficiency – Semi rigid theory and successive approximations – Lift distribution – Rigid and elastic wings. Tail efficiency. Effect of elastic deformation on static longitudinal stability.

### UNIT IV FLUTTER PHENOMENON

14

Non-dimensional parameters – Stiffness criteria – Dynamic mass balancing – Dimensional similarity. Flutter analysis – Two dimensional thin airfoils in steady incompressible flow – Quasisteady aerodynamic derivatives. Galerkin method for critical flutter speed – Stability of disturbed motion – Solution of the flutter determinant – Methods of determining the critical flutter speeds – Flutter prevention and control.

### UNIT V EXAMPLES OF AEROELASTIC PROBLEMS

6

Galloping of transmission lines and Flow induced vibrations of transmission lines, tall slender structures and suspension bridges, VIV.

**TOTAL: 45 PERIODS**

**OUTCOME:**

Upon completion of the course, Students can understand the theoretical concepts of material behaviour with particular emphasis on their elasticity property.

**REFERENCES**

1. E.G. Broadbent, "Elementary Theory of Aeroelasticity", Bun Hill Publications Ltd., 1986.
2. R.D.Blevins, "Flow Induced Vibrations", Krieger Pub Co., 2001
3. R.H. Scanlan and R.Rosenbaum, "Introduction to the study of Aircraft Vibration and Flutter", Macmillan Co., New York, 1981.
4. R.L. Bisplinghoff, H.Ashley, and R.L. Halfmann, "Aeroelasticity", II Edition Addison Wesley Publishing Co., Inc., 1996.
5. Y.C. Fung, "An Introduction to the Theory of Aeroelasticity", John Wiley & Sons Inc., New York, 2008.

**EY5092****DESIGN AND ANALYSIS OF TURBOMACHINES**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To design and analyse the performance of Turbo machines for engineering applications
- To understand the energy transfer process in Turbomachines and governing equations of various forms.
- To understand the structural and functional aspects of major components of Turbomachines.
- To design various Turbomachines for power plant and aircraft applications

**UNIT I INTRODUCTION****12**

Basics of isentropic flow – static and stagnation properties – diffuser and nozzle configurations - area ratio – mass flow rate – critical properties. Energy transfer between fluid and rotor velocity triangles for a generalized turbomachines - velocity diagrams. Euler's equation for turbomachines and its different forms. Degree of reaction in turbo-machines – various efficiencies – isentropic, mechanical, thermal, overall and polytropic

**UNIT II CENTRIFUGAL AND AXIAL FLOW COMPRESSORS****9**

Centrifugal compressor - configuration and working – slip factor - work input factor – ideal and actual work - pressure coefficient - pressure ratio. Axial flow compressor – geometry and working – velocity diagrams – ideal and actual work – stage pressure ratio - free vortex theory – performance curves and losses

**UNIT III COMBUSTION CHAMBER****9**

Basics of combustion. Structure and working of combustion chamber – combustion chamber arrangements - flame stability – fuel injection nozzles. Flame stabilization - cooling of combustion chamber

**UNIT IV AXIAL AND RADIAL FLOW TURBINES****9**

Elementary theory of axial flow turbines - stage parameters- multi-staging - stage loading and flow coefficients. Degree of reaction - stage temperature and pressure ratios – single and twin spool arrangements – performance. Matching of components. Blade Cooling. Radial flow turbines.

**UNIT V GAS TURBINE AND JET ENGINE CYCLES****9**

Gas turbine cycle analysis – simple and actual. Reheated, Regenerative and Intercooled cycles for power plants. Working of Turbojet, Turbofan, Turboprop, Ramjet, Scarmjet and Pulsejet Engines and cycle analysis – thrust, specific impulse, specific fuel consumption, thermal and propulsive efficiencies.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

When a student completes this subject, he / she can

- Understand the design principles of the turbomachines
- Analyse the turbomachines to improve and optimize its performance

**REFERENCES:**

1. Austin H. Chruuch, Centrifugal pumps and blowers, John wiley and Sons, 1980.
2. Cohen H., Rogers, G F C. and Saravanmotto H I H., Gas Turbine Theory-5th Edition, John Wiely, 2001.
3. Csanady G.T., Theory of Turbo machines, McGraw Hill, 1964.
4. Ganesan V., Gas Turbines, Tata McGrawHill, 2011.
5. Hill P G. and Peterson C R., Mechanics and Thermodynamics of Propulsion, Addition-Wesley, 1970.
6. Khajuria P.R. and Dubey S.P., Gas Turbines and Propulsive Systems, Dhanpat Rai Publications, 2003.
7. Mattingly J D., Elements of Gas turbine Propulsion-1st Edition, McGraw Hill, 1997.

**AO5011****HELICOPTER AERODYNAMICS****L T P C  
3 0 0 3****OBJECTIVES:**

- To impart knowledge to the students and fundamental aspects of helicopter aerodynamics, performance of helicopters, stability and control aspects and also to expose them basic and aerodynamic design aspects.

**UNIT I INTRODUCTION****7**

Types of rotorcraft – autogyro, gyrodyne, helicopter, Main rotor system – articulated, semi rigid, rigid rotors, Collective pitch control, cyclic pitch control, anti torque pedals.

**UNIT II HELICOPTER AERODYNAMICS****12**

Momentum / actuator disc theory, Blade element theory, combined blade element and momentum theory, vortex theory, rotor in hover, rotor model with cylindrical wake and constant circulation along blade, free wake model, Constant chord and ideal twist rotors, Lateral flapping, Coriolis forces, reaction torque, compressibility effects, Ground effect.

**UNIT III PERFORMANCE****9**

Hover and vertical flight, forward level flight, Climb in forward flight, optimum speeds, Maximum level speed, rotor limits envelope – performance curves with effects of altitude

**UNIT IV STABILITY AND CONTROL****9**

Helicopter Trim, Static stability – Incidence disturbance, forward speed disturbance, angular velocity disturbance, yawing disturbance, Dynamic Stability.

**UNIT V AERODYNAMIC DESIGN****8**

Blade section design, Blade tip shapes, Drag estimation – Rear fuselage upsweep,

**TOTAL: 45 PERIODS****OUTCOME:**

Upon completion of the course, students will learn about the basic ideas of evolution, performance and associated stability problems of helicopter.

## REFERENCES

1. A. Gessow and G.C.Meyers, "Aerodynamics of the Helicopter", Macmillan and Co., New York, 1982.
2. J. Seddon, "Basic Helicopter Aerodynamics", AIAA Education series, Blackwell scientific publications, U.K, 1990.
3. John Fay, "The Helicopter", Himalayan Books, New Delhi, 1995.
4. Lalit Gupta, "Helicopter Engineering", Himalayan Books, New Delhi, 1996.
5. Lecture Notes on "Helicopter Technology", Department of Aerospace Engineering, IIT –Kanpur and Rotary Wing aircraft R&D center, HAL, Bangalore, 1998.

AO5012

EXPERIMENTAL AERODYNAMICS

L T P C  
3 0 0 3

### OBJECTIVES:

- To make the students learn basic wind tunnel measurements and flow visualization methods, flow measurement variables and data acquisition method pertaining to experiments in aerodynamics.

### UNIT I BASIC MEASUREMENTS IN FLUID MECHANICS 8

Objective of experimental studies – Fluid mechanics measurements – Properties of fluids – Measuring instruments – Performance terms associated with measurement systems – Direct measurements - Analogue methods – Flow visualization –Components of measuring systems – Importance of model studies - Experiments on Taylor-Proudman theorem and Ekman layer – Measurements in boundary layers -

### UNIT II WIND TUNNEL MEASUREMENTS 8

Characteristic features, operation and performance of low speed, transonic, supersonic and special tunnels - Power losses in a wind tunnel – Instrumentation and calibration of wind tunnels – Turbulence- Wind tunnel balance – Principle and application and uses – Balance calibration.

### UNIT III FLOW VISUALIZATION AND ANALOGUE METHODS 10

Visualization techniques – Smoke tunnel – Hele-Shaw apparatus - Interferometer – Fringe-Displacement method – Shadowgraph - Schlieren system – Background Oriented Schlieren (BOS) System - Hydraulic analogy – Hydraulic jumps – Electrolytic tank

### UNIT IV PRESSURE, VELOCITY AND TEMPERATURE MEASUREMENTS 10

Pitot-Static tube characteristics - Velocity measurements - Hot-wire anemometry – Constant current and Constant temperature Hot-Wire anemometer – Hot-film anemometry – Laser Doppler Velocimetry (LDV) – Particle Image Velocimetry (PIV) – Pressure Sensitive Paints - Pressure measurement techniques - Pressure transducers – Temperature measurements.

### UNIT V DATA ACQUISITION SYSTEMS AND UNCERTAINTY ANALYSIS 9

Data acquisition and processing – Signal conditioning - Estimation of measurement errors – Uncertainty calculation - Uses of uncertainty analysis.

**TOTAL: 45 PERIODS**

### OUTCOME:

Upon completion of the course, students will learn about the measurement of flow properties in wind tunnels and their associated instrumentation.

## REFERENCES

1. Rathakrishnan, E., "Instrumentation, Measurements, and Experiments in Fluids,"CRC Press – Taylor & Francis, 2007.
2. Robert B Northrop, "Introduction to Instrumentation and Measurements", Second Edition, CRC Press, Taylor & Francis, 2006.

**OBJECTIVES:**

- To make the students learn the kinetic theory of hypersonic flows and statistical thermodynamic aspects of flows at very high temperatures and also to make them familiarize the calculations transport properties of gases high temperature.

**UNIT I INTRODUCTION****8**

Nature of high temperature flows – Chemical effects in air – Real perfect gases – Gibb's free energy and entropy by chemical and non equilibrium – Chemically reacting mixtures and boundary layers.

**UNIT II STATISTICAL THERMODYNAMICS****8**

Introduction to statistical thermodynamics – Relevance to hypersonic flow - Microscopic description of gases – Boltzman distribution – Cartesian function

**UNIT III KINETIC THEORY AND HYPERSONIC FLOWS****9**

Chemical equilibrium calculation of equilibrium composition of high temperature air – equilibrium properties of high temperature air – collision frequency and mean free path – velocity and speed distribution functions.

**UNIT IV INVISCID HIGH TEMPERATURE FLOWS****10**

Equilibrium and non – equilibrium flows – governing equations for inviscid high temperature equilibrium flows – equilibrium normal and oblique shock wave flows – frozen and equilibrium flows – equilibrium conical and blunt body flows – governing equations for non equilibrium inviscid flows.

**UNIT V TRANSPORT PROPERTIES IN HIGH TEMPERATURE GASES****10**

Transport coefficients – mechanisms of diffusion – total thermal conductivity – transport characteristics for high temperature air – radiative transparent gases – radiative transfer equation for transport, absorbing and emitting and absorbing gases.

**TOTAL: 45 PERIODS****OUTCOME:**

Upon completion of the course, students will learn statistical thermodynamics and the transport properties of high temperature gases.

**REFERENCES**

1. John D. Anderson, Jr., Hypersonic and High Temperature Gas Dynamics, McGraw-Hill Series, New York, 1996.
2. John D. Anderson, Jr., Modern Compressible Flow with Historical perspective, McGraw-Hill Series, New York, 1996.
3. John T. Bertin, Hypersonic Aerothermodynamics publishers - AIAA Inc., Washington, D.C., 1994.
4. T.K. Bose, High Temperature Gas Dynamics,
5. William H. Heiser and David T. Pratt, Hypersonic Air breathing propulsion, AIAA Education Series.

**OBJECTIVES:**

- To make the students learn about various jet control methods, jet acoustics aspects and free shear layer flow theory pertaining to turbulent jets with high speed.

**UNIT I INTRODUCTION****9**

Types of nozzles – over expanded and underexpanded flows - Isentropic flow through nozzles– Interaction of nozzle flows over adjacent surfaces – Mach disk - Jet flow – types - Numerical problems.

**UNIT II COMPRESSIBLE FLOW THEORY****9**

One-dimensional compressible fluid flow – flow through variable area passage – nozzles and diffusers – normal and oblique shock waves and calculation of flow and fluid properties across the shocks and expansion fans. Interaction of shocks with solid and fluid surface.

**UNIT III JET CONTROL****9**

Types of jet control - single jet, multi jet, co-flow jet, parallel flow jet. Subsonic jets- Mathematical treatment of jet profiles- Theory of Turbulent jets- Mean velocity and mean temperature- Turbulence characteristics of free jets- Mixing length- Experimental methods for studying jets and the Techniques used for analysis- Expansion levels of jets- Overexpanded, Correctly expanded, Underexpanded jets - Control of jets. Centre line decay, Mach number Profile, Iso-Mach (or iso-baric) contours, Shock cell structure in underexpanded and overexpanded jets, Mach discs.

**UNIT IV BOUNDARY LAYER CONCEPT****9**

Boundary Layer – displacement and momentum thickness- laminar and turbulent boundary layers over flat plates – velocity distribution in turbulent flows over smooth and rough boundaries- laminar sublayer. Shock-boundary layer interactions.

**UNIT V JET ACOUSTICS****9**

Introduction to Acoustic – Types of noise – Source of generation- Traveling wave solution- standing wave solution – multi-dimensional acoustics -Noise suppression techniques– applications to problems.

**TOTAL: 45 PERIODS****OUTCOME:**

Upon completion of this course, students will be able to understand various jet control methods, jet acoustics aspects and free shear layer flow theory pertaining to turbulent jets with high speed.

**REFERENCES**

- Ethirajan Rathakrishnan, “Applied Gas Dynamics”, John Wiley, NY,, 2010.
- Liepmann and Roshko, “Elements of Gas Dynamics”, John Wiley, NY, 1963.
- Rathakrishnan E., “Gas Dynamics”, Prentice Hall of India, New Delhi, 2008.
- Shapiro, AH, “Dynamics and Thermodynamics of Compressible Fluid Flow”, Vols. I & II, Ronald Press, New York, 1953.

**OBJECTIVES**

- To impart knowledge to the students and basic principles of combustion, types of flames and also make them familiarize the combustion process in gas turbine, ramjet, scram jet and rocket engines.

<b>UNIT I</b>	<b>THERMODYNAMICS OF COMBUSTION</b>	<b>8</b>
Stoichiometry – absolute enthalpy- enthalpy of formation- enthalpy of combustion- laws of thermochemistry- pressure and temperature effect on enthalpy of formation, adiabatic flame temperature, chemical and equilibrium products of combustion.		
<b>UNIT II</b>	<b>PHYSICS AND CHEMISTRY OF COMBUSTION</b>	<b>9</b>
Fundamental laws of transport phenomena, Conservations Equations, Transport in Turbulent Flow. Basic Reaction Kinetics, Elementary reactions, Chain reactions, Multistep reactions, simplification of reaction mechanism, Global kinetics.		
<b>UNIT III</b>	<b>PREMIXED AND DIFFUSED FLAMES</b>	<b>12</b>
One dimensional combustion wave, Laminar premixed flame, Burning velocity measurement methods, Effects of chemical and physical variables on Burning velocity, Flame extinction, Ignition, Flame stabilizations, Turbulent Premixed flame. Gaseous Jet diffusion flame, Liquid fuel combustion, Atomization, Spray Combustion, Solid fuel combustion.		
<b>UNIT IV</b>	<b>COMBUSTION IN GAS TURBINE , RAMJET AND SCRAMJET</b>	<b>8</b>
Combustion in gas turbine chambers, recirculation, combustion efficiency, flame holders, subsonic combustion in ramjet, supersonic combustion in scramjet. Subsonic and supersonic combustion controlled by decision mixing and heat convection.		
<b>UNIT V</b>	<b>COMBUSTION IN CHEMICAL ROCKET</b>	<b>8</b>
Combustion in liquid propellant rockets. Combustion of solid propellants- application of laminar flame theory to the burning of homogeneous propellants, Combustion in hybrid rockets. combustion instability in rockets.		

**TOTAL: 45 PERIODS**

**OUTCOME:**

Upon completion of the course, students will learn about the thermodynamics, physics and chemistry of combustion.

**REFERENCES**

1. D. P. Mishra . “ Fundamentals of Combustion”, Prentice Hall of India, New Delhi, 2008.
2. H. S. Mukunda, “Understanding Combustion”, 2<sup>nd</sup> edition, Orient Blackswan, 2009.
3. Kuo K.K. “Principles of Combustion” John Wiley and Sons, 2005.
4. Warren C. Strahle , “An Introduction to Combustion”, Taylor & Francis, 1993.

<b>AO5015</b>	<b>PROPELLER AERODYNAMICS</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

<b>UNIT I</b>	<b>AIR SCREW THEORY</b>	<b>8</b>
Introduction – Non-Dimensional Coefficients – Air screw design – development of airscrew theory. The actuator- disc theory, working states of rotor, optimum rotor, Efficiency of rotor.		
<b>UNIT II</b>	<b>THE AXIAL MOMENTUM THEORY</b>	<b>10</b>
The rankine-Froude theory- The momentum Equation – Ideal efficiency of a propeller. The general momentum theory- General equations – constant circulation- approximate solution- minimum loss of energy- constant efficiency. Propeller efficiency- Energy equation – approximate solution- efficiency- numerical results.		
<b>UNIT III</b>	<b>THE BLADE ELEMENT THEORY</b>	<b>9</b>
Primitive Blade Element Theory- Efficiency of the blade element- Blade interface- The vortex system of a propeller- induced velocity- The airfoil characteristics- Multi plane Interference- cascade of airfoils – Airfoil characteristics in a cascade.		

**UNIT IV THE VORTEX THEORY 9**  
 The propeller blades- Energy and Momentum- Propeller characteristics – The application of the Vortex theory- The effect of solidity and pitch – Approximate method of solution- Effective Aspect ratio of the blades. Propellers of highest efficiency- Minimum loss of energy- Lightly loaded Propellers- Effect of profile drag- The effect of number of blades- Application of Prandtl's Formula.

**UNIT V EXPERIMENTAL AND SIMULATION APPROACH OF PROPELLERS 9**  
 Experimental Methods- Wind tunnel interference- Thrust and Torque distribution- Scale effect- Compressibility Effect. Basics of propeller simulations- Domain selection- Grid independency study- Turbulence model investigation.

**TOTAL: 45 PERIODS**

**OUTCOME:**

Upon completion of the course, students will gain knowledge on various Propeller theories and propeller simulations

**REFERENCES:**

1. Durand, W.F., "Applied Aerodynamics- Volume IV", Stanford University, California, 1934.
2. "Modeling Propeller Flow-Fields Using CFD" – AIAA 2008-402.
3. Kerwin, Justin, "lecture Notes on Hydrofoils and Propellers", Cambridge, 2001.
4. Seddon, J., "Basic Helicopter Aerodynamics", BSP Professional Books, Oxford London, 1990.

**AO5009 AIRCRAFT GUIDANCE AND CONTROL L T P C**  
**3 0 0 3**

**UNIT I INTRODUCTION 4**  
 Introduction to Guidance and control - definition, Historical background

**UNIT II AUGMENTATION SYSTEMS 7**  
 Need for automatic flight control systems, Stability augmentation systems, control augmentation systems, Gain scheduling concepts.

**UNIT III LONGITUDINAL AUTOPILOT 12**  
 Displacement Autopilot-Pitch Orientation Control system, Acceleration Control System, Glide Slope Coupler and Automatic Flare Control and Flight path stabilization, Longitudinal control law design using back stepping algorithm.

**UNIT IV LATERAL AUTOPILOT 10**  
 Damping of the Dutch Roll, Methods of Obtaining Coordination, Yaw Orientation Control system, turn compensation, Automatic lateral Beam Guidance. Introduction to Fly-by-wire flight control systems, Lateral control law design using back stepping algorithm.

**UNIT V MISSILE AND LAUNCH VEHICLE GUIDANCE 12**  
 Operating principles and design of guidance laws, homing guidance laws- short range, Medium range and BVR missiles, Launch Vehicle- Introduction, Mission requirements, Implicit guidance schemes, Explicit guidance, Q guidance schemes

**TOTAL: 45 PERIODS**

**OUTCOME:**

Upon completion of the course, students will learn about longitudinal and lateral autopilot, guidance of missile and launch vehicles.

**REFERENCES:**

1. Bernad Etkin, 'Dynamic of flight stability and control', John Wiley, 1972.
2. Blake Lock, J.H 'Automatic control of Aircraft and missiles ', John Wiley Sons, New York, 1990.
3. Collinson R.P.G, 'Introduction to Avionics', Chapman and Hall, India, 1996.
4. Garnel.P. & East.D.J, 'Guided Weapon control systems', Pergamon Press, Oxford, 1977.
5. Nelson R.C 'Flight stability & Automatic Control', McGraw Hill, 1989.
6. Stevens B.L & Lewis F.L, 'Aircraft control & simulation', John Wiley Sons, New York, 1992.

**AO5092****AVIONICS****L T P C  
3 0 0 3****OBJECTIVES:**

- To introduce the basic of avionics and its need for civil and military aircrafts
- To impart knowledge about the avionic architecture and various avionics data buses
- To gain more knowledge on various avionics subsystems

**UNIT I INTRODUCTION TO AVIONICS****9**

Need for avionics in civil and military aircraft and space systems – integrated avionics and weapon systems – typical avionics subsystems, design, technologies – Introduction to digital computer and memories.

**UNIT II DIGITAL AVIONICS ARCHITECTURE****9**

Avionics system architecture – data buses – MIL-STD-1553B – ARINC – 420, ARINC-429 – ARINC – 629.

**UNIT III FLIGHT DECKS AND COCKPITS****9**

Control and display technologies: CRT, LED, LCD, EL and plasma panel – Touch screen – Direct voice input (DVI) – Civil and Military Cockpits: MFDS, HUD, MFK, HOTAS.

**UNIT IV INTRODUCTION TO NAVIGATION SYSTEMS****9**

Radio navigation – ADF, DME, VOR, LORAN, DECCA, OMEGA, TACAN, ILS, MLS, Hyperbolic navigation systems, Ground Control Approach Systems. Dead reckoning navigation systems, Doppler navigational and inertial navigation– Inertial Navigation Systems (INS) – INS block diagram – Satellite navigation systems – Traffic Alert and Collision Avoidance System (TCAS), GPS.

**UNIT V AIR DATA SYSTEMS AND AUTO PILOT****9**

Air data quantities – Altitude, Air speed, Vertical speed, Mach meter, Total air temperature, Mach warning, Altitude warning – Auto pilot – Basic principles, Longitudinal and lateral auto pilot.

**TOTAL: 45 PERIODS****OUTCOMES:**

- To introduce the basic of avionics and its need for civil and military aircrafts
- To impart knowledge about the avionic architecture and various avionics data buses
- To gain more knowledge on various avionics subsystems

**REFERENCES:**

1. Albert Helfrick.D., "Principles of Avionics", Avionics Communications Inc., 2004
2. Collinson.R.P.G. "Introduction to Avionics", Chapman and Hall, 1996.
3. Middleton, D.H., Ed., "Avionics systems, Longman Scientific and Technical", Longman Group UK Ltd., England, 1989.
4. Spitzer, C.R. "Digital Avionics Systems", Prentice-Hall, Englewood Cliffs, N.J., U.S.A. 1993.
5. Spitzer. C.R. "The Avionics Hand Book", CRC Press, 2000
6. Pallet.E.H.J. "Aircraft Instruments and Integrated Systems", Longman Scientific.

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CHOICE BASED CREDIT SYSTEM**

**PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):**

- To provide students with strong fundamental concepts and also advanced techniques and tools to build various communication systems.
- To enable graduates to attain successful professional careers by applying their engineering skills in communication system design to meet out the challenges in industries and academia.
- To engage graduates in lifelong learning, adapt emerging technology and pursue research for the development of innovative products.

**PROGRAM OUTCOMES (POS):**

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**PROGRAMME SPECIFIC OBJECTIVES (PSOs)**

- To inculcate the ability in graduates to design and analyze the subsystems such as RF, Signal Processing, Modern communication systems and networks.
- To enhance problem solving skills in communication systems design using latest hardware and software tools.
- To apply communication engineering principles and practices for developing products for scientific and business applications.

**MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) WITH PROGRAMME OUTCOMES (POs):**

The mapping between the Programme Educational Objectives (PEOs) and the Programme Outcomes (POs) is given in the following table

PEOs	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
PEO 1	3	2	1	1	2	1	-	-	2	-	-	2
PEO 2	3	3	2	3	3	2	1	1	2	2	1	1
PEO 3	3	3	3	3	3	1	1	1	2	2	1	3

The mapping between the Programme Specific Objectives (PSOs) and the Programme Outcomes (POs) is given in the following table

PSOs	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
PSO 1	3	2	1	1	1	1	1	-	1	-	-	1
PSO 2	3	3	1	3	3	1	1	-	1	-	-	1
PSO 3	3	3	2	3	2	3	2	2	2	2	2	2

**M.E. COMMUNICATION SYSTEMS  
SEMESTER COURSE WISE PO MAPPING**

	SUBJECTS	Programme Outcomes												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	
<b>I Y E A R</b>	<b>SEMESTER I</b>	Applied Mathematics for Communication Engineers	3	3	2	1	1	-	-	-	-	-	-	1
		Advanced Radiation Systems	3	3	2	2	2	2	2	1	2	-	1	2
		Advanced Digital Communication Techniques	3	2	1	1	2	1	-	-	2	-	-	2
		Advanced Digital Signal Processing	3	3	3	3	3	3	2	1	1	1	1	2
		Optical Networks	3	2	2	1	2	1	1	-	1	-	-	2
		<b>Professional Elective I</b>												
		Advanced Satellite Communication and Navigation Systems	3	3	1	1	2	1	-	-	2	1	-	2
		<u>DSP Processor Architecture and Programming</u>	2	1	3	3	3	1	-	-	2	1	-	2
		<u>Analog and Mixed Mode VLSI Design</u>	3	3	3	1	3	1	2	2	1	-	-	2
		<u>Real Time Embedded Systems</u>	3	3	3	3	3	2	2	1	2	2	2	3
		<u>MEMS and NEMS</u>	2	2	2	2	2	1	1	-	1	-	-	1
	Communication Systems Laboratory	3	3	1	1	2	1	1	-	2	-	1	3	
	<b>SEMESTER II</b>	Advanced <u>Wireless Communication Systems</u>	3	3	2	2	2	2	2	1	2	-	1	2
		<u>MIC and RF System Design</u>	2	2	3	3	2	3	-	1	2	1	1	3
		<u>Electromagnetic Interference and Compatibility</u>	3	3	2	3	2	2	1	1	1	-	-	2
<b>Professional Elective II</b>														
<u>Communication Network Modeling and Simulation</u>		3	2	1	1	2	1	-	-	2	-	-	2	

		<u>Digital Communication Receivers</u>	2	2	3	3	2	2	1	1	2	2	1	2	
		<u>Detection and Estimation Theory</u>	3	3	3	3	3	2	-	1	1	2	1	2	
		<u>VLSI for Wireless Communication</u>	1	2	3	3	3	2	1	1	2	2	1	2	
		<u>Cognitive Radio Networks</u>	3	2	2	1	2	1	1	-	1	-	-	3	
		<b>Professional Elective III</b>													
		Advanced Antenna Design	2	2	3	3	2	3	-	1	2	1	1	3	
		<u>Advanced Digital Image Processing</u>	2	3	3	3	3	2	1	1	2	2	1	2	
		<u>Radar Signal Processing</u>	3	3	2	2	2	2	1	-	2	2	1	2	
		<u>Speech Processing and Synthesis</u>	3	3	3	3	3	3	2	2	2	2	1	3	
		Advanced Wireless Networks	1	1	1	2	2	1	1	1	2	-	1	2	
		<b>Professional Elective IV</b>													
		<u>Wavelet Transforms and its Applications</u>	2	3	3	3	3	2	-	1	2	2	1	3	
		Spectrum Management Techniques													
		Broadband Access Technologies	3	1	1	1	1	1	-	-	2	1	-	2	
		Software Defined Radio	3	1	1	1	2	1	-	-	2	1	-	2	
		Space Time Wireless Communication	2	2	3	3	3	2	2	1	2	2	1	3	
		<u>RF System Design Laboratory</u>	3	3	3	3	3	2	2	2	3	3	3	3	
		Term Paperwriting and Seminar	3	3	3	2	1	2	1	1	2	2	1	3	
II Y E A R	SEMESTER III	Millimeter Wave Communication	3	3	2	2	2	2	2	1	2	-	1	2	
		<b>Professional Elective V</b>													
		<u>Network Routing Algorithms</u>	3	2	1	1	2	1	-	-	2	-	-	-	2
		<u>Wireless Adhoc and Sensor Networks</u>	3	2	1	1	2	1	-	-	2	-	-	-	2
		<u>Internet of Things</u>	3	2	1	1	3	2	-	-	2	1	-	-	2
		<u>Multimedia Compression Techniques</u>	3	3	2	2	3	2	2	2	1	2	2	1	3
		Ultra Wide Band Communication	3	3	3	2	3	2	1	-	1	-	-	1	2

		<b>Professional Elective VI</b>												
		<u>Soft Computing Techniques</u>	3	3	2	3	2	1	1	1	2	1	1	2
		<u>Network Processors</u>	1	1	1	1	2	1	1	-	1	-	-	1
		Network Management	1	1	1	2	2	1	1	1	2	-	1	2
		<u>Communication Network Security</u>	3	2	2	3	2	2	1	1	2	1	1	3
		High Performance Switching Architectures	3	3	3	3	3	2	2	2	3	3	2	3
	<b>SEMESTER IV</b>	Project Work Phase – II	3	3	3	3	3	3	3	2	3	2	3	3

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**CURRICULA AND SYLLABI**

**SEMESTER - I**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MA5154	Applied Mathematics for Communication Engineers	FC	4	4	0	0	4
2.	CU5191	Advanced Radiation Systems	PC	3	3	0	0	3
3.	CU5151	Advanced Digital Communication Techniques	PC	3	3	0	0	3
4.	AP5152	Advanced Digital Signal Processing	PC	5	3	2	0	4
5.	CU5192	Optical Networks	PC	3	3	0	0	3
6.		Professional Elective I	PE	3	3	0	0	3
<b>PRACTICALS</b>								
7.	CU5161	Communication Systems Laboratory	PC	4	0	0	4	2
<b>TOTAL</b>				<b>25</b>	<b>19</b>	<b>2</b>	<b>4</b>	<b>22</b>

**SEMESTER II**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	CU5291	Advanced Wireless Communication Systems	PC	3	3	0	0	3
2.	CU5201	MIC and RF System Design	PC	3	3	0	0	3
3.	CU5292	Electromagnetic Interference and Compatibility	PC	3	3	0	0	3
4.		Professional Elective II	PE	3	3	0	0	3
5.		Professional Elective III	PE	3	3	0	0	3
6.		Professional Elective IV	PE	3	3	0	0	3
<b>PRACTICALS</b>								
7.	CU5211	RF System Design Laboratory	PC	4	0	0	4	2
8.	CP5281	Term Paper Writing and Seminar	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>24</b>	<b>18</b>	<b>0</b>	<b>6</b>	<b>21</b>

**SEMESTER III**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	CU5301	Millimeter Wave Communication	PC	3	3	0	0	3
2.		Professional Elective V	PE	3	3	0	0	3
3.		Professional Elective VI	PE	3	3	0	0	3
<b>PRACTICALS</b>								
4.	CU5311	Project Work Phase I	EEC	12	0	0	12	6
<b>TOTAL</b>				<b>21</b>	<b>9</b>	<b>0</b>	<b>12</b>	<b>15</b>

**SEMESTER IV**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>PRACTICALS</b>								
1.	CU5411	Project Work Phase II	EEC	24	0	0	24	12
<b>TOTAL</b>				<b>24</b>	<b>0</b>	<b>0</b>	<b>24</b>	<b>12</b>

**TOTAL NO. OF CREDITS: 70**

### FOUNDATION COURSES (FC)

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MA5154	Applied Mathematics for Communication Engineers	FC	4	4	0	0	4

### PROFESSIONAL CORE (PC)

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CU5191	Advanced Radiation Systems	PC	3	3	0	0	3
2.	CU5151	Advanced Digital Communication Techniques	PC	3	3	0	0	3
3.	AP5152	Advanced Digital Signal Processing	PC	5	3	2	0	4
4.	CU5192	Optical Networks	PC	3	3	0	0	3
5.	CU5161	Communication Systems Laboratory	PC	4	0	0	4	2
6.	CU5291	Advanced Wireless Communication Systems	PC	3	3	0	0	3
7.	CU5201	MIC and RF System Design	PC	3	3	0	0	3
8.	CU5292	Electromagnetic Interference and Compatibility	PC	3	3	0	0	3
9.	CU5211	RF System Design Laboratory	PC	4	0	0	4	2
10.	CU5301	Millimeter Wave Communication	PC	3	3	0	0	3

### EMPLOYABILITY ENHANCEMENT COURSE (EEC)

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CP5281	Term Paper Writing and Seminar	EEC	2	0	0	2	1
2.	CU5311	Project Work Phase – I	EEC	12	0	0	12	6
3.	CU5411	Project Work Phase – II	EEC	24	0	0	24	12

**PROFESSIONAL ELECTIVES (PE)\*  
SEMESTER I  
ELECTIVE I**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CU5091	Advanced Satellite Communication and Navigation Systems	PE	3	3	0	0	3
2.	DS5191	DSP Processor Architecture and Programming	PE	3	3	0	0	3
3.	CU5001	Analog and Mixed Mode VLSI Design	PE	3	3	0	0	3
4.	CU5092	Real Time Embedded Systems	PE	3	3	0	0	3
5.	VL5091	MEMS and NEMS	PE	3	3	0	0	3

**SEMESTER II  
ELECTIVE II**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CU5002	Communication Network Modeling and Simulation	PE	3	3	0	0	3
2.	CU5071	Digital Communication Receivers	PE	3	3	0	0	3
3.	CU5072	Detection and Estimation Theory	PE	3	3	0	0	3
4.	CU5073	VLSI for Wireless Communication	PE	3	3	0	0	3
5.	NC5251	Cognitive Radio Networks	PE	3	3	0	0	3

**SEMESTER II  
ELECTIVE III**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CU5003	Advanced Antenna Design	PE	3	3	0	0	3
2.	DS5291	Advanced Digital Image Processing	PE	3	3	0	0	3
3.	DS5292	Radar Signal Processing	PE	3	3	0	0	3
4.	CP5096	Speech Processing and Synthesis	PE	3	3	0	0	3
5.	NC5252	Advanced Wireless Networks	PE	3	3	0	0	3

**SEMESTER II  
ELECTIVE IV**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CU5093	Wavelet Transforms and its Applications	PE	3	3	0	0	3
2.	EL5071	Broadband Access Technologies	PE	3	3	0	0	3
3.	CU5094	Software Defined Radio	PE	3	3	0	0	3
4.	CU5095	Space Time Wireless Communication	PE	3	3	0	0	3
5.	CU5096	Pattern Recognition and Machine Learning	PE	3	3	0	0	3

**SEMESTER III  
ELECTIVE V**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	NC5071	Network Routing Algorithms	PE	3	3	0	0	3
2.	CU5097	Wireless Adhoc and Sensor Networks	PE	3	3	0	0	3
3.	CP5292	Internet of Things	PE	3	3	0	0	3
4.	MU5091	Multimedia Compression Techniques	PE	3	3	0	0	3
5.	CU5074	Ultra Wide Band Communication	PE	3	3	0	0	3

**SEMESTER III  
ELECTIVE VI**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MP5092	Soft Computing Techniques	PE	3	3	0	0	3
2.	NC5072	Network Processors	PE	3	3	0	0	3
3.	NE5071	Network Management	PE	3	3	0	0	3
4.	NC5291	Communication Network Security	PE	3	3	0	0	3
5.	CU5004	High Performance Switching Architectures	PE	3	3	0	0	3

**OBJECTIVES:**

The primary objective of this course is to demonstrate various analytical skills in applied mathematics and extensive experience with the tactics of problem solving and logical thinking applicable in communication engineering. This course also will help the students to identify, formulate, abstract, and solve problems in electrical engineering using mathematical tools from a variety of mathematical areas, including linear algebra, matrix linear programming, probability, numerical solution of ordinary differential equations and queuing models.

**UNIT I LINEAR ALGEBRA****12**

Vector spaces – Norms – Inner products – Eigenvalues using QR transformations – QR factorization - Generalized eigenvectors – Canonical forms – Singular value decomposition and applications - Pseudo inverse – Least square approximations - Toeplitz matrices and some applications.

**UNIT II LINEAR PROGRAMMING****12**

Formulation – Graphical solution – Simplex method – Big M method - Two phase method - Transportation problems - Assignment models.

**UNIT III NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS****12**

Runge - Kutta method of fourth order for system of IVPs - Numerical stability of Runge - Kutta method - Adams - Bashforth multistep method - Shooting method, BVP : Finite difference method and collocation method and orthogonal collocation method.

**UNIT IV PROBABILITY AND RANDOM VARIABLES****12**

Probability – Axioms of probability – Conditional probability – Baye’s theorem - Random variables - Probability function - Two dimensional random variables - Joint distributions – Marginal and conditional distributions – Functions of two dimensional random variables – Regression curve – Correlation.

**UNIT V QUEUEING MODELS****12**

Poisson Process – Markovian queues – Single and multi - server models – Little’s formula - Machine interference model – Steady state analysis – Self service queue.

**TOTAL: 60 PERIODS****OUTCOMES:**

**After completing this course, students should demonstrate competency in the following skills:**

- Concepts on vector spaces, linear transformation, inner product spaces, eigenvalues and generalized eigenvectors.
- Apply various methods in linear algebra to solve system of linear equations.
- Could develop a fundamental understanding of linear programming models, able to develop a linear programming model from problem description, apply the simplex method for solving linear programming problems.
- Numerical solution of differential equations by single and multistep methods.
- Computation of probability, random variables and their associated distributions, correlations and regression.
- Conceptualize the principle of optimality and sub-optimization, formulation and computational procedure of dynamic programming.
- Exposing the basic characteristic features of a queuing system and acquire skills in analyzing queuing models.
- Using discrete time Markov chains to model computer systems.

**REFERENCES:**

1. Bronson, R. and Costa, G. B., "Linear Algebra", 2<sup>nd</sup> Edition, Academic Press, 2007.
2. Burden, R. C. and Faires, J. D., "Numerical Analysis ", 9<sup>th</sup> Edition, Cengage Learning, 2016.
3. Gross, D., Shortle, J.F., Thompson, J. M. and Harris, C. M., "Fundamentals of Queueing Theory ", 4<sup>th</sup> Edition, Wiley, 2014.
4. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8<sup>th</sup> Edition, 2015.
5. Sastry, S. S., "Introductory Methods of Numerical Analysis ", 5<sup>th</sup> Edition, PHI Learning, 2015.
6. Taha H.A., "Operations Research: An Introduction", 9<sup>th</sup> Edition, Pearson Education Asia, New Delhi, 2016.

<b>CU5191</b>	<b>ADVANCED RADIATION SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand antenna radiation and its parameters.
- To enhance the student knowledge in the area of various antenna design.
- To design mono pole, dipole and patch antenna and to impart the knowledge about modern antennas.

**UNIT I ANTENNA FUNDAMENTALS 9**

Wave equations, radiation pattern, HPBW, FNBW, gain and directivity, polarization, equivalent circuit, radiation resistance, Radiation integrals, Radiation from surface and line current distributions – dipole, monopole, loop antenna, Antenna parameters, Image theory; Induction, reciprocity theorem, Balance to unbalance transformer, Introduction to numerical techniques.

**UNIT II RADIATION FROM APERTURES 9**

Field equivalence principle, Radiation from Rectangular and Circular apertures, Uniform aperture, distribution on an infinite ground plane; Slot antenna; Horn antenna; Reflector antenna, aperture blockage, design considerations.

**UNIT III ARRAYS 9**

Introduction-General structure of phased array, linear array theory, variation of gain as a function of pointing direction, effects of phase quantization, frequency scanned arrays, analog beamforming matrices-Active modules, digital beam forming, MEMS technology in phased arrays-Retrodirective and self phased arrays.

**UNIT IV MICRO STRIP ANTENNA 9**

Radiation mechanism from patch; Excitation techniques; Microstrip dipole; Rectangular patch, Circular patch, and Ring antenna – radiation analysis from transmission line model, cavity model; input impedance of rectangular and circular patch antenna; Microstrip array and feed network; Applications of microstrip array antenna.

**UNIT V SPECIAL ANTENNAS AND MEASUREMENTS 9**

Mobile phone antenna ,base station, hand set antenna, UWB antenna, PIFA, Vivaldi antenna, Antenna for automobiles, Broadband antenna, antenna factor, Gain, impedance and radiation pattern measurements, Test sites and anechoic chamber.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Ability to understand antenna concepts
- Ability to design antenna for various applications
- Knowledge of modern antenna design

**REFERENCES:**

1. Balanis.A, "Antenna Theory Analysis and Design", John Wiley and Sons, New York, 1982.
2. Hubregt.J.Visser "Antenna Theory and Applications" 1<sup>st</sup> Edition, John Wiley & Sons Ltd,New York,2012.
3. S.Drabowitch et.al., "Modern Antennas", 2nd Edition Springer science business Media,Inc.2005
4. Xavier Begaud, "Ultra Wide Band Antennas" , 1<sup>st</sup> Edition, ISTE Ltd and John Wiley & Sons Ltd, New York,2013.
5. Zhijun Zhang" Antenna Design for Mobile Devices" 1<sup>st</sup> Edition, John Wiley & Sons (Asia) Ltd, New York,2011.

<b>CU5151</b>	<b>ADVANCED DIGITAL COMMUNICATION TECHNIQUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the basics of signal-space analysis and digital transmission.
- To understand the coherent and noncoherent receivers and its impact on different channel characteristics.
- To understand the different Equalizers
- To understand the different block coded and convolutional coded digital communication systems.
- To understand the basics of Multicarrier and Multiuser Communications.

**UNIT I COHERENT AND NON-COHERENT COMMUNICATION 9**

Coherent receivers – Optimum receivers in WGN – IQ modulation & demodulation – Noncoherent receivers in random phase channels; MFSK receivers – Rayleigh and Rician channels – Partially coherent receivers – DPSK; M-PSK; M-DPSK-BER Performance Analysis. Carrier Synchronization- Bit synchronization.

**UNIT II EQUALIZATION TECHNIQUES 9**

Band Limited Channels- ISI – Nyquist Criterion- Controlled ISI-Partial Response signals- Equalization algorithms – Viterbi Algorithm – Linear equalizer – Decision feedback equalization – Adaptive Equalization algorithms.

**UNIT III BLOCK CODED DIGITAL COMMUNICATION 9**

Architecture and performance – Binary block codes; Orthogonal; Biorthogonal; Transorthogonal – Shannon's channel coding theorem; Channel capacity; Matched filter; Concepts of Spread spectrum communication – Coded BPSK and DPSK demodulators– Linear block codes; Hamming; Golay; Cyclic; BCH ; Reed – Solomon codes. Space time block codes.

**UNIT IV CONVOLUTIONAL CODED DIGITAL COMMUNICATION 9**  
 Representation of codes using Polynomial, State diagram, Tree diagram, and Trellis diagram – Decoding techniques using Maximum likelihood, Viterbi algorithm, Sequential and Threshold methods – Error probability performance for BPSK and Viterbi algorithm, Turbo Coding.

**UNIT V MULTICARRIER AND MULTIUSER COMMUNICATIONS 9**  
 Single Vs multicarrier modulation, orthogonal frequency division multiplexing (OFDM), Modulation and demodulation in an OFDM system, An FFT algorithmic implementation of an OFDM system, Bit and power allocation in multicarrier modulation, Peak-to-average ratio in multicarrier modulation. Introduction to CDMA systems, multiuser detection in CDMA systems – optimum multiuser receiver, suboptimum detectors, successive interference cancellation.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon Completion of the course, the students will be able to:**

- Develop the ability to understand the concepts of signal space analysis for coherent and non- coherent receivers.
- Conceptually appreciate different Equalization techniques
- Possess knowledge on different block codes and convolutional codes.
- Comprehend the generation of OFDM signals and the techniques of multiuser detection.

**REFERENCES:**

1. Bernard Sklar, “Digital Communications”, second edition, Pearson Education, 2001.
2. John G. Proakis, “Digital Communication”, Fifth Edition, Mc Graw Hill Publication, 2008.
3. M.K.Simon, S.M.Hinedi and W.C.Lindsey, “Digital communication techniques; Signal Design and Detection”, Prentice Hall of India, New Delhi, 1995.
4. Richard Van Nee & Ramjee Prasad, “OFDM for Multimedia Communications” Artech House Publication, 2001.
5. Stephen G. Wilson, “Digital Modulation and Coding”, First Indian Reprint, Pearson Education, 2003.
6. Simon Haykin, “Digital communications”, John Wiley and sons, 1998.
7. Theodore S.Rappaport, ‘Wireless Communications’, 2<sup>nd</sup> edition, Pearson Education, 2002.

<b>AP5152</b>	<b>ADVANCED DIGITAL SIGNAL PROCESSING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>2</b>	<b>0</b>	<b>4</b>

**OBJECTIVES:**

- The student comprehends mathematical description and modelling of discrete time random signals.
- The student is conversant with important theorems and random signal processing algorithms.
- The student learns relevant figures of merit such as power, energy, bias and consistency.
- The student is familiar with estimation, prediction, filtering, multirate concepts and techniques.

**UNIT I DISCRETE RANDOM SIGNAL PROCESSING 9+6**

Discrete random processes – Ensemble averages – Wide sense stationary process – Properties - Ergodic process – Sample mean & variance - Auto-correlation and Auto-correlation matrices- Properties – White noise process – Weiner Khitchine relation - Power spectral density – Filtering random process – Spectral Factorization Theorem – Special types of Random Processes – AR,MA, ARMA Processes – Yule-Walker equations.

**UNIT II SPECTRUM ESTIMATION****9+6**

Bias and Consistency of estimators - Non-Parametric methods – Periodogram – Modified Periodogram – Barlett's method – Welch's method – Blackman-Tukey method – Parametric methods – AR, MA and ARMA spectrum estimation - Performance analysis of estimators.

**UNIT III SIGNAL MODELING AND OPTIMUM FILTERS****9+6**

Introduction- Least square method – Pade approximation – Prony's method – Levinson Recursion – Lattice filter - FIR Wiener filter – Filtering – Linear Prediction – Non Causal and Causal IIR Wiener Filter – Mean square error – Discrete Kalman filter.

**UNIT IV ADAPTIVE FILTERS****9+6**

FIR Adaptive filters - Newton's steepest descent method – Widrow Hoff LMS Adaptive algorithm – Convergence – Normalized LMS – Applications – Noise cancellation - channel equalization – echo canceller – Adaptive Recursive Filters - RLS adaptive algorithm – Exponentially weighted RLS-sliding window RLS.

**UNIT V MULTIRATE SIGNAL PROCESSING****9+6**

Decimation - Interpolation – Sampling Rate conversion by a rational factor  $I/D$  – Multistage implementation of sampling rate conversion – Polyphase filter structures – Applications of multirate signal processing.

**TOTAL 45+30: 75 PERIODS****OUTCOMES:**

- Formulate time domain and frequency domain description of Wide Sense Stationary process in terms of matrix algebra and relate to linear algebra concepts.
- State W-K theorem, spectral factorization theorem, spectrum estimation, bias and consistency of estimators.
- Wiener filtering, LMS algorithms, Levinson recursion algorithm, applications of adaptive filters
- Decimation, interpolation, Sampling rate conversion, Applications of multirate signal processing

**REFERENCES:**

1. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Prentice Hall of India, New Delhi, 2005.
2. Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons Inc., New York, 2006.
3. P. P. Vaidyanathan, "Multirate Systems and Filter Banks", Prentice Hall, 1992.
4. S. Kay, "Modern spectrum Estimation theory and application", Prentice Hall, Englewood Cliffs, NJ1988.
5. Simon Haykin, "Adaptive Filter Theory", Prentice Hall, Englewood Cliffs, NJ1986.
6. Sophoncles J. Orfanidis, "Optimum Signal Processing", McGraw-Hill, 2000.

**CU5192****OPTICAL NETWORKS****L T P C  
3 0 0 3****OBJECTIVES:****The students should be made to understand:**

- Optical system components like optical amplifiers, wavelength converters.
- Up-to-date survey of development in Optical Network Architectures.
- Packet switching.

- Network design perspectives.
- Different Optical Network management techniques and functions.

## **UNIT I**

**9**

Introduction to Optical Networks: Telecommunications Networks Architecture, Services, circuit switching and packet switching, Optical Networks: Multiplexing Techniques, Second generation Optical Networks, Optical Packet Switching, Transmission Basics: Wavelength, frequencies, and channel spacing, Wavelength standards, Optical power and loss, Network Evolution, Nonlinear Effects: Self-phase Modulation, Cross-phase Modulation, Four Wave mixing, Solitons. Components: Couplers, Isolators and Circulators, Multiplexers and Filters, Optical Amplifiers, Transmitters, Detectors, Switches, Wavelength Converters.

## **UNIT II**

**9**

Transmission System Engineering: System Model, Power Penalty, Transmitter, Receiver, Optical Amplifiers, Crosstalk, Dispersion, Wavelength Stabilization, Overall Design Considerations. Optical Internets: Migration to IP optical networking, IP and Optical backbone, IP Routing table, MPLS and optical cross connect table, Protocol stack Alternatives, Internetworking SS7 and Legacy Transport, Internet transport network protocol stack.

## **UNIT III**

**9**

SONET, SDH and Optical Transport Networks (OTNs): SONET and SDH: SONET multiplexing hierarchy, Frame structure, Functional Component, problem detection, concatenation. Architecture of Optical Transport Networks (OTNs): Digital wrapper, in-band and out-of band control signalling, Importance of Multiplexing and multiplexing hierarchies, SONET multiplexing hierarchies, SDH multiplexing hierarchies, New Optical Transport, OTN layered Model, Generic Framing Procedure (GFP)

## **UNIT IV**

**9**

WDM, Network topologies, MPLS and Optical Networks: WDM: WDM operation, Dense Wavelength Division Multiplexing (DWDM), Erbium-doped Fiber (EDF), WDM amplifiers, Add-Drop Multiplexers, Wavelength Continuity Property, Higher dispersion for DWDM, Tunable DWDM Lasers.

## **UNIT V**

**9**

Network topologies and protection schemes: Robust networks, Line and path protection switching, Types of topology, Point to point topology, bi-directional line-switched ring (BLSR), meshed topology, Passive optical networks, Metro optical networks 28 MPLS and Optical Networks: IS label switching, Forwarding equivalence class (FEC), Types of MPLS nodes, Label distribution and binding, label swapping and traffic forwarding, MPLS support of Virtual Private Networks (VPN), MPLS traffic engineering, Multi protocol Lambda switching (MPIS).

**TOTAL : 45 PERIODS**

## **OUTCOMES:**

**At the end of the course, the student should be able to:**

- Design and Analyze Network Components
- Assess and Evaluate optical networks

## **REFERENCES:**

1. Rajiv Ramaswami and Kumar Sivarajan, "Optical Networks – Practical Perspective", 3<sup>rd</sup> Edition, Morgan - Kaufmann Publishers.
2. Optical Networks, Third Generation Transport Systems, Uyles Black, Pearson

**CU5161**

**COMMUNICATION SYSTEMS LABORATORY**

**L T P C  
0 0 4 2**

**OBJECTIVES:**

- To acquire knowledge on Transmission line and S- parameter estimation of microwave devices.
- To introduce the basics of Microstrip Patch Antenna and its analysis .
- To study & measure the performance of digital communication systems.
- To provide a comprehensive knowledge of Wireless Communication.
- To learn about the design of digital filter and its adaptive filtering algorithms.

**LIST OF EXPERIMENTS**

**USE NETWORK ANALYSER FOR THE FOLLOWING EXPERIMENTS:**

1. Measurement of transmission line parameters.
2. S-parameter estimation of Microwave devices.
3. Design and testing of a Microstrip coupler.
4. Characteristics of Microstrip patch antenna.

**USE APPROPRIATE SIMULATION TOOLS FOR THE FOLLOWING EXPERIMENTS:**

1. Generation & detection of binary digital modulation techniques.
2. Spread Spectrum communication system-Pseudo random binary sequence generation-Baseband DSSS.
3. Digital Filter Design
4. Performance evaluation of simulated CDMA system
5. Channel equalizer design(LMS,RLS)
6. Antenna Radiation Pattern measurement

**TOTAL : 60 PERIODS**

**OUTCOMES:**

**Upon the completion of course, students are able to**

- Measure and analyze various transmission line parameters.
- Design Microstrip patch antennas.
- Implement the adaptive filtering algorithms
- To generate and detect digital communication signals of various modulation techniques using MATLAB.
- Evaluate cellular mobile communication technology and propagation model.

**CU5291**

**ADVANCED WIRELESS COMMUNICATIONS SYSTEM**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

**The students should be made to:**

- Understand Concepts of MIMO diversity and spatial multiplexing.
- Learn Massive MIMO system
- Know millimeter wave communication

**UNIT I INFORMATION THEORETIC ASPECTS OF MIMO 10**

Review of SISO fading communication channels, MIMO Channel models, Classical i.i.d. and extended channels, Frequency selective and correlated channels models, Capacity of MIMO channels, Ergodic and outage capacity, capacity bounds and influence of channel properties on the capacity.

**UNIT II MIMO DIVERSITY AND SPATIAL MULTIPLEXING 10**

Sources and types of diversity, analysis under Rayleigh fading, Diversity and channel knowledge. Alamouti space time code. MIMO spatial multiplexing: Space time receivers, ML, ZF, MMSE and Sphere decoding, BLAST receivers and Diversity multiplexing trade - off.

**UNIT III MASSIVE MIMO SYSTEM 9**

Introduction - MIMO for LTE, capacity of massive MIMO, Pilot Design for massive MIMO, Resource allocation and transceivers design, Base band and RF implementation, Channel Models.

**UNIT IV MILLIMETER WAVE COMMUNICATION 8**

Spectrum regulation, Channel propagation, Hardware technology for mmW systems, architecture and mobility, Beam forming techniques, Beam finding, Physical layer techniques - Duplex scheme and Transmission Scheme.

**UNIT V SOFTWARE DEFINED RADIO AND COGNITIVE RADIO 8**

SDR - Definition, Origin, key characteristic, hardware and software architecture, waveforms. Cognitive Radio - Definitions, Cognitive theories, architectures, Cognitive radio as self controlling system, Ontology based cognitive radio.

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Analyze MIMO system.
- Discuss millimeter wave communication.
- Demonstrate software defined radio and cognitive radio.

**REFERENCES:**

1. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press 2005.
2. Hamid Jafarkhani, "Space - Time Coding: Theory and Practices", Cambridge University Press 2005.
3. Mischa Dohler, Jose F. Monserrat Afif Osseiran " 5G Mobile and Wireless Communication Technology", Cambridge University Press 2016.
4. Mieczyslaw M Kokar, Lezek Lechowicz, "Cognitive Radio Interoperability through Waveform Reconfiguration" ARTECH House 2016.

**CU5201**

**MIC AND RF SYSTEM DESIGN**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the fundamentals of RF design and Microwave integrated circuits.
- To understand the various components of RF system for Wireless Communications.
- To know the basic techniques needed for analysis of RF systems.



- EMI problems.
- Solution methods in PCB.
- Measurements techniques for emission.
- Measurement techniques for immunity.

**UNIT I BASIC THEORY 9**

Introduction to EMI and EMC, Intra and inter system EMI, Elements of Interference, Sources and Victims of EMI, Conducted and Radiated EMI emission and susceptibility, Case Histories, Radiation hazards to humans, Various issues of EMC, EMC Testing categories EMC Engineering Application.

**UNIT II COUPLING MECHANISM 9**

Electromagnetic field sources and Coupling paths, Coupling via the supply network, Common mode coupling, Differential mode coupling, Impedance coupling, Inductive and Capacitive coupling, Radioactive coupling, Ground loop coupling, Cable related emissions and coupling, Transient sources, Automotive transients.

**UNIT III EMI MITIGATION TECHNIQUES 9**

Working principle of Shielding and Murphy's Law, LF Magnetic shielding, Apertures and shielding effectiveness, Choice of Materials for H, E, and free space fields, Gasketing and sealing, PCB Level shielding, Principle of Grounding, Isolated grounds, Grounding strategies for Large systems, Grounding for mixed signal systems, Filter types and operation, Surge protection devices, Transient Protection.

**UNIT IV STANDARD AND REGULATION 9**

Need for Standards, Generic/General Standards for Residential and Industrial environment, Basic Standards, Product Standards, National and International EMI Standardizing Organizations; IEC, ANSI, FCC, AS/NZS, CISPR, BSI, CENELEC, ACEC. Electro Magnetic Emission and susceptibility standards and specifications, MIL461E Standards.

**UNIT V EMI TEST METHODS AND INSTRUMENTATION 9**

Fundamental considerations, EMI Shielding effectiveness tests, Open field test, TEM cell for immunity test, Shielded chamber, Shielded anechoic chamber, EMI test receivers, Spectrum analyzer, EMI test wave simulators, EMI coupling networks, Line impedance stabilization networks, Feed through capacitors, Antennas, Current probes, MIL -STD test methods, Civilian STD test methods.

**OUTCOMES:**

**At the end of this course, the student should be able to:**

- Identify Standards
- Compare EMI test methods
- Discuss EMI mitigation techniques

**REFERENCES:**

1. Bemhard Keiser, "Principles of Electromagnetic Compatibility", 3<sup>rd</sup> Ed, Artech house, Norwood, 1986.
2. Clayton Paul, "Introduction to Electromagnetic Compatibility", Wiley Interscience, 2006.
3. Daryl Gerke and William Kimmel, "EDN's Designer's Guide to Electromagnetic Compatibility", Elsevier Science & Technology Books, 2002
4. Dr Kenneth L Kaiser, "The Electromagnetic Compatibility Handbook", CRC Press 2005.
5. Electromagnetic Compatibility by Norman Violette ,Published by Springer, 2013
6. Electromagnetic Interference and Compatibility: Electrical noise and EMI specifications Volume 1 of A Handbook Series on Electromagnetic Interference and Compatibility, Donald R. J. White Publisher-Don white consultants Original from the University of Michigan Digitized 6 Dec 2007
7. Henry W. Ott, "Electromagnetic Compatibility Engineering", John Wiley & Sons Inc, Newyork, 2009
8. V Prasad Kodali, "Engineering Electromagnetic Compatibility", IEEE Press, Newyork, 2001.
9. W Scott Bennett, "Control and Measurement of Unintentional Electromagnetic Radiation", John Wiley & Sons Inc., (Wiley Interscience Series) 1997.

**CU5211****RF SYSTEM DESIGN LABORATORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**OBJECTIVES:**

- To enable the students to verify the basic principles and design aspects involved in high frequency communication systems components
- To expose the student to different high frequency components and conduct the experiments to analyze and interpret data to produce meaningful conclusion and match with theoretical concepts.
- To design and develop RF components using microstrip technology

**LIST OF EXPERIMENTS:**

(ADS/IE3D/HFSS or any similar/ equivalent tool may be used for the design)

1. Measurement of S parameters for a) Inductor b) Capacitor c) impedance matching circuits, filters using network analyzer
2. Design of  $\lambda/2$ ,  $\lambda/4$  micro strip transmission line.
3. Design of microstrip inductor and capacitor.
4. Design of impedance matching network.
5. Design of low pass, high pass, band pass and band stop filter at RF .
6. Design and characterization of micro strip patch antennas
7. Design and characterization of LNA
8. Design and characterization of Mixer
9. Design and characterization of VCO

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**Upon Completion of the course, the students will be able to:**

- Apply knowledge to identify a suitable architecture and systematically design an RF system.
- Comprehensively record and report the measured data, and would be capable of analyzing, interpreting the experimentally measured data and produce the meaningful conclusions.
- Design and develop microstrip filters.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

Network analyser Equipment - 1.5 GHz (Minimum) - 1 No  
 ADS/IE3D/HFSS or any similar / equivalent Electromagnetic Simulation tool  
 for Design experiments - 10 User license  
 Desktop PC's for hosting Electromagnetic simulation tool – 10 Numbers  
 Inductor, Capacitor, matching circuits, filters capable of operating at 500 MHz or above

**CP5281**

**TERM PAPER WRITING AND SEMINAR**

**L T P C  
0 0 2 1**

In this course, students will develop their scientific and technical reading and writing skills that they need to understand and construct research articles. A term paper requires a student to obtain information from a variety of sources (i.e., Journals, dictionaries, reference books) and then place it in logically developed ideas. The work involves the following steps:

1. Selecting a subject, narrowing the subject into a topic
2. Stating an objective.
3. Collecting the relevant bibliography (atleast 15 journal papers)
4. Preparing a working outline.
5. Studying the papers and understanding the authors contributions and critically analysing each paper.
6. Preparing a working outline
7. Linking the papers and preparing a draft of the paper.
8. Preparing conclusions based on the reading of all the papers.
9. Writing the Final Paper and giving final Presentation

Please keep a file where the work carried out by you is maintained.  
 Activities to be carried Out.

<b>Activity</b>	<b>Instructions</b>	<b>Submission week</b>	<b>Evaluation</b>
Selection of area of interest and Topic	You are requested to select an area of interest, topic and state an objective	2 <sup>nd</sup> week	<b>3 %</b> Based on clarity of thought, current relevance and clarity in writing
Stating an Objective			

Collecting Information about your area & topic	<ol style="list-style-type: none"> <li>1. List 1 Special Interest Groups or professional society</li> <li>2. List 2 journals</li> <li>3. List 2 conferences, symposia or workshops</li> <li>4. List 1 thesis title</li> <li>5. List 3 web presences (mailing lists, forums, news sites)</li> <li>6. List 3 authors who publish regularly in your area</li> <li>7. Attach a call for papers (CFP) from your area.</li> </ol>	3 <sup>rd</sup> week	<b>3%</b> ( the selected information must be area specific and of international and national standard)
Collection of Journal papers in the topic in the context of the objective – collect 20 & then filter	<ul style="list-style-type: none"> <li>• You have to provide a complete list of references you will be using- Based on your objective -Search various digital libraries and Google Scholar</li> <li>• When picking papers to read - try to: <ul style="list-style-type: none"> <li>• Pick papers that are related to each other in some ways and/or that are in the same field so that you can write a meaningful survey out of them,</li> <li>• Favour papers from well-known journals and conferences,</li> <li>• Favour “first” or “foundational” papers in the field (as indicated in other people’s survey paper),</li> <li>• Favour more recent papers,</li> <li>• Pick a recent survey of the field so you can quickly gain an overview,</li> <li>• Find relationships with respect to each other and to your topic area (classification scheme/categorization)</li> </ul> </li> <li>• Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered</li> </ul>	4 <sup>th</sup> week	<b>6%</b> ( the list of standard papers and reason for selection)
Reading and notes for first 5 papers	<p>Reading Paper Process</p> <ul style="list-style-type: none"> <li>• For each paper form a Table answering the following questions: <ul style="list-style-type: none"> <li>• What is the main topic of the article?</li> <li>• What was/were the main issue(s) the author said they want to discuss?</li> <li>• Why did the author claim it was important?</li> <li>• How does the work build on other’s work, in the author’s opinion?</li> <li>• What simplifying assumptions does the author claim to be making?</li> <li>• What did the author do?</li> <li>• How did the author claim they were going to evaluate their work and</li> </ul> </li> </ul>	5 <sup>th</sup> week	<b>8%</b> ( the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)

	<p>compare it to others?</p> <ul style="list-style-type: none"> <li>• What did the author say were the limitations of their research?</li> <li>• What did the author say were the important directions for future research?</li> </ul> <p>Conclude with limitations/issues not addressed by the paper ( from the perspective of your survey)</p>		
Reading and notes for next 5 papers	Repeat Reading Paper Process	6 <sup>th</sup> week	<b>8%</b> ( the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)
Reading and notes for final 5 papers	Repeat Reading Paper Process	7 <sup>th</sup> week	<b>8%</b> ( the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)
Draft outline 1 and Linking papers	Prepare a draft Outline, your survey goals, along with a classification / categorization diagram	8 <sup>th</sup> week	<b>8%</b> ( this component will be evaluated based on the linking and classification among the papers)
Abstract	Prepare a draft abstract and give a presentation	9 <sup>th</sup> week	<b>6%</b> (Clarity, purpose and conclusion) <b>6%</b> Presentation & Viva Voce
Introduction Background	Write an introduction and background sections	10 <sup>th</sup> week	<b>5%</b> ( clarity)
Sections of the paper	Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey	11 <sup>th</sup> week	<b>10%</b> (this component will be evaluated based on the linking and classification among the papers)
Your conclusions	Write your conclusions and future work	12 <sup>th</sup> week	<b>5%</b> ( conclusions – clarity and your ideas)
Final Draft	Complete the final draft of your paper	13 <sup>th</sup> week	<b>10%</b> (formatting, English, Clarity and linking) <b>4%</b> Plagiarism Check Report





## OUTCOMES:

At the end of this course, the student should be able to:

- Discuss satellite navigation and global positioning system
- Outline deep space networks and inter planetary missions

## REFERENCES:

1. Adimurthy.V,” Concept design and planning of India’s first interplanetary mission” Current Science, VOL. 109, NO. 6, 1054 25 SEPTEMBER 2015.
2. Anil K. Maini, Varsha Agrawal, ‘Satellite Technology: Principles and Applications’, Third Edition, Wiley, 2014.
3. Daniel Minoli’ “Innovations in Satellite Communication and Satellite Technology” Wiley, 2015
4. Daniel Minoli, “Satellite Systems Engineering in an IPv6 Environment”, CRC Press, First Edition, 2009.
5. Hofmann-Wellenhof B., Lichtenegger H., and Elmar Wasle, “Global Navigational Satellite Systems” Springer-Verlag, 2008.
6. Jim Taylor, “ Deep Space Communications” John Wiley & Sons, 2016.
7. Louis J. Ippolito, Jr. “Satellite Communications Systems Engineering: Atmospheric Effects, Satellite Link Design and System Performance”, Second Edition, 2017
8. <http://www.isro.gov.in/pslv-c25-mars-orbiter-mission>
9. [https://en.wikipedia.org/wiki/Mars\\_Orbiter\\_Mission](https://en.wikipedia.org/wiki/Mars_Orbiter_Mission)
10. <https://en.wikipedia.org/wiki/Chandrayaan-1>

<b>DS5191</b>	<b>DSP PROCESSOR ARCHITECTURE AND PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

## OBJECTIVES:

The objective of this course is to provide in-depth knowledge on

- Digital Signal Processor basics
- Third generation DSP Architecture and programming skills
- Advanced DSP architectures and some applications.

### **UNIT I FUNDAMENTALS OF PROGRAMMABLE DSPs 9**

Multiplier and Multiplier accumulator – Modified Bus Structures and Memory access in PDSPs – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining – Special Addressing modes in P-DSPs – On chip Peripherals.

### **UNIT II TMS320C5X PROCESSOR 9**

Architecture – Assembly language syntax - Addressing modes – Assembly language Instructions - Pipeline structure, Operation – Block Diagram of DSP starter kit – Application Programs for processing real time signals.

### **UNIT III TMS320C6X PROCESSOR 9**

Architecture of the C6x Processor - Instruction Set - DSP Development System: Introduction – DSP Starter Kit Support Tools- Code Composer Studio - Support Files - Programming Examples to Test the DSK Tools – Application Programs for processing real time signals.

### **UNIT IV ADSP PROCESSORS 9**

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.

**UNIT V            ADVANCED PROCESSORS****9**

Architecture of TMS320C54X: Pipe line operation, Code Composer studio – Architecture of TMS320C6X - Architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.

**TOTAL :        45        PERIODS****OUTCOMES:****Students should be able to:**

- Become Digital Signal Processor specialized engineer
- DSP based System Developer

**REFERENCES:**

1. Avtar Singh and S. Srinivasan, Digital Signal Processing – Implementations using DSPMicroprocessors with Examples from TMS320C54xx, cengage Learning India PrivateLimited, Delhi 2012
2. B.Venkataramani and M.Bhaskar, “Digital Signal Processors – Architecture, Programming and Applications” – Tata McGraw – Hill Publishing Company Limited. NewDelhi, 2003.
3. RulphChassaing, Digital Signal Processing and Applications with the C6713 and C6416, DSK, A John Wiley & Sons, INC., Publication, 2005
4. User guides Texas Instrumentation, Analog Devices, Motorola.

**CU5001****ANALOG AND MIXED MODE VLSI DESIGN****L T P C****3 0 0 3****OBJECTIVES:**

- To study the concepts of MOS large signal model and small signal model
- To understand the concepts of D/A conversion methods and their architectures.
- To learn filters for ADC.
- To study about the switched capacitor circuits.

**UNIT I            INTRODUCTION AND BASIC MOS DEVICES****9**

Challenges in analog design-Mixed signal layout issues- MOS FET structures and characteristics-large signal and small signal model of single stage Amplifier-Source follower- Common gate stage – Cascode Stage – large and small signal analysis of differential amplifier with active load, pole-zero estimation, zero value time constant method, frequency response of CS, cascade and cascade amplifiers

**UNIT II            SUBMICRON CIRCUIT DESIGN****9**

Submicron CMOS process flow, Capacitors and resistors, Current mirrors, Digital Circuit Design, Delay Elements – Adders- OP Amp parameters and Design

**UNIT III            DATA CONVERTERS****9**

Static and dynamic errors in DAC and ADC – Architectures & Characteristics of Sample and Hold-Digital to Analog Converters- DAC- R-2R, weighted DAC, multiplying DAC, segmented DAC and sigma delta DAC. ADC – Flash ADC, pipelined ADC, successive approximation ADC, sigma delta ADC.

**UNIT IV SNR IN DATA CONVERTERS 9**  
Overview of SNR of Data Converters- Clock Jitters- Improving Using Averaging – Decimating Filters for ADC- Band pass and High Pass Sinc Filters- Interpolating Filters for DAC

**UNIT V SWITCHED CAPACITOR CIRCUITS 9**  
Resistors, First order low pass Circuit, Switched capacitor Amplifier, Switched Capacitor Integrator – Design of flip around sample and hold circuit – pipelined ADC.

**TOTAL: 45PERIODS**

**OUTCOMES:**

**At the end of this course, the student should be able to:**

- Discuss submicron circuit design
- Compare data converters
- Design and analyze switched capacitor circuits

**REFERENCES:**

1. J. Jacob Wikner, Mikael Gustavsson, Nianxiong Tan “CMOS Data Converters for Communications” Springer, 2000.
2. Van de Plassche, Rudy J., “CMOS Integrated Analog-to-Digital and Digital-to-Analog Converters” Springer, 2003.

**CU5092 REAL TIME EMBEDDED SYSTEMS LT P C  
3 0 0 3**

**OBJECTIVES:**

- To study the basic concepts of ARM processors
- To understand the computing platform and design analysis of ARM processors
- To study the concepts of Operating systems in ARM
- To study the concept of embedded networks
- To understand case studies related to embedded systems

**UNIT I INTRODUCTION TO ARM PROCESORS 9**  
Fundamentals of ARM, ARM Instruction set, Thumb Instruction set, ARM assembly language programming, Digital Signal Processing in ARM, Exceptions & Interrupt Handling.

**UNIT II COMPUTING PLATFORM AND DESIGN ANALYSIS 9**  
CPU buses – Memory devices – I/O devices – Memory Protection Units – Memory Management Units – Component interfacing – Design with microprocessors – Development and Debugging – Program design – Model of programs – Assembly and Linking – Basic compilation techniques – Analysis and optimization of execution time, power, energy, program size – Program validation and testing.

**UNIT III PROCESS AND OPERATING SYSTEMS 9**  
Multiple tasks and multi processes – Processes – Context Switching – Scheduling policies - Multiprocessor – Inter Process Communication mechanisms – Evaluating operating system performance – Power optimization strategies for processes – Firmware and Operating Systems for ARM processor.

**UNIT IV HARDWARE ACCELERATES & NETWORKS 9**  
Accelerators – Accelerated system design – Distributed Embedded Architecture – Networks for Embedded Systems – Network based design – Internet enabled systems.

**UNIT V CASE STUDY****9**

Hardware and software co-design - Data Compressor - Software Modem – Personal Digital Assistants – Set–Top–Box. – System-on-Silicon – FOSS Tools for embedded system development.

**TOTAL: 45 PERIODS****OUTCOMES:**

**At the end of this course, the student should be able to:**

- Revise computing platform and design analysis
- Demonstrate multiple tasks and multi processes
- Discuss hardware and software co-design

**REFERENCES:**

1. Andrew N Sloss, Dominic Symes and Chris Wright, “ARM system developer’s guide – Designing and Optimizing System Software”, Morgan Kaufmann publishers, 2004.
2. David E-Simon, “An Embedded Software Primer”, Pearson Education, 2007.
3. K.V.K.K.Prasad, “Embedded Real-Time Systems: Concepts, Design & Programming”, dreamtech press, 2005.
4. Tim Wilmshurst, “An Introduction to the Design of Small Scale Embedded Systems”, Palgrave Publisher, 2004.
5. Wayne Wolf, “Computers as Components - Principles of Embedded Computer System Design”, Morgan Kaufmann Publisher, 2006.

**VL5091****MEMS AND NEMS****L T P C  
3 0 0 3****OBJECTIVES:**

- To introduce the concepts of micro electro mechanical devices.
- To know the fabrication process of Microsystems.
- To know the design concepts of micro sensors and micro actuators.
- To familiarize concepts of quantum mechanics and nano systems.

**UNIT I OVERVIEW****9**

New trends in Engineering and Science: Micro and Nanoscale systems, Introduction to Design of MEMS and NEMS, MEMS and NEMS – Applications, Devices and structures. Materials for MEMS: Silicon, silicon compounds, polymers, metals.

**UNIT II MEMS FABRICATION TECHNOLOGIES****9**

Microsystem fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect- Ratio (LIGA and LIGA-like) Technology; Packaging: Microsystems packaging, Essential packaging technologies, Selection of packaging materials

**UNIT III MICRO SENSORS****9**

MEMS Sensors: Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors- engineering mechanics behind these Microsensors. Case study: Piezo-resistive pressure sensor.

**UNIT IV MICRO ACTUATORS****9**

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators), Micromechanical Motors and pumps. Case study: Comb drive actuators.

**UNIT V NANOSYSTEMS AND QUANTUM MECHANICS****9**

Atomic Structures and Quantum Mechanics, Molecular and Nanostructure Dynamics: Schrodinger Equation and Wave function Theory, Density Functional Theory, Nanostructures and Molecular Dynamics, Electromagnetic Fields and their quantization, Molecular Wires and Molecular Circuits.

**TOTAL: 45 PERIODS****OUTCOMES:**

**At the end of this course, the student should be able to:**

- Discuss micro sensors
- Explain micro actuators
- Outline nanosystems and Quantum mechanics

**REFERENCES:**

1. Chang Liu, "Foundations of MEMS", Pearson education India limited, 2006.
2. Marc Madou, "Fundamentals of Microfabrication", CRC press 1997.
3. Stephen D. Senturia, "Micro system Design", Kluwer Academic Publishers, 2001
4. Sergey Edward Lyshevski, "MEMS and NEMS: Systems, Devices, and Structures" CRC Press, 2002.
5. Tai Ran Hsu, "MEMS and Microsystems Design and Manufacture", Tata Mcraw Hill, 2002.

**CU5002****COMMUNICATION NETWORKS MODELLING AND SIMULATION****L T P C  
3 0 0 3****OBJECTIVES:**

**The students should be made to be**

- Learn modeling and simulation
- Understand Monte Carlo simulation
- Study channel modeling and mobility modeling

**UNIT I INTRODUCTION TO MODELING AND SIMULATION****9**

Introduction, Discrete-event Simulation, Modeling for Computer Simulation, Tools and Methods for Network Simulation, The Simulation Platform, Simulation Framework, Tools and Modeling Approaches for Simulating Hardware.

**UNIT II MONTE CARLO SIMULATION****9**

Fundamental concepts, Application to communication systems, Monte Carlo integration, Semianalytic techniques, Case study: Performance estimation of a wireless system.

**UNIT III LOWER LAYER & LINK LAYER WIRELESS MODELING****9**

Physical Layer Modeling, Description of the Main Components of the PHY Layer, Accurate Simulation of Physical Layers, Physical Layer Modeling for Network Simulations, Link Layer Modeling, Medium Access Control (MAC) Protocols, Logical Link Control, Forward Error Detection and Correction, Backward Error Detection and Correction, Queueing and Processing Delay.

**UNIT IV CHANNEL MODELING & MOBILITY MODELING 9**

Channel Modeling :The Physics of Radiation, The Nature of Electromagnetic Radiation, Classification of Propagation Models, Deterministic Approaches by Classical Field Theory, Deterministic Geometric Optical Approaches, Empirical Path Loss Approaches, Stochastic Shadowing Models, Stochastic Fading Models, MIMO Channel Models.

Mobility modeling :Categorization of Mobility Models, Mobility Models, Random Walk Model, Random Waypoint Model, Random Direction Model, Gauss-Markov Model, Manhattan Model, Column Model , Pursue Model, Nomadic Community Model, Selection of Appropriate Mobility Models.

**UNIT V HIGHER LAYER MODELING & MODELING THE NETWORK TOPOLOGY 9**

Higher Layer Modeling :Modeling the Network Layer and Routing Protocols, Components of a Routing Protocol, Metrics, Virtual Routing on Overlays, Modeling Transport Layer Protocols, Modeling Application Traffic.

Modeling the Network Topology : Abstraction of Network Topologies by Graphs, Characterizing Graphs, Common Topology Models, Geometric Random Graphs – The Waxman Model, Hierarchical Topologies, Preferential Linking – The Barabási-Albert Model , Modeling the Internet.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of this course, the student should be able to**

- Apply Monte Carlo simulation
- Discuss Lower Layer and Link Layer Wireless Modeling
- Compare channel modeling and mobility modeling

**REFERENCES:**

1. Irene Karzela, "Modeling and Simulating Communications Networks", Prentice Hall India, 1998
2. K.Wehrle. Gunes, J.Gross, "Modeling and Tools for Network simulation", Springer, 2010.
3. M.C. Jeruchim, P.Balaban and K. Sam Shanmugam, "Simulation of Communication Systems: Modeling, Methodology and Techniques", Plenum Press, New York, 2001.
4. Nejat; Bragg, Arnold, "Recent Advances in Modeling and Simulation Tools for Communication Networks and Services", Springer, 2007
5. William.H.Tranter, K. Sam Shanmugam, Theodore. S. Rappaport, Kurt L. Kosbar, "Principles of Communication Systems Simulation", Pearson Education (Singapore) Pvt. Ltd, 2004.

**CU5071 DIGITAL COMMUNICATION RECEIVERS L T P C  
3 0 0 3**

**OBJECTIVES:**

- To understand the basic principles of digital communication techniques.
- To gain knowledge about receivers for AWGN channel and Fading channels.
- To understand the concepts of synchronization and adaptive equalization techniques.

**UNIT I REVIEW OF DIGITAL COMMUNICATION TECHNIQUES 9**

Base band communication; signal space representation, linear and nonlinear modulation techniques, Error tracking and Spectral characteristics of digital modulation.

**UNIT II OPTIMUM RECEIVERS FOR AWGN CHANNEL 9**

Correlation demodulator, matched filter , maximum likelihood sequence detector, optimum receiver for CPM signals, optimum receivers for signals with random phase in AWGN channel, envelope detection of M-ary orthogonal signals and correlated binary signals.

**UNIT III RECEIVERS FOR FADING CHANNELS 9**

Characterization of fading multiple channels, statistical models, flat and frequency selective fading, diversity technique, parameter synchronization for flat fading channels, digital signaling over a frequency selective and slowly fading channel ,coded waveform for fading channel.

**UNIT IV SYNCHRONIZATION TECHNIQUES 9**

Carrier and signal synchronization, carrier phase estimation-PLL, Decision directed loops, symbol timing estimation, maximum likelihood and non-decision directed timing estimation, joint estimation.

**UNIT V ADAPTIVE EQUALIZATION 9**

Zero forcing algorithm, LMS algorithm, adaptive decision-feedback equalizer and Equalization of Trellis-coded signals. Kalman algorithm, blind equalizers and stochastic gradient algorithm.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon Completion of the course, the students will be able to**

- Apply basic principles of digital communication techniques.
- Discuss on receivers for AWGN & Fading channel
- Describe various synchronization techniques.
- Design adaptive equalization algorithms to satisfy the evolving demands in digital communication.

**REFERENCES:**

1. Heinrich Meyer, Mare Moeneclacy, Stefan.A.Fechtel, " Digital communication receivers ", Vol I & Vol II, John Wiley, New York, 1997.
2. H.Meyr & G.Ascheid, Synchronization in Digital Communications, John Wiley, 1990
3. John.G.Proakis, "Digital communication "4th Edition, McGraw-Hill, New York, 2001.
4. R.G. Gallager, "Principles of Digital Communication", Newyork, Cambridge University Press, 2008
5. Simon Marvin, "Digital communication over fading channel; An unified approach to performance Analysis ", John Wiley, New York, 2000.
6. U.Mengali & A.N.D'Andrea, Synchronization Techniques for Digital Receivers, Kluwer, 1997.

**CU5072**

**DETECTION AND ESTIMATION THEORY**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To understand the concepts of detection and estimation.
- To learn the basics of multi-user detection theory
- To understand the theory behind various estimation techniques.
- To understand Wiener filter and Kalman filter in detail.

**UNIT I REVEIW OF PROBABILITY AND STOCHASTIC PROCESS 9**

Conditional Probability, Bayes' Theorem , Random Variables, Conditional Distributions and Densities, moments and distribution of random variables., Stationary Processes Cyclostationary Processes Averages and Ergodicity Autocorrelation Function Power Spectral Density Discrete Time Stochastic Processes, Spatial Stochastic Processes, Random Signals, Relationship of Power Spectral Density and Autocorrelation Function.

**UNIT II SINGLE AND MULTIPLE SAMPLE DETECTION 9**

Hypothesis Testing and the MAP Criterion, Bayes Criterion, Minimax Criterion, Neyman-Pearson Criterion, Sequential Detection, The Optimum Digital Detector in Additive Gaussian Noise , Performance of Binary Receivers in AWGN.

**UNIT III FUNDAMENTALS OF ESTIMATION THEORY 9**

Formulation of the General Parameter Estimation Problem, Relationship between Detection and Estimation Theory, Types of Estimation Problems, Properties of Estimators, Bayes estimation, Minimax Estimation, Maximum-Likelihood Estimation, Comparison of Estimators of Parameters.

**UNIT IV WIENER AND KALMAN FILTERS 9**

Orthogonality Principle, Autoregressive Techniques, Discrete Wiener Filter, Continuous Wiener Filter, Generalization of Discrete and Continuous Filter Representations , Linear Least-Squares Methods, Minimum-Variance Weighted Least-Squares Methods, Minimum-Variance, LeastSquares, Kalman Algorithm - Computational Considerations, Signal Estimation, Continuous Kalman Filter, Extended Kalman Filter.

**UNIT V APPLICATIONS 9**

Detector Structures in Non-Gaussian Noise , Examples of Noise Models, Receiver Structures, and Error-Rate Performance, Estimation of Non-Gaussian Noise Parameters Fading Multipath Channel Models, Receiver Structures with Known Channel Parameters, Receiver Structures without Knowledge of Phase, Receiver Structures without Knowledge of Amplitude or Phase, Receiver Structures and Performance with No Channel Knowledge.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- To be able to apply detection and estimation theory to solve communication problems.
- To apply probability and stochastic process concepts in detection and estimation.
- To design Wiener and Kalman filters to solve linear estimation problems.

**REFERENCES:**

1. Harry L. Van Trees, "Detection, Estimation and Modulation Theory", Part I John Wiley \ and Sons, New York, 2004.
2. Ludeman, Lonnie C. Random processes: filtering, estimation, and detection. John Wiley & Sons, Inc., 2003
3. Sergio Verdu " Multi User Detection" Cambridge University Press, 1998
4. Steven M. Kay, "Fundamentals of Statistical Processing, Volume I: Estimation Theory", Prentice Hall Signal Processing Series, Prentice Hall, PTR, NewJersey, 1993.
5. Thomas Schonhoff, "Detection and Estimation Theory", Prentice Hall, NewJersey, 2007.

**CU5073**

**VLSI FOR WIRELESS COMMUNICATION**

**L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To understand the concepts of basic wireless communication concepts.
- To study the parameters in receiver and low noise amplifier design.
- To study the various types of mixers designed for wireless communication.
- To study and design PLL and VCO.
- To understand the concepts of transmitters and power amplifiers in wireless communication.

<b>UNIT I</b>	<b>COMMUNICATION CONCEPTS</b>	<b>9</b>
Introduction – Overview of Wireless systems – Standards – Access Methods – Modulation schemes – Classical channel – Wireless channel description – Path loss – Multipath fading – Standard Translation.		
<b>UNIT II</b>	<b>RECEIVER ARCHITECTURE &amp; LOW NOISE AMPLIFIERS</b>	<b>9</b>
Receiver front end – Filter design – Non-idealities – Design parameters – Noise figure & Input intercept point. LNA Introduction – Wideband LNA design – Narrow band LNA design: Impedance matching & Core amplifier.		
<b>UNIT III</b>	<b>MIXERS</b>	<b>9</b>
Balancing Mixer - Qualitative Description of the Gilbert Mixer - Conversion Gain – Distortion – Noise - A Complete Active Mixer. Switching Mixer – Distortion, Conversion Gain & Noise in Unbalanced Switching Mixer - A Practical Unbalanced Switching Mixer. Sampling Mixer - Conversion Gain, Distortion, Intrinsic & Extrinsic Noise in Single Ended Sampling Mixer.		
<b>UNIT IV</b>	<b>FREQUENCY SYNTHESIZERS</b>	<b>9</b>
PLL – Phase detector – Dividers – Voltage Controlled Oscillators – LC oscillators – Ring Oscillators – Phase noise – Loop filters & design approaches – A complete synthesizer design example (DECT) – Frequency synthesizer with fractional divider.		
<b>UNIT V</b>	<b>TRANSMITTER ARCHITECTURES &amp; POWER AMPLIFIERS</b>	<b>9</b>
Transmitter back end design – Quadrature LO generator – Power amplifier design.		

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of this course, the student should be able to**

- Design LNA and Mixers
- Evaluate frequency synthesizers
- Design and analyze power amplifiers

**REFERENCES:**

1. Bosco H Leung “VLSI for Wireless Communication”, Pearson Education, 2002.
2. B.Razavi ,”RF Microelectronics” , Prentice-Hall ,1998.
3. Behzad Razavi, “Design of Analog CMOS Integrated Circuits” McGraw-Hill, 1999.
4. Emad N Farag and Mohamed I Elmasry, “Mixed Signal VLSI wireless design – Circuits & Systems”, Kluwer Academic Publishers, 2000.
5. J. Crols and M. Steyaert, “CMOS Wireless Transceiver Design,” Boston, Kluwer Academic Pub., 1997.
6. Thomas H.Lee, “The Design of CMOS Radio – Frequency Integrated Circuits”, Cambridge University Press ,2003.

<b>NC5251</b>	<b>COGNITIVE RADIO NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

**The students should be made to be**

- Understand the concepts of cognitive radio
- Learn spectrum sensing and dynamic spectrum access

**UNIT I INTRODUCTION TO SOFTWARE-DEFINED RADIO AND COGNITIVE RADIO 9**

Evolution of Software Defined Radio and Cognitive radio: goals, benefits, definitions, architectures, relations with other radios, issues, enabling technologies, radio frequency spectrum and regulations.

**UNIT II COGNITIVE RADIO ARCHITECTURE 9**

Cognitive Radio – functions, components and design rules, Cognition cycle – orient, plan, decide and act phases, Inference Hierarchy, Architecture maps, Building the Cognitive Radio Architecture on Software defined Radio Architecture, Overview of IEEE 802.22 standard for broadband wireless access in TV bands.

**UNIT III SPECTRUM SENSING AND DYNAMIC SPECTRUM ACCESS 9**

Introduction – Primary user detection techniques – energy detection, feature detection, matched filtering, cooperative detection , Bayesian Approach, Neyman Pearson fusion rule for spectrum sensing, Optimum spectrum sensing - Kullback Leibler Divergence and other approaches, Fundamental Tradeoffs in spectrum sensing, Spectrum Sharing Models of Dynamic Spectrum Access - Unlicensed and Licensed Spectrum Sharing, Fundamental Limits of Cognitive Radio.

**UNIT IV MAC AND NETWORK LAYER DESIGN FOR COGNITIVE RADIO 9**

MAC for cognitive radios – Multichannel MAC - slotted ALOHA – CSMA, Network layer design – routing in cognitive radios, flow control and error control techniques.

**UNIT V ADVANCED TOPICS IN COGNITIVE RADIO 9**

Cognitive radio for Internet of Things - Features and applications – Enabling technologies and protocols – M2M technologies - Data storage and analysis techniques - Requirement and challenges of IoT – Energy efficiency– MIMO Cognitive Radio – Power allocation algorithms.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of this course, the student should be able to**

- Compare MAC and network layer design for cognitive radio
- Discuss cognitive radio for Internet of Things and M2M technologies

**REFERENCES:**

1. Alexander M. Wyglinski, Maziar Nekovee, Thomas Hou, “Cognitive Radio Communications and Networks”, Academic Press, Elsevier, 2010.
2. Bruce Fette, “Cognitive Radio Technology”, Newnes, 2006.
3. Kwang-Cheng Chen, Ramjee Prasad, “Cognitive Radio Networks”, John Wiley and Sons, 2009.
4. Huseyin Arslan (Ed.), “Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems, Springer, 2007.
5. S.Shanmugavel, M.A.Bhagyaveni, R.Kalidoss, “Cognitive Radio-An Enabler for Internet of things”, River Publishers, 2017.

**OBJECTIVES:**

- To understand the antenna radiation characteristics and arrays.
- To enhance the student knowledge in the area of various antenna design.
- To enhance the student knowledge in the area of antenna for practical applications.

**UNIT I ANTENNA FUNDAMENTALS AND ARRAYS 9**

Review of Electromagnetic Wave equations, Radiation integrals, Radiation from surface and line current distributions – dipole, monopole, loop antenna, Antenna parameters, linear array theory, frequency scanned arrays, phased arrays-Retro directive and self phased arrays. Introduction to numerical techniques.

**UNIT II MICRO STRIP ANTENNA 9**

Radiation Mechanism from patch; transmission line model based analysis, cavity model, Excitation techniques; Microstrip dipole; Rectangular patch, Circular patch, Microstrip Yagi antenna, Microstrip array, Gain improvement techniques in microstrip antenna.

**UNIT III APERTURES AND REFLECTOR ANTENNAS 9**

Field equivalence principle, Radiation from Rectangular and Circular apertures, Uniform aperture distribution on an infinite ground plane, Babinet's principle, Slot antenna; Horn antenna; Reflector antenna, aperture blockage, and design consideration, Design of C band and Ku band reflector antenna.

**UNIT IV MODERN ANTENNA STRUCTURES 9**

Frequency independent antenna, spiral antenna, active antenna, dielectric antenna, Leaky wave antenna, Plasma antenna, wearable antenna, reconfigurable antenna, meta material, EBG antenna, Frequency selective structures, Broad band and multi band antenna, Antenna for cellular base stations, MIMO antennas.

**UNIT V ANTENNA FOR SPECIAL APPLICATIONS 9**

Antenna for EMI/EMC testing, Antenna for EM issues in medical diagnosis and treatment, Antenna for MRI systems, Antenna for 60 GHz applications, RFID antenna, Antenna for wireless charging systems, Antenna for automobile radar, Terahertz antennas, antenna for sensor applications.

**TOTAL : 45 PERIODS****OUTCOMES:**

- The student would be able to understand recent design techniques in antenna.
- Ability to design and assess the performance of various antenna
- The student would be able to design the antenna for various industrial, medical and sensor applications.

**REFERENCES:**

1. Balanis.A, "Antenna Theory Analysis and Design", John Wiley and Sons, New York, 1982.
2. Hubregt.J.Visser "Antenna Theory and Applications" 1<sup>st</sup> Edition, John Wiley & Sons Ltd,Newyork,2012.
3. John D Krauss, Ronald J Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation: Fourth Edition, Tata McGraw-Hill, 2006.
4. Zhijun Zhang" Antenna Design for Mobile Devices" 1<sup>st</sup> Edition, John Wiley & Sons (Asia) Ltd, Newyork, 2011.



## REFERENCES:

1. Ardeshir Goshtasby, "2D and 3D Image registration for Medical, Remote Sensing and Industrial Applications", John Wiley and Sons, 2005.
2. Anil K. Jain, 'Fundamentals of Digital Image Processing', Pearson Education, Inc., 2002.
3. John C. Russ, "The Image Processing Handbook", CRC Press, 2007.
4. Mark Nixon, Alberto Aguado, "Feature Extraction and Image Processing", Academic Press, 2008.
5. Rafael C. Gonzalez, Richard E. Woods, 'Digital Image Processing', Pearson Education, Inc., Second Edition, 2004.
6. Rick S. Blum, Zheng Liu, "Multisensor image fusion and its Applications", Taylor & Francis, 2006.

**DS5292**

## **RADAR SIGNAL PROCESSING**

**L T P C**  
**3 0 0 3**

### **OBJECTIVES:**

- To understand the basic concepts of Radar systems and Signal models.
- To illustrate the concepts of Sampling and Quantization of pulsed radar signals.
- To provide in-depth knowledge in Radar waveforms and Doppler processing.

### **UNIT I INTRODUCTION TO RADAR SYSTEMS**

**9**

Basic radar function, elements of pulsed radar, review of signal processing concepts and operations, A preview of basic radar signal processing, radar system components, advanced radar signal processing

### **UNIT II SIGNAL MODELS**

**9**

Components of a radar signal, amplitude models, types of clutters, noise model and signal-to noise ratio, jamming, frequency models: the doppler shift, spatial models, spectral model

### **UNIT III SAMPLING AND QUANTIZATION OF PULSED RADAR SIGNALS**

**9**

Domains and criteria for sampling radar signals, Sampling in the fast time dimension, Sampling in slow time: selecting the pulse repetition interval, sampling the doppler spectrum, Sampling in the spatial and angle dimension, Quantization, I/Q Imbalance and Digital I/Q

### **UNIT IV RADAR WAVEFORMS**

**9**

Introduction, The waveform matched filter, Matched filtering of moving targets, The ambiguity function, The pulse burst waveform, frequency-modulated pulse compression waveforms, Range sidelobe control for FM waveforms, the stepped frequency waveform, Phase-modulated pulse compression waveforms, COSTAS Frequency codes.

### **UNIT V DOPPLER PROCESSING**

**9**

Alternate forms of the Doppler spectrum, Moving target indication (MTI), Pulse Doppler processing, dwell-to-dwell stagger, Pulse pair processing, additional Doppler processing issues, clutter mapping and the moving target detector, MTI for moving platforms: adaptive displaced phase center antenna processing

**TOTAL: 45 PERIODS**

## OUTCOMES:

Upon completion of the course, students will be able to:

- Explain the principles of elements and functions involved in radar signal processing.
- Describe different types of radar waveforms.
- Discuss on Doppler processing and its issues

## REFERENCES:

1. Francois Le Chevalier, "Principles of Radar and Sonar Signal Processing", Artech House
2. Fred E. Nathanson, "Radar Design Principles-Signal Processing and the Environment", , PHI
3. Mark A. Richards, "Fundamentals of Radar Signal Processing", McGraw-Hill, New York, 2005
4. Michael O Kolawole, Radar systems, Peak Detection and Tracking, 2010,Elseveir  
Introduction to Radar Systems 3<sup>rd</sup> Edition, Skolnik, McGraw Hill.
5. Peyton Z. Peebles, "Radar Principles", 2009 Wiley India

**CP5096**

**SPEECH PROCESSING AND SYNTHESIS**

**L T P C**

**3 0 0 3**

## OBJECTIVES:

- To introduce speech production and related parameters of speech.
- To illustrate the concepts of speech signal representations and coding.
- To understand different speech modeling procedures such Markov and their implementation issues.
- To gain knowledge about text analysis and speech synthesis.

### **UNIT I FUNDAMENTALS OF SPEECH PROCESSING 9**

Introduction – Spoken Language Structure – Phonetics and Phonology – Syllables and Words – Syntax and Semantics – Probability, Statistics and Information Theory – Probability Theory – Estimation Theory – Significance Testing – Information Theory.

### **UNIT II SPEECH SIGNAL REPRESENTATIONS AND CODING 9**

Overview of Digital Signal Processing – Speech Signal Representations – Short time Fourier Analysis – Acoustic Model of Speech Production – Linear Predictive Coding – Cepstral Processing – Formant Frequencies – The Role of Pitch – Speech Coding – LPC Coder, CELP, Vocoders.

### **UNIT III SPEECH RECOGNITION 9**

Hidden Markov Models – Definition – Continuous and Discontinuous HMMs – Practical Issues – Limitations. Acoustic Modeling – Variability in the Speech Signal – Extracting Features – Phonetic Modeling – Adaptive Techniques – Confidence Measures – Other Techniques.

### **UNIT IV TEXT ANALYSIS 9**

Lexicon – Document Structure Detection – Text Normalization – Linguistic Analysis – Homograph Disambiguation – Morphological Analysis – Letter-to-sound Conversion – Prosody – Generation schematic – Speaking Style – Symbolic Prosody – Duration Assignment – Pitch Generation

### **UNIT V SPEECH SYNTHESIS 9**

Attributes – Formant Speech Synthesis – Concatenative Speech Synthesis – Prosodic Modification of Speech – Source-filter Models for Prosody Modification – Evaluation of TTS Systems.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Students will be able to:**

- Model speech production system and describe the fundamentals of speech.
- Extract and compare different speech parameters.
- Choose an appropriate statistical speech model for a given application.
- Design a speech recognition system.
- Use different text analysis and speech synthesis techniques.

**REFERENCES:**

1. Ben Gold and Nelson Morgan, "Speech and Audio Signal Processing, Processing and Perception of Speech and Music", Wiley- India Edition, 2006
2. Claudio Bechetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons, 1999.
3. Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education, 2002.
4. Frederick Jelinek, "Statistical Methods of Speech Recognition", MIT Press, 1997.
5. Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003.
6. Steven W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", California Technical Publishing, 1997.
7. Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education, 2004.

**NC5252**

**ADVANCED WIRELESS NETWORKS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To study about advanced wireless network, LTE, 4G and Evolutions from LTE to LTE.
- To study about wireless IP architecture, Packet Data Protocol and LTE network architecture
- To study about adaptive link layer, hybrid ARQ and graphs routing protocol.
- To study about mobility management, cellular network, and micro cellular networks

**UNIT I INTRODUCTION**

**9**

. Introduction to 1G/2G/3G/4G Terminology. Evolution of Public Mobile Services -Motivation for IP Based Wireless Networks -Requirements and Targets for Long Term Evolution (LTE) - Technologies for LTE- 4G Advanced Features and Roadmap Evolutions from LTE to LTE-A - Wireless Standards. Network Model-Network Connectivity-Wireless Network Design with Small World Properties

**UNIT II WIRELESS IP NETWORK ARCHITECTURES**

**9**

3GPP Packet Data Networks - Network Architecture - Packet Data Protocol (PDP) Context -Configuring PDP Addresses on Mobile Stations - Accessing IP Networks through PS Domain – LTE network Architecture - Roaming Architecture- Protocol Architecture- Bearer Establishment Procedure -Inter-Working with other RATs.

**UNIT III ADAPTIVE LINK AND NETWORK LAYER 9**  
 Link Layer Capacity of Adaptive Air Interfaces-Adaptive Transmission in *Ad Hoc* Networks-  
 Adaptive Hybrid ARQ Schemes for Wireless Links-Stochastic Learning Link Layer Protocol-  
 Infrared Link Access Protocol-Graphs and Routing Protocols-Graph Theory-Routing with  
 Topology Aggregation-Network and Aggregation Models

**UNIT IV MOBILITY MANAGEMENT 9**  
 Cellular Networks-Cellular Systems with Prioritized Handoff-Cell Residing Time Distribution-  
 Mobility Prediction in Pico- and Micro-Cellular Networks

**UNIT V QUALITY OF SERVICE 9**  
 QoS Challenges in Wireless IP Networks - QoS in 3GPP - QoS Architecture, Management  
 and Classes -QoS Attributes - Management of End-to-End IP QoS - EPS BearersandQoSIn  
 LTE networks.

**TOTAL :45 PERIODS**

**OUTCOMES:**

- Familiar with the latest 4G networks and LTE
- Understand about the wireless IP architecture and LTE network architecture.
- Familiar with the adaptive link layer and network layer graphs and protocol.
- Understand about the mobility management and cellular network.
- Understand about the wireless sensor network architecture and its concept.

**REFERENCES:**

1. Ayman ElNashar, Mohamed El-saidny, Mahmoud Sherif, "Design, Deployment and Performance of 4G-LTE Networks: A Practical Approach", John Wiley & Sons, 2014.
2. Crosspoint Boulevard, "Wireless and Mobile All-IP Networks", Wiley Publication, 2005.
3. Jyh-Cheng Chen and Tao Zhang, "IP-Based Next-Generation Wireless Networks Systems, Architectures, and Protocols", John Wiley & Sons, Inc. Publication,2006.
4. Minoru Etoh, "Next Generation Mobile Systems3G and Beyond," Wiley Publications,2005.
5. Savo Glisic," advanced wireless networks-technology and business models", Third Edition, John Wiley & Sons, Ltd, 2016
6. Savo Glisic,"Advanced Wireless Networks-4G Technologies", John Wiley & Sons, Ltd,2006.
7. StefaniaSesia, IssamToufik and Matthew Baker, "LTE – The UMTS Long Term Evolution From Theory to Practice", John Wiley & Sons, Inc. Publication, Second Edition, 2011.

**CU5093**

**WAVELET TRANSFORMS AND ITS APPLICATIONS**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

- To introduce the fundamentals concepts of wavelet transforms.
- To study system design using Wavelets
- To learn the different wavelet families & their applications.

**UNIT I INTRODUCTION TO WAVELETS 9**

Introduction to Multirate signal processing- Decimation and Interpolation, Quadrature Mirror Filters, Subband coding, Limitations of Fourier transform, Short time Fourier transform and its drawbacks, Continuous Wavelet transform, Time frequency representation, Wavelet System and its characteristics, Orthogonal and Orthonormal functions and function space

**UNIT II MULTIREOLUTION CONCEPT AND DISCRETE WAVELET TRANSFORM 9**

Multiresolution formulation of wavelet systems- signal spaces, scaling function, wavelet function and its properties, Multiresolution analysis, Haar scaling and wavelet function, Filter banks-Analysis and Synthesis, 1D and 2D Discrete wavelet transform, Wavelet Packets, Tree structured filter bank, Multichannel filter bank, Undecimated wavelet transform.

**UNIT III WAVELET SYSTEM DESIGN 9**

Refinement relation for orthogonal wavelet systems, Restrictions on filter coefficients, Design of Daubechies orthogonal wavelet system coefficients, Design of Coiflet and Symlet wavelets.

**UNIT IV WAVELET FAMILIES 9**

Continuous Wavelets- Properties of Mexican hat wavelet, Morlet, Gaussian and Meyer wavelets. Orthogonal wavelets- Properties of Haar wavelets, Daubechies wavelets, Symlets, Coiflets and Discrete Meyer wavelets. Properties of Biorthogonal wavelets, Applications of wavelet families.

**UNIT V WAVELET APPLICATIONS 9**

Denosing of Signals and Images, Image enhancement, Edge detection, Image Fusion, Image compression, Wavelet based feature extraction, Analysis of phonocardiogram signals, Analysis of EEG signals, Speech enhancement for hearing aids

**TOTAL: 45 PERIODS**

**OUTCOME:**

- The students will be able to apprehend the detailed knowledge about the Wavelet transforms & its applications.

**REFERENCES:**

1. C.Sidney Burrus, Ramesh Gopinath & Haito Guo, 'Introduction to wavelets and wavelet transform', Prentice Hall, 1998.
2. G.Strang and T.Nguyen, 'Wavelet and filter banks', Wesley and Cambridge Press.
3. Metin Akay, 'Time frequency and wavelets in biomedical signal processing', Wiley-IEEE Press, October 1997.
4. M.Vetterli and J. Kovacevic, 'Wavelets and sub band coding', Prentice Hall, 1995.
5. P.P.Vaidyanathan, 'Multi rate systems and filter banks', Prentice Hall 1993
4. Raguveer m Rao & Ajith S. Bopardikar, 'Wavelet transforms – Introduction to theory and applications', Addison Wesley, 1998
5. S.Mallet, 'A Wavelet tour of Signal Processing', Academic Press 1998

**OBJECTIVES:**

- To give fundamental concepts related to broadband access technologies.
- To understand the current and emerging wired and wireless access technologies.
- To acquire knowledge about cable modems and fiber access technologies.
- To have an exposure to different systems standards for next generation broadband access networks.

**UNIT I REVIEW OF ACCESS TECHNOLOGIES 5**

Phone-Line modem, cable-access, ISDN, Emerging Broad band Technologies, Cable DSL, Fiber and Wireless, Standards for access network.

**UNIT II DIGITAL SUBSCRIBER LINES 10**

Asymmetric Digital subscriber lines (ADSL) – Rate Adaptive subscriber line (RADSL)-ISDN Digital subscriber line (IDSL) - High bit rate DSL (HDSL)-Single line DSL (SDSL) - very high bit rate DSL (VDSL) - Standards for XDSL & Comparison.

**UNIT III CABLE MODEM 10**

Cable Modem, DOCSIS – Physical Cabling, Dual Modem Operation, Hub Restriction, Upstream Operation – Downstream operation – Access control – framing Security sub layer – Data link layer – LLC & Higher layers – ATM centric VS IP – centric cable modem.

**UNIT IV FIBER ACCESS TECHNOLOGIES 10**

Optical Fiber in access networks, Architecture and Technologies- Hybrid fiber – Coax (HFC) system, Switched Digital Video (SDV) – Passive optical networks (PON) – FTTX (FTTH, FTTB, FTTC, FTT cab) comparison, Broadband PON , Gigabit-Capable PON.

**UNIT V BROAD BAND WIRELESS 10**

Fixed Wireless, Direct Broadcast Satellite (DBS), Multi channel multi point distribution services (MMDS), Local multi point distribution services (LMDS), and Wideband integrated Digital Interactive Services (WIDIS), Mobile Wireless 3G – IMT 2000, Introduction to LTE-A.

**TOTAL : 45 PERIODS****OUTCOMES:**

- To able to design systems meeting out the requirements of the recent standards.
- To meet out the industry requirements for man power in next generation networks.
- To be able to contribute towards the enhancement of the existing wireless technologies.

**REFERENCES:**

1. Dennis J. Rauschmayer, "ADSL/VDSL Principles: A Practical and Precise Study of Asymmetric Digital Subscriber Lines and Very High Speed Digital Subscriber Lines", Macmillan Technology Series, 1998.
2. Gilbert Held, "Next Generation Modems: A Professional Guide to DSL and Cable Modems", John Wiley & Sons, 2000.
3. Leonid G. Kazovsky, Ning Cheng, Wei-Tao Shaw, David Gutierrez, Shing-Wa Wong, "Broadband Optical Access Networks", John Wiley and Sons, New Jersey, 2011.
4. Martin P. Clarke, "Wireless Access Network: Fixed Wireless Access and WLL Network Design and Operation", John Wiley & Sons 2000.
5. Niel Ransom and Albert A. Azzam, "Broadband Access Technologies: ADSL, VDSL Cable Modem, Fiber and LMDS", McGraw Hill, 1999.
6. Sassan Ahmadi, "LTE-Advanced – A practical systems approach to understanding the 3GPP LTE Releases 10 and 11 radio access technologies", Elsevier, 2014.

7. Walter J Woralski, "ADSL and DSL Technologies", McGraw Hill Computer Communication Series, Second Edition Oct 2001.
8. William Webb, "Introduction to Wireless Local Loop Broadband and Narrow Band System", Mobile Communication Series, Artech House Publishers, Second Edition 2000.

**CU5094**

**SOFTWARE DEFINED RADIO**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

**The students should be made to:**

- Understand radio frequency implementation
- Learn multi rate signal processing and digital generation of signals

**UNIT I INTRODUCTION & CASE STUDIES 9**

Introduction to software Radio concepts: Need for software Radios, Definition of software Radio, Characteristics and Benefits. Design Principles. Case studies: SPEAK easy, JTRS, SDR-3000.

**UNIT II RADIO FREQUENCY IMPLEMENTATION 9**

The purpose of the RF Front End, Dynamic Range, RF receivers front end Topologies, Importance of the components to Overall performance, Transmitter Architecture, Noise and Distortion in the RF Chain, ADC and DAC Distortion, Flexible RF systems using MEMS.

**UNIT III MULTI RATE SIGNAL PROCESSING AND DIGITAL GENERATION OF SIGNALS. 9**

Sample rate conversion principles. Digital filter Banks. Timing recovery in Digital Receivers using Multi rate Digital filters. Approaches to Direct Digital Synthesis. Analysis of spurious signal Band pass signal generation, Generation of Random sequences.

**UNIT IV DATA CONVERTERS AND SMART ANTENNAS 9**

Parameters of Ideal and practical Data Converters, Techniques to Improve Data Converter performance, Common ADC and DAC Architectures. Smart Antennas- Hardware implementation of Smart Antennas.

**UNIT V DIGITAL HARDWARE AND SOFTWARE CHOICES 9**

DSP Processors, FPGA, ASIC s. Trade offs, Object oriented programming, Object Brokers, GNU Radio-USRP.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of this course, the students should be able to:**

- Design data converters
- Evaluate smart antennas
- Discuss digital hardware and software choices

## REFERENCES:

1. Jeffrey H.Reed, "Software Radio: A Modern Approach to Radio Engineering, Prentice Hall,2002.
2. Joseph Mitola, "Software Radio Architecture: Object Oriented Approaches to Wireless System Engineering", Wiley-Inter science; I Edition 2000,ISBN:0471384925
3. Radio, G. N. U. "The gnu software radio." Available from World Wide Web: <https://gnuradio.org> (2007).
4. S.Shanmugavel, M.A.Bhagyaveni, R.Kalidoss, "Cognitive Radio-An Enabler for Internet of things", River Publishers, 2017.

**CU5095**

**SPACE TIME WIRELESS COMMUNICATION**

**L T P C  
3 0 0 3**

## OBJECTIVES:

- To acquire the knowledge on various modulation and coding schemes for space-time Wireless Communications.
- To understand transmission and decoding techniques associated with Wireless Communications.
- To understand multiple-antenna systems such as multiple-input multiple-output (MIMO) and Space-Time Codes.

### **UNIT I      MULTIPLE ANTENNA PROPAGATION AND ST CHANNEL CHARACTERIZATION**

**9**

Wireless channel, Scattering model in macrocells, Channel as a ST random field, Scattering functions, Polarization and field diverse channels, Antenna array topology, Degenerate channels, reciprocity and its implications, Channel definitions, Physical scattering model, Extended channel models, Channel measurements, sampled signal model, ST multiuser and ST interference channels, ST channel estimation.

### **UNIT II      CAPACITY OF MULTIPLE ANTENNA CHANNELS**

**8**

Capacity of frequency flat deterministic MIMO channel: Channel unknown to the transmitter, Channel known to the transmitter, capacity of random MIMO channels, Influence of ricean fading, fading correlation, XPD and degeneracy on MIMO capacity, Capacity of frequency selective MIMO channels.

### **UNIT III      SPATIAL DIVERSITY**

**8**

Diversity gain, Receive antenna diversity, Transmit antenna diversity, Diversity order and channel variability, Diversity performance in extended channels, Combined space and path diversity, Indirect transmit diversity, Diversity of a space-time- frequency selective fading channel.

### **UNIT IV      MULTIPLE ANTENNA CODING AND RECEIVERS**

**10**

Coding and interleaving architecture, ST coding for frequency flat channels, ST coding for frequency selective channels, Receivers(SISO,SIMO,MIMO),Iterative MIMO receivers, Exploiting channel knowledge at the transmitter: linear pre-filtering, optimal pre-filtering for maximum rate, optimal pre-filtering for error rate minimization, selection at the transmitter, Exploiting imperfect channel knowledge.

**UNIT V ST OFDM, SPREAD SPECTRUM AND MIMO MULTIUSER DETECTION 10**  
 SISO-OFDM modulation, MIMO-OFDM modulation, Signaling and receivers for MIMO-OFDM, SISO-SS modulation, MIMO-SS modulation, Signaling and receivers for MIMO-SS. MIMOMAC, MIMO-BC, Outage performance for MIMO-MU, MIMO-MU with OFDM, CDMA and multiple antennas.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- To be able to design and evaluate receiver and transmitter diversity techniques.
- To be able to design and develop OFDM based MIMO systems.
- To be able to calculate capacity of MIMO systems.

**REFERENCES:**

1. Andre Viterbi “ Principles of Spread Spectrum Techniques” Addison Wesley 1995
2. Jafarkhani, Hamid. Space-time coding: Theory and Practice. Cambridge University Press, 2005.
3. Paulraj, Rohit Nabar, Dhananjay Gore., “Introduction to Space Time Wireless Communication Systems”, Cambridge University Press, 2003
4. Sergio Verdu “ Multi User Detection” Cambridge University Press, 1998

**CU5096**

**PATTERN RECOGNITION AND MACHINE LEARNING**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- Study the fundamental of pattern classifier.
- To know about various clustering concepts.
- To originate the various structural pattern recognition and feature extraction.
- To understand the basic of concept learning and decision trees
- To explore recent advances in pattern recognition.

**UNIT I PATTERN CLASSIFIER 9**  
 Overview of Pattern recognition – Discriminant functions – Supervised learning –Parametric estimation – Maximum Likelihood Estimation – Bayesian parameter Estimation – Problems with Bayes approach– Pattern classification by distance functions –Minimum distance pattern classifier.

**UNIT II CLUSTERING 9**  
 Clustering for unsupervised learning and classification -Clustering concept – C-means algorithm – Hierarchical clustering procedures -Graph theoretic approach to pattern clustering -Validity of clusters.

**UNIT III FEATURE EXTRACTION AND STRUCTURAL PATTERN RECOGNITION 9**  
 KL Transforms – Feature selection through functional approximation – Binary selection -Elements of formal grammars - Syntactic description - Stochastic grammars –Structural representation.

**UNIT IV INTRODUCTION, CONCEPT LEARNING AND DECISION TREES 9**  
 Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search

**UNIT V RECENT ADVANCES****9**

Neural network structures for pattern recognition -Neural network based pattern associators – Unsupervised learning in neural pattern recognition -Self organizing networks -Fuzzy logic -Fuzzy pattern classifiers -Pattern classification using Genetic Algorithms.

**TOTAL:45 PERIODS****OUTCOMES:****Upon Completion of the course, the students will be able to**

- Classify the data and identify the patterns.
- Utilize the given data set to extract and select features for Pattern recognition.
- Describe the decision tree and concept learning.
- Discuss on recent advances in pattern recognition.

**REFERENCES:**

1. Duda R.O., and Hart.P.E., Pattern Classification and Scene Analysis, Wiley, New York, 1973.
2. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons, New York, 1993.
3. Narasimha Murty M and Susheela Devi V, “Pattern Recognition – An Algorithmic Approach”, Springer, Universities Press, 2011
4. Robert J.Schalkoff, Pattern Recognition : Statistical, Structural and Neural Approaches, John Wiley & Sons Inc., New York, 2007.
5. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (Indian Edition), 2013.
6. Tou and Gonzalez, Pattern Recognition Principles, Wesley Publication Company, London, 1974.

**NC5071****NETWORK ROUTING ALGORITHMS**

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**OBJECTIVES:**

- To expose the students to the layered architecture for communication networks and the specific functionality of the network layer.
- To enable the student to understand the basic principles of routing and the manner this is implemented in conventional networks and the evolving routing algorithms based on internetworking requirements, optical backbone and the wireless access part of the network.
- To enable the student to understand the different routing algorithms existing and their performance characteristics.

**UNIT I INTRODUCTION****7**

ISO OSI Layer Architecture, TCP/IP Layer Architecture, Functions of Network layer, General Classification of routing, Routing in telephone networks, Dynamic Non hierarchical Routing (DNHR), Trunk status map routing (TSMR), real-time network routing (RTNR), Distance vector routing, Link state routing, Hierarchical routing.

**UNIT II INTERNET ROUTING****10**

Interior protocol : Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Bellman Ford Distance Vector Routing. Exterior Routing Protocols: Exterior Gateway Protocol (EGP) and Border Gateway Protocol (BGP). Multicast Routing: Pros and cons of Multicast and Multiple Unicast Routing, Distance Vector Multicast Routing Protocol (DVMRP), Multicast Open Shortest Path First (MOSPF), MBONE, Core Based Tree Routing.





## REFERENCES:

1. Adrian Perrig, J. D. Tygar, "Secure Broadcast Communication: In Wired and Wireless Networks", Springer, 2006.
2. Carlos De Moraes Cordeiro, Dharma Prakash Agrawal "Ad Hoc and Sensor Networks: Theory and Applications (2nd Edition), World Scientific Publishing, 2011.
3. C.Siva Ram Murthy and B.S.Manoj, "Ad Hoc Wireless Networks – Architectures and Protocols", Pearson Education, 2004.
4. C.K.Toth, "Ad Hoc Mobile Wireless Networks", Pearson Education, 2002.
5. Erdal Çayırıcı , Chunming Rong, "Security in Wireless Ad Hoc and Sensor Networks", John Wiley and Sons, 2009.
6. Holger Karl, Andreas willig, Protocols and Architectures for Wireless Sensor Networks, John Wiley & Sons, Inc .2005.
7. Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, "Ad Hoc Mobile Wireless Networks", Auerbach Publications, 2008.
8. Walteneagus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks Theory and Practice", John Wiley and Sons, 2010.

CP5292

INTERNET OF THINGS  
P C

L T

3 0 0 3

## OBJECTIVES:

- To understand the fundamentals of Internet of Things
- To learn about the basics of IOT protocols
- To build a small low cost embedded system using Raspberry Pi.
- To apply the concept of Internet of Things in the real world scenario.

### UNIT I INTRODUCTION TO IoT

9

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology

### UNIT II IoT ARCHITECTURE

9

M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture

### UNIT III IoT PROTOCOLS

9

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP - Security

### UNIT IV BUILDING IoT WITH RASPBERRY PI & ARDUINO

9

Building IOT with RASPBERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

### UNIT V CASE STUDIES AND REAL-WORLD APPLICATIONS

9

Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs - Cloud for IoT -

Amazon Web Services for IoT.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Analyze various protocols for IoT
- Develop web services to access/control IoT devices.
- Design a portable IoT using Rasperry Pi
- Deploy an IoT application and connect to the cloud.
- Analyze applications of IoT in real time scenario

**REFERENCES:**

1. Arshdeep Bahga, Vijay Madiseti, "Internet of Things – A hands-on approach", Universities Press, 2015
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.
3. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012.
4. Jan Ho" Iler, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
5. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012.

**MU5091**

**MULTIMEDIA COMPRESSION TECHNIQUES**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the basic ideas of compression algorithms related to multimedia components – Text, speech, audio, image and Video.
- To understand the principles and standards and their applications with an emphasis on underlying technologies, algorithms, and performance.
- To appreciate the use of compression in multimedia processing applications
- To understand and implement compression standards in detail.

**UNIT I FUNDAMENTALS OF COMPRESSION**

**9**

Introduction To multimedia – Graphics, Image and Video representations – Fundamental concepts of video, digital audio – Storage requirements of multimedia applications – Need for compression – Taxonomy of compression Algorithms - Elements of Information Theory – Error Free Compression – Lossy Compression.

**UNIT II TEXT COMPRESSION**

**9**

Huffman coding – Adaptive Huffman coding – Arithmetic coding – Shannon-Fano coding – Dictionary techniques – LZW family algorithms.

**UNIT III IMAGE COMPRESSION**

**9**

Image Compression: Fundamentals — Compression Standards – JPEG Standard – Sub-band coding – Wavelet Based compression – Implementation using Filters – EZW, SPIHT coders – JPEG 2000 standards – JBIG and JBIG2 standards.

**UNIT IV AUDIO COMPRESSION****9**

Audio compression Techniques – law, A-Law companding – Frequency domain and filtering – Basic sub-band coding – Application to speech coding – G.722 – MPEG audio – progressive encoding – Silence compression, Speech compression – Formant and CELP vocoders.

**UNIT V VIDEO COMPRESSION****9**

Video compression techniques and Standards – MPEG video coding: MPEG-1 and MPEG-2 video coding: MPEG-3 and MPEG-4 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – DVI real time compression – Current Trends in Compression standards.

**TOTAL : 45 PERIODS****OUTCOMES:**

**Upon Completion of the course, the students should be able to**

- Implement basic compression algorithms with MATLAB and its equivalent open source environments.
- Design and implement some basic compression standards
- Critically analyze different approaches of compression algorithms in multimedia related mini projects.

**REFERENCES:**

1. David Solomon, "Data Compression – The Complete Reference", Fourth Edition, Springer Verlag, New York, 2006.
2. Darrel Hankerson, Greg A Harris, Peter D Johnson, 'Introduction to Information Theory and Data Compression' Second Edition, Chapman and Hall ,CRC press, 2003.
3. Khalid Sayood: Introduction to Data Compression", Morgan Kauffman Harcourt India, Third Edition, 2010.
4. Mark S. Drew, Ze-Nian Li, "Fundamentals of Multimedia", PHI, 2009.
5. Peter Symes : Digital Video Compression, McGraw Hill Pub., 2004.
6. Yun Q.Shi, Huifang Sun, "Image and Video Compression for Multimedia Engineering, Algorithms and Fundamentals", CRC Press, 2003.

**CU5074****ULTRA WIDEBAND COMMUNICATION**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To give fundamental concepts related to Ultra wide band
- To understand the channel model and signal processing for UWB.
- To acquire knowledge about UWB antennas and regulations.

**UNIT I INTRODUCTION TO UWB****9**

History, Definition, FCC Mask, UWB features, UWB Interference: IEEE 802.11.a Interference, Signal to Interference ratio calculation, Interference with other wireless services.

**UNIT II UWB TECHNOLOGIES AND CHANNEL MODELS****9**

Impulse Radio, Pulsed Multiband, Multiband OFDM, features : Complexity, Power Consumption, Security and achievable data rate. MIMO Multiband OFDM, Differential multiband OFDM, Performance characterization, Ultra Wide Band Wireless Channels

Channel model: Impulse Response Modeling of UWB Wireless Channels, IEEE UWB channel model, Path loss, Delay profiles, Time and frequency modeling.

**UNIT III UWB SIGNAL PROCESSING 9**

Data Modulation schemes, UWB Multiple Access Modulation, BER, Rake Receiver, Transmit- Reference (T-R) Technique, UWB Range- Data Rate Performance, UWB Channel Capacity, UWB Wireless Locationing: Position Locationing Methods, Time of Arrival Estimation, NLOS Location Error , Locationing with OFDM

**UNIT IV UWB ANTENNAS 9**

Antenna Requirements, Radiation Mechanism of the UWB Antennas, Types of Broad band antennas, Parameters, Analysis of UWB Antennas, Link Budget for UWB System. Design examples of broad band UWB antennas.

**UNIT V UWB APPLICATIONS AND REGULATIONS 9**

Wireless Ad hoc Networking, UWB Wireless Sensor, RFID, Consumer Electronics and Personal, Asset Location, Medical applications, UWB Regulation and standards in various countries , UWB Regulation in ITU, IEEE Standardization

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- The student would be able to understand UWB technologies.
- Ability to assess the performance of UWB channels.
- The student would be able to design UWB antenna for various applications.

**REFERENCES:**

1. Homayoun Nikookar and Ramjee Prasad, "Introduction to Ultra Wideband for Wireless Communications" 1<sup>st</sup> Edition, Springer Science & Business Media B.V. 2010.
2. Thomas Kaiser, Feng Zheng "Ultra Wideband Systems with MIMO", 1<sup>st</sup> Edition, John Wiley & Sons Ltd, New York, 2010.
3. W. Pam Siriwongpairat and K. J. Ray Liu, "Ultra-Wideband Communications Systems: Multiband OFDM approach" John Wiley and IEEE press, New York 2008.

<b>MP5092</b>	<b>SOFT COMPUTING TECHNIQUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To know the basics of artificial neural networks
- To provide adequate knowledge about feed forward /feedback neural networks
- To apply the concept of fuzzy logic in various systems.
- To have the idea about genetic algorithm
- To provide adequate knowledge about the applications of Soft Computing.

**UNIT I ARTIFICIAL NEURAL NETWORK 9**

Introduction-Basic concepts of Neural Network-Model of an Artificial Neuron-Characteristics of Neural Network-Learning Methods-Backpropagation Network Architecture-Backpropagation Learning-Counter Propagation Network-Hopfield/Recurrent Network-Adaptive Resonance Theory.

**UNIT II FUZZY LOGIC 9**  
 Basic concepts of Fuzzy Logic-Fuzzy Sets and Crisp Sets-Fuzzy Set Theory and Operations-Properties of Fuzzy Sets-Fuzzy and Crisp relations, Fuzzy to Crisp Conversion-Membership Functions-Interference in Fuzzy Logic-Fuzzy if-then Rules, Fuzzy implications and Fuzzy Algorithms,Fuzzification & Defuzzification-Fuzzy Controller.

**UNIT III NEURO-FUZZY MODELLING 9**  
 ANFIS Architecture-Classification and Regression Trees-Data Clustering algorithms-Rulebase Structure Identification.

**UNIT IV GENETIC ALGORITHMS 9**  
 Basic concepts-Working Principle-Inheritance Operators-Cross Over-Inversion & Deletion-Mutation Operator-Generation Cycle.

**UNIT V APPLICATIONS OF SOFTCOMPUTING 9**  
 Genetic Algorithm Application- Bagley and Adaptive Game-Playing Program- Greg Viols Fuzzy Cruise Controller-Air Conditioner Controller-Application of Back Propagation Neural Network.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Knowledge on concepts of soft computational techniques.
- Able to apply soft computational techniques to solve various problems.
- Motivate to solve research oriented problems.

**REFERENCES:**

1. George J. Klir and Bo Yuan, 'Fuzzy Sets and Fuzzy Logic Theory and Applications', Printice Hall of India, 2002.
2. J.S.R.Jang,C.T.Sun and E.Mizutani,"Neuro-Fuzzy and Soft Computing",PHI,2004, Pearson Education 2004.
3. Laurene Fausett,"Fundamentals of Neural Networks: Architectures, Algorithms and Pearson Education India, 2006.
4. S.Rajasekaran and G.A.V.Pai."Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2010.
3. Timothy J Ross, "Fuzzy logic with Engineering Applications", John Wiley and Sons, 2009.
4. Zimmermann H.J."Fuzzy Set Theory and Its Application" Springer International Edition, 2011.

**NC5072**

**NETWORK PROCESSORS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES :**

**The students should be made to:**

- Learn network processors
- Study commercial network processors
- Understand network processor architecture

**UNIT I INTRODUCTION 9**  
 Traditional protocol processing Systems – Network processing Hardware – Basic Packet Processing Algorithms and data Structures - Packet processing functions – Protocol

Software – Hardware Architectures for Protocol processing – Classification and Forwarding – Switching Fabrics.

**UNIT II NETWORK PROCESSOR TECHNOLOGY 9**

Network Processors: Motivation and purpose - Complexity of Network Processor Design – Network Processor Architectures architectural variety, architectural characteristics Peripheral Chips supporting Network Processors: Storage processors, Classification Processors, Search Engines, Switch Fabrics, Traffic Managers.

**UNIT III COMMERCIAL NETWORK PROCESSORS 9**

Multi-Chip Pipeline, Augmented RISC processor, Embedded Processor plus Coprocessors, Pipeline of Homogeneous processors. Configurable Instruction set processors – Pipeline of Heterogeneous processors – Extensive and Diverse processors – Flexible RISC plus Coprocessors – Scalability issues – Design Tradeoffs and consequences.

**UNIT IV NETWORK PROCESSOR: ARCHITECTURE AND PROGRAMMING 9**

Architecture: Intel Network Processor: Multi headed Architecture Overview – Features- Embedded RISC processor - Packet Processor Hardware – Memory interfaces – System and Control Interface Components – Bus Interface. Programming Software Development Kit-IXP Instruction set – register formats – Micro Engine Programming – Intra thread and Inter-thread communication– thread synchronization – developing sample applications – control plane – ARM programming.

**UNIT V IOS TECHNOLOGIES 9**

CISCO COS – Connectivity and scalability – high availability – IP routing – IP services – IPV6 – Mobile IP – MPLS – IP Multicast 0 Manageability – QoS – Security – Switching – Layer VPN2.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**At the end of this course, the students should be able to:**

- Discuss network processor architecture
- Compare different programming
- Explain IOS technologies

**REFERENCES:**

1. Douglas E.Comer “Networks Systems Design using Network Processors” Prentice Hall JaN. 2003.
2. Erik, J.Johnson and Aaron R.Kunze, “IXP2400/2806 Programming: The Microengine Coding Grade” Intel Press.
3. Hill Carlson, “Intel Internet Exchange Architecture & Applications a Practical Guide to Intel’s network Processors” Intel press. www.cisco.com
4. Panas C. Lekkas, “Network Processors: Architectures, Protocols and Paradigms (Telecom Engineering)”, McGraw Hill, Professional, 2003.
5. Patrick Crowley, M aFranklin, H. Hadminglu, PZ Onfryk, “Network Processor Design, Issues and Practices Vol-1” Morgan Kaufman, 2002.
6. Patrick Crowley, M aFranklin, H. Hadimioglyum PZ Onufryk, Network Processor Design, Issues and Prentices vol.II, Morgan Kaufman, 2003.
7. Ran Giladi, Network Processors: Architecture, Programming, and Implementation, Morgan Kauffmann, 2008.

**NE5071**

**NETWORK MANAGEMENT**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- To appreciate the need for interoperable network management as a typical distributed application
- To familiarize concepts and terminology associated with SNMP
- To be aware of current trends in network management technologies

**UNIT I OSI NETWORK MANAGEMENT 8**

OSI Network management model - Organizational model - Information model, Communication model. Abstract Syntax Notation - Encoding Structure, Macros Functional Model CMIP/CMIS

**UNIT II BROADBAND NETWORK MANAGEMENT 9**

Broadband networks and services, ATM Technology - VP, VC, ATM Packet, Integrated service, ATM LAN emulation, Virtual LAN, ATM Network Management - ATM Network reference model, Integrated local Management Interface. ATM Management Information base, Role of SNMP and ILMI in ATM Management, M1, M2, M3, M4 interface. ATM Digital Exchange Interface Management.

**UNIT III SIMPLE NETWORK MANAGEMENT PROTOCOL 10**

SNMPv1 Network Management: Communication and Functional Models. The SNMP Communication Model, Functional model. SNMP Management SNMPv2: Major Changes in SNMPv2, SNMPv2 System Architecture, SNMPv2 Structure of Management Information, The SNMPv2 Management Information Base, SNMPv2 Protocol, Compatibility With SNMPv1. Configuration management, Fault management, Performance management, Event Correlation Techniques 168 security management, Accounting management, Report Management, Policy Based Management, Services Level Management.

**UNIT IV NETWORK MANAGEMENT SYSTEMS 9**

Network Management Tools, Network Statistics Measurement Systems, History of Enterprise Management, Commercial Network management Systems, System Management and Enterprise Management Solutions.

**UNIT V WEB-BASED MANAGEMENT 9**

NMS with Web Interface and Web-Based Management, Web Interface to SNMP Management, Embedded Web-Based Management, Desktop management Interface, Web-Based Enterprise Management, WBEM: Windows Management Instrumentation, Java management Extensions, Management of a Storage Area Network.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**After the completion of this course, students will be able to**

- Diagnose problems and make minor repairs to computer networks using appropriate diagnostics software b
- Demonstrate how to correctly maintain LAN computer systems
- Maintain the network by performing routine maintenance tasks
- Apply network management tools

## REFERENCES:

1. Lakshmi G Raman, "Fundamentals of Telecommunication Network Management", Eastern Economy Edition IEEE Press, New Delhi, 1999.
2. Mani Subramanian, "Network Management - Principles and Practice", Pearson Education, Second edition, 2010.
3. Mani Subramanian, "Network Management Principles and Practice", Addison Wesley, Second edition, 2010.
4. Mark Burges, "Principles of Network System Administration", Wiley, 2000.
5. Salah Aaidarons and Thomas Plevayk, "Telecommunications Network Technologies and Implementations", Eastern Economy Edition IEEE press, New Delhi, 1998.
6. Stephen Morris, "Network Management, MIBs and MPLS - Principles, Design and Implementation", Pearson Education, 2003.

## WEB REFERENCES:

1. <http://www.apps.ietf.org/rfc/rfc1095.html>
2. [ycchen.im.ncnu.edu.tw/nm/ch\\_5x.ppt](http://ycchen.im.ncnu.edu.tw/nm/ch_5x.ppt)
3. [en.wikipedia.org/wiki/Systems\\_Management](http://en.wikipedia.org/wiki/Systems_Management)
4. [www.rivier.edu/faculty/vriabov/NWM\\_ch\\_14.ppt](http://www.rivier.edu/faculty/vriabov/NWM_ch_14.ppt) 169

NC5291

COMMUNICATION NETWORK SECURITY

L T P C  
3 0 0 3

## OBJECTIVES :

The students should be made to:

- Understand the need and concept of security
- Learn cryptosystems

## UNIT I INTRODUCTION AND NUMBER THEORY

9

Introduction to Information Security, Computer Security & Network Security. Need For Security. Security – Goals, Attacks, Security Services and Mechanisms, and Techniques. Number Theory and Mathematics for Symmetric Cryptography- Finite Arithmetic, Congruence Arithmetic-Linear Congruence and Quadratic Congruence. Mathematics for Asymmetric-Key Cryptography: Fermat's Theorem and Euler's Theorem, Primes, Primality Testing, Factorization, CRT, Exponentiation. Classical Symmetric-Key Ciphers –Substitution Ciphers, Transposition Ciphers.

## UNIT II SYMMETRIC AND ASYMMETRIC CRYPTOSYSTEMS

9

Modern Symmetric-Key Cipher - Block Ciphers (DES, 3DES, AES and its mode of operations), Stream Ciphers, Asymmetric-Key Cryptosystem- RSA, ElGamal, ECC, Key Management - Diffie-Hellman (DH) Mechanism, Kerberos – Needham Schroeder Protocol.

## UNIT III AUTHENTICATION, DIGITAL SIGNATURES AND CERTIFICATES

9

Message Integrity & Message Authentication - Message Authentication Code (MAC), Cryptographic Hash Functions – Birthday Attacks, Digital Signatures - Digital Signature Standards (FIPS 186-2), DSA (ANSI X9.30), RSA (ANSI X9.31) – Public Key Distribution – RSA schemes, Digital Certificates - PKI Certificates, PKI Life Cycle Management .

## UNIT IV TRUSTED IDENTITY

9

Entity Authentication: Password System- Fixed and One time Passwords (S/Key) RFC 2289 – Callback Systems, Zero Knowledge, Challenge and Response Systems – RADIUS — ITU-T X.509.

**UNIT V SECURITY AT LAYERS****9**

Network Layer Security - IPSec, Transport Layer Security- SSL/TLS, SSH, Application Layer Security -PGP, S/MIME, Firewall - Concepts, Architecture, Packet Filtering, Proxy Services and Bastion Hosts.

**TOTAL: 45 PERIODS****OUTCOMES:**

**At the end of this course, the students should be able to:**

- Explain digital signature standards
- Discuss authentication
- Explain security at different layers

**REFERENCES:**

1. Behrouz A.Forouzan, "Cryptography and Network Security", Special Edition, Tata McGraw Hill, 2007.
2. Bruce Schneier, "Applied Cryptography", John Wiley & Sons, 1994.
3. Charlie Kaufmann, Radia Perlman, Mike Speciner, "Network Security", Second Edition, Prentice Hall, 2002
4. Douglas R.Stinson, "Cryptography: Theory and Practice", CRC Press Series on Discrete Mathematics and its Applications, 1995.
5. David M. Durton, "Elementary Number Theory", Tata Mcgraw Hill, Sixth Edition, 2009.
6. William Stallings "Cryptography and Network Security: Principles and Practice", 3rd Edition, Pearson Education, 2002.
7. William Stallings "Network Security Essentials: Applications and Standards", 2nd Edition, Pearson Education, 2000.

**CU5004****HIGH PERFORMANCE SWITCHING ARCHITECTURES**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To enable the student to understand the basics of switching technologies and their implementation LANs, ATM networks and IP networks.
- To enable the student to understand the different switching architectures and queuing strategies and their impact on the blocking performances.
- To expose the student to the advances in packet switching architectures and IP addressing and switching solutions and approaches to exploit and integrate the best features of different architectures for high speed switching.

**UNIT I LAN SWITCHING TECHNOLOGY****9**

Switching Concepts, LAN Switching, switch forwarding techniques - cut through and store and forward, Layer 3 switching, Loop Resolution, Switch Flow control, virtual LANs.

**UNIT II ATM SWITCHING ARCHITECTURES****9**

Blocking networks - basic - and- enhanced banyan networks, sorting networks - merge sorting, re-arrangeable networks - full-and- partial connection networks, non blocking networks - Recursive network construction, comparison of non-blocking network, Switching with deflection routing - shuffle switch, tandem banyan switch.

**UNIT III      QUEUES IN ATM SWITCHES      9**  
Internal Queueing -Input, output and shared queueing, multiple queueing networks – combined Input, output and shared queueing - performance analysis of Queued switches.

**UNIT IV      PACKET SWITCHING ARCHITECTURES      9**  
Architectures of Internet Switches and Routers- Bufferless and buffered Crossbar switches, Multi-stage switching, Optical Packet switching; Switching fabric on a chip; Internally buffered Crossbars.

**UNIT V      IP SWITCHING      9**  
Addressing model, IP Switching types - flow driven and topology driven solutions, IP Over ATM address and next hop resolution, multicasting, Ipv6 over ATM.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- The student would be able to identify suitable switch architectures for a specified networking scenario and demonstrate its blocking performance.
- The student would be in a position to apply his knowledge of switching technologies, architectures and buffering strategies for designing high speed communication networks and analyse their performance

**REFERENCES**

1. Achille Pattavina, "Switching Theory: Architectures and performance in Broadband ATM networks ", John Wiley & Sons Ltd, New York. 1998
2. Christopher Y Metz, "Switching protocols & Architectures", McGraw - Hill Professional Publishing, NewYork.1998.
3. Elhanany M. Hamdi, "High Performance Packet Switching architectures", Springer Publications, 2007.
4. Rainer Handel, Manfred N Huber, Stefan Schroder, "ATM Networks - Concepts Protocols, Applications", 3<sup>rd</sup> Edition, Addison Wesley, New York. 1999.
5. Rich Siefert, Jim Edwards, "The All New Switch Book – The Complete Guide to LAN Switching Technology", Wiley Publishing, Inc., Second Edition, 2008.

**ANNA UNIVERSITY  
AFFILIATED INSTITUTIONS  
REGULATIONS – 2017  
CHOICE BASED CREDIT SYSTEM  
M.E. EMBEDDED SYSTEM TECHNOLOGIES**

**Programme Educational Objective**

- 1) To prepare students for successful careers in industry that meets the needs of Indian and global industries as employable professionals.
- 2) To develop the ability among students to synthesize data and technical concepts for application to product design, system development of societal importance.
- 3) To provide opportunity for students to work as part of teams on multi disciplinary projects to solve engineering, technical issues of societal demands.
- 4) To provide the P.G students with a sound foundation in the mathematical, scientific and engineering fundamentals necessary to formulate, solve and analyze engineering problems and to prepare them for employability and higher studies.
- 5) To promote student awareness of the life long learning and to introduce them to professional ethics and codes of professional practice.

**Program Outcomes**

- a) To Offer the P.G Program in Embedded System Technology with imparting domain knowledge in Electrical circuits, electronic devices, information technology and communication engineering to develop inter-process communication techniques based on hardware– software approaches for real time process automations.
- b) To enhance teaching & research contributions in Embedded System Technology with an ability to design and construct hardware and software systems, component or process keeping in tune with the latest developments and Industry requirements particularly for electrical and allied consumer electronics industries.
- c) An ability to design and conduct experiments as well as to organize, analyze and interpret data on multidisciplinary domains onto role of electronics, computer science, communication engineering for electrical applications.
- d) Be able to identify problems in major issues of Electrical Systems , analyse problems, coordinate through all options in design & developments and solve them using the knowledge base of Embedded Technology.
- e) To extend advanced teaching & training sessions with promoting industry based internships, leading to development of self-employable entrepreneurs and globally employable professionals.
- f) To provide guidance and supervision in identified domains of Embedded Application Development for Electrical & related Industries with realistic concerns such as economic, environmental, ethical, health and safety, manufacturability and technology sustainability.
- g) An ability to effectively communicate technical information in speech, presentation, and in writing.

- h) An understanding of professional, legal and ethical issues and responsibilities as it pertains to engineering profession with engaging in life-long learning with knowledge of contemporary issues.

Programme Educational Objectives	Programme Outcomes							
	a	b	c	d	e	f	g	h
1	✓	✓			✓	✓		
2				✓	✓	✓	✓	
3					✓		✓	✓
4	✓	✓	✓			✓		✓
5					✓	✓		✓

**MAPPING – PG- EMBEDDED SYSTEM TECHNOLOGIES**

			POa	POb	POc	POd	POe	POf	POg	POh	
YEAR 1	SEM 1	Applied Mathematics for Electrical Engineers	✓				✓				
		Advanced Digital Principles and Design	✓	✓	✓	✓					
		Microcontroller Based System Design	✓	✓	✓	✓					
		Design of Embedded Systems		✓	✓	✓	✓	✓			
		Software for Embedded System		✓	✓	✓	✓	✓			
		Elective I									
	Embedded System Lab I										
	SEM 2	Real Time Operating System									
		Pervasive Devices and Technology		✓	✓	✓	✓	✓			
		RISC Processor Architecture and Programming									
		Internet of Things									
		Elective II									
		Elective III									
Embedded System Lab II			✓	✓	✓	✓	✓	✓		✓	
Technical Seminar		✓	✓	✓	✓	✓	✓		✓		
YEAR 2	SEM 3	Elective IV	✓	✓	✓	✓					
		Elective V									
		Elective VI									
		Technical Seminar		✓	✓	✓	✓	✓	✓		✓
	Project Work Phase I		✓	✓	✓	✓	✓	✓		✓	
	SEM 4	Project Work Phase II		✓	✓	✓	✓	✓		✓	

**ANNA UNIVERSITY, CHENNAI**  
**AFFILIATED INSTITUTIONS**  
**REGULATIONS – 2017**  
**CHOICE BASED CREDIT SYSTEM**  
**M.E. EMBEDDED SYSTEM TECHNOLOGIES (FULL TIME)**  
**CURRICULUM AND SYLLABUS I TO IV SEMESTERS**

**SEMESTER I**

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	MA5155	Applied Mathematics for Electrical Engineers	FC	4	4	0	0	4
2.	ET5101	Advanced Digital Principles and Design	PC	5	3	2	0	4
3.	ET5151	Microcontroller Based System Design	PC	3	3	0	0	3
4.	ET5152	Design of Embedded Systems	PC	3	3	0	0	3
5.	ET5191	Software for Embedded Systems	PC	3	3	0	0	3
6.		Professional Elective I	PE	3	3	0	0	3
<b>PRACTICALS</b>								
7.	ET5111	Embedded System Lab I	PC	4	0	0	4	2
<b>TOTAL</b>				<b>25</b>	<b>19</b>	<b>2</b>	<b>4</b>	<b>22</b>

**SEMESTER II**

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.	ET5251	Real Time Operating Systems	PC	3	3	0	0	3
2.	ET5201	Pervasive Devices and Technology	PC	3	3	0	0	3
3.	ET5202	RISC Processor Architecture and Programming	PC	5	3	2	0	4
4.	ET5203	Internet of Things	PC	3	3	0	0	3
5.		Professional Elective II	PE	3	3	0	0	3
6.		Professional Elective III	PE	3	3	0	0	3
<b>PRACTICALS</b>								
7.	ET5211	Embedded System Lab II	PC	4	0	0	4	2
<b>TOTAL</b>				<b>24</b>	<b>18</b>	<b>2</b>	<b>4</b>	<b>21</b>

**SEMESTER III**

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1.		Professional Elective IV	PE	3	3	0	0	3
2.		Professional Elective V	PE	3	3	0	0	3
3.		Professional Elective VI	PE	3	3	0	0	3
<b>PRACTICALS</b>								
4.	ET5311	Project Work Phase I	EEC	12	0	0	12	6
5.	ET5312	Technical Seminar	EEC	2	0	0	2	1
<b>TOTAL</b>				<b>23</b>	<b>9</b>	<b>0</b>	<b>14</b>	<b>16</b>

**SEMESTER IV**

SI.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>PRACTICALS</b>								
1.	ET5411	Project Work Phase II	EEC	24	0	0	24	12
<b>TOTAL</b>				<b>24</b>	<b>0</b>	<b>0</b>	<b>24</b>	<b>12</b>

**TOTAL NO. OF CREDITS : 71**

### FOUNDATION COURSES (FC)

S.No	Course Code	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MA5155	Applied Mathematics for Electrical Engineers	FC	4	4	0	0	4

### PROFESSIONAL CORE (PC)

S.No	Course Code	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	ET5101	Advanced Digital Principles and Design	PC	5	3	2	0	4
2.	ET5151	Microcontroller Based System Design	PC	3	3	0	0	3
3.	ET5152	Design of Embedded Systems	PC	3	3	0	0	3
4.	ET5191	Software for Embedded Systems	PC	3	3	0	0	3
5.	ET5111	Embedded System Lab I	PC	4	0	0	4	2
6.	ET5251	Real Time Operating Systems	PC	3	3	0	0	3
7.	ET5201	Pervasive Devices and Technology	PC	3	3	0	0	3
8.	ET5202	RISC Processor Architecture and Programming	PC	5	3	2	0	4
9.	ET5203	Internet of Things	PC	3	3	0	0	3
10.	ET5211	Embedded System Lab II	PC	4	0	0	4	2

### PROFESSIONAL ELECTIVES (PE)\*

#### SEMESTER I

#### ELECTIVE I

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	ET5091	MEMS Technology	PE	3	3	0	0	3
2.	ET5001	Advanced Computer Architecture and Parallel Processing	PE	3	3	0	0	3
3.	IN5092	Digital Instrumentation	PE	3	3	0	0	3

**SEMESTER II  
ELECTIVE II AND III**

1.	ET5002	Embedded Linux	PE	3	3	0	0	3
2.	ET5071	Advanced Digital Signal Processing	PE	3	3	0	0	3
3.	ET5003	Python Programming	PE	3	3	0	0	3
4.	ET5004	Embedded Product Development	PE	3	3	0	0	3
5.	ET5005	Automotive Embedded System	PE	3	3	0	0	3
6.	ET5006	Reconfigurable Processor and SoC Design	PE	3	3	0	0	3

**SEMESTER III  
ELECTIVE IV, V AND VI**

1.	ET5092	Digital Image Processing	PE	3	3	0	0	3
2.	ET5007	Embedded Networking and Automation of Electrical System	PE	3	3	0	0	3
3.	ET5008	Smart System Design	PE	3	3	0	0	3
4.	ET5009	Entrepreneurship Development	PE	3	3	0	0	3
5.	ET5010	Nano Electronics	PE	3	3	0	0	3
6.	ET5011	Distributed Embedded Computing	PE	3	3	0	0	3
7.	PS5091	Smart Grid	PE	3	3	0	0	3
8.	PS5073	Electric Vehicles and Power Management	PE	3	3	0	0	3
9.	ET5012	Soft Computing and Optimization Techniques	PE	3	3	0	0	3
10.	ET5013	Wireless And Mobile Communication	PE	3	3	0	0	3
11.	ET5014	Cryptography And Network Security	PE	3	3	0	0	3
12.	IN5079	Robotics and Control	PE	3	3	0	0	3

**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

S.No	Course Code	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	ET5311	Project Work Phase I	EEC	12	0	0	12	6
2.	ET5312	Technical Seminar	EEC	2	0	0	2	1
3.	ET5411	Project Work Phase II	EEC	24	0	0	24	12

**OBJECTIVES :**

- The main objective of this course is to demonstrate various analytical skills in applied mathematics and extensive experience with the tactics of problem solving and logical thinking applicable for the students of electrical engineering. This course also will help the students to identify, formulate, abstract, and solve problems in electrical engineering using mathematical tools from a variety of mathematical areas, including matrix theory, calculus of variations, probability, linear programming and Fourier series.

**UNIT I MATRIX THEORY****12**

Cholesky decomposition - Generalized Eigenvectors - Canonical basis - QR Factorization - Least squares method - Singular value decomposition.

**UNIT II CALCULUS OF VARIATIONS****12**

Concept of variation and its properties – Euler’s equation – Functional dependant on first and higher order derivatives – Functionals dependant on functions of several independent variables – Variational problems with moving boundaries – Isoperimetric problems - Direct methods : Ritz and Kantorovich methods.

**UNIT III PROBABILITY AND RANDOM VARIABLES****12**

Probability – Axioms of probability – Conditional probability – Baye’s theorem - Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a random variable.

**UNIT IV LINEAR PROGRAMMING****12**

Formulation – Graphical solution – Simplex method – Big M method - Two phase method - Transportation and Assignment models.

**UNIT V FOURIER SERIES****12**

Fourier trigonometric series : Periodic function as power signals – Convergence of series – Even and odd function : Cosine and sine series – Non periodic function : Extension to other intervals - Power signals : Exponential Fourier series – Parseval’s theorem and power spectrum – Eigenvalue problems and orthogonal functions – Regular Sturm - Liouville systems – Generalized Fourier series.

**TOTAL : 60 PERIODS****OUTCOMES :**

After completing this course, students should demonstrate competency in the following skills:

- Apply various methods in matrix theory to solve system of linear equations.
- Maximizing and minimizing the functional that occur in electrical engineering discipline.
- Computation of probability and moments, standard distributions of discrete and continuous random variables and functions of a random variable.
- Could develop a fundamental understanding of linear programming models, able to develop a linear programming model from problem description, apply the simplex method for solving linear programming problems.
- Fourier series analysis and its uses in representing the power signals.

## REFERENCES :

1. Andrews L.C. and Phillips R.L., "Mathematical Techniques for Engineers and Scientists", Prentice Hall of India Pvt. Ltd., New Delhi, 2005.
2. Bronson, R. "Matrix Operation", Schaum's outline series, 2<sup>nd</sup> Edition, McGraw Hill, 2011.
3. Elsgolc, L. D. "Calculus of Variations", Dover Publications, New York, 2007.
4. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8<sup>th</sup> Edition, 2015.
5. O'Neil, P.V., "Advanced Engineering Mathematics", Thomson Asia Pvt. Ltd., Singapore, 2003.
6. Taha, H.A., "Operations Research, An Introduction", 9<sup>th</sup> Edition, Pearson education, New Delhi, 2016.

**ET5101**

**ADVANCED DIGITAL PRINCIPLES AND DESIGN**

**LT P C  
3 2 0 4**

### COURSE OBJECTIVES:

- To expose the students to the fundamentals of sequential system design, Asynchronous circuits, switching errors .
- To teach the fundamentals of modeling through comparative study on the classification of commercial family of Programmable Device
- To study on Fault identification in digital switching circuits
- To introduce logics for design of Programmable Devices
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

### UNIT I SEQUENTIAL CIRCUIT DESIGN

**12**

Analysis of Clocked Synchronous Sequential Networks (CSSN) Modeling of CSSN – State table Assignment and Reduction – Design of CSSN – ASM Chart – ASM Realization.

### UNIT II ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN

**12**

Analysis of Asynchronous Sequential Circuit (ASC) – Flow Table Reduction – Races in ASC – State Assignment Problem and the Transition Table – Design of ASC – Static and Dynamic Hazards – Essential Hazards – Designing Hazard free circuits

### UNIT III FAULT DIAGNOSIS AND TESTABILITY ALGORITHMS

**12**

Fault Table Method – Path Sensitization Method – Boolean Difference Method – Kohavi Algorithm – Tolerance Techniques –Built-in Self Test.

### UNIT IV ARCHITECTURES & DESIGN USING PROGRAMMABLE DEVICES

**12**

Realize combinational, Arithmetic, Sequential Circuit with Programmable Array Logic; Architecture and application of Field Programmable Logic Sequence. Architecture of EPLD, Programmable Electrically Erasable Logic – Programming Techniques -Re-Programmable Devices Architecture-Function blocks, I/O blocks, Interconnects- Xilinx FPGA – Xilinx 2000 - Xilinx 4000 family.

## UNIT V HDL PROGRAMMING

12

Overview of digital design with VHDL, hierarchical modelling concepts, gate level modelling, data flow modelling, behavioural modelling, task & functions, logic synthesis-simulation-Design examples, Ripple carry Adders, Carry Look ahead adders, Multiplier, ALU, Shift Registers, Multiplexer, Comparator, Test Bench

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process: Discussions / Practice on Workbench : Logic Synthesis and Simulation for digital designs

**TOTAL : 45+ 30=75 PERIODS**

**OUTCOMES :** After the completion of this course the student will be able to:

- Analyze and design sequential digital circuits
- Design and use programming tools for implementing digital circuits of industry standards
- Identify the requirements and specifications of the system required for a given application
- Learners can acquire knowledge about HDL programming.
- Improved Employability and entrepreneurship capacity due to knowledge upgradation on recent trends in digital design for embedded systems.

### **REFERENCES:**

1. Donald G. Givone, "Digital principles and Design", Tata McGraw Hill 2002.
2. Stephen Brown and Zvonk Vranesic, "Fundamentals of Digital Logic with VHDL Deisgn", Tata McGraw Hill, 2002
3. William J. Dally / Curtis Harting / Tor M. Aamodt," Digital Design Using VHDL:A Systems Approach, Cambridge Univerity Press,2015.
4. Charles H. Roth Jr., "Digital Systems design using VHDL", Cengage Learning, 2010.
5. Mark Zwolinski, "Digital System Design with VHDL", Pearson Education, 2004
6. Parag K Lala, "Digital System design using PLD", BS Publications, 2003
7. Stephen M.Trimberger, FPGA Technology, Springer, 1994
8. Nripendra N Biswas, "Logic Design Theory", Prentice Hall of India, 2001
9. Charles H. Roth Jr., "Fundamentals of Logic design", Thomson Learning, 2004.
10. John V.Oldfeild ,Richard C.Dorf,"Field Programmable Gate Arrays",Wiley India Edition,2008

ET5151

**MICROCONTROLLER BASED SYSTEM DESIGN**

**L T P C  
3 0 0 3**

### **COURSE OBJECTIVES**

- To introduce the fundamentals of microcontroller based system design.
- To teach I/O and RTOS role on microcontroller.
- To know Microcontroller based system design, applications.
- To teach I/O interface in system Design
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

<b>UNIT I</b>	<b>8051 ARCHITECTURE</b>	<b>9</b>
Architecture – memory organization – addressing modes – instruction set – Timers - Interrupts - I/O ports, Interfacing I/O Devices – Serial Communication.		
<b>UNIT II</b>	<b>8051 PROGRAMMING</b>	<b>9</b>
Assembly language programming – Arithmetic Instructions – Logical Instructions –Single bit Instructions – Timer Counter Programming – Serial Communication Programming, Interrupt Programming, LCD digital clock, thermometer – Significance of RTOS for 8051		
<b>UNIT III</b>	<b>PIC MICROCONTROLLER</b>	<b>9</b>
Architecture – memory organization – addressing modes – instruction set – PIC programming in Assembly & C –I/O port, Data Conversion, RAM & ROM Allocation, Timer programming, practice in MP-LAB.		
<b>UNIT IV</b>	<b>PERIPHERAL OF PIC MICROCONTROLLER</b>	<b>9</b>
Timers – Interrupts, I/O ports- I2C bus-A/D converter-UART- CCP modules -ADC, DAC and Sensor Interfacing –Flash and EEPROM memories.		
<b>UNIT V</b>	<b>SYSTEM DESIGN – CASE STUDY</b>	<b>9</b>
Interfacing LCD Display – Keypad Interfacing - Generation of Gate signals for converters and Inverters - Motor Control – Controlling DC/ AC appliances – Measurement of frequency - Stand alone Data Acquisition System.		

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process :

Discussions/Practice on Workbench : 8051/PIC/ATMEL/other Microcontroller based Assembly/C language programming – Arithmetic Programming– Timer Counter Programming – Serial Communication- Programming Interrupt –RTOS basis in Task creation and run – LCD digital clock/thermometer- Motor Control

**TOTAL : 45 PERIODS**

**OUTCOMES :** After the completion of this course the student will be able to:

- 8-bit microcontrollers, learn assembly and C-programming of PIC.
- learn Interfacing of Microcontroller.
- Learners will study about PIC microcontroller and system design.
- The course would enable students to enrich their knowledge with hands on experiments and project based learning
- Effectively utilize microcontroller software development tools such as a compiler, make files, or compile scripts

**REFERENCES:**

1. Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey ‘ PIC Microcontroller and Embedded Systems using Assembly and C for PIC18’, Pearson Education 2008
2. Rajkamal, ”Microcontrollers Architecture, Programming Interfacing,& System Design, Pearson,2012.
3. Muhammad Ali Mazidi, Sarmad Naimi ,Sepehr Naimi’ AVR Microcontroller and Embedded Systems using Assembly and C”, Pearson Education 2014.
4. Muhammad Ali Mazidi, Janice G. Mazidi and Rolin D. McKinlay, ‘The 8051 Microcontroller and Embedded Systems’ Prentice Hall, 2005.
5. John Iovine, ‘PIC Microcontroller Project Book ’, McGraw Hill 2000
6. Senthil Kumar, Saravanan, Jeevanathan, ”microprocessor & microcontrollers, Oxford, 2013.
7. Myke Predko, “Programming and customizing the 8051 microcontroller”, TMcGraw Hill 2001.

**COURSE OBJECTIVES**

- To provide a clear understanding on the basic concepts, Building Blocks of Embedded System
- To teach the fundamentals of Embedded processor Modeling , Bus Communication in processors, Input/output interfacing
- To introduce on processor scheduling algorithms , Basics of Real time operating system
- To discuss on aspects required in developing a new embedded processor, different Phases & Modeling of embedded system
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

**UNIT I INTRODUCTION TO EMBEDDED SYSTEMS****9**

Introduction to Embedded Systems –Structural units in Embedded processor, selection of processor & memory devices- DMA, Memory management methods- memory mapping, cache replacement concept, Timer and Counting devices, Watchdog Timer, Real Time Clock

**UNIT II EMBEDDED NETWORKING AND INTERRUPTS SERVICE MECHANISM****9**

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols - RS232 standard – RS485 –USB – Inter Integrated Circuits (I<sup>2</sup>C) – interrupt sources , Programmed-I/O busy-wait approach without interrupt service mechanism- ISR concept— multiple interrupts – context and periods for context switching, interrupt latency and deadline -Introduction to Basic Concept Device Drivers.

**UNIT III RTOS BASED EMBEDDED SYSTEM DESIGN****9**

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication-shared memory, message passing-, Interprocess Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance-comparison of commercial RTOS features - RTOS Lite, Full RTOS, VxWorks, µC/OS-II, RT Linux,

**UNIT IV SOFTWARE DEVELOPMENT TOOLS****9**

Software Development environment-IDE, assembler, compiler, linker, simulator, debugger, Incircuit emulator, Target Hardware Debugging, need for Hardware-Software Partitioning and Co-Design. Overview of UML, Scope of UML modeling, Conceptual model of UML, Architectural, UML basic elements-Diagram- Modeling techniques - structural, Behavioral, Activity Diagrams.

**UNIT V EMBEDDED SYSTEM APPLICATION DEVELOPMENT****9**

Objectives, different Phases & Modeling of the Embedded product Development Life Cycle (EDLC), Case studies on Smart card- Adaptive Cruise control in a Car -Mobile Phone software for key inputs.

Note: Class Room Discussions and Tutorials can include the following Guidelines for improved Teaching /Learning Process: Practice through any of Case studies through Exercise/Discussions on Design , Development of embedded Products like : Smart card -Adaptive Cruise control in a Car - Mobile Phone -Automated Robonoid

**TOTAL: 45 PERIODS**

**OUTCOMES** : After the completion of this course the student will be able to:

- An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems
- Design real time embedded systems using the concepts of RTOS.
- Foster ability to understand the role of embedded systems in industry

## REFERENCES

1. Rajkamal, 'Embedded system-Architecture, Programming, Design', TMH,2011.
2. Peckol, "Embedded system Design",JohnWiley&Sons,2010
3. Shibu.K.V, "Introduction to Embedded Systems", TataMcgraw Hill,2009
4. Lyla B Das," Embedded Systems-An Integrated Approach",Pearson2013
5. Elicia White,"Making Embedded Systems",O'Reilly Series,SPD,2011
6. Bruce Powel Douglass,"Real-Time UML Workshop for Embedded Systems,Elsevier,2011
7. Simon Monk, "Make: Action, Movement, Light and Sound with Arduino and Raspberry Pi", O'Reilly Series ,SPD,2016.
8. Tammy Noergaard, "Embedded System Architecture, A comprehensive Guide for Engineers and Programmers", Elsevier, 2006
9. Jonathan W.Valvano,"Embedded Microcomputer Systems ,Real Time Interfacing",Cengage Learning,3<sup>rd</sup> edition,2012
10. Michael Margolis,"Arduino Cookbook, O'Reilly Series ,SPD,2013.

ET5191

SOFTWARE FOR EMBEDDED SYSTEMS

L T P C  
3 0 0 3

## COURSE OBJECTIVES

- To expose the students to the fundamentals of embedded Programming.
- To Introduce the GNU C Programming Tool Chain in Linux.
- To study basic concepts of embedded C , Embedded OS&Python Programming
- To introduce time driven architecture, Serial Interface with a case study.
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

## UNIT I EMBEDDED PROGRAMMING

9

C and Assembly - Programming Style - Declarations and Expressions - Arrays, Qualifiers and Reading Numbers - Decision and Control Statements - Programming Process - More Control Statements - Variable Scope and Functions - C Preprocessor - Advanced Types - Simple Pointers - Debugging and Optimization – In-line Assembly.

## UNIT II. C PROGRAMMING TOOL CHAIN IN LINUX

9

C preprocessor - Stages of Compilation - Introduction to GCC - Debugging with GDB - The Make utility - GNU Configure and Build System - GNU Binary utilities - Profiling - using *gprof* - Memory Leak Detection with *valgrind* - Introduction to GNU C Library

**UNIT III EMBEDDED C 9**

Adding Structure to 'C' Code: Object oriented programming with C, Header files for Project and Port, Examples. Meeting Real-time constraints: Creating hardware delays - Need for timeout mechanism - Creating loop timeouts - Creating hardware timeouts.

**UNIT IV EMBEDDED OS 9**

Creating embedded operating system: Basis of a simple embedded OS, Introduction to sEOS, Using Timer 0 and Timer 1, Portability issue, Alternative system architecture, Important design considerations when using sEOS- Memory requirements - embedding serial communication & scheduling data transmission - Case study: Intruder alarm system.

**UNIT V PYTHON PROGRAMMING 9**

Basics of PYTHON Programming Syntax and Style – Python Objects– Dictionaries – comparison with C programming on Conditionals and Loops – Files – Input and Output – Errors and Exceptions – Functions – Modules – Classes and OOP – Execution Environment.

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process:

Discussions/Practice on Workbench : Program Development and practice in exercises with C, C++ Linux and Python Programming Environments.

**TOTAL : 45 PERIODS**

**OUTCOMES :** After the completion of this course the student will be able to:

- Ability to use GNU C to develop embedded software.
- knowledge and understanding of fundamental embedded systems design paradigms, architectures, possibilities and challenges, both with respect to software and hardware
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

**REFERENCES**

1. Steve Oualline, 'Practical C Programming 3<sup>rd</sup> Edition', O'Reilly Media, Inc, 2006.
2. Michael J Pont, "Embedded C", Pearson Education, 2007.
3. Christian Hill, Learning Scientific Programming with Python , CAMBRIDGE UNIVERSITY PRESS ,2016.
4. Wesley J.Chun, "Core python application Programming 3<sup>rd</sup> Edition", Pearson Educat, 2016.
5. Mark J.Guzdial," introduction to computing and programming in python – a Multimedia approach ,4<sup>th</sup> edition, Pearson Education, 2015.
6. Stephen Kochan, "Programming in C", 3rd Edition, Sams Publishing, 2009.
7. Mark Lutz,"Learning Python,Powerful OOPs,O'reilly,2011.
8. Peter Prinzs, Tony Crawford, "C in a Nutshell",O'Reilly,2016.
9. Dr.Bandu Meshram, "Object Oriented Paradigm C++ BeginnersGuide C&C++",SPD, 2016.
10. David Griffiths, Dawn Griffiths, "Head First C", O'reilly,2015.

Sl.No	Experiment Detail	Equipment/ Supports Required	Training outcomes	Related programme outcomes
1.	Programming in Higher Level Languages/ Platforms	C/C++/Java/Embedded C/Embedded Java/ Compilers&Platforms	The students will learn design with simulators/ programming environments	a,b,c,d
2.	Programming with 8 bit Microcontrollers : <ul style="list-style-type: none"> <li>✓ Assembly programming</li> </ul> Study on incircuit Emulators, crosscompilers, debuggers	8051 Micropontrrollers with peripherals; ;IDE, Board Support Software Tools /C Compiler/others	The students will learn design with simulators/experiments,in programming processor boards, processor interfacing/ designing digital controllers	2,3,4,a,c,d
3.	I/O Programming with 8 bit Microcontrollers I/O Interfacing : Timers/ Interrupts/ Serial port programming/PW M Generation/ Motor Control/ADC/DAC / LCD/ RTC Interfacing/ Sensor Interfacing	8051 Micropontrrollers with peripherals;Board Support Software Tools, peripherals with interface		a,f
4.	Programming with AVR/ PIC Microcontrollers : <ul style="list-style-type: none"> <li>✓ Assembly programming</li> <li>✓ C programming</li> <li>✓ programming</li> <li>✓ Interfacing peripherals</li> </ul> Study on incircuit Emulators, crosscompilers,	AVR/ PIC Micropontrrollers with peripherals; ;IDE, Board Support Software Tools /C Compiler/others	The students will learn design with simulators/experiments,in	a,b,c,d

	debuggers		programming	
5. .	I/O Programming with AVR/ PIC Microcontrollers I/O Interfacing : Timers/ Interrupts/ Serial port programming/PW M Generation/ Motor Control/ADC/DAC / LCD/ RTC Interfacing/ Sensor Interfacing	AVR/ PIC Microcontrollers with peripherals; Board Support Software Tools, peripherals with interface	processor boards, processor interfacing/ designing digital controllers	2,3,4,a,c,d
6.	Programming with Arduino Microcontroller Board :  Study on incircuit Emulators, crosscompilers, debuggers	Arduino Boards with peripherals ;IDE, Board Support Software Tools /Compiler/others		a,f
7. .	VHDL Programming in FPGA processors	Processor Boards with Board Support Tools & Interfaces	The students will learn design ,modeling & simulation of Combinational, Sequential, Synchronous, Asynchronous circuits with simulators/experiments ,in programming processor boards, processor interfacing/designing reprogrammable system	a,f
8.	Verilog HDL Programming in FPGA processors	Processor Boards with Board Support Tools & Interfaces	The students will learn design ,modeling & simulation of Combinational, Sequential, Synchronous, Asynchronous circuits with simulators/experiments ,in programming processor boards, processor interfacing/designing reprogrammable system	a,f
9. ..	Programming & Simulation in Simulators /Tools/others	Simulation Tools as Proteus/ ORCAD	The students will learn design with experiments,in programming	a,b,c,d
10. .	Programming &	Simulation Tools as Matlab	suites/ simulators/Tool	2,3,4,a,c,d

	Simulation in Simulators /Tools/others	/others	Bench.	
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**TOTAL : 60 PERIODS**

**Note:** Note:Laboratory training, discussions can include the given guidelines for improved teaching /learning process :Hands on experiences can be with Case specific experiments in domains on range of processors,programmes,simulators,circuits that support theory subjects.

**REFERENCE:**

1. Mohamammad Ali Mazidi & Mazidi ‘ 8051 Microcontroller and Embedded Systems’, Pearson Education
2. Mohammad Ali Mazidi, Rolind Mckinley and Danny Causey, ‘PIC Microcontroller and Embedded Systems’ Pearson Education
3. Simon Monk,” Make Action-with Arduino and Raspberry Pi,SPD ,2016.
4. Wesley J.Chun,”Core Python Applications Programming,3<sup>rd</sup> ed,Pearson,2016
5. Kraig Mitzner, ‘Complete PCB Design using ORCAD Capture and Layout’, Elsevier
6. Vinay K.Ingle,John G.Proakis,”DSP-A Matlab Based Approach”,Cengage Learning,2010
7. Taan S.Elali,”Discrete Systems and Digital Signal Processing with Matlab”,CRC Press2009.
8. *Jovitha Jerome,”Virtual Instrumentation using Labview”PHI,2010.*
9. Woon-Seng Gan, Sen M. Kuo, ‘Embedded Signal Processing with the Micro Signal Architecture’, John Wiley & Sons, Inc., Hoboken, New Jersey 2007
10. Dogan Ibrahim, ‘Advanced PIC microcontroller projects in C’, Elsevier 2008

**ET5251**

**REAL TIME OPERATING SYSTEMS**

**LT P C  
3 0 0 3**

**COURSE OBJECTIVES**

- To expose the students to the fundamentals of interaction of OS with a computer and User computation.
- To teach the fundamental concepts of how process are created and controlled with OS.
- To study on programming logic of modeling Process based on range of OS features
- To compare types and Functionalities in commercial OS, application development using RTOS
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

**UNIT I REVIEW OF OPERATING SYSTEMS**

**9**

Basic Principles - Operating System structures – System Calls – Files – Processes – Design and Implementation of processes – Communication between processes – Introduction to Distributed operating system – issues in distributed system:states,events,clocks-Distributed scheduling-Fault & recovery.

**UNIT II OVERVIEW OF RTOS 9**

RTOS Task and Task state –Multithreaded Preemptive scheduler- Process Synchronisation- Message queues– Mail boxes -pipes – Critical section – Semaphores – Classical synchronisation problem – Deadlocks

**UNIT III REAL TIME MODELS AND LANGUAGES 9**

Event Based – Process Based and Graph based Models – Real Time Languages – RTOS Tasks – RT scheduling - Interrupt processing – Synchronization – Control Blocks – Memory Requirements.

**UNIT IV REAL TIME KERNEL 6**

Principles – Design issues – RTOS Porting to a Target – Comparison and Basic study of various RTOS like – VX works – Linux supportive RTOS – C Executive.

**UNIT V INTRODUCTION TO EMBEDDED OS 12**

Discussions on Basics of Linux supportive RTOS – uCOS-C Executive for development of RTOS Application –introduction to Android Environment -The Stack – Android User Interface – Preferences, the File System, the Options Menu and Intents, with one Case study

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process: Discussions/Practice on Workbench :on understanding the scheduling techniques, timing circuitary, memory allotment scheme , overview of commercial Embedded OS.

**TOTAL : 45 PERIODS**

**OUTCOMES :** After the completion of this course the student will be able to:

- Real-time scheduling and schedulability analysis, including clock-driven and priority-driven scheduling
- Theoretical background (specification/verification) and practical knowledge of real-time operating systems.
- After completing the course students will appreciate the use of multitasking techniques in real-time systems, understand the fundamental concepts of real-time operating systems
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

**REFERENCES:**

1. Silberschatz, Galvin, Gagne” Operating System Concepts, 6<sup>th</sup> ed, John Wiley, 2003
2. Charles Crowley, “Operating Systems-A Design Oriented approach” McGraw Hill, 1997
3. Raj Kamal, “Embedded Systems- Architecture, Programming and Design” Tata McGraw Hill, 2006.
4. Karim Yaghmour, Building Embedded Linux System”, O’reilly Pub, 2003
5. C.M. Krishna, Kang, G. Shin, “Real Time Systems”, McGraw Hill, 1997.
6. Marko Gargenta, “Learning Android “, O’reilly 2011.
7. Herma K., “Real Time Systems – Design for distributed Embedded Applications”, Kluwer Academic, 1997.
8. Corbet Rubini, Kroah-Hartman, “Linux Device Drivers”, O’reilly, 2016.
9. Mukesh Sigal and N G Shi “Advanced Concepts in Operating System”, McGraw Hill, 2000
10. D.M.Dhamdhare, “Operating Systems, A Concept-Based Approach, TMH, 2008

**COURSE OBJECTIVES**

- To expose the fundamentals of wireless sensor technology, classification
- To teach the infrastructure of WSN processor and its functions in networking
- To study on challenges in on interconnectivity of networks & Network communication
- To discuss on commercial wireless technology
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

**UNIT I WIRELESS SENSOR DEVICES & NETWORKING****12**

Challenges for Wireless Sensor Networks- Characteristic requirements for WSN ,WSN vs Adhoc Networks - introduction to Sensor node networking with any Commercially available sensor nodes – Physical layer and transceiver design considerations in WSNs, -Applications of sensor networks

**UNIT II BUILDING PERVASIVE SENSOR NETWORK****12**

Single-Node Architecture - Hardware Components, constraints & challenges in resources- Energy Consumption of Sensor Nodes, Operating Systems for Wireless Sensor Networks – Introduction - Operating System Design Issues - Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts. Data Dissemination-Flooding and Gossiping-Data gathering Sensor Network Scenarios –Optimization, Goals and Figures of Merit – Design Principles for WSNs- Gateway Concepts – Need for gateway

**UNIT III. WIRELESS TECHNOLOGY****6**

Wireless LAN – IEEE 802.11 System Architecture , protocol Architecture – Services , AdHoc Networks, Hiper LAN , Bluetooth , Wireless PAN, Wireless MAN, Wireless Backbone Networks , Wireless Access Technology

**UNIT IV OVERVIEW OF SENSOR NETWORK PROTOCOLS****9**

Introduction to fundamentals of Wireless sensor network MAC Protocols - Low duty cycle protocols and wakeup concepts - Contention-based protocols - Schedule-based protocols - IEEE 802.15.4 MAC protocol- Energy usage profile, Choice of modulation scheme-basic principle for data transfer and energy management for SMAC , Leach & Zigbee communication

**UNIT V WIRELESS NETWORKING OF DEVICES****6**

Classification of Wireless Networking of Devices, introduction to RF WPAN 802.15.1 &Bluetooth - protocol stack,frame, link manager layer –Bluetooth piconet–application.

Note:Class room discussions and tutorials can include the following guidelines for improved teaching /learning process : Discussions/Exercise/Practice on Workbench : on the basics of Zigbee protocols, sensor motes, role of special microcontrollers for Zigbee communication etc

**TOTAL : 45 PERIODS**

**OUTCOMES :** After the completion of this course the student will be able to:

- Relate to current trends in pervasive computing and develop a sense of their practicality
- Identify distinguishing features of the different mobile device categories, namely, Pocket PCs, Personal Digital Assistants (PDAs), and wireless phones.

- Recognize the difference between writing code for workstations and servers on one hand and for resource-constrained devices on the other hand.
- The learning process delivers insight onto building of sensor networks, communication in zigbee network and sensor networks protocols are studied.
- Design and develop a pervasive computing device for a specific need.
- Develop a framework for pervasive computing.

## REFERENCES

1. Holger Karl, Andreas Willig, "Protocols & Architectures for WSN", John Wiley, 2012
2. Mark Ciampa, Jorge Olenewa, "Wireless Communications, Cengage Learning, 2009.
3. Frank Adelstein, Sandeep K.S Gupta et al, "Fundamentals of Mobile & Pervasive Computing, TMcHill, 2010.
4. Jaganathan Sarangapani, Wireless AdHoc & Sensor N/Ws-Protocols&Control, CRC 2007.
5. Kaveh Pahlavan, Prasanth Krishnamoorthy, " Principles of Wireless Networks' PHI/Pearson Education, 2003
6. Natalia Olifer and Victor Olifer, "Computer Networks principles. technologies and protocols for network design", Wiley, 2015
7. Feng Zhao, Leonidas Guibas "Wireless Sensor Networks", Elsevier, 2005.
8. William Stallings, " Wireless communications and Networks", PHI/Pearson Education, 2002.
9. Mullet, "Introduction to wireless telecommunications systems and networks", cengage learning, 2010
10. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

## ET5202 RISC PROCESSOR ARCHITECTURE AND PROGRAMMING

L T P C  
3 2 0 4

### COURSE OBJECTIVES

- To teach the architecture of general AVR processor
- To teach the architecture and programming of 8/16 bit RISC processor
- To teach the implementation of DSP in ARM processor
- To discuss on memory management, application development in RISC processor
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

### UNIT I AVR MICROCONTROLLER ARCHITECTURE

12

Architecture – memory organization – addressing modes – I/O Memory – EEPROM – I/O Ports – SRAM – Timer – UART – Interrupt Structure- Serial Communication with PC – ADC/DAC Interfacing

### UNIT II ARM ARCHITECTURE AND PROGRAMMING

12

Arcon RISC Machine – Architectural Inheritance – Core & Architectures -- The ARM Programmer's model -Registers – Pipeline - Interrupts – ARM organization - ARM processor family – Co-processors. Instruction set – Thumb instruction set – Instruction cycle timings

### UNIT III ARM APPLICATION DEVELOPMENT

12

Introduction to RT implementation with ARM – Exception Handling – Interrupts – Interrupt handling schemes- Firmware and bootloader – Free RTOS Embedded Operating Systems concepts –example on ARM core like ARM9 processor

**UNIT IV MEMORY PROTECTION AND MANAGEMENT 12**  
Protected Regions-Initializing MPU, Cache and Write Buffer-MPU to MMU-Virtual Memory-Page Tables-TLB-Domain and Memory Access Permission-Fast Context Switch Extension.

**UNIT V DESIGN WITH ARM MICROCONTROLLERS 12**  
Assembler Rules and Directives- Simple ASM/C programs- Hamming Code- Division-Negation-Simple Loops –Look up table- Block copy- subroutines-application.

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process: Discussions/Exercise/Practice on Workbench : on Programming practices on the KEIL Work Bench for Simple ASM/C / Input & output interfacing programs with ARM 7/ARM 9/Nuvoton Processors

**TOTAL : 60 PERIODS**

**OUTCOMES :** After the completion of this course the student will be able to:

- Describe the programmer's model of ARM processor and create and test assembly level programming.
- Analyze various types of coprocessors and design suitable co-processor interface to ARM processor.
- Identify the architectural support of ARM for operating system and analyze the function of memory Management unit of ARM.
- Students will develop more understanding on the concepts ARM Architecture, programming and application development.
- The learning process delivers insight into various embedded processors of RISC architecture / computational processors with improved design strategies.

#### **REFERENCES**

1. Steve Furber, 'ARM system on chip architecture', Addison Wesley
2. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield 'ARM System
3. Developer's Guide Designing and Optimizing System Software', Elsevier 2007.
4. Muhammad Ali Mazidi, Sarmad Naimi ,Sepehr Naimi' AVR Microcontroller and Embedded Systems using Assembly and C", Pearson Education 2014.
5. ARM Architecture Reference Manual, LPC213x User Manual
6. www.Nuvoton .com/websites on Advanced ARM Cortex Processors
7. Trevor Martin, 'The Insider's Guide To The Philips ARM7-Based Microcontrollers,
8. An Engineer's Introduction To The LPC2100 Series' Hitex (UK) Ltd.,

**ET5203**

**INTERNET OF THINGS**

**LT P C  
3 0 0 3**

#### **COURSE OBJECTIVES**

- To Study about **Internet of Things** technologies and its role in real time applications
- To familiarize the accessories and communication techniques for IOT.
- To familiarize the different platforms and Attributes for IOT

**UNIT I INTRODUCTION TO INTERNET OF THINGS 6**  
Overview, Technology drivers , Business drivers,Typical IoT applications , Trends and implications

**UNIT II IOT ARCHITECTURE: 12**

Node Structure - Sensing, Processing, Communication, Powering, Networking - Topologies, Layer/Stack architecture ,IoT standards,Cloud computing for IoT,Bluetooth, Bluetooth Low Energy, beacons.

**UNIT III PROTOCOLS AND WIRELESS TECHNOLOGY FOR IOT 9**

**Protocols :** NFC, RFID, Zigbee MIPI, M-PHY, UniPro, SPMI, SPI, M-PCle Wired vs. Wireless communication,GSM, CDMA, LTE, GPRS, small cell.

**Wireless technologies for IoT:** WiFi (IEEE 802.11), Bluetooth/Bluetooth Smart, ZigBee/ZigBee Smart, UWB (IEEE 802.15.4), 6LoWPAN, Proprietary systems.

**UNIT IV DATA ANALYSTICS FOR IOT 9**

**Services/Attributes:** Big-Data Analytics and Visualization,Dependability,Security,Maintainability.

**Data analytics for IoT:** A framework for data-driven decision making , Descriptive, Predictive and Prescriptive Analytics , Business Intelligence and Artificial Intelligence Importance of impact and open innovation in data-driven decision making.

**UNIT V CASE STUDIES 9**

Home Automation, smart cities, Smart Grid, Electric vehicle charging, Environment, Agriculture, Productivity Applications

**TOTAL : 45 PERIODS**

**OUTCOMES**

- Students will develop more understanding on the concepts of IOT and its present developments.
- Students will study about different IOT technologies.
- Students will acquire knowledge about different platforms and Infrastructure for IOT
- Students will learn the art of implementing IOT for smart applications and control

Note: Class Room Discussions and Tutorials can include the following Guidelines for improved Teaching /Learning Process: Practice through any of Case studies through Exercise/Discussions on Design , Development of embedded solutions using wireless communication by processor support

**REFERENCES:**

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4. Adrian McEwen and Hakim Cassimally "Designing the Internet of Things "Wiley,2014.
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7. Lingyang Song/Dusit Niyato/ Zhu Han/ Ekram Hossain," Wireless Device-to-Device Communications and Networks, CAMBRIDGE UNIVERSITY PRESS,2015
8. OvidiuVermesan and Peter Friess (Editors), "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers Series in Communication, 2013
9. Vijay Madiseti , ArshdeepBahga, "Internet of Things (A Hands on-Approach)", 2014

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11. Lars T. Berger and Krzysztof Iniewski, "Smart Grid applications, communications and security", Wiley, 2015
12. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama and Nick Jenkins, "Smart Grid Technology and Applications", Wiley, 2015.
13. Upena Dalal, "Wireless Communications & Networks, Oxford, 2015

**ET5211**

**EMBEDDED SYSTEM LAB II**

**LT P C  
0 0 4 2**

Sl. No	Experiment Detail	Equipment/ Supports Required	Training outcomes	Related programme outcomes
1.	Programming ARM processor : ARM7 / ARM9/ARM Cortex  Study on incircuit Emulators, crosscompilers, debuggers	Microcontrollers with peripherals; IDE, Board Support Software Tools /Keil/uCOS Compiler/others		a,b,c,d
	I/O Programming with ARM processor : ARM7 / ARM9/ARM Cortex Microcontrollers I/O Interfacing : Timers/ Interrupts/ Serial port programming/PWM Generation/ Motor Control/ADC/DAC/ LCD/ RTC Interfacing/ Sensor Interfacing	ARM processor : ARM7 / ARM9/ARM Cortex Microcontrollers with peripherals; Board Support Software Tools, peripherals with interface	The students will learn design with	2,3,4,a,c,d
2.	Programming with Rasberry Pi Microcontroller Board :  Study on incircuit Emulators, crosscompilers, debuggers	Rasberry Pi Boards with peripherals ; IDE, Board Support Software Tools /Compiler/others	simulators/experiments,in programming processor boards, processor	a,f
3.	I/O Programming with Arduino ,Rasberry Pi Microcontroller Boards I/O Interfacing : Timers/ Interrupts/ Serial port programming/PWM Generation/ Motor Control/ADC/DAC/ LCD/ RTC Interfacing/ Sensor Interfacing	Arduino,Rasberry Pi Microcontroller Boards with peripherals; Board Support Software Tools, peripherals with interface	interfacing/ designing digital controllers	a,f
4.	Programming with DSP	Processor Boards with Board	The students	a,b,c,d

	processors	Support Tools & Interfaces	will learn design & simulation of Arithmetic ,Logic programs, Filters, Signal analysis with simulators/experiments ,in programming processor boards, processor interfacing/ Tools	
5.	Programming in Freeware softwares/ Platforms	Programming Compilers&Platforms on freeware	The students will learn programming , compiling in various tools & software domains	2,3,4,a,c,d
6.	<u>Software &amp; Modelling tools</u> <ul style="list-style-type: none"> <li>✓ Study on MEMS Tools</li> <li>✓ Study on process Controller modeling</li> <li>✓ PLC/SCADA/PCB</li> <li>✓ one type CAD Tool</li> </ul>	Personal Computers, Licenced software & programming/modelling tools		a,f
7.	Programming & Simulation in GUI Simulators /Tools/others <ul style="list-style-type: none"> <li>✓ Graphical User interface simulations &amp; modeling of instrumentation &amp; controllers</li> </ul>	Simulation Tools as Labview /others	The students will learn programming , compiling in various tools & software domains	a,f
8.	Study of one type of Real Time Operating Systems (RTOS)	Compilers & Platforms with VXWorks/ Keil/ Android/ Tiny OS/ Linux Support/any RTOS		a,b,c.d
9.	Programming & Simulation in Python Simulators/Tools/others	Programming in Python Platform		2,3,4,a,c,d
10	Programming with wired/wireless communication protocol/Network Simulators	Learning Communication Protocols & Support Software Tools for BUS & network communication	Learning Communication Protocols & Experimenting with Support Software Tools for communication interfaces	a,f

**TOTAL : 60 PERIODS**

**Note:** Laboratory training, discussions can include the given guidelines for improved teaching /learning process :Hands on experiences with Case specific experiments in domains on range of work Benches,programmable Test suites,simulators,circuit boards that support the practical skill training supportive to theory subjects .

**REFERENCES:**

1. Mohamammad Ali Mazidi & Mazidi ‘ 8051 Microcontroller and Embedded Systems’, Pearson Education
2. Mohammad Ali Mazidi, Rolind Mckinley and Danny Causey, ‘PIC Microcontroller and Embedded Systems’ Pearson Education
3. Simon Monk,” Make Action-with Arduino and Raspberry Pi,SPD ,2016.
4. Wesley J.Chun,”Core Python Applications Programming,3<sup>rd</sup> ed,Pearson,2016
5. Kraig Mitzner, ‘Complete PCB Design using ORCAD Capture and Layout’, Elsevier
6. Vinay K.Ingle,John G.Proakis,”DSP-A Matlab Based Approach”,Cengage Learning,2010
7. Taan S.Elali,”Discrete Systems and Digital Signal Processing with Matlab”,CRC Press2009.
8. *Jovitha Jerome,”Virtual Instrumentation using Labview”PHI,2010.*
9. Woon-Seng Gan, Sen M. Kuo, ‘Embedded Signal Processing with the Micro Signal Architecture’, John Wiley & Sons, Inc., Hoboken, New Jersey 2007
10. Dogan Ibrahim, ‘Advanced PIC microcontroller projects in C’, Elsevier 2008

**ET5311**

**PROJECT WORK PHASE I**

**L T P C**  
**0 0 12 6**

**Pre-requisites:** choice of project title for project can also be done as per broad domain of research topic listed.

domains	Course objectives : to expose to many of the following by choice for learning	Training outcomes	Related programme outcomes
1.0	<ul style="list-style-type: none"> <li>✓ Programming in C/ Embedded C / C++ / JAVA</li> <li>✓ Network Simulators</li> <li>✓ Network programming</li> <li>✓ Python programming</li> <li>✓ Programming on Pervasive Computing</li> <li>✓ Java for Wireless Devices</li> </ul>	Skill development in software programming/working in simulators, emulators, learn using the commercial packages for wired, wireless communications	a,b,c,d
2.0	<ul style="list-style-type: none"> <li>Embedded Processors</li> <li>✓ uC, ARM processors</li> <li>✓ DSP / Image / Video Processors</li> <li>✓ VHDL Programming in processors</li> </ul>	The students will learn design with simulators/experiments,in programming processor boards, processor interfacing/designing reprogrammable system	2,3,4,a,c,d
3.0	<ul style="list-style-type: none"> <li>✓ Android / LINUX OS Internals/VxWorks/Keil</li> <li>✓ MPLAB/Os/any RTOS tool suite</li> </ul>	The students will skill through OS programming through API, libraries	a,f

4.0	<ul style="list-style-type: none"> <li>✓ Virtual Instrumentation programming</li> <li>✓ Simulink/Matlab Tools</li> <li>✓ Study on MEMS Tools</li> <li>✓ Study on process Controller modeling</li> <li>✓ PLC/SCADA/PCB/ORCAD</li> <li>✓ one CAD Tool</li> </ul>	The students will apply programming logic for modeling/simulating for embedded application /products & service development	a,f
5.0	<ul style="list-style-type: none"> <li>✓ Entrepreneurship development</li> </ul>	Skill The students will know to pickup skills for product development/establish consultancy services with an outlook into selecting commercially viable market for technical demands	d,e,f,g,h,

Guidelines onto Topics:

1. Network Simulators-Design and Implement many processor based network deployment /involve IOT or sensor network with use of monitoring tool to record sensor values, establish communication,get network statistics like packets sent and received, percentage errors, desktop grabbing, remote monitoring etc.
2. Embedded Processors- Implement an IO peripheral interface ARM/ PIC / MSP 430 /Arduino/RPi/ other advanced embedded Processor through Study of CAN / I2C / Ethernet/any serial bus communication /any other communication protocol for IO interface
3. Virtual Instrumentation programming to design smart metering Design and Implement though GUI suite /tool to record Sensor data recording with signal analysis to discuss on system performance and implement controller scheme.
4. Study on process Controller modelling -with math lab suite with modeling, analysis for Embedded control of systems/vehicle modeling/communication of systems
5. VHDL Programming on Programmable Logic Devices -Design and Implementation with using Xilinx/Altera FPGA / CPLD on Design ,verification of simple Combinational/Sequential Circuits
6. Study on CAD Tool- device modeling,code design ,verification,analysis on Tools.
7. DSP / Image / Video Processing - Simulation / Implementation of any few of its algorithms
8. Network simulation- using NS2/ Programming of TCP/IP protocol stack /any network simulator tools -Network Deployment /Design and Implement a GUI or text based network monitoring tool to record network statistics like packets sent and received, percentage errors,, security concepts,.
9. Programming in C/ Embedded C / Python/C++ / JAVA/others- Embedded Application development
10. Android / LINUX OS Internals/VxWorks/Keil -Study on programming of the OS through one API for Driver interfaces, Disk driver and Terminal drivers

11. Programming on Pervasive Computing on mobile device application Platform through any one Operating System /Palm OS / Windows CE/ Embedded Linux -J2ME / Symbian /Android/others
12. Java for Wireless Devices to Set up the development environment with Basic Data types, Libraries ,Wireless Messaging,Architecture for messaging application,Messaging API, Making a device connection using HTTP
13. Study on MEMS –device,structural modeling & analysis using CAD lab SUITE
14. PLC/SCADA/PCB study-develop one Case Study as Application with suitable platform.
15. Entrepreneurship Skill development through Product Design with Cost Estimation – Learn through survey on : project/product identification, development plan and execution, the Activity planning, schedule development ,Integration Management configuration management, Time management-,Cost estimation, Service&Quality Management planning , Human Resource Management- Organizational planning , staff acquisition, Communication - Information distribution , reporting, Risk Management,Environment Safety Management Procurement Management- contract, Ethics,Legal & Government rules on administration.

**ET5091**

**MEMS TECHNOLOGY**

**L T P C**  
**3 0 0 3**

**COURSE OBJECTIVES**

- To teach the students properties of materials ,microstructure and fabrication methods.
- To teach the design and modeling of Electrostatic sensors and actuators.
- To teach the characterizing thermal sensors and actuators through design and modeling
- To teach the fundamentals of piezoelectric sensors and actuators through exposure to different MEMS and NEMS devices
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

**UNIT I MICRO-FABRICATION, MATERIALS AND ELECTRO-MECHANICAL CONCEPTS 9**  
Overview of micro fabrication – Silicon and other material based fabrication processes – Concepts: Conductivity of semiconductors-Crystal planes and orientation-stress and strain-flexural beam bending analysis-torsional deflections-Intrinsic stress- resonant frequency and quality factor.

**UNIT II ELECTROSTATIC SENSORS AND ACTUATION 9**  
Principle, material, design and fabrication of parallel plate capacitors as electrostatic sensors and actuators-Applications

**UNIT III THERMAL SENSING AND ACTUATION 9**  
Principle, material, design and fabrication of thermal couples, thermal bimorph sensors, thermal resistor sensors-Applications.

**UNIT IV PIEZOELECTRIC SENSING AND ACTUATION 9**

Piezoelectric effect-cantilever piezoelectric actuator model-properties of piezoelectric materials-Applications.

## **UNIT V CASE STUDIES**

**9**

Piezoresistive sensors, Magnetic actuation, Micro fluidics applications, Medical applications, Optical MEMS.-NEMS Devices

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process: Discussions/Exercise/Practice on Workbench: on the basics /device model design aspects of thermal/peizo/resistive sensors etc.

**TOTAL : 45 PERIODS**

**OUTCOMES :** After the completion of this course the student will be able to:

- Understand basics of microfabrication, develop models and simulate electrostatic and electromagnetic sensors and actuators
- Understand material properties important for MEMS system performance, analyze dynamics of resonant micromechanical structures
- The learning process delivers insight onto design of micro sensors, embedded sensors & actuators in power aware systems like grid.
- Understand the design process and validation for MEMS devices and systems, and learn the state of the art in optical microsytms
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

## **REFERENCES**

1. Chang Liu, "Foundations of MEMS", Pearson International Edition, 2006.
2. Marc Madou , "Fundamentals of microfabrication",CRC Press, 1997.
3. Boston , "Micromachined Transducers Sourcebook",WCB McGraw Hill, 1998.
- 4.M.H.Bao "Micromechanical transducers :Pressure sensors, accelerometers and gyroscopes", Elsevier, Newyork, 2000.

**ET5001**

**ADVANCED COMPUTER ARCHITECTURE AND  
PARALLEL PROCESSING**

**LT P C  
3 0 0 3**

## **COURSE OBJECTIVES**

- To educate the students to the fundamentals of parallel processing
- To teach the fundamentals of network topologies for multiprocessors
- To introduce different pipeline designs
- To introduce features of parallel processors , memory technologies, OS for multiprogrammed computer
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

## **UNIT I THEORY OF PARALLELISM**

**9**

Parallel Computer models – the state of computing-introduction to parallel processing- parallelism in uniprocessors& Multiprocessors,-parallel architectural classification schemes-speedup performance laws- -Program and Network Properties-H/W-S/W Parallelism

**UNIT II SYSTEM INTERCONNECT ARCHITECTURES 9**  
System interconnect Architectures-Network Properties and routing-Static Interconnection Networks-Dynamic Interconnection Networks-Multiprocessor System Interconnects-interprocessor communication network-Structure of Parallel Computers; Hierarchical bus systems-Crossbar switch and multiport memory-multistage and combining network

**UNIT III PIPELINING AND SUPERSCALAR TECHNOLOGIES 6**  
Pipeline principle and implementation-classification of pipeline processor-introduction of arithmetic,instruction,processor pipelining-pipeline mechanisms-hazards

**UNIT IV HARDWARE TECHNOLOGIES 15**  
Introduction to features of advanced embedded processors through Basic Comparative study : of Architectures -addressing modes -instruction types-performance of- Parallel and scalable architectures, Multiprocessor and SIMD ,MIMD computers, *RISC,CISC,Superscalar,VLIW , Vector, Systolic processors of their unique features* -Scalable, Multithreaded and data flow Architectures-inter PE communication-interconnection networks- Array & vector processors, vector instruction types-performance modeling-design of vectorising compiler- case Architecture of Itanium processor, Pentium Processor, SPARC Processor.

**UNIT V OS ISSUES FOR MULTI PROCESSOR 6**  
Introduction-Need for Pre emptive OS – Synchronising and Scheduling in Multiprocessor OS-, Usual Os scheduling Techniques, threads – Classification of multi processor OS – Software requirements of multiprocessor OS, Distributed scheduler – PVM – PT Threads in shared memory systems

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process: :Discussions/Practice on Workbench: modelling of Computing Algorithms /ALU Functional Blocks

**TOTAL : 45 PERIODS**

**OUTCOMES** : After the completion of this course the student will be able to:

- An ability to understand the operations of multiprocessor and multicomputer systems.
- To understand the various advanced processor technology, pipelining and scalable architectures.
- To know the working of superscalar pipeline, cache memory organization.
- To understand the principles of multithreading, multithread architecture, static and dynamic data flow.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

**REFERENCES:**

1. Kai Hwang “Advanced Computer Architecture”.Tata McGraw Hill 2000
2. Advanced Computer architecture , By Rajiv Chopra, S Chand , 2010
3. John L. Hennessy, David A. Petterson, “Computer Architecture: A Quantitative Approach”, 4th Edition, Elsevier, 2007
4. Dezso Sima, Terence Fountain, Peter Kacsuk, “Advanced computer Architecture – A design Space Approach”. Pearson Education,2003.
5. Sajjan G. Shiva “Advanced Computer Architecture”, Taylor & Francis, 2008
6. Rajaraman, C.Siva Ram Murthy, “Parallel Computers- Architecture and Programming”, Prentice Hall India, 2008
7. Carl Homacher, Zvonko Vranesic, Sefwat Zaky, “Computer Organisation”, 5<sup>th</sup> Edition, TMH, 2002.

8. David E. Culler, Jaswinder Pal Singh with Anoop Gupta “Parallel Computer Architecture” ,Elsevier, 2004.
9. John P. Shen. “Modern processor design Fundamentals of super scalar processors”, Tata McGraw Hill 2003.
10. Harry F. Jordan Gita Alaghaband, “Fundamentals of Parallel Processing”. Pearson Education, 2003.
11. Richard Y. Kain, “Advanced computer architecture – A system Design Approach”, PHI, 2003.

**IN5092**

**DIGITAL INSTRUMENTATION**

**LT P C  
3 0 0 3**

**COURSE OBJECTIVES**

- To discuss to the students on the fundamentals building blocks of a digital instrument
- To teach the digital data communication techniques
- To study on bus communication standards and working principles
- To teach Graphical programming using GUI for instrument building
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

**UNIT I DATA ACQUISITION SYSTEMS**

**10**

Overview of A/D converter, types and characteristics – Sampling, Errors. Objective – Building blocks of Automation systems -Calibration, Resolution, Data acquisition interface requirements.–Counters – Modes of operation- Frequency, Period, Time interval measurements, Prescaler, Heterodyne converter for frequency measurement, Single and Multi channel Data Acquisition systems-Digital storage Oscilloscope-digital display interface.

**UNIT II INSTRUMENT COMMUNICATION**

**10**

Introduction, Modem standards, Data transmission systems- Time Division Multiplexing (TDM) – Digital Modulation Basic requirements of Instrument Bus Communications standards, interrupt and data handshaking , serial bus- basics, Message transfer, - RS-232, USB, RS-422, Ethernet Bus- CAN standards interfaces .General considerations -advantages and disadvantages-Instrumentation network design ,advantages and limitations ,general considerations, architecture, model, and system configuration of : HART network, Mod Bus, Fieldbus

**UNIT III VIRTUAL INSTRUMENTATION BASICS**

**12**

Block diagram ,role,and Architecture for VI— tool bar,Graphical system design &programming usingGUI – Virtual Instrumentation for test, control design-modular programming-conceptual and prog approaches for creation of panels,icons-Loops-Arrays-clusters-plotting data-structures-strings and File I/O- Instrument Drivers

**UNIT IV CONFIGURING PROGRAMMABLE INSTRUMENTATION**

**7**

Microprocessor based system design –Peripheral Interfaces systems and instrument communication standards –Data acquisition with processor and with VI – Virtual Instrumentation Software and hardware simulation of I/O communication blocks-peripheral interface – ADC/DAC – Digital I/O – Counter , Timer-servo motor control-PID control.

**UNIT V CASE STUDIES**

**6**

Processor based DAS, Data loggers, VI based process measurements like temperature, pressure and level development system- DSO interface -digital controller for colour video display.

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process :Discussions/Exercise/Practice on Workbench for Digital Control of Relays/Solenoids, Digital I/O – Counter , Timer-servo motor control-PID control.  
/ LCD graphics Interface/storage interface,

**TOTAL : 45 PERIODS**

**OUTCOMES :** After the completion of this course the student will be able to:

- Use digital integrated circuit logic family chips.
- Perform computational and measurement activities using digital techniques, build sequential and combinational logic circuits.
- Analyse working of A/D and D/A converters, use display devices for digital circuits, use digital meters for measurements.
- Graduates will understand the fundamental principles of electrical and electronics circuits and instrumentation, enabling them to understand current technology and to adapt to new devices and technologies.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

**REFERENCES:**

1. Mathivanan, “PC based Instrumentation Concepts and practice”, Prentice-Hall India, 2009
2. Jovitha Jerome, ”Virtual Instrumentation using Labview” PHI, 2010.
3. Gregory J. Pottie / William J. Kaiser, Principles Of Embedded Networked Systems Design, CAMBRIDGE UNIVERSITY PRESS (CUP), 2016
4. Jonathan W Valvano, “Embedded Microcomputer systems”, Brooks/Cole, Thomson, 2010.
5. Cory L. Clark, ”Labview Digital Signal Processing & Digital Communication, TMcH, 2005
6. Lisa K. wells & Jeffrey Travis, Lab VIEW for everyone, Prentice Hall, New Jersey, 1997.
7. H S Kalsi, “Electronic Instrumentation” Second Edition, Tata McGraw-Hill, 2006.
8. K. Padmanabhan, S. Ananthi A Treatise on Instrumentation Engineering , I K Publish, 2011
9. Gary Johnson, LabVIEW Graphical Programming, Second edition, McG Hill, Newyork, 1997.

**ET5002**

**EMBEDDED LINUX**

**LT P C  
3 0 0 3**

**COURSE OBJECTIVES**

- To expose the students to the fundamentals of Linux Operating system, its basic commands and shell programming
- To teach the history of embedded Linux, various distributions and basics of GNU Cross Platform Tool Chain.
- To study on different Host-Target setup, debug and various memory device, file systems and performance tuning .
- To introduce the concept of configuring kernel using the cross-platform tool chain.
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

**UNIT I FUNDAMENTALS OF LINUX**

**9**

Basic Linux System Concepts: Working with Files and Directories - Introduction to Linux File system - Working with Partitions and File systems - Understanding Linux Permissions; Using Command Line Tools: Executing Commands from the Command Line - Getting to a Shell - Popular Command-Line Commands - Working with the Bash Shell

**UNIT II VARIOUS DISTRIBUTIONS AND CROSS PLATFORM TOOL CHAIN 9**

Introduction - History of Embedded Linux - Embedded Linux versus Desktop Linux - Commercial Embedded Linux Distribution - Choosing a distribution - Embedded Linux Distributions - Architecture of Embedded Linux - Linux Kernel Architecture - Porting Roadmap - GNU Cross Platform Toolchain

**UNIT III HOST-TARGET SETUP AND OVERALL ARCHITECTURE 9**

Real Life Embedded Linux Systems - Design and Implementation Methodology - Types of Host/Target Development Setups - Types of Host/Target Debug Setups - Generic Architecture of an Embedded Linux System - System Startup - Types of Boot Configurations - System Memory Layout - Processor Architectures - Buses and Interfaces - I/O – Storage

**UNIT IV KERNEL CONFIGURATION\_ 9**

A Practical Project Workspace - GNU Cross-Platform Development Toolchain - C Library Alternatives - Other Programming Languages - Eclipse: An Integrated Development Environment - Terminal Emulators - Selecting a Kernel - Configuring the Kernel - Compiling the Kernel - Installing the Kernel - Basic Root Filesystem Structure - Libraries - Kernel Modules and Kernel Images - Device Files - Main System Applications - System Initialization

**UNIT V LINUX DRIVERS 9**

Introduction in to basics on Linux drivers, introduction to GNU cross platform Toolchain- Case study on programming one serial driver for developing application using Linux Driver

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process: Discussions/Practice on Workbench : on design of Algorithms for Practicing Shell Programming in Linux / Developing programs in GCC and Eclipse / Learning Debugging and Profiling/Linux Driver interface

**TOTAL : 45 PERIODS**

**OUTCOMES :** After the completion of this course the student will be able to:

- To use Linux desktop and GNU tool chain with Eclipse IDE
- Cross compile Linux kernel and port it to target board.
- Add applications and write customized application for the Linux kernel in the target board.
- Students will study about distributions and cross platform tool chain.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

**REFERENCES:**

1. Karim Yaghmour, Jon Masters, Gilad Ben-Yossef, and Philippe Gerum, 'Building Embedded Linux Systems 2<sup>nd</sup> Edition', SPD -O'Reilly Publications, 2008
2. P.Raghavan,Amol Lad,Sriram Neelakandan,"EmbeddedLinux System Design & Development,Auerbach Publications, 2012
3. William von Hagen, 'Ubuntu Linux Bible 3rd Edition', Wiley Publishing Inc., 2010
4. Jonathan Corbet, Alessandro Rubini & Greg Kroah-Hartman, 'Linux Device Drivers 3<sup>rd</sup> Edition', SPD -O'Reilly Publications, 2011
5. Robert Love,"Linux System Programming, SPD -O'Reilly Publications, 2010

**COURSE OBJECTIVES**

- To expose the students to the fundamentals of digital signal processing in frequency domain & its application
- To teach the fundamentals of digital signal processing in time-frequency domain & its application
- To compare Architectures & features of Programmable DSP processors & develop logical functions of DSP processors
- To discuss on Application development with commercial family of DSP Processors
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

**UNIT I FUNDAMENTALS OF DSP****12**

Frequency interpretation, sampling theorem, aliasing, discrete-time systems, constant-coefficient difference equation. Digital filters: FIR filter design – rectangular, Hamming, Hanning windowing technique. IIR filter design – Butterworth filter, bilinear transformation method, frequency transformation. Fundamentals of multirate processing – decimation and interpolation.

**UNIT II TRANSFORMS AND PROPERTIES****9**

Discrete Fourier transform (DFT): - properties, Fast Fourier transform (FFT), DIT-FFT, and DIF-FFT. Wavelet transforms: Introduction, wavelet coefficients – orthonormal wavelets and their relationship to filter banks, multi-resolution analysis, and Haar and Daubechies wavelet.

**UNIT III ADAPTIVE FILTERS****9**

Wiener filters – an introduction. Adaptive filters: Fundamentals of adaptive filters, FIR adaptive filter – steepest descent algorithm, LMS algorithm, NLMS, applications – channel equalization. Adaptive recursive filters – exponentially weighted RLS algorithm.

**UNIT IV ARCHITECTURE OF COMMERCIAL DIGITAL SIGNAL PROCESSORS****9**

Introduction to commercial digital signal processors, Categorization of DSP processor – Fixed point and floating point, Architecture and instruction set of the TI TMS 320 C54xx and TMS 320 C6xxx DSP processors, On-chip and On-board peripherals – memory (Cache, Flash, SDRAM), codec, multichannel buffered I/O serial ports (McBSPs), interrupts, direct memory access (DMA), timers and general purpose I/Os.

**UNIT V INTERFACING I/O PERIPHERALS FOR DSP BASED APPLICATIONS****6**

Introduction, External Bus Interfacing Signals, Memory Interface, I/O Interface, Programmed I/O, Interrupts, Design of Filter, FFT Algorithm, Application for Serial Interfacing, DSP based Power Meter, Position control, CODEC Interface.

**TOTAL : 45 PERIODS**

Note: Discussions / Exercise / practice on signal analysis, transforms, filter design concepts with simulation tools such as Matlab / Labview / CC studio will help the student understand signal processing concepts and DSP processors.

Overview of TMS320C54xx and TMS320C67xx /other DSP Starter Kits, Introduction to code composer studio (CCS), Board support library, Chip support library and Runtime support library, Generating basic signals, Digital filter design, Spectrum analysis, Adaptive filters, Speech and Audio processing applications.

**OUTCOMES** : After the completion of this course the student will be able to:

- Students will learn the essential advanced topics in DSP that are necessary for successful Postgraduate level research.
- Students will have the ability to solve various types of practical problems in DSP
- Comprehend the DFTs and FFTs, design and Analyze the digital filters, comprehend the Finite word length effects in Fixed point DSP Systems.
- The conceptual aspects of Signal processing Transforms are introduced.
- The comparison on commercial available DSProcessors helps to understand system design through processor interface.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

#### REFERENCES:

1. John. G. Proakis, Dimitris G. Manolakis, "Digital signal processing", Pearson Edu, 2002
2. Sen M.Kuo,Woon-Seng S.Gan, "Digital Signal Processors- Pearson Edu, 2012
3. Ifeachor E. C., Jervis B. W , "Digital Signal Processing: A practical approach, Pearson-Education, PHI/ 2002
4. Shaila D. Apte, " Digital Signal Processing", Second Edition, Wiley, 2016.
5. Robert J.Schilling,Sandra L.Harris,"Introd. To Digital Signal Processing with Matlab",Cengage,2014.
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**ET5003**

**PYTHON PROGRAMMING**

**LT P C**

**3 0 0 3**

#### COURSE OBJECTIVES:

- Students will learn the grammar of Python programming language.
- Students will understand and be able to use the basic programming principles such as data types, variable, conditionals, loops, recursion and function calls.
- Students will learn how to use basic data structures such as List, Dictionary and be able to manipulate text files and images.
- Students will understand the process and will acquire skills necessary to effectively attempt a programming problem and implement it with a specific programming language - Python.
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

<b>UNIT I</b>	<b>INTRODUCTION TO PYTHON</b>	<b>9</b>
Introduction to Python language – Using the interpreter – Python data types and functions – Working with Data – List, Dictionary and Set – Processing Primitives – List comprehensions – File Handling – Object model including Variables, Reference counting, Copying, and Type checking – Error handling.		
<b>UNIT II</b>	<b>PROGRAM ORGANIZATION AND FUNCTIONS</b>	<b>9</b>
Organize Large programs into functions – Python functions including scoping rules and documentation strings – Modules and Libraries – Organize programs into modules – System administration, Text processing, Subprocesses, Binary data handling, XML parsing and Database Access – Installing third-party libraries.		
<b>UNIT III</b>	<b>CLASSES AND OBJECTS</b>	<b>9</b>
Introduction to Object-oriented programming – Basic principles of Object-oriented programming in Python – Class definition, Inheritance, Composition, Operator overloading and Object creation – Python special modules – Python Object System – Object representation, Attribute binding, Memory management, and Special properties of classes including properties, slots and private attributes.		
<b>UNIT IV</b>	<b>TESTING, DEBUGGING, AND SOFTWARE DEVELOPMENT PRACTICE</b>	<b>9</b>
Python Software development – Use of documentation string – Program testing using doctest and unittest modules – Effective use of assertions – Python debugger and profiler – Iterators and Generators to set up data processing pipelines – An effective technique for addressing common system programming problems (e.g. processing large datafiles, handling infinite data streams, etc.)		
<b>UNIT V</b>	<b>TEXT I/O HANDLING</b>	<b>9</b>
Text generation, Template strings and Unicode-packages – Python Integration Primer – Network programming – Accessing C code – Survey on how Python interacts with other language programs.		

**TOTAL: 45 PERIODS**

Note: Class Room Discussions and Tutorials can include the following Guidelines for improved Teaching /Learning Process: Practice through any of Case studies through Exercise/Discussions on Design , Development of embedded solutions with improved programming skill learnt through python that can be adopted while programming on other domains.

**COURSE OUTCOMES:**

- Students will be able to develop skill in system administration and network programming by learning Python.
- Students will also learn how to effectively use Python’s very powerful processing primitives, modeling etc.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

**REFERENCES:**

1. Mark Lutz, "Learning Python, Powerful OOPs, O'reilly, 2011
2. Robert Sedgewick, Kevin Wayne , Robert Dondero, Intr Programming in Python, Pearson, 2016.
3. Mark J. Guzdial, Barbara Ericson, "Introduction to Computing & Programming in Python, 4<sup>th</sup> Edition Pearson, 2015.
4. Budd, Timothy. Exploring Python. McGraw-Hill science, 2009.
5. Guttag, John. Introduction to Computation and Programming Using Python. MIT Press, 2013.
6. Zelle, John M. Python Programming: An Introduction to Computer Science. 1st ed. Franklin Beedle & Associates, 2003

**OBJECTIVE**

- The course aims at providing the basic concepts of product design, product features and its architecture so that student can have a basic knowledge in the common features a product has and how to incorporate them suitably in product.

**UNIT I CONCEPTS OF PRODUCT DEVELOPMENT****12**

Need for PD- Generic product Development Process Phases- Product Development Process Flows- Product Development organization structures-Strategic importance of Product Planning process – Product Specifications-Target Specifications-Plan and establish product specifications - integration of customer, designer, material supplier and process planner, Competitor and customer - Understanding customer and behavior analysis. Concept Generation, Five Step Method-Basics of Concept selection- Creative thinking –creativity and problem solving- creative thinking methods- generating design concepts-systematic methods for designing –functional decomposition – physical decomposition

**UNIT II INTRODUCTION TO APPROACHES IN PRODUCT DEVELOPMENT****12**

Product development management - establishing the architecture - creation - Product Architecture changes - variety – component standardization , clustering -geometric layout development - Fundamental and incidental interactions - related system level design issues - secondary systems - architecture of the chunks - creating detailed interface specifications-Portfolio Architecture-competitive benchmarking- Approach for the benchmarking process-Design for manufacturing - Industrial Design-Robust Design – Prototype basics - Principles of prototyping - Planning for prototypes- Economic & Cost Analysis -Testing Methodologies- Product Branding

**UNIT III INDUSTRIAL DESIGN STRATEGIES****6**

Role of Integrating CAE, CAD, CAM tools for Simulating product performance and manufacturing processes electronically- Basics on reverse engineering – Reverse engineering strategies – Finding reusable software components – Recycling real-time embedded software based approach and its logical basics- Incorporating reverse engineering for consumer product development –case study on DeskJet Printer

**UNIT IV ELECTRONIC PRODUCT DEVELOPMENT STAGES****6**

Product Development Stages-Embedded product modeling- Linear, Iterative, Prototyping, Spiral - Selection of Sensor, Voltage Supply, Power supply protection, Grounding and noise elimination methods, Thermal protection with heat management – PCB design steps – Software design and testing method – documentation.

**UNIT V EMBEDDED PRODUCTS DESIGN****9**

Creating general Embedded System Architecture(with **Case study example:** Mobile Phone / DeskJet Printer./ Robonoid as a product) -Architectural Structures- Criteria in selection of Hardware & Software Components, processors, input/output interfaces & connectors, ADC System ,Memory ,choosing Bus Communication Standards, Criteria in selection of Embedded OS/Device Drivers, Need for Developing with IDE, Translation & Debugging Tools & Application Software, Performance Testing, Costing, Benchmarking ,Documentation

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process: Term Project/Presentation on specific product design can be given for Assessment

**TOTAL: 45 PERIODS**

## OUTCOMES:

On completion of the course the student will be able to

- understand the integration of customer requirements in product design
- Apply structural approach to concept generation, creativity, selection and testing
- Understand various aspects of design such as industrial design, design of Consumer specific product, its Reverse Engineering manufacture, economic analysis and product architecture
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

## REFERENCES

1. "Product Design and Development", Anita Goyal, Karl T Ulrich, Steven D Eppinger, McGraw –Hill International Edns.1999/ Tata McGrawEducation, ISBN-10-007-14679-9
2. R.G. Kaduskar and V.B. Baru, " Electronic Product Design", Wiley, 2014
3. George E.Dieter, Linda C.Schmidt, "Engineering Design", McGraw-Hill International Edition,4th Edition, 2009, ISBN 978-007-127189-9
4. Stephen Armstrong, Engineering and Product Development Management ; The Holistic Approach, CAMBRIDGE UNIVERSITY PRESS (CUP),2014
5. *Rajkamal, 'Embedded system-Architecture, Programming, Design', TMH,2011.*
6. KEVIN OTTO & KRISTIN WOOD, "Product Design and Development", 4th Edition,2009, Product Design Techniques in Reverse Engineering and New Product Development, , Pearson Education (LPE),2001./ISBN 9788177588217
7. Yousef Haik, T. M. M. Shahin, "Engineering Design Process", 2nd Edition Reprint, Cengage Learning, 2010, ISBN 0495668141
8. Clive L.Dym, Patrick Little, "Engineering Design: A Project-based Introduction", 3rd Edition, John Wiley & Sons, 2009, ISBN 978-0-470-22596-7

**ET5005**

**AUTOMOTIVE EMBEDDED SYSTEM**

**LT P C  
3 0 0 3**

## COURSE OBJECTIVES

- To expose the students to the fundamentals and building of Electronic Engine Control systems .
- To teach on functional components and circuits for vehicles
- To discuss on programmable controllers for vehicles
- To teach logics of automation & commercial techniques for vehicle communication
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

## UNIT I BASICS OF ELECTRONIC ENGINE CONTROL SYSTEMS

**9**

Motivation, concept for electronic engine controls and management-Standards; introduction to fuel economy- automobile sensors-volumetric, thermal, air-fuel ratio, solenoid, hall effect- exhaust gas oxygen sensors, Oxidizing catalytic efficiency, emission limits and vehicle performance; advantages of using Electronic engine controls – open and closed loop fuel control; Block diagram of Electronic ignition system and Architecture of a EMS with multi point fuel injection system, Direct injection; programmed ignition- actuators interface to the ECU; starter motors and circuits - sensors interface to the ECU; Actuators and their characteristics – exhaust gas recirculation.

## UNIT II FUEL CELL FOR AUTOMOTIVE POWER

**9**

Fuel cell-Introduction-Proton exchange membrane FC (PEM), Solid oxide fuel cell (SOFC)-properties of fuel cells for vehicles-power system of an automobile with fuel cell based drive, and their characteristics

### **UNIT III VEHICLE MANAGEMENT SYSTEMS**

**9**

Electronic Engine Control-engine mapping,air/fuel ratio spark timing control strategy, fuel control, electronic ignition-Vehicle cruise control- speed control-anti-locking braking system-electronic suspension - electronic steering , wiper control ; Vehicle system schematic for interfacing with EMS, ECU. Energy Management system for electric vehicles- for sensors, accelerators, brake-Battery management, Electric Vehicles-Electrical loads, power management system-electrically assisted power steering system.

### **UNIT IV AUTOMOTIVE TELEMATICS**

**9**

Role of Bluetooth, CAN, LIN and flex ray communication protocols in automotive applications; Multiplexed vehicle system architecture for signal and data / parameter exchange between EMS, ECUs with other vehicle system components and other control systems; Realizing bus interfaces for diagnostics, dashboard display ,multimedia electronics- Introduction to Society of Automotive Engineers(SAE). J1850 message with(IFR) in frame response in protocol-Local Interconnect n/w [LI N], Bluetooth.

### **UNIT V ELECTRONIC DIAGNOSTICS FOR VEHICLES**

**9**

System diagnostic standards and regulation requirements –On board diagnosis of vehicles electronic units &electric units-Speedometer, oil and temperature gauges, and audio system .

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process : Discussions//Practice on Workbench/Exercise/ AUTOSAR/ Vehicle simulators :on the basics of interfacing sensors, actuators to special automobile-microcontrollers, role of Instrumentation software packages / special automobile-microcontrollers for i/o port communication applicable to vehicles

**TOTAL:45 PERIODS**

**OUTCOMES** : After the completion of this course the student will be able to:

- Design and develop automotive embedded systems.
- Analyze various embedded products used in automotive industry.
- Evaluate the opportunities involving technology, a product or a service required for developing a startup idea used for automotive applications
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

### **REFERENCES**

1. William B. Ribbens ,”Understanding Automotive Electronics”, Elseiver,2012
2. Ali Emedi, Mehrded ehsani, John M Miller , “Vehicular Electric power system- land, Sea, Air and Space Vehicles” Marcel Decker, 2004.
3. L.Vlacic,M.Parent,F.Harahima,”Intelligent Vehicl Technologies”,SAE International,2001.
4. Jack Erjavec,Jeff Arias,”Alternate Fuel Technology-Electric ,Hybrid& Fuel Cell Vehicles”,Cengage ,2012
5. Electronic Engine Control technology – Ronald K Jurgen Chilton’s guide to Fuel Injection – Ford
6. Automotive Electricals / Electronics System and Components, Tom Denton, 3<sup>rd</sup> Edition, 2004.
7. Uwe Kiencke, Lars Nielsen, “Automotive Control Systems: For Engine, Driveline, and Vehicle”, Springer; 1 edition, March 30, 2000 .
8. Automotive Electricals Electronics System and Components, Robert Bosch Gmbh, 4<sup>th</sup> Edition, 2004.
9. Automotive Hand Book, Robert Bosch, Bently Publishers, 1997.
10. Jurgen, R., Automotive Electronics Hand Book.

**COURSE OBJECTIVES**

- To introduce the Reconfigurable Processor technologies
- To familiarize the need and role of Reconfigurable Processor for embedded system applications.
- To impart the knowledge of Reconfigurable embedded Processor for real time applications.

**UNIT I INTRODUCTION****9**

Introduction to reconfigurable processor- Reconfigurable Computing-Programming elements and Programming Tools for Reconfigurable Processors, ASIC design flow- Hardware/Software Codesign-FPAA Architecture overview- recent trends in Reconfigurable Processor & SoC.

**UNIT II PROGRAMMABLE LOGIC DEVICES CPLD****9**

Introduction to Programmable logic devices, SPLDs, CPLD building blocks- Architectures and features of Altera:MAX 7000, MAX V- Xilinx XC 9500, CoolRunner-II.

**UNIT III PROGRAMMABLE LOGIC DEVICES FPGA****9**

FPGA architecture overview- Challenges of FPGA processor design-Opportunities of FPGA processor design- Designing SoftCore Processors – Designing Hardcore Processors –hardware/software co simulation- FPGA to multi core embedded computing- FPGA based on-board computer system.

**UNIT IV RECONFIGURABLE SOC PROCESSORS****9**

SoC Overview –Architecture and applications of Xilinx Virtex II pro ,Zynq-7000, Altera Excalibur, Cyclone V -Triscend A7, E5- Atmel FPSLIC- Multicore SoCs.

**UNIT V RECONFIGURABLE PROCESSOR AND SOC APPLICATIONS****9**

Reconfigurable processor based DC motor control- digital filter design- mobile phone development-High Speed Data Acquisition -Image Processing application-controller implementation for mobile robot.

Note: Class Room Discussions and Tutorials can include the following Guidelines for improved Teaching /Learning Process: Practice through any of Case studies through Exercise/Discussions on Design , Development of embedded solutions using reconfigurable processor support

**TOTAL:45 PERIODS**

**OUTCOMES** : After the completion of this course the student will be able to:

- Adaptability, in its complete strength, is present in reconfigurable processors, which makes it an important IP in modern System-on-Chips (SoCs).
- Reconfigurable processors have risen to prominence as a dominant computing platform across embedded, general-purpose, and high-performance application domains during the last decade
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

**REFERENCES**

1. Nurmi, Jari (Ed.) "Processor Design System-On-Chip Computing for ASICs and FPGAs" Springer, 2007.
2. Ian Grout , "Digital system design with FPGAs and CPLDs" Elsevier, 2008.



## **COURSE OUTCOMES:**

At the end of the course students will comprehend

- Fundamentals of image processing and techniques involved in image enhancement, segmentation and compression and their real-time applications
- The implementation of image processing applications using software and hardware.

## **REFERENCES:**

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image processing", 2<sup>nd</sup> edition, Pearson education, 2003
2. Anil K. Jain, "Fundamentals of digital image processing", Pearson education, 2003
3. Milan Sonka, ValclavHalavac and Roger Boyle, "Image processing, analysis and machine vision", 2<sup>nd</sup> Edition, Thomson learning, 2001
4. Mark Nixon and Alberto Aguado, "Feature extraction & Image processing for computer vision", 3<sup>rd</sup> Edition, Academic press, 2012
5. Donald G. Bailey, "Design for Embedded Image processing on FPGAs" John Wiley and Sons, 2011.

**ET5007**

## **EMBEDDED NETWORKING AND AUTOMATION OF ELECTRICAL SYSTEM**

**LT P C  
3 0 0 3**

## **COURSE OBJECTIVES**

- To expose the students to the fundamentals of wired embedded networking techniques.
- To expose the students to the fundamentals of wireless embedded networking
- To study on design of automation in instrumentation
- To introduce design of Programmable measurement & control of electrical Devices & grid
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired
- over the 5 Units of the subject for improved employability skills

### **UNIT I            EMBEDDED PROCESS COMMUNICATION WITH INSTRUMENT BUS            9**

Embedded Networking: Introduction – Cluster of Instruments in System: introduction to bus protocols, connectors, Bus Architecture & Interfacing of external instruments to – RS 232C, RS – 422, RS 485 and USB standards – embedded ethernet – MOD bus and CAN bus.

### **UNIT II            WIRELESS EMBEDDED NETWORKING            9**

Wireless sensor networks – Introduction – Sensor node architecture – Commercially available sensor nodes -Network Topology –Localization –Time Synchronization - Energy efficient MAC protocols – SMAC –Energy efficient and robust routing – Data Centric routing Applications of sensor networks; Applications - Home Control - Building Automation - Industrial Automation

### **UNIT III            BUILDING SYSTEM AUTOMATION            9**

Concept of Uc Based & PC based data acquisition – Concept of Virtual Instrumentation - Programming Environment to build a Virtual Instrumentation, Building system automation with graphical user interface programming-Programmable Logic Controllers-introduction-Ladder& Functional Block programming-Case study on Temperature control, Valve sequencing control

**UNIT IV MEASUREMENT AND EMBEDDED CONTROL OF ELECTRICAL APPARATUS 9**

Sensor Types & Characteristics: Sensing Voltage, Current, flux, Torque, Position, Proximity, Force, Data acquisition & Display system- Signal conditioning circuit design- computers/ embedded processor interfacing circuit -design automation and protection of electrical appliances –processor based digital controllers for switching Actuators: Servo motors, Stepper motors, Relays

**UNIT V COMMUNICATION FOR LARGE ELECTRICAL SYSTEM AUTOMATION 9**

Data Acquisition, Monitoring, Communication, Event Processing, and Polling Principles, SCADA system principles – outage management– Decision support application for substation automation, extended control feeder automation, Performance measure and response time, SCADA Data Models, need, sources, interface.

**NOTE**

Discussions/Exercise/Practice on Workbench /simulators: on the basics interface of sensors, actuators to microcontrollers, role of virtual Instrumentation software packages/ simulators/ special microcontrollers for i/o port communication with electrical loads.

**TOTAL : 45 PERIODS****COURSE OUTCOMES:**

- The learning process delivers insight into categorizing various i/p-o/p configurations of computational processors with improved communication strategies
- Improved Employability and enterprisership capacity due to knowledge upgradation on recent trends in embedded systems design .

**REFERENCES:**

1. Control and automation of electrical power distribution systems, James Northcote-Green, Robert Wilson, CRC, Taylor and Francis, 2006
2. Krzysztof Iniewski, "Smart Grid ,Infrastructure & Networking", TMcGH, 2012
3. Robert Faludi, "Building Wireless Sensor Networks, O'Reilly, 2011
4. W. Bolton, Programmable Logic Controllers, 5th Ed, Elsevier, 2010.
5. Shih-Lin Wu, Yu-Chee Tseng, {"Wireless Ad Hoc Networking, PAN, LAN, SAN, Aurebach Pub, 2012
6. Jan Axelson 'Embedded Ethernet and Internet Complete', Penram publications
7. Bhaskar Krishnamachari, 'Networking wireless sensors', Cambridge press 2005
8. Robert H. Bishop, "Learning with Lab-View" Prentice Hall, 2009
9. Sanjay Gupta, "Virtual Instrumentation, LABVIEW", TMH, New Delhi, 2003
- 10 Ernest O. Doebelin and Dhanesh N Manik, " Measurement Systems – Application and Design", 5th Edn, TMH, 2007.

**ET5008****SMART SYSTEM DESIGN****LT P C  
3 0 0 3****COURSE OBJECTIVES**

- To understand about the smart system technologies and its role in real time applications
- To expose students to different open source platforms and Attributes.
- To familiarize the design and development of embedded system based system design.

**UNIT I INTRODUCTION****9**

Overview of smart system design and requirements- Hardware and software selection & co-design- Communications-smart sensors and actuators-Open-source resources for embedded system- android

for embedded system - Embedded system for Ecommerce- Embedded system for Smart card design and development –Recent trends.

**UNIT II MOBILE EMBEDDED SYSTEM 9**

Design requirements-Hardware platform- OS and Software development platform- Mobile Apps development- Applications: heart beat monitoring, blood pressure monitoring, mobile banking and appliances control.

**UNIT III HOME AUTOMATION: 9**

Home Automation System Architecture-Essential Components- Linux and Raspberry Pi – design and real time implementation.

**UNIT IV SMART APPLIANCES AND ENERGY MANAGEMENT 9**

Overview- functional requirements-Embedded and Integrated Platforms for Energy Management- Energy Measurement Techniques for Smart Metering-Smart Embedded Appliances Networks – Security Considerations.

**UNIT V EMBEDDED SYSTEMS AND ROBOTICS 9**

Robots and Controllers-components - Aerial Robotics -Mobile Robot Design- Three-Servo Ant Robot-Autonomous Hexacopter System.

**TOTAL : 45 PERIODS**

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process :Discussions on integration of H/W & S/W technology in automation of system/process.

**OUTCOMES**

- Students will develop more understanding on the concepts of smart system design and its present developments.
- Students will study about different embedded open source and cost effective techniques for developing solution for real time applications.
- Students will acquire knowledge on different platforms and Infrastructure for Smart system design.
- Students will learn the art of implementing embedded system for smart applications and control.

**REFERENCES:**

1. Thomas Bräunl, Embedded Robotics ,Springer, 2003.
2. Grimm, Christoph, Neumann, Peter, Mahlkech and Stefan, Embedded Systems for Smart Appliances and Energy Management , Springer 2013.
3. Raj Kamal, *Embedded Systems - Architecture,. Programming and Design"* , McGraw- Hill, 2008
4. Nilanjan Dey, Amartya Mukherjee, Embedded Systems and Robotics with Open Source Tools, CRC press, 2016.
5. Karim Yaghmour, Embedded Android , O'Reilly, 2013.
6. Steven Goodwin ,Smart Home Automation with Linux and Raspberry Pi, Apress, 2013
7. C.K.Toh, " AdHoc mobile wireless networks", Prentice Hall, Inc, 2002.
8. Kazem Sohraby, Daniel Minoli and Taieb Znati, " Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley & Sons, 2007.
9. Anna Ha'c, "Wireless Sensor Network Designs", John Wiley & Sons Ltd, 2003.
10. Robert Faludi,"Wireless Sensor Networks",O'Reilly,2011.

**COURSE OBJECTIVES**

- To develop an understanding on business promotion process.
- To expose students on the skills required for success in business.
- To impart embedded system technology based entrepreneurship.

**UNIT I BASICS FOR ENTREPRENEURSHIP****9**

The entrepreneurial culture and structure -theories of entrepreneurship -entrepreneurial traits - types -behavioural patterns of entrepreneurs -entrepreneurial motivation -establishing entrepreneurial systems -idea processing, personnel, financial information and intelligence, rewards and motivation - concept bank -Role of industrial Fairs.

**UNIT II CHALLENGES FOR ENTREPRENEURSHIP****9**

Setting quality standards- recruitment strategies- time schedules- Financial analysis - credit facilities- Marketing channel – advertisement- institutions providing technical, financial and marketing assistance- factory design -design requirements -applicability of the Factories Act.

**UNIT III RESPONSIBILITIES IN ENTREPRENEURSHIP****9**

Steps for starting a small industry -selection of type of organization -Incentives and subsidies - Central Govt. schemes and State Govt. Schemes -incentives to SSI -registration, Registration and Licensing requirements for sales tax, CST, Excise Duty -Power -Exploring export possibilities- incentives for exports -import of capital goods and raw materials- Entrepreneurship development programmes in India- Role and Improvement in Indian Economy.

**UNIT IV SCOPE IN EMBEDDED SYSTEM FIELD****9**

Entrepreneurship opportunities in Embedded system technologies - embedded systems design, modeling, Feasibility study on embedded system products- Entrepreneurial skills for embedded system hardware and software architecture, software and hardware co-design and challenges; problems of entrepreneurship in Embedded system field.

**UNIT V SCOPE THROUGH EMBEDDED PRODUCTS****9**

Embedded system Product development- feature driven development- release management-market pull product search ,Entrepreneurial case studies: Mobile phone development- automation components-Washing machine- Food Processing system and devices- High Performance embedded computers- Industrial Controllers.

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process :Discussions with Case studies on establishing entrepreneurial development through Government supported schemes for utilizing technology.

**TOTAL : 45 PERIODS**

**OUTCOMES :** After the completion of this course the student will be able to:

- Manage people, processes, and resources within a diverse organization.
- Apply knowledge of leadership concepts in an integrated manner.
- Analyze the internal/external factors affecting a business/organization to evaluate business opportunities.
- demonstrate extemporaneous speaking skills developed through in-class discussion of text materials, case study analyses, and current entrepreneurship-related issues.

- demonstrate basic computer proficiency, including the use of word processing, presentation, and spreadsheet software packages, as well as a basic facility with the internet and other research tools.
- Key concepts underpinning entrepreneurship and its application in the recognition and exploitation of product/ service/ process opportunities
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

## REFERENCES

- 1 Kuratko, Entrepreneurship : A Contemporary Approach, Thomson Learning, 2001.
- 2 Thomas Zimmerer et.al., Essentials of Entrepreneurship and small business Management 3rd Ed. Pearson Education, 2002.
- 3 Greene, Entrepreneurship: Ideas in Action, Thomson Learning, Mumbai, 2000
- 4 Jeffry Timmons, New Ventrure creation, McGraw Hill, 1999.
- 5 Gupta and Smivasan, Entrepreneurial Development, New Delhi, Sultan Chand, 1992
6. LyLa B. Das "Embedded Systems: An Integrated Approach" Pearson, 2013
7. James K.peckol , " Embedded Systems: A contemporary Design Tool", Wiley,2014

**ET5010**

**NANO ELECTRONICS**

**LT P C  
3 0 0 3**

## COURSE OBJECTIVES

- To introduce the properties of electron and its implication for electronics
- To teach the importance and the issues of Nanoscale CMOS technology.
- To introduce the characteristics and applications of nano electronic devices, nano fabrication methods and techniques.
- To teach the circuits and architectural features of nano memory devices.
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

### UNIT I INTRODUCTION

**12**

Particles, waves, Wave mechanics, schrodinger equation, free and confined electrons, particle statistics and density of states. Electron transport in semiconductors and nanostructures, Quantum dots, Quantum Well, Quantum wire , materials and its properties, Ballistic electron transport, 1D transport , Spin electronics- Electrical and Electronics Applications of Nanotechnology.

### UNIT II NANOSCALE CMOS

**9**

Survey of modern electronics and trends towards nanoelectronics CMOS scaling, challenges and limits, static power, device variability, interconnect - CNT-FET, HEMT , pHEMT FinFET, FerroFET-nanoscale CMOS circuit design and analysis

### UNIT III NANO ELECTRONIC STRUCTURE AND DEVICES.

**9**

Resonant-tunneling diodes- Resonant Tunneling Transistor-Single-electron transfer devices-Potential effect transistors- Quantum-dot cellular automata, Nano Photonic Devices-Molecular electronic devices -Nano-electromechanical system devices

### UNIT IV NANO ELECTRONIC MEMORIES

**6**

Nano tube for memories- Nano RAM- Nanoscale DRAM, SRAM, Tunnel magnetoresistance-Giant magnetoresistance- design and applications.

## **UNIT V FABRICATION TECHNIQUES**

**9**

Clean room standards-Microfabrication –nanofabrication- nanofabrication issues- E-beam lithography- X-ray and ion-beam lithography- nanoimprint lithography- Scanning probe lithography- dip-pen nanolithography- Nano-characterization techniques.

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process :Discussions/Practice on Workbench : on modelling of nano/micro analog &digital devices.

**TOTAL : 45 PERIODS**

**OUTCOMES** : After the completion of this course the student will be able to:

- Students will understand the divers electronic device fabrication.
- The students should be able to understand basic and advanced concepts of nanoelectronic devices, sensors and transducers and their applications in nanotechnology
- The concepts of a quantum well, quantum transport and tunnelling effects.
- Understand the impact of nanoelectronics onto information technology, communication and computer science.
- Design integrated circuits (micro chip) using state-of-the-art CMOS technology
- The learning process delivers insight into categorizing various nano configurations of computational processors with improved design strategies.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

### **REFERENCES :**

1. Hagelstein, Peter L., Stephen D. Senturia, and Terry P. Orlando, "Introduction to Applied Quantum and Statistical Physics.", New York, NY: Wiley, 2004.
2. Rainer Waser, "Nanoelectronics and Information Technology", Wiley 2005
3. Michael A. Nielsen and Isaac L. Chuang, "Quantum Computation and Quantum Information", Cambridge University Press, 2000.
4. Adrian Ionesu and Kaustav Banerjee eds. "Emerging Nanoelectronics: Life with and after CMOS" , Vol I, II, and III, Kluwer Academic, 2005.
5. Kiyoo Itoh Masashi Horiguchi ,Hitoshi Tanaka, Ultra Low voltage nano scale memories. Spl Indian Edition, Springer.
6. George W. Hanson, Fundamental of nanoelectronics, Pearson education.

**ET5011**

**DISTRIBUTED EMBEDDED COMPUTING**

**L T P C**  
**3 0 0 3**

### **COURSE OBJECTIVES**

- To expose the students to the fundamentals of Network communication technologies and distributed computing.
- To teach the fundamentals of Internet
- To study on Java based Networking and distributed computing
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

<b>UNIT I</b>	<b>DISTRIBUTED SYSTEM</b>	<b>9</b>
Introduction- Communication in distribution system-Client/Server Model-Synchronization in distributed system		
<b>UNIT II</b>	<b>EMBEDDED JAVA</b>	<b>9</b>
Overview of JAVA – Programs- Multithreaded programming- APPLET programming- I/O streaming- RMI- Introduction to Embedded JAVA		
<b>UNIT III</b>	<b>DISTRIBUTED COMPUTING</b>	<b>9</b>
Definition- Model of distributed computation- Distributed shared memory- Authentication in distributed system		
<b>UNIT IV</b>	<b>SECURITY IN COMPUTING</b>	<b>9</b>
Security meaning- Threads in networks- Network security control- Firewall- Authentication- E-mail security- Security in web services- Case studies		
<b>UNIT V</b>	<b>WEB BASED HOME AUTOMATION</b>	<b>9</b>
Components of Distributed Embedded - Protocols & Standards - Hardware/Software selection for Distributed Embedded – case study : Web based Home Automation		

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process :Discussions/Practice on Workbench : Program Development and practice in exercises with XML/HTML/Java Programming Environments.

**TOTAL : 45 PERIODS**

**OUTCOMES :** After the completion of this course the student will be able to:

- Able to apply knowledge from undergraduate engineering and other disciplines to identify, formulate, solve novel advanced electronics engineering along with soft computing problems that require advanced knowledge within the field.
- Able to understand and integrate new knowledge within the field and advanced technical knowledge in multiple contexts.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

**REFERENCES:**

1. Andrew S. Tanenbaum, “Distributed operating systems”, Pearson 2013
2. E Balagurusamy,” Programming with JAVA”, Mc Graw Hill 2013
3. Ajay D Kshemkalyani,Mukesh Singhal, “Distributed Computing” – Principles, Algorithm and systems, Cambridge university press 2008
4. Charles P. Pfleeger, “Security in Computing”, Pearson 2009.

**PS5091**

**SMART GRID**

**LT P C  
3 0 0 3**

**OBJECTIVES:**

- To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure.
- To familiarize the power quality management issues in Smart Grid.
- To familiarize the high performance computing for Smart Grid applications

**UNIT I INTRODUCTION TO SMART GRID 9**  
Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid.

**UNIT II SMART GRID TECHNOLOGIES 9**  
Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/Var control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).

**UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE 9**  
Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices (IED) & their application for monitoring & protection.

**UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID 9**  
Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

**UNIT V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS 9**  
Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- Learners will develop more understanding on the concepts of Smart Grid and its present developments.
- Learners will study about different Smart Grid technologies.
- Learners will acquire knowledge about different smart meters and advanced metering infrastructure.
- Learners will have knowledge on power quality management in Smart Grids
- Learners will develop more understanding on LAN, WAN and Cloud Computing for Smart Grid applications.

**REFERENCES**

- 1 Stuart Borlase “Smart Grid :Infrastructure, Technology and Solutions”, CRC Press 2012.
- 2 Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, “Smart Grid: Technology and Applications”, Wiley 2012.
- 3 Vehbi C. Güngör, DilanSahin, TaskinKocak, Salih Ergüt, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke, “Smart Grid Technologies: Communication Technologies and Standards” IEEE Transactions On Industrial Informatics, Vol. 7, No. 4, November 2011.
- 4 Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang “Smart Grid – The New and Improved Power Grid: A Survey” , IEEE Transaction on Smart Grids, vol. 14, 2012.

**OBJECTIVES:**

- To understand the concept of electrical vehicles and its operations
- To understand the need for energy storage in hybrid vehicles
- To provide knowledge about various possible energy storage technologies that can be used in electric vehicles

**UNIT I ELECTRIC VEHICLES AND VEHICLE MECHANICS 9**

Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Engine ratings, Comparisons of EV with internal combustion Engine vehicles, Fundamentals of vehicle mechanics

**UNIT II ARCHITECTURE OF EV's AND POWER TRAIN COMPONENTS 9**

Architecture of EV's and HEV's – Plug-n Hybrid Electric Vehicles (PHEV)- Power train components and sizing, Gears, Clutches, Transmission and Brakes

**UNIT III CONTROL OF DC AND AC DRIVES 9**

DC/DC chopper based four quadrant operations of DC drives – Inverter based V/f Operation (motoring and braking) of induction motor drive system – Induction motor and permanent motor based vector control operation – Switched reluctance motor (SRM) drives

**UNIT IV BATTERY ENERGY STORAGE SYSTEM 9**

Battery Basics, Different types, Battery Parameters, Battery modeling, Traction Batteries.

**UNIT V ALTERNATIVE ENERGY STORAGE SYSTEMS 9**

Fuel cell – Characteristics- Types – hydrogen Storage Systems and Fuel cell EV – Ultra capacitors

**TOTAL : 45 PERIODS****OUTCOMES:**

Learners will understand the operation of Electric vehicles and various energy storage technologies for electrical vehicles

**REFERENCES**

- 1 Iqbal Hussain, “**Electric and Hybrid Vehicles: Design Fundamentals, Second Edition**” CRC Press, Taylor & Francis Group, Second Edition (2011).
- 2 Ali Emadi, Mehrdad Ehsani, John M.Miller, “Vehicular Electric Power Systems”, Special Indian Edition, Marcel dekker, Inc 2010.

**COURSE OBJECTIVES:**

The main objectives of this course is to make the students

- Understand the fundamental concepts of soft computing, artificial neural networks and optimization techniques
- Familiarize with recent advancements in Artificial neural networks and optimization techniques

**UNIT I INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS 9**  
Introduction to soft computing: soft computing vs. hard computing – various types of soft computing techniques, from conventional AI to computational intelligence, applications of soft computing. Fundamentals of neural network: biological neuron, artificial neuron, activation function, single layer perceptron – limitations. Multi-layer perceptron – back propagation algorithm.

**UNIT II ARTIFICIAL NEURAL NETWORKS 9**  
Radial basis function networks – reinforcement learning. Hopfield / recurrent network – configuration – stability constraints, associative memory and characteristics, limitations and applications. Hopfield vs. Boltzmann machine. Advances in neural networks – convolution neural networks. Familiarization of Neural network toolbox.

**UNIT III FUZZY LOGIC AND NEURO FUZZY SYSTEMS 9**  
Fundamentals of fuzzy set theory: fuzzy sets, operations on fuzzy sets, scalar cardinality, union and intersection, complement, equilibrium points, aggregation, projection, composition. Fuzzy membership functions. Fundamentals of neuro-fuzzy systems – ANFIS. Familiarization of ANFIS Toolbox.

**UNIT IV INTRODUCTION TO OPTIMIZATION TECHNIQUES 9**  
Classification of optimization problems – classical optimization techniques. Linear programming – simplex algorithm. Non-linear programming – steepest descent method, augmented Lagrange multiplier method – equality constrained problems.

**UNIT V ADVANCED OPTIMIZATION TECHNIQUES 9**  
Simple hill climbing algorithm, Steepest ascent hill climbing – algorithm and features. Simulated annealing – algorithm and features. Genetic algorithm: working principle, fitness function. Familiarization with Optimization Toolbox.  
Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process :Discussions/Practice on Workbench : on role of Fuzzy,Neural ,Genetic algorithms and Concepts in design of intelligent systems.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

At the end of the course students will

- Comprehend the fundamentals of artificial neural network, fuzzy systems and optimization techniques
- Understand the significance of various optimization algorithms applied to engineering problems.
- Be capable of developing ANN-based models
- Be capable of choosing appropriate optimization techniques for engineering applications. .

**REFERENCES:**

1. Laurene V. Fausett, "Fundamentals of neural networks, architecture, algorithms and applications, Pearson Education, 2008.
2. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and soft computing", Prentice Hall of India, 2003.
3. Simon Haykin, "Neural Networks – A comprehensive foundation", Pearson Education, 2005.
4. David E. Goldberg, "Genetic algorithms in search, optimization and machine learning", Pearson Education, 2009.
5. Singiresu S. Rao, "Engineering Optimization – Theory and Practice", 4<sup>th</sup> edition, John Wiley & Sons, 2009.
6. Thomas Weise, "Global Optimization algorithms – Theory and applications", self-published, 2009

**COURSE OBJECTIVES**

- To expose the students to the fundamentals of wireless communication technologies.
- To teach the fundamentals of wireless mobile network protocols
- To study on wireless network topologies
- To introduce network routing protocols
- To study the basis for classification of commercial family of wireless communication technologies

**UNIT I INTRODUCTION****9**

Wireless Transmission – signal propagation – Free space and two ray models – spread spectrum – Satellite Networks – Capacity Allocation – FDMA – TDMA- SDMA – DAMA

**UNIT II MOBILE NETWORKS****9**

Cellular Wireless Networks – GSM – Architecture – Protocols – Connection Establishment – Frequency Allocation – Handover – Security – GPRA.

**UNIT III WIRELESS NETWORKS****9**

Wireless LAN – IEEE 802.11 Standard-Architecture – Services – Hiper LAN, Bluetooth

**UNIT IV ROUTING****9**

Mobile IP- SIP – DHCP – AdHoc Networks – Proactive and Reactive Routing Protocols – Multicast Routing - WSN routing – LEACH- SPIN- PEGASIS

**UNIT V TRANSPORT AND APPLICATION LAYERS****9**

TCP over Adhoc Networks – WAP – Architecture – WWW Programming Model – WDP – WTLS – WTP – WSP – WAE – WTA Architecture – WML – WML scripts.

**TOTAL : 45 PERIODS**

*Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process :Discussions on wireless technology ,its integration for multi system by networked communication.*

**OUTCOMES :** After the completion of this course the student will be able to:

- Knowledge of basic and advanced theories on wireless communications systems in physical, link and network layer.
- Ability to understand, model, and design mobile networks.
- Ability to understand and apply mathematically model in wireless communications.
- Wireless communication transceiver algorithm design
- Mobile system design methodology, link level simulation for wireless communications.
- Fundamentals of mobile communication including various propagation path loss models under different operating conditions and their impact on received signal strength
- The learning process delivers insight into categorizing various embedded & communication protocols for networking of distributed static & mobile systems.

## REFERENCES

1. Kaveh Pahlavan, Prasanth Krishnamoorthy, " Principles of Wireless Networks' PHI/Pearson Education, 2003
2. C. Siva Ram Murthy and B.S. Manoj, AdHoc Wireless Networks: Architectures and protocols, Prentice Hall PTR, 2004
3. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, " Principles of Mobile computing", Springer, New york, 2003.
4. C.K.Toth, " AdHoc mobile wireless networks", Prentice Hall, Inc, 2002.
5. Charles E. Perkins, " Adhoc Networking", Addison-Wesley, 2001.
6. Jochen Schiller, " Mobile communications", PHI/Pearson Education, Second Edition, 2003.
7. William Stallings, " Wireless communications and Networks", PHI/Pearson Education, 2002.

ET5014

CRYPTOGRAPHY AND NETWORK SECURITY

L T P C  
3 0 0 3

## COURSE OBJECTIVES

- To expose the students to the fundamentals of data security.
- To teach the fundamentals of mathematical aspects in creating Encryption keys
- To teach the fundamentals of Security in data & wireless communication.
- To teach the fundamentals of Secured system operation.
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

### UNIT I SYMMETRIC CIPHERS

9

Overview – classical Encryption Techniques – Block Ciphers and the Data Encryption standard – Introduction to Finite Fields – Advanced Encryption standard – Contemporary, Symmetric Ciphers – Confidentiality using Symmetric Encryption.

### UNIT II PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS

9

Introduction to Number Theory – Public-Key Cryptography and RSA – Key Management – Diffie-Hellman Key Exchange – Elliptic Curve Cryptography – Message Authentication and Hash Functions – Hash Algorithms – Digital Signatures and Authentication Protocols.

### UNIT III NETWORK SECURITY PRACTICE

9

Authentication Applications – Kerberos – X.509 Authentication Service – Electronic mail Security – Pretty Good Privacy – S/MIME – IP Security architecture – Authentication Header – Encapsulating Security Payload – Key Management.

### UNIT IV SYSTEM SECURITY

9

Intruders – Intrusion Detection – Password Management – Malicious Software – Firewalls – Firewall Design Principles – Trusted Systems.

### UNIT V WIRELESS SECURITY

9

Introduction to Wireless LAN Security Standards – Wireless LAN Security Factors and Issues.

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process :Discussions/Exercise/Practice on Workbench : on the basics /numerical design aspects of encryption, decryption keys/password creation etc

**TOTAL : 45 PERIODS**

**OUTCOMES** : After the completion of this course the student will be able to:

- Identify the major types of threats to information security and the associated attacks, understand how security policies, standards and practices are developed.
- Describe the major types of cryptographic algorithms and typical applications, write code to encrypt and decrypt information using some of the standard algorithms
- To be exposed to original research in network security and master information security governance, and related legal and regulatory issues
- The learning process delivers insight onto role of security aspects during data transfer and communication in systems like grid.
- Improved Employability and entrepreneurship capacity due to knowledge upgradation on recent trends in embedded systems design.

**REFERENCES:**

1. William Stallings, "Cryptography And Network Security – Principles And Practices", Pearson Education, 3rd Edition, 2003.
2. Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill, 2003.
3. Natalia Olifer and Victor Olifer, "Computer Networks principles.technologies and protocols for network design", Wiley, 2015
4. Bruce Schneier, "Applied Cryptography", John Wiley and Sons Inc, 2001.
5. Stewart S. Miller, "Wi-Fi Security", McGraw Hill, 2003.
6. Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security In Computing", 3<sup>rd</sup> Edition, Pearson Education, 2003.
7. Mai, "Modern Cryptography: Theory and Practice", First Edition, Pearson Education, 2003.

**IN5079**

**ROBOTICS AND CONTROL**

**L T P C  
3 0 0 3**

**COURSE OBJECTIVES**

- To introduce robot terminologies and robotic sensors To educate direct and inverse kinematic relations
- To educate on formulation of manipulator Jacobians and introduce path planning techniques
- To educate on robot dynamics
- To introduce robot control techniques

**UNIT I INTRODUCTION AND TERMINOLOGIES**

**9**

Definition-Classification-History- Robots components-Degrees of freedom-Robot joints-coordinates-Reference frames-workspace-Robot languages-actuators-sensors-Position, velocity and acceleration sensors-Torque sensors-tactile and touch sensors-proximity and range sensors- vision system-social issues.

**UNIT II KINEMATICS**

**9**

Mechanism-matrix representation-homogenous transformation-DH representation-Inverse kinematics solution and programming-degeneracy and dexterity

**UNIT III DIFFERENTIAL MOTION AND PATH PLANNING**

**9**

Jacobian-differential motion of frames-Interpretation-calculation of Jacobian-Inverse Jacobian- Robot Path planning

**UNIT IV DYNAMIC MODELLING****9**

Lagrangian mechanics- Two-DOF manipulator- Lagrange-Euler formulation – Newton- Euler formulation – Inverse dynamics

**UNIT V ROBOT CONTROL SYSTEM****9**

- Linear control schemes- joint actuators- decentralized PID control- computed torque control – force control- hybrid position force control- Impedance/ Torque control

**TOTAL : 45 PERIODS****OUTCOMES:**

- Ability to understand the components and basic terminology of Robotics
- Ability to model the motion of Robots and analyze the workspace and trajectory planning of robots
- Ability to develop application based Robots
- Ability to formulate models for the control of mobile robots in various industrial applications

**REFERENCES**

1. R.K. Mittal and I J Nagrath, “ Robotics and Control”, Tata MacGraw Hill, Fourth edition.
2. Saeed B. Niku ,”Introduction to Robotics ”, Pearson Education, 2002.
3. Fu, Gonzalez and Lee Mcgrahill ,”Robotics ”, international edition.
4. R.D. Klafter, TA Chmielewski and Michael Negin, "Robotic Engineering, An Integrated approach",Prentice Hall of India, 2003.