NEHRU INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

An ISO 9001 : 2015 and 14001:2015 Certified Institution, Affiliated to Anna University, Chennai
(Approved by AICTE, New Delhi and Recognized by UGC with Section 2(f) and 12(B))
Re-Accredited by NAAC "A+", NBA Accredited UG Courses: AERO & CSE
Nehru Gardens, Thirumalayampalayam, Coimbatore-641 105

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CURRICULUM

B.E. - Computer Science and Engineering

REGULATION – 2023 (Revised)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION AND MISSION OF THE INSTITUTION

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.

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.

VISION AND MISSION OF THE DEPARTMENT

VISION

- To produce highly competent and innovative Computing Professionals to meet the global demands

MISSION

- To impart quality education by creative teaching learning process
- To be technically competent, ethical and socially responsible throughout the professional career
- To inculcate leadership qualities and entrepreneurship culture to meet the global standards

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- Acquire and Apply knowledge in Computer Science, Mathematics, Science and inter-disciplinary engineering principles in order to excel in computer professional career
- Analyze real life problems adapting to new Computing Technologies for

professional excellence and ethical attitude in order to provide economically feasible engineering solutions

- Carry out complex engineering problems with best practices exhibiting communication skills, team work and interpersonal skills to enable continued computer professional development through life-long learning

PROGRAM OUTCOMES (POs)

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 analyse 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 modelling 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

PROGRAM SPECIFIC OUTCOMES (PSOs)

- **Professional Skills:** Acquaint in-depth knowledge on the basic and advanced computer science domains like Data Sciences, Cryptography, Cloud and Distributed Computing, Neural Networks and Artificial Intelligence.

- **Entrepreneurship and Successful Career:** Apply the standard practices to have successful career path in the field of information and communication technology and entrepreneurship

SCHEME OF EXAMINATION
B.E. / B.Tech. - COMPUTER SCIENCE AND ENGINEERING
Regulation 2023 (Revised) - Choice Based Credit System
(Applicable to students admitted from the year 2023 -2024 onwards)

SEMESTER	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIOD/ WEEK	EXAMINATION MARKS			CREDITS
					CIA	ESE	TOTAL	
I	U23IP100	Induction Programme /Bridge Course	-	-	-	-	-	0
THEORY INTEGRATED LAB								
I	U23EN101	English for Engineers	HSMC	4	50	50	100	3
I	U23GE102	Problem Solving Using C	ESC	4	50	50	100	3
THEORY								
I	U23MA103	Engineering Mathematics-I	BSC	4	40	60	100	4
I	U23PH104	Engineering Physics	BSC	3	40	60	100	3
I	U23CY105	Engineering Chemistry	BSC	3	40	60	100	3
I	U23GE106	Heritage of Tamils	HSMC	1	40	60	100	1
I	U23GE107	Biology for Engineers	BSC	2	40	60	100	2
PRACTICAL								
I	U23BS118	Physics and Chemistry Laboratory	BSC	4	60	40	100	2
			TOTAL	25	-	-	-	21

SEMESTER	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIOD/ WEEK	EXAMINATION MARKS			CREDITS
					CIA	ESE	TOTAL	
THEORY								
II	U23DM201	Discrete Mathematics	BSC	4	40	60	100	4
II	U23PH202	Physics for Information Science	BSC	3	40	60	100	3
II	U23GE203	Tamils and Technology	HSMC	1	40	60	100	1
II	U23BC204	Basic Civil and Mechanical Engineering	ESC	3	40	60	100	3
II	U23GE205	Basic Electrical and Electronics Engineering	ESC	3	40	60	100	3
THEORY WITH INTEGRATED LAB								
II	U23EN206	Proficiency in English	HSMC	4	50	50	100	3
II	U23GE207	Problem Solving using Python	ESC	4	50	50	100	3
PRACTICAL								
II	U23GE218	Engineering Practices Laboratory	ESC	2	60	40	100	1
ENHANCEMENT COURSES								
II		Skill Enhancement Course – I	SEC	2	100	-	100	1
II		Value Enhancement Course – I	VEC	2	100	-	100	1
			TOTAL	28	-	-	-	23

CURRICULUM
AND
SYLLABUS

B.E. - Computer Science and Engineering

Regulation 2023 (Revised) - Choice Based Credit System

Semester – I

S. No.	Course Code	Course Title	Category	L	T	P	Contact Period	C
1	U23IP100	Induction Programme /Bridge Course	-	-	-	-	-	0
THEORY WITH INTEGRATED LAB								
2	U23EN101	English for Engineers	HSMC	2	0	2	4	3
3	U23GE102	Problem Solving Using C	ESC	2	0	2	4	3
THEORY								
4	U23MA103	Engineering Mathematics-I	BSC	3	1	0	4	4
5	U23PH104	Engineering Physics	BSC	3	0	0	3	3
6	U23CY105	Engineering Chemistry	BSC	3	0	0	3	3
7	U23GE106	Heritage of Tamils	HSMC	1	0	0	1	1
8	U23GE107	Biology for Engineers	BSC	2	0	0	2	2
PRACTICAL								
9	U23BS118	Physics and Chemistry Laboratory	BSC	0	0	4	4	2
			TOTAL	**16**	**1**	**8**	**25**	**21**

Course Code	Title			
U23IP100	Induction Programme			
Semester: I	L	T	P	Credits
	-	-	-	0

Course Content

Description

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

"Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed."

"One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character.

"Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity
This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts
Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values
This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities

rather than lecturing.
Discussions would be conducted in small groups of about 20 students with a faculty 3 mentor each.
It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity
Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules
This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People
Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area
A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations
They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities
About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering/Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References: Guide to Induction program from AICTE

Course designed by	Verified by
Signature of the Faculty Member	Signature of the Chairperson-BoS
D. Edison, AP/S&H Name and Department of the Faculty Member	Head of the Department Department of Science & Humanities Nehru Institute of Engineering & Technology Nehru Gardens, Thirumalayampalayam, Coimbatore - 641 105 Name and Seal of the Chairperson-BoS

Course Code	Title					
U23EN101	ENGLISH FOR ENGINEERS					
Semester: I	L	T	P	Credits	CIA: 50 Marks	ESE: 50 Marks
	2	0	2	3		
Course pre-requisites	Basic Grammar & Communication Strategies					

Course Objectives

1	To enable learners of engineering and technology to develop their basic communication skills in English.
2	To acquire, command in both the respective skills (listening and reading) and the productive skills (writing and speaking) of the English language.
3	To understand the key concepts of values, life skills and business communication, motivate students to look within and create a better version of themselves.
4	To focus on developing basic fluency in English, using vocabulary in the technical field, and strengthening reading and official written communication skills.
5	To use language efficiently in expressing their opinions via various media.

Course Category	Humanities, Social Science and Management Course (HSMC)
Development Needs	Global / National

Course Description: To focus on developing basic fluency in English, using vocabulary in the technical field, and strengthening reading and official written communication skills.

Course Content

Unit	Description	
I	**INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION:** **Reading -** Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts. **Writing -** Writing oneself, Writing Definition; Jumbled sentence. **Grammar** – Simple present tense, Present continuous, Present perfect, Present perfect continuous; Question types: Wh/ Yes or No/ and Tags; Word formation, One-word substitution.	
	Contact Periods	06
II	**NARRATION AND SUMMATION:** **Reading:** biographies, travelogues, newspaper reports. **Writing -** Guided writing- Paragraph writing, Short Report on an event (field trip, etc.), **Grammar** – Simple past tense, Past continuous, Past perfect, Past perfect continuous Subject-Verb Agreement; Prepositions, Word forms (prefixes & suffixes); Error Correction.	
	Contact Periods	06
III	**DESCRIPTION OF PROCESS/PRODUCT:** **Reading** – Reading advertisements, and gadget reviews; finding key information from a given text. **Writing -** Instructions; Process description. **Grammar -** Simple future tense, Future continuous, Future perfect, Future perfect continuous; Imperatives; Adjectives; Degrees of comparison; Compound Words.	
	Contact Periods	06

IV	**CLASSIFICATION AND RECOMMENDATIONS:** **Reading** – Journal reports, predicting content of reading habits, Reading articles (Activity). **Writing** –Memos to colleagues or friends; Opinion Blogs. **Grammar** – Articles; Pronouns - Possessive & Relative pronouns, Cause and Effect.	
	Contact Periods	**06**
V	**EXPRESSION:** **Reading** – Reading editorials; Poster making (Activity). **Writing** – Creative Writing, Checklist. **Grammar** –Punctuation; Compound Nouns, Homonyms; and Homophones, Simple, Compound & Complex Sentences.	
	Contact Periods	**06**
	Total Periods	**30**

LIST OF EXPERIMENTS

1. Listen to one's activities and asking question.
2. Self-Introduction, Peer group activities.
3. Listening to mock interview questions and answering.
4. Listening to documentaries video and responding.
5. Likes and dislikes, experiences.
6. Listen to product and process descriptions.
7. Talk about a Product, work place experiences.
8. Listening to TED Talks.
9. Talk about any great Personalities or Celebrities.
10. Listening to Debates & Discussing.

Contact Periods	**30**
Total Periods	**60**

Course Outcomes

Upon successful completion of the course, students will be able to:

CO 1	Listen and comprehend complex academic texts.	K2
CO 2	Understand the denotative and connotative meanings of technical texts.	K3
CO 3	Identify definitions, descriptions, narrations and essays on various topics.	K4
CO 4	Apply different methods of integration in solving practical problems.	K3
CO 5	Express their opinions effectively in both oral and written medium of communication.	K6

K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating

Text Books	1. English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition). 2. English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN.Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.
Reference Books	1. Technical Communication – Principles and Practices by Meenakshi Raman & SangeetaSharma, Oxford Univ. Press, 2016, New Delhi. 2. A Course Book on Technical English by Lakshmi Narayanan, Scitech

Publications (India) Pvt. Ltd.
3. English for Technical Communication (With CD) By Aysha Viswamohan,
Mcgraw HillEducation, ISBN:0070264244.
4. Effective Communication Skill, Kulbhusan Kumar, R S Salaria, Khanna Publishing House.
5. Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New
Delhi, 2003.
6. Practical English Usage, 2016 published by Oxford by Michael Swan.

Tools for Assessment – Theory

CIA I	CIA II	CIA III	Assignment/ Seminar/ Case Study	Attendance	Total
10	10	10	5	5	40

Tools for Assessment – Practical

Model Exam I	Model Exam II	Total
50	50	100

Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	3	2	-	2
CO2	1	-	-	-	-	-	-	-	3	2	-	2
CO3	1	-	-	-	-	-	-	-	3	2	-	2
CO4	1	-	-	-	-	-	-	-	3	2	-	2
CO5	1	-	-	-	-	-	-	-	3	2	-	2

3-High; 2-Medium; 1-Low

CO \ PSO	PSO1	PSO2
CO1	-	2
CO2	-	2
CO3	-	2
CO4	-	2
CO5	-	2

Course designed by	Verified by
R. Hg Signature of the Faculty Member	Signature of the Chairperson-BoS
Dr. R. Deepa Asp - S&H Name and Department of the Faculty Member	Head of the Department Department of Science & Humanities Nehru Institute of Engineering & Technology Nehru Gardens, Thirumalayampalayam, Coimbatore-641 105 Name and Seal of the Chairperson-BoS

Course Code	Title					
U23GE102	PROBLEM SOLVING USING C					
Semester: I	L	T	P	Credits	CIA: 50 Marks	ESE: 50 Marks
	2	0	2	3		
Course pre-requisites	Basic Knowledge of Programming Knowledge					

Course Objectives

1	To understand the constructs of C Language.
2	To apply C programs using basic programming constructs.
3	To analyse C programs using arrays and strings.
4	To apply modular applications in C using functions.
5	To create applications in C using pointers and structures.

Course Category	Engineering Sciences Course (ESC)
Development Needs	Global

Course Description: Study the constructs of C Language.

Course Content

Unit	Description	
I	**PROBLEM SOLVING:** Problem Solving: Introduction to computer-based problem solving, Program design and implementation issues, Algorithms for problem solving: Simple problems based on numerical methods, Operations on ordered set of elements, Solving quadratic equations, Operations on matrices.	
	Contact Periods	06
II	**OVERVIEW OF C**: Basic Data types, Modifying the Basic Datatypes, Identifier-Names, Variables, Type Qualifiers, Constants, Operators, Expressions, Selection, Iteration and Jump Statements. Introduction to Arrays: Declaration, Initialization – One dimensional array –Two dimensional arrays - String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.	
	Contact Periods	06
III	**FUNCTIONS AND POINTERS:** Modular programming - Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion, Binary Search using recursive functions –Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Parameter passing: Pass by value, Pass by reference.	
	Contact Periods	06
IV	**STRUCTURES AND UNIONS:** Structure - Nested structures – Pointer and Structures – Array of structures – Self-referential structures – Dynamic memory allocation - Singly linked list – typedef – Union - Storage classes and Visibility.	
	Contact Periods	06
V	**FILE PROCESSING:** Files – Types of file processing: Sequential access, Random access – Sequential access file - Random access file - Command line arguments.	
	Contact Periods	06
	Total Periods	30

LIST OF EXPERIMENTS (Any Ten)
1. Decision-making constructs: if-else, goto, switch-case, break-continue 2. Loops: for, while, do-while 3. Arrays: 1D and 2D, Multi-dimensional arrays, traversal, Sorting and Searching 4. Strings: operations 5. Functions: call, return, passing parameters by (value, reference), passing arrays to function. 6. Recursion 7. Pointers: Pointers to functions, Arrays, Strings, Pointers to Pointers, Array of Pointers 8. Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions. 9. Files: reading and writing, File pointers, file operations, random access, processor directives. 10. C Program for Gauss Elimination Method 11. C Program for Sum of Taylor Series Program 12. C Program for Trapezoidal Method 13. C Program for Gauss-Jordan Method 14. C Program for Simpson 1/3 Rule 15. C program for operations on Matrices 16. Mini Project

Contact Periods	**30**
Total Periods	**60**

Course Outcomes
Upon successful completion of the course, Students will be able to:

CO 1	Understand basic Problem-solving methodologies.	K2
CO 2	Apply applications using arrays and strings.	K3
CO 3	Analyze modular applications in C using functions with pointers.	K4
CO 4	Apply applications in C using structures and Unions.	K3
CO 5	Understand the concepts of sequential and random-access file processing.	K2

K1:Remembering; K2:Understanding; K3:Applying; K4:Analyzing; K5:Evaluating; K6:Creating

Text Books	1. Yashwant Kanetkar, Let Us C: Authentic guide to C programming language - 19th Edition Paperback – 15 December 2022. 2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
Reference Books	1 Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018. 2 HarshaPriya, R. Ranjeet, Programming and Problem Solving Through "C" Language, 1st Edition, Fire Wall Media, 2015. 3 Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013. 4. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013. 5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996.

Tools for Assessment-Theory

CIA I	CIA II	CIA III	Assignment / Seminar/ Case Study	Attendance	Total
10	10	10	5	5	40

Tools for Assessment-Practical

Model Exam I	Model Exam II	Total
50	50	100

Mapping												
CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	1	2	1	1	1	2	-	3	2
CO2	2	2	2	1	2	1	1	1	2	-	3	2
CO3	2	3	2	1	2	1	1	1	2	-	3	1
CO4	3	2	2	1	3	1	1	1	2	-	3	2
CO5	2	3	3	1	2	1	2	1	2	-	3	1

3 – High, 2-Medium, 1-Low.

CO\ PSO	PSO1	PSO2
CO1	2	1
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	1

Course designed by	Verified by
Signature of the Faculty Member	Signature of the Chairperson-BoS
JEEVANANTHAM G, AP(SG) COMPUTER SCIENCE & ENGINEERING Name and Department of the Faculty Member	Dr. S. SUBASREE, M Tech. Ph.D Professor and Head, Computer Science and Engineering Nehru Institute of Engineering and Technology Coimbatore, TN, India Name and Seal of the Chairperson-BoS

Course Code	Title					
U23MA103	ENGINEERING MATHEMATICS-I					
Semester: I	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	1	0	4		
Course pre-requisites	Higher Secondary Level, Bridge Course					

Course Objectives

1	To familiarize the students to solve the first order linear differential equations using numerical methods.
2	To familiarize the students to solve the second order linear differential equations using numerical methods.
3	To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.
4	To introduce the numerical techniques of interpolation in various intervals which plays an important role in engineering and technology disciplines
5	To understand types of matrices and their properties, concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.

Course Category	Basic Science Course (BSC)
Development Needs	Global / National

Course Description: The course helps the students to develop the fundamentals and basic concepts in linear ODE's by numerical solutions. Students will be able to solve problems related to engineering applications by using these techniques.

Course Content

Unit	Description	
I	**ORDINARY DIFFERENTIAL EQUATION:** First-order linear ordinary differential equations-application to solve simple engineering and scientific problems. Numerical solution of first-order and linear ordinary differential equations: Errors and approximations, order of convergence, Modified Euler's method, and Runge - Kutta fourth order method to solve simple engineering and scientific problems.	
	Contact Periods	**12**
II	**SECOND-ORDER LINEAR ODE'S:** Second-order linear ODE's with constant coefficients – Solution by Inverse differential operator, Application to Oscillations of a mass spring system and L-C-R circuit. Numerical Solution of second order linear ODE: Runge-Kutta method and Milnes Predictor Corrector method to solve problems on oscillations of a mass spring system and L-C-R circuits.	
	Contact Periods	**12**
III	**MULTIPLE INTEGRALS**: Introduction of integrals – Evaluation of double and triple integrals – Region of integration - changing into polar coordinates. Application to find Area, Volume and total mass by double integral.	
	Contact Periods	**12**
IV	**INTERPOLATION TECHNIQUES**: Interpolation, Lagrange's interpolation formula, Newton's divided difference interpolation formula. Newton-Gregory forward and backward interpolation formula, Newton's Forward and Backward differences.	
	Contact Periods	**12**

V	**MATRIX ALGEBRA:** Solution to the system of linear equations. Elementary row transformation of a matrix, RREF, Rank of a matrix. Gauss-Elimination method. Approximate solution by Gauss-Seidel method. Solution of system of Ordinary Differential equations by Matrix method.
Contact Periods	**12**
Total Periods	**60**

Course Outcomes **Upon successful completion of the course, students will be able to:**		**Knowledge Level**
CO 1	Apply the numerical techniques to the first order ordinary differential equations.	K3
CO 2	Understand the numerical techniques to the second order ordinary differential equations.	K2
CO 3	Apply multiple integral ideas in solving areas, volumes and other practical problems	K3
CO 4	Apply the numerical techniques of interpolation in various intervals.	K3
CO 5	Understand the matrix representation of a set of linear equations and to analyse the solution of the System of equations.	K2

K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating

Text Books	1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley, 10th Edition, 2020. 2. Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, 4th Edition, 2010. 3. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Editon, 2016.
Reference Books	1. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018. 2. Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009. 3. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016. 4. Narayanan. S. and Manicavachagom Pillai. T. K., "Calculus" Volume I and II, S.Viswanathan Publishers Pvt. Ltd., Chennai, 2009. 5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.

Tools for Assessment (40 Marks)

CIA I	CIA II	CIA III	Assignment/ Seminar/ Case Study	Attendance	Total
10	10	10	5	5	40

Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	-	-	-	1	-	1	-	1
CO2	3	3	2	1	-	-	-	1	-	1	-	1
CO3	3	3	2	1	-	-	-	1	-	1	-	1
CO4	3	3	2	1	-	-	-	1	-	1	-	1
CO5	3	3	2	1	-	-	-	1	-	1	-	1

3-High; 2-Medium; 1-Low

CO \ PSO	PSO1	PSO2
CO1	2	1
CO2	2	1
CO3	2	1
CO4	2	1
CO5	2	1

Course designed by	Verified by
K. Ramesh Signature of the Faculty Member	Signature of the Chairperson-BoS
Dr. K. Ramesh / Mathematics Name and Department of the Faculty Member	Head of the Department Department of Science & Humanities Nehru Institute of Engineering & Technology Nehru Gardens, Thirumalayampalayam, Coimbatore - 641 105 Name and Seal of the Chairperson-BoS

Course Code	Title					
U23PH104	ENGINEERING PHYSICS					
Semester: I	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites	Higher Secondary Level					

Course Objectives

1	To grasp the fundamentals of Matter Properties and their practical implications across diverse Engineering fields.
2	To explore the applications of Lasers and Fiber optics in Engineering contexts.
3	To apply principles of Ultrasonics and Thermal Physics to Engineering challenges.
4	To understand Quantum Physics concepts and their applications.
5	To analyse the structure of crystals and explore their significance.

Course Category	Basic Science Course (BSC)
Development Needs	Global / National

Course Description: Engineering physics provides students with a broad exposure to the basic physical theories underlying engineering. students will complete certain concept in Physics intended to provide a good exposure in various directions in both theoretical and applied Physics.

Course Content

Unit	Description	
I	**PROPERTIES OF MATTER:** Introduction - Elasticity - Stress-strain diagram and its uses - Factors affecting elastic modulus - Torsional stress and deformations - Torsional pendulum: theory and experiment - Bending of beams - Bending moment - Cantilever: theory and experiment - Uniform and non-uniform bending: theory and experiment - I-shaped girders - Applications.	
	Contact Periods	**09**
II	**LASER AND FIBER OPTICS:** Introduction – Spontaneous and stimulated emission. Population inversion, pumping methods- Einstein's A and B coefficients: derivation. Types of lasers - Nd-YAG, CO_2 - Industrial Applications of Lasers -Fiber Optics: Principle and propagation of light - Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) - Temperature and displacement sensors.	
	Contact Periods	**09**
III	**ULTRASONICS AND THERMAL PHYSICS**: Introduction - Piezoelectric effect - piezoelectric generator - Velocity measurement - Acoustic grating - Medical applications. Introduction to heat - Transfer of heat energy: Thermal conduction, convection, and radiation - Thermal conductivity - Forbe's and Lee's disc method: theory and experiment - Applications: heat exchangers, refrigerators, ovens, and solar water heaters.	
	Contact Periods	**09**
IV	**QUANTUM PHYSICS:** Introduction - Black body radiation - Planck's theory - Deduction of Wien's displacement law and Rayleigh-Jeans' Law from Planck's theory - Compton effect: Theory and experimental verification - Matter waves - Physical significance of wave function - Schrödinger's wave equation: Time independent and time dependent equations - Particle in a one-dimensional box- Microscope: Scanning Tunnelling microscope.	
	Contact Periods	**09**
V	**CRYSTAL PHYSICS:** Introduction - 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 - Polymorphism and allotropy - Crystal defects - Point, line, and surface defects.
Contact Periods	**09**
Total Periods	**45**

Course Outcomes

Upon successful completion of the course, students will be able to:

CO 1	Understand the basics of properties of matter and its applications.	K2
CO 2	Remember the concepts of LASER and optical devices and their applications in fiber optics.	K1
CO 3	Understand the basic concepts of ultrasonics & thermal properties of materials and their applications in expansion joints and heat exchangers,	K2
CO 4	Apply knowledge an advanced physics concepts of quantum theory and its applications in tunneling microscopes.	K3
CO 5	Understand the basics of crystals, their structures and different crystal growth techniques.	K2

K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating

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. 4. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGraw-Hill (Indian Edition), 2020.
Reference Books	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. Palanisamy P.K. "Engineering Physics." SCITECH Publications, 2011. 4. Kittle, C, "Introduction to solid state Physics," Wiley, 2005. 5. Mani P. "Engineering Physics I." Dhanam Publications, 2011. 6. Senthilkumar G. "Engineering Physics I." VRB Publishers, 2011.

Tools for Assessment (40 Marks)

CIA I	CIA II	CIA III	Assignment/ Seminar/Case Study	Attendance	Total
10	10	10	5	5	40

Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	-	1	-	1	-	-	1	-	1
CO2	3	3	1	-	1	-	1	-	1	-	-	1
CO3	3	3	1	-	1	-	1	-	1	-	-	1
CO4	3	2	1	-	1	-	-	-	-	1	-	1
CO5	3	3	1	-	-	-	1	-	1	-	-	1

3-High; 2-Medium; 1-Low

CO \ PSO	PSO1	PSO2
CO1	1	1
CO2	1	1
CO3	1	1
CO4	1	1
CO5	1	1

Course designed by	Verified by
Signature of the Faculty Member	Signature of the Chairperson-BoS
[Dr. N. Pethyperaja, Associate professor of Physics, Department of Science & Humanities] Name and Department of the Faculty Member	Head of the Department Department Nehru Institute of Engineering & Tech. Nehru Gardens, Thirumalayampalayam, Coimbatore - 641 105 Name and Seal of the Chairperson-BoS

Course Code	Title					
U23CY105	ENGINEERING CHEMISTRY					
Semester: I	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites	Higher Secondary Level					

Course Objectives

1	To inculcate a sound understanding of water treatment techniques.
2	To understand the basic concepts of electrochemistry and its applications.
3	To introduce the basic concepts of corrosion and its control methods.
4	To facilitate the understanding of different types of fuels, their preparation, properties, and combustion characteristics.
5	To familiarize the students with the properties and applications of different types of advanced engineering materials.

Course Category	Basic Science Course (BSC)
Development Needs	Global / National

Course Description: Chemistry is required to solve global problems and issues for future engineering.

Course Content

Unit	Description	
I	**WATER TECHNOLOGY:** Introduction - Sources of water - Impurities in water - Types of water - Water Quality Standards - Hardness of water - Expression of hardness - Units of hardness - Estimation of hardness of water by EDTA method - Disadvantages of using hard water - Boiler troubles - Scale and sludge. Softening of water - External treatment method - Demineralization process - Internal treatment method - Sodium Aluminate, Phosphate and Calgon conditioning - Desalination of Brackish water by reverse osmosis method.	
	Contact Periods	**09**
II	**ELECTROCHEMISTRY:** Introduction - Cells - Representation of a galvanic cell - Reversible and irreversible cells - Electrode potential - Nernst equation - Reference electrode - Standard hydrogen electrode - Glass electrode - Electrochemical series and its applications. **Battery**: Introduction, Types of batteries - Primary Battery: alkaline battery, Secondary Battery : lead storage battery and lithium ion battery, Flow Battery : H_2-O_2 fuel cell - Super Capacitors, E-Vehicle.	
	Contact Periods	**09**
III	**CORROSION AND ITS CONTROL:** Corrosion: Introduction - Types of corrosion: Chemical and Electrochemical - Factors influencing rate of corrosion. 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.	
	Contact Periods	**09**
IV	**FUELS AND COMBUSTION:** Fuels: Introduction - Requirements of a good fuel - Classification of fuels - Solid fuels - Coal - Proximate analysis of coal - Manufacture of Metallurgical coke - Otto-Hoffman byproduct oven - Liquid fuel - Manufacture of synthetic	

	petrol by Bergius method. Knocking - Octane number - Cetane number - Power alcohol and biodiesel - Gaseous fuel - LPG, CNG. **Combustion** - Principle of combustion - Calorific value - Gross and net calorific values - Explosive range - Spontaneous ignition temperature – Flue gas analysis-ORSAT method.
	Contact Periods 09
V	**ADVANCED ENGINEERING MATERIALS**: Introduction to Polymers - Thermoplastic and Thermosetting. Properties of polymers: Tg, Tacticity, & Molecular weight. Composites - Fibre-reinforced composites and its applications. Abrasives - Moh's scale of hardness - types - natural [Diamond] - synthetic [SiC]; Refractories - characteristics - classifications [Acidic, basic and neutral refractories] - properties - refractoriness - RUL - porosity - thermal spalling; Lubricants - definition - function - characteristics - properties - viscosity index, flash and fire points, cloud and pour points, oiliness; Nano materials - CNT- synthesis [laser evaporation] - applications.
	Contact Periods 09
	Total Periods 45

Course Outcomes
Upon successful completion of the course, students will be able to:

CO 1	Infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.	K1
CO 2	Understand the basic concept of Electrochemistry for its applications in different engineering sectors.	K2
CO 3	Reduce corrosion problems by applying appropriate control methods.	K3
CO 4	Recommend suitable fuels for engineering processes and applications.	K3
CO 5	Recognize different types of engineering materials and apply them for suitable applications in energy sectors.	K4

K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating

Text Books	1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018. 2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008. 3. S.S. Dara, "A Text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018.
Reference Books	1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Textbook of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018. 2. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017. 3. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014. 4. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019. 5. O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013. 5. Gowariker V.R., Viswanathan N.V., and Jayadev Sreedhar, "Polymer Science", New Age International P (Ltd.,), Chennai, 2022.

Tools for Assessment (40 Marks)

CIA I	CIA II	CIA III	Assignment/Seminar/ Case study	Attendance	Total
10	10	10	5	5	40

Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	-	-	-	1	-	-	-	-	1
CO2	3	1	1	-	-	-	1	-	-	-	-	1
CO3	3	1	1	-	-	-	1	-	-	-	-	1
CO4	3	1	1	-	-	-	1	-	-	-	-	1
CO5	3	1	1	-	-	-	1	-	-	-	-	1

3-High; 2-Medium; 1-Low

CO \ PSO	PSO1	PSO2
CO1	1	1
CO2	1	1
CO3	1	1
CO4	1	1
CO5	1	1

Course designed by	Verified by
Signature of the Faculty Member	Signature of the Chairperson-BoS
A. Lakshmi Priya / Chemistry Name and Department of the Faculty Member	Head of the Department Department of Science & Humanities Nehru Institute of Engineering & Technology Nehru Gardens, Thirumalayampalayam, Coimbatore - 641 105 Name and Seal of the Chairperson-BoS

Course Code	Title					
U23GE106	HERITAGE OF TAMILS					
Semester:I	L	T	P	Credits	CIA:40 Marks	ESE: 60 Marks
	1	0	0	1		
Course pre-requisites	Higher Secondary Level					

Course Objectives

1	To learn the extensive literature of classical tamil.
2	To review the fine arts heritage of Tamil culture.
3	To realize the contribution in Indian freedom struggle.
4	To understand the role of Temple in Sangam cities/ports, Chola conquest.
5	To examine Tamil cultural influence in India.

Course Category	Humanities, Social Science and Management Course (HSMC)
Development Needs	Global/National

Course Description: Used to explores the rich culture, linguistic and historical aspects of the Tamil community.

Course Content

Unit	Description	
I	**LANGUAGE AND LITERATURE**: Language Families in India - Dravidian Languages - Tamil as a Classical Language - Classical Literature in Tamil - Secular Nature of Sangam Literature - Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.	
		Contact Periods 03
II	**HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE:** Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments. - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.	
		Contact Periods 03
III	**FOLK AND MARTIAL ARTS:** Therukoothu, Karakattam, VilluPattu, KaniyanKoothu, Oyillattam, Leather Puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.	
		Contact Periods 03
IV	**THINAI CONCEPT OF TAMILS:** Flora and Fauna of Tamils & Agam and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.	
		Contact Periods 03
V	**CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE:** Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India - Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine - Inscriptions & Manuscripts Print History of Tamil Books.	
		Contact Periods 03

	Total Periods	**15**
Course Outcomes **Upon successful completion of the course, students will be able to:**		
CO 1	Remember the extensive literature of tamil and its classical nature, musical instruments, Folk, thinai concept, Indian Freedom Struggle & Aham, Puram and Aram Concept	K1
CO 2	Remember the principles in Thirukural, Bhakti Literature Azhwars and Nayanmars , heritage of sculpture, painting and musical instruments of ancient people, victory of chozha dynasty	K1
CO 3	Understand on folk and martial arts of tamil people, Justice in Sangam Literature, Development of Modern literature in Tamil, Making of musical instru ments	K2
CO 4	Understand the role of Temples in Social and Economic Life of Tamils, Ancient Cities and Ports of Sangam Age, Conquest of Cholas	K2
CO 5	Understand the Cultural Influence of Tamils over the other parts of India, contribution of tamils self-esteem movement and siddha medicine, Print History of Tamil Books	K2
K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating		
Text Books	1. தமிழகவரலாறு - மக்களும் பண்பாடும் - .கே. கேபிள்ளை: தமிழ்நாடு பாட நூல் மற்றும் கல்வியியல் பணிகள் கழகம், பதிப்பு-16, ஆண்டு-2020 2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம் . (விகடன்பிரசுரம்)பதிப்பு-1, ஆண்டு-2016 3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகரநாகரிகம் (தொல்லியல்துறை(வெளியீடு).பதிப்பு-1, ஆண்டு-2016	
Reference Books	1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print) 2016. 2. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies) 2010. 3. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies) 1995. 4. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu). Edition: 1 Year 2016. 5. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu). 2022. 6. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book..Edition: 1 Year 2016.	

Tools for Assessment (40 Marks)

CIAI	CIAII	CIAIII	Assignment/Seminar/ Case Study	Attendance	Total
10	10	10	5	5	40

Mapping

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	1	2	2	-	2	-	1
CO2	1	-	-	-	-	1	2	2	-	2	-	1
CO3	1	-	-	-	-	1	2	2	-	2	-	1
CO4	1	-	-	-	-	1	2	2	-	2	-	1
CO5	1	-	-	-	-	1	2	2	-	2	-	1

3-High;2-Medium;1-Low

CO \PSO	PSO1	PSO2
CO1	1	1
CO2	1	1
CO3	1	1
CO4	1	1
CO5	1	1

Course designed by	Verified by
Signature of the Faculty Member	Signature of the Chairperson-BoS
Dr. DEEPAK. A. S & H Dept.	Head of the Department Department of Science & Humanities Nehru Institute of Engineering & Technology Nehru Gardens, Thirumalayampalayam, Coimbatore - 641 105
Name and Department of the Faculty Member	Name and Seal of the Chairperson-BoS

Course Code	Title					
U23BS118	PHYSICS AND CHEMISTRY LABORATORY					
Semester: I	L	T	P	Credits	CIA: 60 Marks	ESE: 40 Marks
	0	0	4	2		
Course pre-requisites	Higher Secondary Level, Physical measurements, Volumetric analysis					

Course Objectives

1	To learn the proper use of various kinds of physics laboratory equipment.
2	To learn problem solving skills related to physics principles and interpretation of experimental data.
3	To determine error in physics experimental measurements and techniques used to minimize such error.
4	To induce the students to familiarize with electro analytical techniques such as, pH metry, and potentiometry in the determination of impurities in aqueous solutions.
5	To estimate the amount of mineral acid in the given sample by conductometric method.

Course Category	Basic Science Course (BSC)
Development Needs	Global / National

Course Description: In depth understanding of Physics and chemistry is needed for the engineer for the more beneficial solutions.

Course Content

PHYSICS LABORATORY

LIST OF EXPERIMENTS (Any Five)

1. Determination of rigidity modulus - Torsional pendulum.
2. Determination of Young's modulus - Non uniform bending method.
3. Determination of Young's modulus - Uniform bending method
4. Determination of thickness of a thin wire - Air wedge method
5. Determination of the wavelength of the laser using grating
6. Determination of Numerical Aperture and acceptance angle using Optical fibre.
7. Determination of velocity of sound and compressibility of liquid - Ultrasonic interferometer.
8. Determination of thermal conductivity of a bad conductor - Lee's Disc method.
9. Melde's string experiment.
10. Determination of Band gap of a semiconductor.
11. Photoelectric effect.
12. Michelson Interferometer.

Contact Periods	**15**

CHEMISTRY LABORATORY

LIST OF EXPERIMENTS (Any Five)

1. Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using the primary standard.
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. Determination of strength of given hydrochloric acid using pH meter.
6. Determination of strength of acids in a mixture of acids using conductivity meter.
7. Estimation of iron content of the given solution using potentiometer.

Contact Periods	**15**
Total Periods	**30**

Course Outcomes

Upon successful completion of the course, students will be able to:

CO 1	Understand the proper use of various kinds of physics laboratory equipment.	K2
CO 2	Develop the problem solving skills related to physics principles and interpretation of experimental data.	K4
CO 3	Determine error in physics experimental measurements and techniques used to minimize such error.	K3
CO 4	Develop a strong foundation on water hardness, alkalinity, dissolved oxygen and its measurement, enabling them to effectively access and manage water quality in various settings.	K4
CO 5	Acquire the necessary knowledge, skills, and attitudes related to the pH, potentiometric and conductometric experiments.	K2

K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating

Tools for Assessment (40 Marks)

Preparation	Conduct of Experiments	Calculations & Result	Viva-Voce	Total
20	30	40	10	100

Tools for Assessment (20 Marks)

Model Exam I	Model Exam II	Total
50	50	100

Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	2	-	-	1	-	-	-	1
CO2	3	2	2	-	2	-	-	1	-	-	-	1
CO3	3	2	2	-	2	-	-	1	-	-	-	1
CO4	3	2	2	-	2	-	-	1	-	-	-	1
CO5	3	2	2	-	2	-	-	1	-	-	-	1

3-High; 2-Medium; 1-Low

CO \ PSO	PSO1	PSO2
CO1	1	2
CO2	1	2
CO3	1	2
CO4	1	2
CO5	1	2

Course designed by	Verified by
1. N. S 2. A Signature of the Faculty Member	Signature of the Chairperson-BoS
1. Dr. N. Sathyapriya, Asp/ Physics 2. A. Lakshmipriya / Chemistry Name and Department of the Faculty Member	Head of the Department Department of Science & Humanities Nehru Institute of Engineering & Technology Nehru Gardens, Thirumalayampalayam, Coimbatore - 641 105 Name and Seal of the Chairperson-BoS

Semester – II

S. No.	Course Code	Course Title	Category	L	T	P	Contact Period	C
THEORY								
1	U23DM201	Discrete Mathematics	BSC	3	1	0	4	4
2	U23PH202	Physics for Information Science	BSC	3	0	0	3	3
3	U23GE203	Tamils and Technology	HSMC	1	0	0	1	1
4	U23BC204	Basic Civil and Mechanical Engineering	ESC	3	0	0	3	3
5	U23GE205	Basic Electrical and Electronics Engineering	ESC	3	0	0	3	3
THEORY WITH INTEGRATED LAB								
6	U23EN206	Proficiency in English	HSMC	2	0	2	4	3
7	U23GE207	Problem Solving using Python	ESC	2	0	2	4	3
PRACTICAL								
8	U23GE218	Engineering Practices Laboratory	ESC	0	0	2	2	1
ENHANCEMENT COURSES								
9		Skill Enhancement Course - I	SEC	0	0	2	2	1
10		Value Enhancement Course - I	VEC	0	0	2	2	1
			TOTAL	**17**	**1**	**10**	**28**	**23**

Course Code	Title					
U23DM201	DISCRETE MATHEMATICS					
Semester: II	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	1	0	4		
Course pre-requisites	Higher Secondary Level, Bridge Course, Engineering Mathematics - I					

Course Objectives

1	To extend student's logical and mathematical maturity and ability to deal with abstraction.
2	To understand the basic concepts of graph theory.
3	To familiarize the applications of algebraic structures.
4	To understand the concepts and significance of lattices and Boolean algebra which are widely used in computer science and engineering.
5	To introduce most of the basic terminologies of probability and combinatorics used in computer science courses and application of ideas to solve practical problems.

Course Category	Basic Science Course (BSC)
Development Needs	Global / National

Course Description: The course helps the students to develop the fundamentals and basic concepts of Logics, Graphs, Structures, Lattices and Boolean Algebra. Students will be able to solve problems related to engineering applications by using these techniques.

Course Content

Unit	Description	
I	**LOGIC AND PROOFS**: Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.	
	Contact Periods	**12**
II	**GRAPH THEORY**: Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.	
	Contact Periods	**12**
III	**ALGEBRAIC STRUCTURES**: Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism's – Normal subgroup and cosets – Lagrange's theorem.	
	Contact Periods	**12**
IV	**LATTICES AND BOOLEAN ALGEBRA:** Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Some special lattices – Boolean algebra – Properties.	
	Contact Periods	**12**
V	**PROBABILITY AND COMBINATORICS**: Probability axioms, conditional probability, partitions and law of total probability, Bayes theorem. Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Solving linear recurrence relations – Inclusion and exclusion principle.	
	Contact Periods	**12**
	Total Periods	**60**

Course Outcomes Upon successful completion of the course, students will be able to:		Knowledge Level
CO 1	Infer knowledge of the concepts needed to test the logic of a program.	K1
CO 2	Understand structures on many levels.	K2
CO 3	Understand concepts and properties of algebraic structures such as groups, subgroups and normal subgroups.	K2
CO 4	Apply class of functions which transform a finite set into another finite set which relates to input and output functions in computer science.	K3
CO 5	Understand probability concepts and the recursive algorithms by solving recurrence relations and proof methods facilitate consideration of program correctness and identifying structures on many levels.	K2

K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating

Text Books	1. Rosen. K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2017. 2. Tremblay. J.P. and Manohar. R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011. 3. Veerarajan, T, "Probability, Statistics, Random Processes and Queuing Theory", 1st Edition, Tata McGraw-Hill, New Delhi, 2019.
Reference Books	1. Grewal. B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018. 2. Grimaldi. R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition, Pearson Education Asia, Delhi, 2013. 3. Koshy. T. "Discrete Mathematics with Applications", Elsevier Publications, 2006. 4. Lipschutz. S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.

Tools for Assessment (40 Marks)

CIA I	CIA II	CIA III	Assignment/ Seminar/ Case Study	Attendance	Total
10	10	10	5	5	40

Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	-	-	-	1	-	1	-	1
CO2	3	3	2	1	-	-	-	1	-	1	-	1
CO3	3	3	2	1	-	-	-	1	-	1	-	1
CO4	3	3	2	1	-	-	-	1	-	1	-	1
CO5	3	3	2	1	-	-	-	1	-	1	-	1

3-High; 2-Medium; 1-Low

CO \ PSO	PSO1	PSO2
CO1	2	1
CO2	2	1
CO3	2	1
CO4	2	1
CO5	2	1

Course designed by	Verified by
K. Ramesh Signature of the Faculty Member	Signature of the Chairperson-BoS
Dr. K. RAMESH Mathematics Name and Department of the Faculty Member	Head of the Department Department of Science & Humanities Nehru Institute of Engineering & Technology Nehru Gardens, Thirumalayampalayam, Coimbatore - 641 105 Name and Seal of the Chairperson-BoS

Course Code	Title					
U23PH202	PHYSICS FOR INFORMATION SCIENCE					
Semester: II	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites	Basics of Engineering Physics and Properties of Materials					

Course Objectives

1	To make the students understand the importance in studying electrical properties of materials.
2	To enable the students to gain knowledge in semiconductor physics.
3	To instil knowledge on magnetic properties of materials.
4	To establish a sound grasp of knowledge on different optical properties of materials, optical displays, and applications.
5	To inculcate an idea of significance of nano structures, quantum confinement and ensuing nano device applications.

Course Category	Basic Science Course (BSC)
Development Needs	Global / National

Course Description: This course is designed to provide a comprehensive understanding of the fundamental principles of physics that underlie information science and technology. The course aims to bridge the gap between traditional physics concepts and their application in the rapidly evolving field of information science.

Course Content

Unit	Description	
I	**ELECTRICAL PROPERTIES OF MATERIALS:** Introduction - Classical free electron theory - Expressions for Electrical and Thermal conductivity - Wiedemann-Franz law - Lorentz Number - Merits and demerits of classical free electron theory - electrons in metals - Particle in a three-dimensional box - degenerate states and non-degenerate states - Quantum free electron theory - Fermi distribution function - Effect of temperature on fermi function - Density of energy states.	
	Contact Periods	**09**
II	**SEMICONDUCTOR PHYSICS:** Introduction - Elemental and Compound semiconductors - Intrinsic semiconductor - carrier concentration derivation - Fermi level - Variation of Fermi level with temperature - Extrinsic semiconductor - 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.	
	Contact Periods	**09**
III	**MAGNETISM AND SUPERCONDUCTIVITY:** 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 – High Tc superconductors – Applications of superconductors – SQUID, Magnetic levitation.	
	Contact Periods	**09**
IV	**DIELECTRIC AND OPTICAL PROPERTIES OF MATERIALS:** 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 - Light absorption – Luminescence and white LEDs. - LED, Organic LED and Optical data storage techniques.	
	Contact Periods	**09**

V	NANO DEVICES: Introduction - Quantum confinement – Quantum structures: quantum wells, wires, and dots — Band gap of nanomaterials - Classification of nanomaterials - Thin Film Growth, Ball Milling, Sol-Gel – Properties and applications – Carbon nanotubes: types and applications.	
	Contact Periods	**09**
	Total Periods	**45**

Course Outcomes

Upon successful completion of the course, students will be able to:

CO 1	Understand theories of electrical and thermal conduction is solids, basic quantum mechanics, and energy bands.	K2
CO 2	Apply knowledge on basics of semiconductor physics and its applications in various devices.	K3
CO 3	Analyze to get knowledge on magnetic and superconductivity properties of materials and their applications in data storage.	K4
CO 4	Understand on the functioning of dielectric and optical materials for optoelectronic devices.	K2
CO 5	Understand the basics of quantum structures and their applications and basics of quantum computing.	K2

K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating

Text Books	1. Arumugam M., Materials Science. Anuradha publishers, 2010. 2. S.O. Kasap. Principles of Electronic Materials and Devices, McGraw-Hill Education (Indian Edition), 2020. 3. Parag K. Lala, Quantum Computing: A Beginner's Introduction, McGraw-Hill Education (Indian Edition), 2020. 4. The Physics and Chemistry of NanoSolids by Frank J. Owens and Charles P. Poole Jr, Wiley-Interscience, 2008.
Reference Books	1. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019. 2. Y.B.Band and Y.Avishai, Quantum Mechanics with Applications to Nanotechnology and Information Science, Academic Press, 2013. 3. V.V.Mitin, V.A. Kochelap and M.A.Stroscio, Introduction to Nanoelectronics, Cambridge Univ.Press, 2008. 4. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson Education (Indian Edition) 2009. 5. B. Rogers, J.Adams and S.Pennathur, Nanotechnology: Understanding Small Systems, CRC Press, 2014. 6. Palanisamy P.K. Materials Science. SCITECH Publishers, 2011. 7. Senthilkumar G. Engineering Physics II. VRB Publishers, 2011.

Tools for Assessment (40 Marks)

CIA I	CIA II	CIA III	Assignment/ Seminar/Case study	Attendance	Total
10	10	10	5	5	40

Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	-	-	-	-	-	-	-	-
CO2	3	1	2	-	-	-	-	-	-	-	-	-
CO3	3	-	-	1	2	1	1	-	-	-	-	-
CO4	3	-	2	1	3	-	1	-	-	-	-	2
CO5	3	2	2	2	2	1	2	-	-	-	-	2

3-High; 2-Medium; 1-Low

CO \ PSO	PSO1	PSO2
CO1	2	1
CO2	2	1
CO3	2	1
CO4	2	1
CO5	2	1

Course designed by	Verified by
Signature of the Faculty Member	Signature of the Chairperson-BoS
[Dr. N. Sathyapriya, Associate professor of Physics, Department of Science & Humanities] Name and Department of the Faculty Member	Head of the Department, Department of Science & Humanities, Nehru Institute of Engineering & Technology, Nehru Gardens, Thirumalayampalayam, Coimbatore - 641 105. Name and Seal of the Chairperson-BoS

Course Code	Title					
U23GE203	TAMILS AND TECHNOLOGY					
Semester:II	L	T	P	Credits	CIA:40 Marks	ESE: 60 Marks
	1	0	0	1		
Course pre-requisites	Higher Secondary Level					

Course Objectives

1	To explore the historical development of technology in the Tamil region.
2	To examine how traditional Tamil practices and knowledge systems have influenced technological advancements.
3	To promote inclusivity and diversity in the technology sector, encouraging the participation of Tamils in various technological fields.
4	To provide a global perspective on Tamil contributions to technology and the role of Tamils in the global technology landscape.
5	To explore the role of the Tamil language in technology, including the development of software, language processing, and digital content in Tamil.

Course Category	Humanities, Social Science and Management Course (HSMC)
Development Needs	Global/National

Course Description:

A course on Tamils and Technology might cover the historical and contemporary contributions of Tamils to the field, exploring advancements, notable figures, and the intersection of Tamil culture with technological developments. Topics could include language technology, computing, and digital innovations, providing a holistic understanding of the Tamils have had on the Technology landscape.

Course Content

Unit	Description	
I	**WEAVING AND CERAMIC TECHNOLOGY:** Weaving Industry during Sangam Age - Ceramic technology - Black and Red Ware Potteries (BRW) - Graffiti on Potteries.	
	Contact Periods	**03**
II	**DESIGN AND CONSTRUCTION TECHNOLOGY:** Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age - Details of Stage Constructions in Silapathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- ThirumalaiNayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.	
	Contact Periods	**03**
III	**MANUFACTURING TECHNOLOGY:** Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel - Copper and gold- Coins as source of history - Minting of Coins - Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silapathikaram- keezhadi.	
	Contact Periods	**03**
IV	**AGRICULTURE AND IRRIGATION TECHNOLOGY:** Dam, Tank, ponds, Sluice, Significance of KumizhiThoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.	
	Contact Periods	**03**

V	**SCIENTIFIC TAMIL & TAMIL COMPUTING:** Development of Scientific Tamil - Tamil computing - Digitalization of Tamil Books - Development of Tamil Software -Tamil Virtual Academy - Tamil Digital Library - Online Tamil Dictionaries - Sorkuvai Project.	
	Contact Periods	**03**
	Total Periods	**15**
Course Outcomes **Upon successful completion of the course, students will be able to:**		
CO 1	Understand the extensive literature of Tamil and its classical nature.	K2
CO 2	Understand the heritage of sculpture, painting and musical instruments of ancient people.	K2
CO 3	Review on folk and martial arts of Tamil people.	K1
CO 4	Realise Thinai concepts, trade and victory of chozha dynasty.	K1
CO 5	Understand the contribution of Tamils in Indian freedom struggle, self-esteem movement and siddha medicine.	K2
K1: Remembering; K2: Understanding; K3: Applying;K4: Analyzing;K5: Evaluating; K6: Creating		
Text Books	1. தமிழகவரலாறு – மக்களும்பண்பாடும்– .கே.கேபிள்ளை. (வெளியீடு): தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம். 2. கணினித்தமிழ் – முனைவர்இல. சுந்தரம் . (விகடன்பிரசுரம்).பதிப்பு-1, ஆண்டு-2016. 3. கீழடி – வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம். (தொல்லியல்துறை(வெளியீடு). பதிப்பு-1, ஆண்டு-2016. 4. பொருநை- ஆற்றங்கரைநாகரீகம். (தொல்லியல்துறை (வெளியீடு)ஆண்டு. 2022.	
Reference Books	1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print) 2016 2. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).2010 3. National The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: Intel Institute of Tamil Studies)1995 4. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu..Edition: 1 Year 2016 5. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) 2022 6. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book...Edition: 1 Year 2016.	

Tools for Assessment (40 Marks)

CIAI	CIAII	CIAIII	Assignment/Seminar/ Case Study	Attendance	Total
10	10	10	5	5	40

Mapping

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	1	-	-	1	2	2	-	2	-	1
CO2	2	-	1	-	-	1	2	2	-	2	-	1
CO3	2	-	1	-	-	1	2	2	-	2	-	1
CO4	2	-	1	-	-	1	2	2	-	2	-	1
CO5	2	-	1	-	-	1	2	2	-	2	-	1

3-High;2-Medium;1-Low

CO \ PSO	PSO1	PSO2
CO1	1	1
CO2	1	1
CO3	1	1
CO4	1	1
CO5	1	1

Course designed by	Verified by
Signature of the Faculty Member	Signature of the Chaipersan-BoS
Dr. Deepak. A. S&H Dept.	Head of the Department Department of Science & Humanities Nehru Institute of Engineering & Technology Nehru Gardens, Thirumalayampalayam, Coimbatore - 641 105
Name and Department of the Faculty Member	Name and Seal of BoS Chairperson

Course Code	Title					
U23BC204	BASIC CIVIL AND MECHANICAL ENGINEERING					
Semester: II	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites	Basics of Mathematics, Physics and Chemistry					

Course Objectives

1	To introduce the equilibrium of particles and rigid bodies
2	To develop basic dynamics concepts – force, momentum, work and energy
3	To introduce the properties of the fluids, behaviour of fluids under static and dynamic conditions
4	To impart knowledge of basic principles of thermodynamics via engineering examples
5	To introduce basics of heat transfer, related to engineering applications

Course Category	Engineering Science Course (ESC)
Development Needs	Global / National

Course Description: The course focus on the behavior of particles, rigid bodies and fluids on the application of forces. And also, it introduces the thermal behavior through laws of thermodynamics and heat transfer.

Course Content

Unit	Description	
I	**ENGINEERING MECHANICS – STATICS:** Fundamental Concepts and Principles, Systems of Units, Statics of Particles -Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Equilibrium of a Particle- Newton's First Law of Motion – Equilibrium of Rigid bodies - Principle of Transmissibility	
	Contact Periods	**09**
II	**ENGINEERING MECHANICS – DYNAMICS:** Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion -Equations of Motions, Dynamic Equilibrium. Work of a Force, Kinetic Energy of a Particle, Principle of Work and Energy	
	Contact Periods	**09**
III	**FLUID MECHANICS:** Properties of fluids – Fluid statics - Pressure Measurements - Buoyancy and floatation - Flow characteristics - Concept of control volume and system - Continuity equation, energy equation and momentum equation - Applications.	
	Contact Periods	**09**
IV	**LAWS OF THERMODYNAMICS:** Systems, Zeroth law of thermodynamics, first law of thermodynamics. Heat and work transfer in flow and non-flow processes. Second law of thermodynamics - Kelvin-Planck and Clausius statement. Third law of thermodynamics.	
	Contact Periods	**09**

V	**HEAT TRANSFER:** Conduction in simple plane, radial and composite walls – Basics of Convective heat transfer - Fundamentals of Radioactive heat transfer – Flow through heat exchangers (concept only).
	Contact Periods 09
	Total Periods 45

Course Outcomes
Upon successful completion of the course, students will be able to:

CO 1	Illustrate the vector and scalar representation of forces and moments, equilibrium of particles and rigid bodies	K2
CO 2	Determine the dynamic forces acting on rigid bodies	K3
CO 3	Understand the properties and behaviour in static conditions. Also, to understand the conservation laws applicable to fluids and its application through fluid kinematics and dynamics	K2
CO 4	Demonstrate understanding of the nature of the thermodynamic processes for pure substances and interpret the Laws of Thermodynamics	K2
CO 5	Get exposed to the basics and modes of heat transfer.	K2

K1:Remembering; K2:Understanding; K3:Applying; K4:Analyzing; K5:Evaluating; K6:Creating

Text Books	1. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, Sanjeev Sanghi, "Vector Mechanics for Engineers: Statics and Dynamics", McGraw Higher Education., 12thEdition, 2019. 2. Modi P.N. and Seth, S.M., "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 22nd edition (2019) 3. R.K.Rajput, "A Text Book Of Engineering Thermodynamics", Fifth Edition, 2017.
Reference Books	1. Meriam J L and Kraige L G, "Engineering Mechanics: Statics and Engineering Mechanics: Dynamics", 7th edition, Wiley student edition, 2017. 2. Timoshenko S, Young D H, Rao J V and SukumarPati, "Engineering Mechanics" 5thEdition, McGraw Hill Higher Education, 2013. 3. Jain A. K. Fluid Mechanics including Hydraulic Machines, Khanna Publishers, New Delhi, 2014. 4. Kumar K. L., Engineering Fluid Mechanics, Eurasia Publishing House (P) Ltd. New Delhi, 2016 5. Michael J. Moran, Howard N. Shapiro, "Fundamentals of Engineering Thermodynamics", 10th Edition, 2020. 6. Nag.P.K., "Engineering Thermodynamics", 6th Edition, Tata McGraw-Hill, New Delhi, 2017.

Tools for Assessment (40 Marks)

CIA I	CIA II	CIA III	Assignment/ Seminar / Case Study	Attendance	Total
10	10	10	5	5	40

Mapping												
CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	-	2	-	-	-	-	3	-	2
CO2	3	1	2	-	2	-	-	-	-	3	-	2
CO3	3	1	2	-	2	-	-	-	-	3	-	2
CO4	3	1	2	-	2	-	-	-	-	3	-	2
CO5	3	1	2	-	2	-	-	-	-	3	-	2

3-High; 2-Medium; 1-Low

CO / PSO	PSO1	PSO2	PSO3
CO 1	2	2	1
CO 2	2	2	1
CO 3	2	2	1
CO 4	2	2	1
CO 5	3	3	1

Course designed by	Verified by
Signature of the Faculty Member	Signature of the Chairperson-BoS
A. S. RAJAN, AP (SG), MECHANICAL ENGINEERING Name and Department of the Faculty Member	Dr. M. SANTHOSH Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore - 641 105, Tamilnadu, India. Name and Seal of the Chairperson-BoS

Course Code	Title					
U23GE205	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING					
Semester: II	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		

Course pre-requisites	Matrices and Calculus, Engineering Physics

Course Objectives

1	To introduce the basics of electric circuits and analysis.
2	To impart knowledge in the basics of working principles and application of electrical machines.
3	To introduce analog devices and their characteristics.
4	To educate on the fundamental concepts of digital electronics.
5	To introduce the functional elements and working of measuring instruments.

Course Category	Engineering Sciences Course (ESC)
Development Needs	Global / National

Course Description: The course helps the students to develop the fundamentals and basic concepts in Electric circuit analysis, Working Principles of Electrical Machines, Analog/Digital Electronics and functiona elements of Measuring. Students will be able to solve problems related to electric circuits' analysis by using Mesh and Nodal analysis.

Course Content

Unit	Description
I	**ELECTRICAL CIRCUITS:** DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with independent sources only (Steady state) Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor
	Contact Periods 9
II	**ELECTRICAL MACHINES:** Construction and Working principle- DC Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, working principle and Applications of Transformer, Induction Motor, Synchronous motor and Alternator.
	Contact Periods 9
III	**ANALOG ELECTRONICS:** Resistor, Inductor and Capacitor in Electronic Circuits-Semiconductor Materials: Silicon &Germanium – PN Junction Diodes, Zener Diode – Characteristics Applications – Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET, IGBT – Types, I-V Characteristics and Applications, Rectifier and Inverters.
	Contact Periods 9
IV	**DIGITAL ELECTRONICS**: Review of number systems, binary codes, error detection and correction codes, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only).

	Contact Periods	**9**
V	**MEASUREMENTS AND INSTRUMENTATION:** Functional elements of an instrument, Standards and calibration, Operating Principle, types -PMMC and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers-CT and PT.	
	Contact Periods	**9**
	Total Periods	**45**

Course Outcomes
Upon successful completion of the course, students will be able to:

CO 1	Compute the electric circuit parameters for simple problems.	K3
CO 2	Explain the working principle and applications of electrical machines.	K2
CO 3	Analyze the characteristics of analog electronic devices.	K4
CO 4	Explain the basic concepts of digital electronics.	K2
CO 5	Explain the operating principles of measuring instruments.	K2

K1:Remembering; K2:Understanding; K3:Applying; K4:Analyzing; K5: Evaluating; K6: Creating

Text Books	1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020. 2. S.K.Bhattacharya "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition, 2017. 3. Sedha R.S., "A textbook book of Applied Electronics", S. Chand & Co., 2008. 4. James A .Svoboda, Richard C. Dorf, "Dorf's Introduction to Electric Circuits", Wiley, 2018. 5. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.
Reference Books	1. Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill Education, 2019. 2. Thomas L. Floyd, 'Digital Fundamentals', 11th Edition, Pearson Education, 2017. 3. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017. 4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002. 5. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010.

Tools for Assessment (40 Marks)

CIA I	CIA II	CIA III	Assignment/ Seminar/ Case Study	Attendance	Total
10	10	10	5	5	40

Mapping												
CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	-	-	-	-	-	1	-	-	2
CO2	2	2	1	-	-	-	-	-	1	-	-	2
CO3	2	2	1	-	-	-	-	-	1	-	-	2
CO4	2	2	1	-	-	-	-	-	1	-	-	2
CO5	2	2	1	-	-	-	-	-	1	-	-	2

3-High; 2-Medium; 1-Low

CO \ PSO	PSO 1	PSO 2
CO1	2	1
CO2	2	1
CO3	2	1
CO4	2	1
CO5	2	1

Course designed by	Verified by
Signature of the Faculty Member	Signature of the Chairperson-BoS
Dr. S. ARUNKUMAR Name and Department of the Faculty Member	Dr.R.KANNAN PROFESSOR & HEAD Name and Seal of the Chairperson-BoS

Dr.R.KANNAN
PROFESSOR & HEAD
Nehru Institute of Engineering & Technology
Coimbatore - 641 105.

Course Code	Title					
U23EN206	PROFICIENCY IN ENGLISH					
Semester: II	L	T	P	Credits	CIA: 50 Marks	ESE: 50 Marks
	2	0	2	3		
Course pre-requisites	Basic Grammer & Communication Strategies					

Course Objectives

1	To engage learners in meaningful language activities to improve their LSRW skills.
2	To identify personality traits and evolve as a better team player.
3	To develop analytical thinking skills for problem solving in communicative contexts.
4	To demonstrate an understanding of job applications and interviews for internship and placements.
5	To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.

Course Category	Humanities, Social Science and Management Course (HSMC)
Development Needs	Global / National

Course Description: The course emphasis the learners to develop their skills in technical writing and also develop their communication skills.

Course Content

Unit	Description	
I	**MAKING COMPARISONS:** **Reading** – Reading advertisements, Extensive Reading (Activity). **Writing** – Reading Comprehension, Writing a review/ summary of story/article. **Grammar** – Active voice & Passive voice, Prepositional phrases.	
		Contact Periods 06
II	**EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING:** **Reading** – Reading longer technical texts, Reading a short story. **Writing** – Personal letter (Inviting your friend), Congratulating letter, Writing responses to complaints and adjustment letter. **Grammar** – Infinitive and Gerunds, Modals.	
		Contact Periods 06
III	**PROBLEM SOLVING:** **Reading** – Case Studies, news reports, reading passages with time limit. **Writing** – Letter to the Editor, Short report on an event (field trip). **Grammar** – If conditional sentence, Phrasal Verbs.	
		Contact Periods 06
IV	**REPORTING OF EVENTS AND RESEARCH:** **Reading** – Newspaper articles; Reading the job advertisements and the profile of the company. **Writing** – Essay writing and its types (Compare & Contrast, Cause & Effect, Problem & Solution). **Grammar** – Reported Speech, Conjunctions.	
		Contact Periods 06
V	**THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY:** **Reading** – Note making skills – making notes from books. **Writing** – Email Writing, Biographical sketches of famous personalities. **Grammar** – Relative Clauses, Collocation, Fixed & Semi-fixed expressions.	

Contact Periods	**06**
Total Periods	**30**

LIST OF EXPERIMENTS

1. Listen to friends conversations, responding.
2. Role play, talk about past events.
3. Listen to speech of great leader.
4. Talk about travel problems & experience.
5. Listen to movie scenes and responding.
6. Welcome address and vote of thanks.
7. Listening a passage and answering.
8. Talk about present, past situations.
9. Listening to Presentations.
10. Talking about everyday experiences.

Contact Periods	**30**
Total Periods	**60**

Course Outcomes

Upon successful completion of the course, students will be able to:

CO 1	Identify cause and effects in events, industrial processes through technical text.	K2
CO 2	Understand and use tools of structured written communication.	K3
CO 3	Identify individual personality types and role in a team.	K3
CO 4	Understand the basics concepts of morality and diversity.	K1
CO 5	Present their opinion in a planned and logical manner, and draft effective resumes in context of job search.	K6

K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating

Text Books	1. English for Engineers & Technologists, Orient Blackswan Private Ltd. Department of English, Anna University, 2020. 2. Barun.K.Mithra, Personality Development and Soft Skills, OUP India, 2019.
Reference Books	1. Jack C. Richards, "Interchange, Student's Book", 4th Edition, Cambridge University Press, New York, 2017. 2. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi. 3. Muralikrishna & Sunitha Mishra, Communication Skills for Engineers and Scientists, PH Learning, New Delhi, 2009. 4. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd.1990, Delhi. 5. Shalini Varma, "Development of Life Skills and Professional Practice", 1st Edition, Vikas Publishing House Pvt. Ltd., 2014.

Tools for Assessment – Theory					
CIA I	CIA II	CIA III	Assignment/ Seminar / Case Study	Attendance	Total
10	10	10	5	5	40

Tools for Assessment – Practical		
Model Exam I	Model Exam II	Total
50	50	100

Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	3	2	-	2
CO2	1	-	-	-	-	-	-	-	3	2	-	2
CO3	1	-	-	-	-	-	-	-	3	2	-	2
CO4	1	-	-	-	-	-	-	-	3	2	-	2
CO5	1	-	-	-	-	-	-	-	3	2	-	2

3-High; 2-Medium; 1-Low

CO \ PSO	PSO1	PSO2
CO1	-	2
CO2	-	2
CO3	-	2
CO4	-	2
CO5	-	2

Course designed by	Verified by
Signature of the Faculty Member	Signature of the Chairperson-BoS
Dr. R. Deepa Associate Professor of English (S&H) Name and Department of the Faculty Member	Head of the Department Department of Science & Humanities Nehru Institute of Engineering & Technology Nehru Gardens, Thirumalayampalayam, Coimbatore - 641 105 Name and Seal of the Chairperson-BoS

Course Code	Title					
U23GE207	PROBLEM SOLVING USING PYTHON					
Semester: II	L	T	P	Credits	CIA: 50 Marks	ESE: 50 Marks
	2	0	2	3		
Course pre-requisites	Basic Knowledge of Python Programming Knowledge					

Course Objective

1	To understand and develop programs using Python.
2	To apply the concepts of strings, control flow, data types in python programs.
3	To apply programs using list, tuples, dictionaries, and files concept in Python.
4	To analyse image processing, networking and object-oriented programming in Python.
5	To create new ideas for problems in real world application using python.

Course Category	Engineering Sciences Course (ESC)
Development Needs	Global

Course Description: Study the constructs of Python Language

Course Content

Unit	Description	
I	**INTRODUCTION TO PYTHON PROGRAMMING:** Introduction to Python Programming- Python Interpreter and Interactive Mode -Variables- Numerical types- Arithmetic operators and Expressions- Psuedo Code - Values and types: int, float, Boolean - Variables, Expressions, Statements -Illustrative Problems.	
	Contact Periods	**06**
II	**DATA TYPES, CONTROL FLOW, STRINGS:** Control Flow -conditional (if), Alternative (if-else), Chained conditional (if-elif-else)- Iteration: state, while, for, break, continue, pass - Strings: string slices, immutability, string functions and methods, string module, Regular expression, Pattern matching. - Illustrative Problems.	
	Contact Periods	**06**
III	**LISTS, TUPLES DICTIONARIES AND FUNCTIONS:** 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. Functions and User Defined Functions: Simple and Mathematical Built–in Functions, Recursion -Illustrative Problems	
	Contact Periods	**06**
IV	**FILES AND OOPS CONCEPT IN PYTHON:** Files, Text files, reading and writing files- format operator; Files and exception handling -Introduction to Object Oriented Programming – Basic principles of Object-Oriented Programming in Python – Class Definition-Object Creation - Inheritance, Composition, Operator Overloading.	
	Contact Periods	**06**
V	**IMAGE PROCESSING & NETWORKING WITH PYTHON AND APPLICATIONS:** Basics of Image processing- Image File Formats – Introduction to Classic Image Processing Algorithm- Image Processing Tools-Fundamentals of Networking- Introduction to Python Sockets- Simple Client/Server Programming-Python Applications.	
	Contact Periods	**06**
	Total Periods	**30**

LIST OF EXPERIMENTS
1. Simple programs to execute the concept of python for editing, saving and handling error message. 2. Python program using Statements and Expressions (exchange the values of two variables, circulate the values of n variables, distance between two points). 3. Scientific problems using Conditionals and Iterative loops (Number series, Number patterns, pyramid pattern). 4. Programs for functions using python (Factorial, larger number in a list). 5. Implementing programs using regular expressions. 6. Program for implementing strings (reverse, palindrome). 7. Implementing real time application using List, Tuples (Items present in library, operations of list and tuples). 8. Python programs for real time using file handling (Coping from one file to another, word count, longest word)

Contact Periods	**30**
Total Periods	**60**

Course Outcomes
Upon successful completion of the course, Students will be able to:

CO 1	Understand the concepts of Python.	K2
CO 2	Apply appropriate constructs to represent data.	K3
CO 3	Apply programs using different constructs in Python.	K3
CO 4	Analyse a real-world application in image processing and networking.	K4
CO 5	Analyse various simple programs for real world application using python.	K4

K1: Remembering; K2: Understanding; K3: Applying; K4: Analysing; K5: Evaluating; K6: Creating

Text Books	1. Kit Jackson, "Python Programming for Beginners: Skyrocket Your Code and Master Python in Less than a Week. Discover the Foolproof, Practical Route to Uncover Insider Hacks, Unlock New Opportunities, and Revolution", 31 May 2023. 2. Bill Lubanovic, "Introducing Python", 2nd Edition, O'Reilly Media, Inc., 2019.
Reference Books	1. Narry Prince, "Python Programming for Beginners", ISBN-13-979-8870875248, 2023. 2. McKinney, "Python Programming", ISBN-13-979-8870534817, 2023. 3. Robert Oliver, "Python Quick Start Guide: The Simplified Beginner's Guide to Python Programming Using Hands-On Projects and Real-World Applications", ISBN-13-978-163610037, 2023. 4. Eric Chou, "Mastering Python Networking: Utilize Python packages and frameworks for network automation, monitoring, cloud, and management", 2023.

Tools for Assessment - Theory

CIA I	CIA II	CIA III	Assignment / Seminar / Case Study	Attendance	Total
10	10	10	5	5	40

Tools for Assessment– Practical

Model Exam I	Model Exam II	Total
50	50	100

Mapping												
CO \ PO	PO1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	1	-	-	-	-	-	1	1	-	3
CO2	2	-	1	-	-	-	-	-	1	1	-	3
CO3	2	-	1	-	-	-	-	-	1	1	-	3
CO4	2	3	1	-	3	-	-	1	1	1	3	3
CO5	2	3	1	1	3	-	-	1	3	1	3	3

3 – High 2-Medium 1-Low

CO \ PSO	PSO1	PSO2
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2

Course designed by	Verified by
Signature of the Faculty Member	Signature of the Chairperson-BoS
JEEVANANTHAM G, AP(SG), COMPUTER SCIENCE & ENGINEERING Name and Department of the Faculty Member	Dr. S. SUBASREE, M Tech. Ph.D Professor and Head, Computer Science and Engineering, Nehru Institute of Engineering and T Coimbatore TN India Name and Seal of the Chairperson-BoS

Course Code	Title					
U23GE218	ENGINEERING PRACTICES LABORATORY					
Semester: II	L	T	P	Credits	CIA: 60 Marks	ESE: 40 Marks
	0	0	2	1		
Course pre-requisites	Basics of Measurements, Basics of Simple Drawings					

Course Objectives

1	To draw pipe line plan; laying and connecting various pipe fittings used in common household plumbing work.
2	To weld various joints in steel plates using arc welding work.
3	To machine various simple processes and assemble simple mechanical assembly of common household equipments.
4	To solder and test simple electrical and electronic circuits.
5	To assemble and test simple electronic components on PCB.

Course Category	Engineering Science Course (ESC)
Development Needs	Global / National

Course Description: Engineering practices encompass a range of activities such as problem identification, solution design, model construction, technology utilization, testing and evaluation of solutions, and solution communication.

Course Content

List of Experiments

GROUP - A (CIVIL & ELECTRICAL)

Part I

CIVIL ENGINEERING PRACTICES:

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
b) Laying pipe connection to the suction side and delivery side of a pump.
c) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:

a) Sawing and Planing
b) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

ELECTRICAL ENGINEERING PRACTICES:

a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket.
b) Fluorescent Lamp wiring with introduction to CFL and LED types.
c) Energy meter wiring and related calculations/ calibration.
d) Study of Iron Box wiring and assembly.
e) Study of Fan Regulator (Resistor type and Electronic type using Diac /Triac /Quadrac).
f) Study of emergency lamp wiring/Water heater.

GROUP - B (MECHANICAL AND ELECTRONICS)	
Part II	**MECHANICAL ENGINEERING PRACTICES:** WELDING WORK: a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding. b) Practicing gas welding. BASIC MACHINING WORK: a) (Simple) Turning, Drilling and Tapping. ASSEMBLY WORK: a) Assembling a centrifugal pump. b) Assembling a household mixer. c) Assembling an air conditioner. SHEET METAL WORK: a) Making of a square tray. FOUNDRY WORK: a) Demonstrating basic foundry operations. **ELECTRONIC ENGINEERING PRACTICES:** SOLDERING WORK: a) Soldering simple electronic circuits and checking continuity. ELECTRONIC ASSEMBLY AND TESTING WORK: a) Assembling and testing electronic components on a small PCB. ELECTRONIC EQUIPMENT STUDY: a) Study elements of smart phone. b) Assembly and dismantle of LED TV. c) Assembly and dismantle of computer/ laptop.
	Total Periods 30

Course Outcomes
Upon successful completion of the course, students will be able to:

CO 1	Understand the basics of Plumbing and carpentry works	K1
CO 2	Comprehend the basic fabrication process like welding and sheet metal operations	K3
CO 3	Understand the machining operations-Turning/Facing/Step turning, Chamfering & Knurling	K1
CO 4	Differentiate the various types of Electrical wiring and analyze basic parameters of Electrical circuits	K2
CO 5	Demonstrate the basic electronic components and equipment's and acquire knowledge in PCB fabrication and Soldering.	K3

K1:Remembering; K2:Understanding; K3:Applying; K4:Analyzing; K5:Evaluating; K6:Creating

Tools for Assessment (40 Marks)				
Preparation	Conduct of Experiments	Calculations & Result	Viva-Voce	Total
20	30	40	10	100

Tools for Assessment (20 Marks)		
Model Exam 1	Model Exam 2	Total
50	50	100

Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	1	1	1	-	-	-	-	2
CO2	3	1	-	-	1	1	1	-	-	-	-	2
CO3	3	1	-	-	1	1	1	-	-	-	-	2
CO4	3	1	-	-	1	1	1	-	-	-	-	2
CO5	3	1	-	-	1	1	1	-	-	-	-	2

3-High; 2-Medium; 1-Low

CO / PSO	PSO1	PSO2	PSO3
CO 1	2	1	1
CO 2	2	1	1
CO 3	2	1	1
CO 4	2	1	1
CO 5	3	1	1

Course designed by	Verified by
Signature of the Faculty Member	Signature of the Chairperson-BoS
A. S. RAJAN, AP(SG) MECHANICAL ENGINEERING Name and Department of the Faculty Member	Dr. M. SANTHOSH Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore - 641 105, Tamilnadu, India. Name and Seal of the Chairperson-BoS