R-2025- F.E Computer Engineering

F.E Syllabus

Semester-I

Theme: Digital Empowerment for All: Unlocking Opportunities through Accessible Technology in Mira Bhayandar and Beyond

Aligned with UNSDG 4: Quality Education, UNSDG 10: Reduced Inequalities, UNSDG 8: Decent Work and Economic Growth

Keywords: Accessible, digital literacy, disabilities.

This theme, " Digital Empowerment for All: Unlocking Opportunities through Accessible Technology in Mira Bhayandar and Beyond," is a critical framework for understanding how technology can be a powerful tool for positive social and economic change, particularly in a context like Mira Bhayandar. It directly addresses the aspirations of several United Nations Sustainable Development Goals (UNSDGs): Quality Education (4), Reduced Inequalities (10), and Decent Work and Economic Growth (8).

- **For Quality Education (UNSDG 4):**
  - **Online Learning Access:** Providing students, especially those in underprivileged areas of Mira Bhayandar, with access to online educational resources, e-libraries, and virtual classrooms.
  - **Digital Skills for Students:** Integrating digital literacy into school curricula, preparing students for a digitally-driven future.
  - **Teacher Training:** Equipping educators with the skills to use technology effectively in their teaching and to adapt to diverse learning needs.
  - **Special Needs Education:** Leveraging accessible technology to provide tailored learning experiences for children with disabilities, enabling their inclusion in mainstream education.

- **For Decent Work and Economic Growth (UNSDG 8):**
  - **Digital Upskilling for Employment:** Training programs in coding, digital marketing, data analysis, and other in-demand digital skills for unemployed youth, women, and other vulnerable groups.
  - **Gig Economy and Remote Work:** Enabling marginalized individuals to access online work opportunities and participate in the gig economy, providing flexible income sources.
  - **Entrepreneurship and E-commerce:** Empowering small businesses and local artisans in Mira Bhayandar to leverage digital platforms for marketing, sales, and reaching wider markets.
  - **Financial Inclusion:** Facilitating access to digital banking, mobile payments, and other financial services for those traditionally excluded from formal financial systems.

- **Accessible Workplaces:** Ensuring that digital tools and environments are accessible, allowing people with disabilities to secure and thrive in decent jobs.

- **For Reduced Inequalities (UNSDG 10):**
- **Equal Access to Information and Services:** Ensuring that all citizens, regardless of socio-economic status, location, gender, age, or disability, can access essential government services, healthcare information, and community resources online.
- **Voice and Participation:** Empowering marginalized groups to use digital platforms for advocacy, community organizing, and civic engagement, thereby increasing their voice in decision-making processes.
- **Bridging Gender and Rural-Urban Divides:** Targeted interventions to address specific digital disparities faced by women or by those in rural areas compared to urban centers like Mira Bhayandar.
- **Empowerment of Persons with Disabilities:** By providing accessible technology, individuals with disabilities can overcome barriers to education, employment, and social participation, leading to greater independence and equality.

  In the context of Mira Bhayandar, a rapidly developing urban area with diverse populations and varying levels of access and privilege, this theme is highly pertinent. It calls for strategic investments in infrastructure, digital literacy, and inclusive technology design to ensure that the city's growth is truly inclusive and benefits all its residents.

Problem Statement:

1. "**In Mira Bhayandar, many students from low-income families and individuals with learning disabilities often struggle to access quality educational resources and skill-building opportunities outside of traditional classroom settings due to a lack of affordable and accessible digital tools and relevant, engaging digital content. This gap limits their ability to independently learn, explore career paths, and develop essential digital literacy skills needed for decent work in the modern economy.**

2. "**Many small businesses, local artisans, and home-based entrepreneurs in Mira Bhayandar, particularly those run by women or individuals from marginalized communities, struggle to effectively leverage digital platforms for market access, sales, and business management due to a lack of digital literacy, affordable e-commerce tools, and understanding of online marketing. This digital exclusion limits their economic growth potential and ability to compete in a rapidly digitizing economy.**"

3. **"Despite significant infrastructure development, many residents in Mira Bhayandar, particularly youth from lower-income backgrounds, lack the specific digital skills required for the new jobs emerging from the city's commercial and service sector growth (e.g., e-commerce logistics, digital customer support, smart city operations)."**

4. **"Accessing reliable, understandable, and culturally relevant health and wellness information remains a challenge for many vulnerable populations in Mira Bhayandar, including women, children, and the elderly, especially when considering digital literacy barriers and the complexity of medical jargon. This often leads to preventable health issues and unequal access to vital health knowledge that impacts their overall well-being and productivity."**

5. **"As the Mumbai Metro Line 9 expands into Mira Bhayandar, a significant portion of daily commuters, particularly those with low digital literacy or visual impairments, faces difficulties in accessing real-time, accurate, and accessible digital information regarding metro schedules, routes, delays, and last-mile connectivity."**

6. **"Individuals new to the digital world in Mira Bhayandar, often lack understanding of data privacy, online security practices, and how their personal information is used, leading to potential exploitation or reluctance to adopt digital services."**

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Course Code	Course Name	Teaching Scheme (Contact Hours Per week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
12111101	Linear Algebra and Calculus	2	1	--	30	15	--	45	90	3

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-1	IAT-2	IAT-1+IAT-2					
12111101	Linear Algebra and Calculus	20	20	40	60	2.5	25	--	125

Rationale:

The topics of matrices and linear equations are fundamental in computer engineering for representing and solving problems involving circuit networks, 3D transformations in graphics, and systems of equations in programming logic. Eigenvalues and eigenvectors are widely used in stability analysis of dynamic systems, facial recognition, and data compression techniques like PCA in machine learning. Similarity and diagonalization simplify matrix computations and are especially useful in systems design and simulation tools where computational efficiency is crucial. Partial differentiation plays a key role in optimizing multivariable functions, commonly used in algorithm tuning, performance analysis, and training of machine learning models. Finally, analytic functions in complex variables provide critical tools for signal analysis, control system design, and solving boundary-value problems in electromagnetic field computations. Collectively, these mathematical foundations support a wide range of applications in computer engineering, from hardware modeling to software optimization.

Course Objectives:

1. To introduce matrix operations and their applications in representing and manipulating data structures in computing.
2. To develop techniques to solve systems of linear equations that arise in algorithmic design, logic circuits, and numerical computation.
3. To understand eigenvalues and eigenvectors and their role in analyzing linear transformations and reducing data complexity.
4. To explore matrix similarity and diagonalization for simplifying computations in modeling and dynamic system simulation.
5. To understand partial derivatives in the context of multivariable optimization relevant to computing system parameters.
6. To introduce analytic functions of complex variables and their applications in signal processing and system analysis.

Course Outcomes:

1. Students will be able to apply matrix operations and use SCILAB to solve problems in computer graphics, data modeling, and graph-based algorithms.
2. Students will be able to solve and analyze systems of linear equations relevant and use SCILAB to memory allocation, logical constraints, and circuit analysis.
3. Students will be able to use eigenvalues and eigenvectors and use SCILAB in applications like machine learning (PCA), Google PageRank, and system behavior analysis.
4. Students will be able to diagonalize matrices and use SCILAB to solve problems in dynamic system modeling, recursive algorithms, and performance optimization.
5. Students will be able to apply partial differentiation and use SCILAB to optimize system performance, algorithm efficiency, and modeling in machine learning.
6. Students will be able to apply properties of analytic functions and use SCILAB in modeling signal behavior, frequency domain analysis, and digital filtering.

Prerequisite:

1. Addition, multiplication, transpose, and inverse of a matrix**.**
2. Review of Complex Numbers-Algebra of Complex Numbers, Cartesian, polar and exponential form of complex number.

DETAILED SYLLABUS

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
I	Matrices	Types of Matrices (Symmetric, Skew- symmetric, Hermitian, Skew-Hermitian, unitary, orthogonal matrices and properties of matrices).	05	CO1
		Rank of a matrix using Echelon form, reduction to normal form and PAQ form.		
		Application of matrices to Coding and De-coding		
		Self-learning Topics: 1. PAQ form for rectangular matrices. 2. Reduction to normal form. 3. Theorems on sum of symmetric and skew symmetric matrices and similar theorems. 4. Properties of transpose, conjugate of matrices	10	
II	System of Linear Equations	System of Linear homogeneous and non–homogeneous equations, their consistency and solutions using rank.	05	CO2
		Linear dependence and independence of vectors. Linear combination of vectors		
		Solution of a system of linear algebraic equations, by (i) Gauss Jacobi Iteration Method, (ii) Gauss Seidel Iteration Method.		
		Self-learning Topics: 1. Vector Spaces	10	

		2. Linear Transformations. 3. Rank -Nullity theorems.		
III	Eigen values and Eigen vectors	Eigenvalues & eigenvectors of all types of matrices (symmetric, skew symmetric, orthogonal, triangular) and its properties (without proof).	05	CO3
		Cayley-Hamilton Theorem (without proof), verification and reduction of higher degree polynomials		
		Self-learning Topics: 1. Quadratic forms. 2. Reduction to quadratic forms 3. Rank, signature and index of a quadratic forms	10	
IV	Similarity and diagonalization of matrix	Similar matrices, diagonalizable matrices, orthogonally diagonalizable matrices and functions of square matrix.	05	CO4
		Minimal polynomial, Derogatory and non-derogatory matrices.		
		Singular value decomposition (SVD)		
		Self-learning Topics: 1. Functions of Square Matrix 2. Orthogonally diagonalization.	10	
V	Partial Differentiation	Function of two and three variables, Partial derivatives of first and higher order. Differentiation of composite function.	05	CO5
		Maxima and Minima of a function of two independent variables.		
		Lagrange's Multiplier method with one condition.		
		Self-learning Topics: 1. Euler's Theorem on Homogeneous functions with two independent variables.	10	

		2. Euler's Theorem on Homogeneous functions with three independent variables. 3. Deductions from Euler's Theorem. 4. Total differentials 5. Implicit Functions		
VI	Complex Variables – Differentiation	Circular functions of complex number and Hyperbolic functions. Analytic function, necessary and sufficient conditions for f(z) to be analytic (without proof),		
		Cauchy-Riemann equations in Cartesian coordinates (without proof, Polar form not included)	05	CO6
		Milne-Thomson method to determine analytic function f(z) when real (u)or imaginary part (v) is given.		
		Harmonic function, Harmonic conjugate, and orthogonal trajectories.		
		Self-learning Topics: 1. Expansion of $\sin^n\theta$, $\cos^n\theta$ in terms of sines and cosines of multiples of θ and Expansion of sinnθ, cosnθ in powers of sinθ, cosθ. 2. Powers and Roots of a complex number. 3. Logarithm of Complex Number 4. Inverse Hyperbolic Functions. Separation of real and imaginary parts of all types of Functions.	10	

Text Books:

1. Grewal B. S.: "Higher Engineering Mathematics", Khanna Publishers, 44th Ed., 2021.

2. Kreyszig E.: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

3. Dass H. K.: "Higher Engineering Mathematics", S Chand & Company Ltd, 12th Ed., 2004.

4. Narayan S.: "Differential Calculus", S.Chand Publications, 30th Ed., 2005.

References:

1. Strang G.: "Linear Algebra and its Applications", Cengage Publications, 4th Ed. 2022.
2. Stewart J.: "Multivariable Calculus" Cengage Publications, 7th Ed., 2019.
3. Jain M.K., Iyengar SRK, Jain R K,: "Numerical Methods for Scientific and Engineering Computation", New Age International Publishers, 6th Ed., 2007.
4. Bali N.P and Goyal M.: "A Textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
5. Williams G.: "Linear Algebra with Applications", Jones Bartlett Publishers Inc., 6th Ed., 2017.
6. Wylie C. R, Barrett L.C..: "Advanced Engineering Mathematics" McGraw Hill Book Co., New York, 6th Ed., 2017.
7. Ramana B.V.: "Higher Engineering Mathematics", Tata McGraw-Hill Publishing Company Limited, 1st Ed., 2006.
8. Gupta C.B, Sing S.R and Mukesh Kumar: "Engineering Mathematic for Semester I and II", Mc-Graw Hill Education, 2015.
9. Lay D. C: "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.
10. Pal S. & Bhunia S. C.: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016

Online References:

Sr. No.	Website Name
1.	https://www.math.ucdavis.edu/~daddel/linear_algebra_appl/Applications/applications.html
2.	https://onlinelibrary.wiley.com/doi/10.1155/2016/4854759
3.	https://archive.nptel.ac.in/courses/111/108/111108066/

4.	https://archive.nptel.ac.in/courses/111/104/111104092/

Term work(TW) for 25 marks:

1. Batch-wise tutorials are to be conducted.

2. Students must be encouraged to write SCILAB Programs in tutorial class only. Each Student has to write **at least 05 SCILAB tutorials** (including print out) and **at least 10** class tutorials on entire syllabus.

3. SCILAB Tutorials on entire syllabus.

The distribution of Term Work marks will be as follows –

1. Regularity and active involvement (Theory and Tutorial) 05 marks

2. Class Tutorials on entire syllabus 10 marks

3. SCILAB Tutorials 10 marks

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) Notional Learning Hour/30
12121102	Engineering Mechanics	2	-	-	30	-	-	30	60	2

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT - 1	IAT - 2	IAT-1+IAT -2					
12121102	Engineering Mechanics	20	20	40	60	2.5	--	--	100

Rationale:

Engineering mechanics is a branch of science that deals with the behaviour of solid bodies when subjected to external forces or loads and the effects of these forces on the bodies. Though traditionally software-focused, Computer and IT engineers increasingly interact with physical systems through areas like robotics, virtual reality, gaming, digital twin technology, and simulation. Engineering Mechanics introduces the physical principles of force, motion, and equilibrium, which are essential for the development of realistic simulation engines, AI-based mechanical system models, and integration of software with hardware systems. This subject helps build computational models of mechanical phenomena and enhances interdisciplinary competence for modern applications.

Course Objectives

1	To acquaint with basic principles of Centroid and its real-life significance
2	To familiarize with the concepts of force, moment, couple, resultant and system of coplanar and non-coplanar forces.
3	To familiarize with the concepts loads, beams, equilibrium conditions, friction and their real-life applications.
4	To understand the motion parameters required for quantification of Kinematics of Particle and Rigid body.

5	To understand the combination of force and motion parameters required for quantification of Kinetics of rigid body.
6	To acquaint with the basics of Robot kinematics

Course Outcomes

1	Demonstrate the understanding of Centroid and locate the same.
2	Determine the resultant and equivalent force-couple system for a given system of forces.
3	Illustrate the concept of loads, supports, beams, conditions of equilibrium, and friction and apply the same in two dimensional systems with the help of FBD.
4	Determine the position, velocity, and acceleration of particle and rigid body using principles of kinematics for rectilinear, curvilinear and general plane motion.
5	Apply the principles of force and acceleration, work-energy and impulse-momentum to particles in motion.
6	Establish the relation between robot joints and parameters

Prerequisite: Student shall have passed HSC (Higher Secondary Certificate) along with basic understanding of physics and mathematics in following topics:-

1. **Basic Vector Algebra**
   – Understanding of vector addition, subtraction, scalar and vector products.
   – Ability to resolve vectors into components.
2. **Fundamentals of Classical Physics**
   – Concepts of force, motion, Newton's laws, equilibrium, and gravity.
   – Understanding of mass, weight, friction, and types of motion.
3. **Basic Trigonometry and Geometry**
   – Familiarity with sine, cosine, tangent functions.
   – Knowledge of angles, triangles, and coordinate systems.
4. **Problem-Solving and Logical Reasoning Skills**
   – Ability to approach real-world physical problems logically.
   – Basic analytical thinking and spatial reasoning.

Detailed Syllabus

Module no.	Module Name	Detailed content	Teaching hours	CO
0	**Prerequisite**	Statics, Dynamics, Kinetics, Kinematics, Rigid body, Deformable body, applying trigonometric functions, resolution of a vector (Force vector), Law of triangle, Polygon law of forces, Newton's laws of motion Velocity, acceleration, displacement, Uniform velocity and accelerated motion, Law of conservation of Energy, Law of conservation of	01 01	

		Momentum, work-energy principle, impulse and momentum principle, and Coefficient of restitution		
1	**Centroid**	i. Characteristics, and real-life significance for Centroid ii. Centroids of primary geometrical shapes and plane laminas **Self-learning topic:** - Centroid for area with sector and real-life application - Exploring Moment of Inertia for primary geometrical shapes and plane laminas	03 03	CO1
2	**Force and System of Forces**	i. Principle of transmissibility, Moment of force about a point and concept of couple ii. Classification of force systems iii. Resultant of coplanar system of forces and Varignon's Theorem iv. Resultant of non-coplanar concurrent system of forces **Self-learning topic:** - Exploring force and a couple system and real-life application of a force and a couple system - Resultant of non-coplanar parallel and general system of forces	05 05	CO2
3	**Equilibrium and Friction**	i. Conditions of equilibrium for system of forces and free body diagrams, Types of beams, loads, and support and its reaction ii. Equilibrium of beams, rollers, and system of bodies iii. Laws of friction. Cone of friction. angle of repose, and angle of friction iv. Application of equilibrium with friction on blocks on horizontal and inclined planes and ladders **Self-learning topic:** Equilibrium of connected bodies (beam and sphere), two force and three	07	CO3

		force members, beams connected using internal hinges - Application of equilibrium with friction - Wedge and block	07	
4	**Kinematics of particles and rigid bodies**	i. Motion along plane curved path, Variable acceleration for rectilinear motion, projectile motion ii. Introduction to General plane motion, problem based on Instantaneous centre (ICR) method for general plane motion (up to 2 linkage mechanism and roller) **Self-learning topic:** - Application of motion graph for real-life problems - ICR for rollers, wheels and three links problems - ICR for system of rigid bodies	06 06	CO4
5	**Kinetics of particles**	i. Introduction to D'Alembert's Principle (DAP), inertia force, dynamic equilibrium, Work done by active forces, impact and collision ii. Problems on DAP (single and double block), and WEP (single block) **Self-learning topic:** - Application of WEP to the real-life problems - Explore the concept of impact and collision for rigid bodies	04 04	CO5
6	**Introduction to Robot Kinematics**	i. Fundamental of Robot Mechanics, Degree of Freedom, D-H Parameters, robot kinematics (Forward) ii. Homogeneous transformation (limited to 2 DOF Serial robot) **Self-learning topic:** - Derive and Analyze - Manual derivation of forward kinematics using D-H parameters	04 04	CO6

		- Explore online simulation tools such as MATLAB Robotics Toolbox Online and refer https://kinematicsplayground.org/ - Solve 2 numerical problems involving: Assigning D-H parameters and finding of end-effector pose using transformation matrices		

Text Books:

1. Engineering Mechanics by A K Tayal, Umesh Publication.
2. Engineering Mechanics by Kumar, Tata McGraw Hill
3. Engineering Mechanics by Beer &Johnston, Tata McGraw Hill

References:

1. Engineering Mechanics by R. C. Hibbeler.
2. Engineering Mechanics by F. L. Singer, Harper& Raw Publication
3. Engineering Mechanics by Macklin & Nelson, Tata McGraw Hill

Online References:

Sr. No.	Website Name
1	https://archive.nptel.ac.in/courses/112/106/112106286/
2	https://archive.nptel.ac.in/courses/112/106/112106180/

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Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30
12121103	**Digital Logic & Computer Organization Architecture**	3	--	--	45	--	--	45	90	3

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration(in Hrs)			
		IAT - 1	IAT - 2	IAT-1+IAT -2					
12121103	**Digital Logic & Computer Organization Architecture**	20	20	40	60	2.5	--	--	100

Rationale :

This syllabus equips students with **computer fundamentals, digital logic design, computer organization, memory systems, arithmetic algorithms, and I/O organization** to develop accessible, inclusive, and sustainable technology solutions, It emphasizes building **digital literacy, design thinking, and problem-solving abilities** that enable learners to create affordable assistive devices, inclusive learning kits, and smart civic systems for **marginalized and differently abled communities**.by integrating **self-learning extensions, and real-world case studies** promotes **equitable access to technology**, and strengthens students' capacity to contribute to the **local digital economy**.aligning with UNSDG 4 (Quality Education), UNSDG 8 (Decent Work), and UNSDG 10 (Reduced Inequalities) under the theme Digital Empowerment for All."

Course Objectives:

1. To impart knowledge of number systems, binary codes, logic gates, and Boolean function minimization.
2. To enable design and analysis of combinational and sequential digital circuits.
3. To develop understanding of computer organization, control unit design, and pipelining.
4. To explain hierarchical memory organization and cache memory implementation.
5. To implement arithmetic algorithms and data representation standards.
6. To analyze I/O architectures and data transfer mechanisms in computing systems

Course Outcomes: At the end of the course students will be able to

1. Apply number system conversions, binary codes, and K-map minimization for digital logic circuits.
2. Design and evaluate combinational and sequential circuits including counters and shift registers.
3. Demonstrate understanding of computer architecture, control unit design, and instruction execution.
4. Analyze memory hierarchy, cache mapping techniques, and coherency mechanisms.
5. Perform arithmetic operations using Booth's algorithm, signed division, and IEEE 754 standards.
6. Compare and implement I/O systems using programmed I/O, interrupts, and DMA techniques.

Prerequisite: Boolean Algebra basics

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DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Boolean Algebra basics:Boolean Variables and Constants, Basic Operations, Boolean Laws & Properties, DeMorgan'sTheorems, Standard Forms Canonical Forms, Boolean Function Reduction.	0	
I	Computer Fundamentals	Introduction to Number System and Codes. Number Systems: Binary, Octal, Decimal, Hexadecimal. and their conversions, 1's and 2's complement Codes: Grey, BCD, Excess-3, ASCII, Boolean Algebra. reduction using Boolean laws. Logic Gates: AND, OR, NOT, NAND, NOR, EX-OR. Standard. SOP and POS form. Reduction of Boolean functions using K-map method (2,3,4 Variable), Don't care condition, NAND, NOR Realization Logic.	8	CO1
		Self-learning Topics: Number System, Quine-McCuskey, codes conversion.	5	
II	Design of Combinational and Sequential Logic	Combinational Circuits: Half & Full Adder, Half & Full subtractor, introduction to Multiplexers and Demultiplexers, Encoders & Decoders. Sequential Circuits: Introduction to Flip Flops: SR, JK, D, T, master slave flip flop, Truth Table. Counters: Introduction to Asynchronous and Synchronous Counters, UP- DOWN counter. Shift Registers: SISO, SIPO, PIPO, PISO.	8	CO2
		Self-learningTopics: McCluskey,Flip-Flop conversion, Counter Design, Universal Shift Register, Ring and twisted ring/Johnson Counter.	7	

III	Introduction of Computer Organization and Architecture	Introduction of Computer Organization and Architecture. Basic organization of computer and block level description of the functional units. Evolution of Computers, Von Neumann model. Performance measure of Computer Architecture, Amdahl's Law. Instruction interpretation and sequencing. Control Unit: Soft wired (Microprogrammed) and hardwired control unit design methods. Introduction to parallel processing concepts, Flynn's classifications, instruction pipelining, pipeline hazards.	8	CO3
		Self-learning Topics: CISC VS RISC Architetcure**,**Microinstruction sequencing and execution. Micro operations, concepts of nano programming. Case study : Design a Power-Efficient Architecture Model for Solar-Based Digital Learning Kits	8	
IV	Memory Organization	Introduction to Memory and Memory parameters. Classifications of primary and secondary memories. Types of RAM and ROM, Allocation policies, Memory hierarchy and characteristics. Cache memory: Concept, locality of reference, architecture (L1, L2, L3), mapping techniques. Cache coherence and write policies., Interleaved and Associative memory.	6	CO4
		Self-learning Topics: Case study on Memory Organization, Numerical on finding EAT, Address mapping, Virtual Memory Management-Concept, Segmentation, Paging, Page Replacement policies.	8	

V	Data Representation and Arithmetic Algorithm	Booth's algorithm. Division of integers: Restoring and non-restoring division, signed division, basics of floating-point representation IEEE 754 floating point(Single & double precision) number representation.	7	CO5
		Self-learning Topics: Real-World Applications of Booth's Algorithm in Digital Signal Processing (DSP) and Embedded Systems, Comparative Study of Booth's Algorithm vs. Traditional Binary Multiplication	9	
VI	I/O Organization	Input/output systems, I/O module-need & functions and Types of data transfer techniques: Programmed I/O, Interrupt driven I/O and DMA Self-learning Topics: Comparison of all I/O methods. Case study : **1.** Develop a Number System Conversion App (Binary/Decimal/Hex/Octal) with audio output for visually impaired learners. **2.** Designing a Digital Clock Interface for Visually Impaired Users Using BCD and ASCII Codes. **3.** Low-Cost Digital Learning Kit for Children with Learning Disabilities **4.** Smart Voting Booth Logic Using Priority Encoders and Decoders for Inclusive Civic Participation. **5.** Queue Management System for Clinics Using Counters and Flip-Flops Implementation of Floating Point-Based Health Metrics Calculator for ASHA Workers	8	CO6
		Self-learning Topics: Comparison of all I/O methods and their uses.	8	

Text Books:

1. R. P. Jain,"Modern Digital Electronics", TMH
2. M. Morris Mano,"Digital Logic and Computer Design", PHI
3. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, Computer Organization, Fifth Edition, Tata McGraw-Hill.
4. William Stallings, Computer Organization and Architecture: Designing for Performance, Eighth Edition,Pearson.

References:

1. Anand Kumar, "Fundamentals of Digital Circuits",. PHI
2. Donald P Leach, Albert Paul Malvino, "Digital Principals & Applications", TMH.
3. B. Govindarajulu,, Computer Architecture and Organization: Design Principles and Applications,
4. Computer Architecture and Organization: Design Principles and Applications, Tata McGraw-Hill
5. Dr. M. Usha, T. S. Srikanth, Computer System Architecture and Organization, First Edition,Wiley-India.
6. John P. Hayes, Computer Architecture and Organization, Third Edition., McGraw-Hill Publication.

Online References:

Sr. No.	Website Name
1.	https://www.nptel.ac.in
2.	https://www.geeksforgeeks.org
3.	https://www.coursera.org/

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learni ng Hour	Total Credit s (C) (Notional Learning Hour/30
12121104	Internet Technology	2	--	--	30	--	--	30	60	2

Course Code	Course Name	Theory					Ter m work	Prac t / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT - 1	IAT -2	IAT-1+ IAT-2					
12121104	Internet Technology	20	20	40	60	2.5	--	--	100

Rationale :

In today's digitally driven world, the Internet has become the foundation for communication, commerce, education, and innovation. Understanding Internet Technology is essential for students to harness the power of web-based platforms, applications, and services that impact all industries and aspects of daily life. This course provides students with the technical knowledge and practical skills required to design, develop, and deploy interactive and accessible web solutions. Through this subject, learners will gain insight into the core principles of web

architecture, standards, and tools, equipping them to build user-centric, responsive, and semantically correct websites. Students will also explore modern trends such as responsive design, multimedia integration, data formats (XML/JSON), and UI/UX prototyping using tools like Figma. The course emphasizes both technical proficiency and design thinking, ensuring students can develop solutions that are not only functional but also accessible, inclusive, and visually appealing.

Course Objectives:

1 To introduce students to the fundamentals of the Internet, web technologies, and protocols.
2 To enable students to build well-structured, semantic, and accessible web pages using HTML5.
3 To apply CSS3 for creating responsive, visually appealing, and device-independent web layouts.
4 To introduce structured data representation using XML and JSON, enabling them to understand syntax, validation methods, and practical applications in data exchange.
5 To introduce students to Figma for UI/UX design and prototyping in web and mobile development.
6 To apply theoretical concepts to real-world case studies focusing on digital empowerment and civic engagement**.**

Outcomes:

1. Understand the evolution, structure, and working principles of the Internet and core web technologies including DNS, protocols, and document models. (L1,L2,L3)
2. Design and develop web pages using semantic HTML5 elements with proper structure, accessibility features, and multimedia integration. (L1,L2,L3,L4,L5,L6)
3. Use CSS3 to create responsive, interactive, and animated web pages with layout control, transitions, and visual styling techniques. (L1,L2,L3,L4,L5,L6)
4. Students will be able to create, validate, and compare XML and JSON documents for effective use in web and application-based data communication. (L1,L2,L3,L4)
5. Use Figma to prototype web and mobile user interfaces, demonstrate navigation flow, component reuse, and collaborative design sharing. (L1,L2,L3,L4,L5)
6. Apply web development concepts to real-life case studies such as health portals,

educational platforms, and library systems to promote digital empowerment (L1,L2,L3,L4,L5,L6)

Prerequisite: None

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
I	Introduction to Internet technology	1.1 Introduction to Web & Internet, History and Evolution of Internet, Internet vs Extranet vs Intranet 1.2 Working of web browser, HTTP/HTTPS protocols DNS, TLS/SSL (security implications) DOM (Document Object Model), URL, URI, Introduction	**03**	CO1
		Self-learning Topics: Explore Nginx and Apache web servers.	**03**	
II	HTML AND HTML5	2.1 Introduction to HTML. Purpose and Structure. Evolution of HTML to HTML5. 2.2 Basic Tags, Text Formatting. Headings and Paragraphs. 2.3 Lists, Hyperlinks and Anchors, Images: Tag and attributes, Grouping Elements, Tables, Input type: 2.4. HTML5 Form Validations: required, pattern, placeholder, autofocus. 2.5 Semantic Elements, Benefits of semantic HTML Accessibility and SEO advantages Multimedia and Embedding in HTML5	**06**	CO2

		Self-learning Topics: Introduction to <canvas> and SVG for basic graphics. New Input Types: email, URL, search, color, range	**07**	
III	CSS AND CSS3	3.1 Introduction to CSS. Purpose and advantages of CSS, Types of CSS: 3.2 CSS Syntax and Selectors: Text properties, Backgrounds, Borders and Outlines, Margin and Padding, Width, Height, and Box Model. 3.3 Display property, Positioning Advanced Selectors (attribute selectors, pseudo-classes) 3.4 CSS3 – Gradients, Rounded Corners Shadows, Transitions and Animations, Transform: rotate, scale, translate opacity and visibility	**06**	CO3
		Self-learning Topics: Z-index, Overflow handling, CSS Grid (basic introduction)	**06**	
IV	XML AND JSON	4.1 Basics of XML: Tags, Elements, Attributes XML Syntax Rules, Well-formed vs Valid XML, XML Document Structure: Prolog, DTD, CDATA 4.2 Namespaces in XML, Document Type Definition (DTD), XML Schema Definition (XSD) 4.3 Introduction to JSON and its advantages, Syntax and Data Types, JSON Objects, Arrays, Nested JSON JSON vs XML: Comparison of use-cases and performance	**05**	CO4
		Self Learning Topics :XML Editors and Validation ls (e.g., Oxygen XML, XML Notepad), Explore lic APIs that return JSON (e.g., Open Weather, Hub, News APIs)	**04**	

V	UI/UX - Figma	5.1 What is Figma? Interface and Navigation 5.2 Creating Frames, Shapes, and Text 5.3 Designing Web Pages and Mobile Screens 5.4 Components and Reusability 5.5 Prototyping and Interactive Links Exporting and Sharing Designs	**05**	CO5
		Self Learning Topics: Figma Plugins and Community Resources	**05**	
VI	Application on Internet Technology	**CASE STUDY 1 :** Instagram-like animations use transitions and transform properties. **Case Study : 2**Netflix and Amazon use responsive design to adapt layout for mobile and desktop. **Case Study 3:** Develop a simple education content portal for youth and adult learners in Mira Bhayandar. C**ase Study 4**: Build an online web interface for local public libraries where users can: Search available books, Reserve a book, View due dates and return policies **Case Study 5:** Smart Health Info Portal - Design a mobile-friendly health information portal for Mira Bhayandar residents that displays nearby clinics, emergency contacts, and health tips. **Case Study 6:** Feedback System for Digital Services- Develop a simple citizen feedback system for digital services in Mira Bhayandar **Case Study 7:** UI Prototype forLocal Government App - Create a Figma-based prototype for a digital public service app aimed at simplifyingservices like birth certificate	**05**	CO6
		Self Learning : Mobile-First Web Development Techniques, **Postman** - API testing tool to work with JSON, XML, and RESTful service.	**05**	

Text Books:

1. **H. M. Deitel, P. J. Deitel, A. B. Goldberg**, Internet & World Wide Web – How to Program, 5th Edition, Pearson Education.
2. **Sasha Vodnik**, HTML5 and CSS3, Illustrated Complete, Cengage Learning, Latest Edition.
3. **Kogent Learning Solutions Inc.**, Web Technologies: HTML, JavaScript, PHP, Java, JSP, ASP.NET, XML and Ajax, Black Book, Dreamtech Press, Latest Edition.
4. **Jon Duckett**, Web Design with HTML, CSS, JavaScript and jQuery Set, Wiley, 1st Edition.
5. **Masud Hossain**, Figma for UI/UX Design, Independently Published, 2022

References:

1. Andrew S. Tanenbaum, *Computer Networks*, 4th Edition, Pearson Education.
2. ISRD Group, *Internet Technology and Web Design*, McGraw Hill Education, Latest Edition.
3. Randy Connolly, Ricardo Hoar, *Fundamentals of Web Development*, Pearson Education, Latest Edition.
4. Jennifer Niederst Robbins, *Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics*, 4th Edition, O'Reilly Media.
5. James F. Kurose, Keith W. Ross, *Computer Networking: A Top-Down Approach*, 7th Edition, Pearson Education.

Online Reference

Sr. No.	Website Name
1.	Figma official tutorials
2.	Mozilla Developer Network (MDN) – HTML/CSS/JS docs
3.	W3Schools Tutorials
4.	CSS Tricks
5.	FreeCodeCamp

R-2025- F.E Computer Engineering

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30)
		L	T	P	L	T	P	SL	Notional Learning Hour	
12121105	C and C++ Programming	3	--	--	45	--	--	45	90	3

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Practical / Oral	Total
		Internal Assessment Test (IAT)			End Sem Exam	Exam Duration in Hrs.			
		IAT - 1	IAT -2	IAT-1+IAT -2					
12121105	C and C++ Programming	20	20	40	60	2.5	--	--	100

Rationale:

The C and C++ Programming course serves as a foundational pillar for first-year engineering students across all branches by developing essential problem-solving and programming skills. It introduces students to both structured and object-oriented programming paradigms, fostering logical thinking and algorithmic design. As C is widely used in system-level programming and C++ forms the basis for modern software development, this course ensures students gain

proficiency in writing efficient, modular, and scalable code. Its relevance spans all engineering disciplines, supporting applications in simulation, automation, modeling, and control systems. By laying the groundwork for advanced subjects like data structures, algorithms, and embedded systems, the course prepares students for future academic and professional challenges in an increasingly digital and automated world.

Course Objectives:

1 To introduce the fundamentals of programming using C and C++, focusing on syntax, semantics, and program structure for developing simple, efficient solutions.

2 To develop the ability to apply control structures, functions, arrays, and strings in solving computational and real-world engineering problems.

3 To enable students to understand and implement user-defined data types such as structures, unions, and enumerations for effective data management.

4 To build foundational knowledge of pointers, memory management, and file handling to facilitate low-level programming and system-level applications.

5 To provide a conceptual and practical understanding of object-oriented programming features in C++, including classes, objects, inheritance, polymorphism, and abstraction.

6 To prepare students for advanced computing courses by enhancing their analytical thinking, debugging skills, and ability to write modular, maintainable, and reusable code.

Course Outcomes:

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

1. Understand and apply the basic concepts of C programming, including algorithm development, structured programming, data types, operators, control structures, and input/output operations, to develop simple programs.

2. Apply and analyze the concepts of functions, arrays, and strings in C to solve computational problems using modular and structured programming techniques.

3. Apply and analyze the use of pointers, structures, and file handling techniques to manage memory efficiently and perform structured data operations in C programming.

4. Understand and apply the fundamental concepts of object-oriented programming in C++, including classes, objects, encapsulation, constructors, and member functions to design modular programs.
5. Analyze and apply advanced object-oriented programming concepts such as polymorphism, inheritance, virtual functions, and abstraction in C++ to develop flexible and reusable software components.
6. Understand and evaluate best programming practices, debugging techniques, and industry standards like MISRA guidelines, and relate C/C++ programming to real-world applications and emerging technologies.

Detailed Syllabus:

M. No.	Module Name	Detail Topics	Hours	CO Mapping
0	**Prerequisite**	• Basic familiarity with **fundamental mathematical** and **logical reasoning skills**. • **Understanding of basic computer operations** – such as using a keyboard, mouse, operating systems, and file handling. • **Logical thinking and problem-solving ability** – including flowcharting, algorithmic thinking, and basic decision-making. • **Basic English comprehension skills** – to read and write code, understand syntax, and follow programming logic.	--	--
1	**Fundamentals of C Programming**	• Introduction to Programming, algorithms and Flowcharts • Program Development Life Cycle (PDLC) - Structure of a C Program, Compilation, Execution • Concepts of Structured Programming in C	**8**	

		• Data Types, Program Statements, Token, Identifiers, Keywords, Constants, Assignment, Declaration and Initialization, Variables, Operators and Expressions, Lvalue and Rvalues, • Input/Output Functions, Type Conversion and Typecasting • Control Structures: if, else, switch-case, loops (for, while, do-while), break, continue, goto		
		Self-Learning Topics: • Write-up on history and evolution of programming languages • Practicing Non-Formatted Input & Output functions – getchar( ), putchar( ), getch( ), getche( ), putch( ), gets( ), puts( ) • Practicing Formatted Input & Output functions – printf( ) - % Format specifiers, formatting the output, escape sequences, Runtime adjustment and precision – Input Function scanf() – format specifiers, formatted input. • Preprocessor Directives in C • Implement pattern generation programs and logic puzzles • Research: Role of C in Embedded Systems • Practicing program development logic using Combines Multiple Control Statements: Number guessing game, ATM simulation program, Login system with 3 attempts limit, **Magic** number finder, Menu-driven bank management functions	**8**	

2	**Functions, Arrays, and Strings**	• **Functions:** Prototype Declaration, Definition, Function Calling, Passing Parameters to the Function, Scope of Variables, Call by Value. • **Storage Classes:** auto, static, register, extern • Recursive Functions, Recursion Vs Iteration • **Arrays**: 1D, 2D Arrays – Declaration, Initialization, Accessing Array Elements, Operations on Arrays, Applications • **Strings**: Declaration, Initialization, String Operations, Array of Strings, String manipulation Functions in string.h	**8**	
		Self-Learning Topics: • Sorting an array, Binary searching • Declaration and Initialization of a Multidimensional Array • Matrix addition, multiplication • Arrays of strings: Two-dimensional character array • Passing Arrays to Functions • Character manipulation in the String using character functions in <ctype.h> • Implement recursive solutions (e.g., Fibonacci, Tower of Hanoi) • Comparison of recursion and iteration (mini presentation) • Industry application: Use of arrays/strings in data processing	**8**	

3	**Pointers, and Structures**	• **Pointers:** Basics, address operator (&), Declaring & initializing Pointer Variables, Indirection Operator and Dereferencing, Pointer Expressions and Pointer Arithmetic, Types of Pointers, Pointer to Pointers, Pointers and Arrays, Call. by value vs Call by address. • **Dynamic Memory Allocation** (malloc, calloc, realloc, free) • **Structures and Unions**, Declaring Structures and Structure Variables, Accessing the members of a structure, Initialization of Structures, typedef, Nested Structures, Arrays of Structures,	**7**	
		Self-Learning Topics: • Call by address using pointers, returning more than one value from a function, returning pointer from a function, structures and pointers, passing structure to function • Structure versus Union, Enumeration types • Processing binary files • Write mini programs for file encryption/decryption • Technical write-up: Memory leaks and how to avoid them • Tools: Memory debugging using Valgrind (demonstration/presentation)	**7**	
4	**Introduction to Object-Oriented Programming (C++)**	• Differences between Procedural and Object-Oriented Programming • Introduction to C++, Structure of a C++ Program • Classes and Objects, Standard input and output stream objects, Access Specifiers, Data hiding and Encapsulation, Array of Objects	**7**	

		• Constructors and Destructors • Friend Functions, Inline Functions		
		Self-Learning Topics: • Explore syntax differences between C and C++ • Implement class-based programs (Employee Management System, Account Management banking system, Addition of Complex Numbers, student management) • Defining the member functions outside the class • Research: Applications of OOP in industry tools (e.g., game development, simulations)	**7**	
5	**Advanced OOP Concepts (C++)**	• **Inheritance:** Creating a Parent-Child relationship between Classes, Types of Inheritance, Implementing Multilevel and Hybrid Inheritance • **Polymorphism:** Introduction of Polymorphism, Types of Polymorphism, **Compile time Polymorphism:** Function overloading, operator overloading, Rules for operator overloading, **Run time polymorphism:** Virtual functions, rules for virtual functions, pure virtual function.	**8**	
		Self-Learning Topics: • Working of Constructors with Multiple Inheritance Creating a "String" data type – An example using Operator and function overloading • Create inheritance-based applications (e.g., employee hierarchy system) • Mini project proposal based on OOP concepts	**8**	

		• Read and summarize advanced topics like Templates or Exception Handling		
6	**Industry Applications and Programming Practices**	• Best Practices in Programming: Modularization, Comments, Code Reusability • Debugging Techniques, Error Handling • Applications in Embedded & Real-Time Systems • Introduction to Competitive Programming – Objectives, how it works, Benefits, platforms • Overview of Software Development Life Cycle (SDLC) • MISRA C and MISRA C++ Safe Coding Rules • Role of C/C++ in current technologies (AI, IoT, Game Development, System Software)	**7**	
		Self-Learning Topics: • Research paper or technical write-up on advanced use of C/C++ (e.g., real-time systems, kernel dev) • Online platform practice (e.g., HackerRank, Codeforces, CodeChef, etc.) • Seminar/presentation on any emerging tech using C/C++	**7**	

Text Books

1. "Programming in C", by Pradeep Dey and Manas Ghosh, Oxford University Press.
2. “Object Oriented Programming with C++” by E. Balagurusamy, McGraw Hill Education**.**
3. "Basics of Computer Science", by Behrouz Forouzan, Cengage Learning.
4. "Programming Techniques through C", by M. G. Venkateshmurthy, Pearson Publications.
5. "Programming in ANSI C", by E. Balagurusamy, Tata McGraw-Hill Education.
6. "Let Us C", by Yashavant Kanetkar, BPB Publications.

Reference Books

1. "The C Programming Language" by Brian W. Kernighan and Dennis M. Ritchie,Prentice Hall.
2. “Programming: Principles and Practice Using C++” by Bjarne Stroustrup, Addison-Wesley
3. "C Programming: A Modern Approach" by K. N. King, W. W. Norton & Company.
4. "C Primer Plus" by Stephen Prata, Addison-Wesley Professional.
5. "Programming in C" by Stephen G. Kochan, Addison-Wesley Professional

Online Resources:

Sr. No.	Website Name
1	Learn C - This website offers a free, interactive tutorial to learn C programming, covering both basic and advanced topics.
2	Codecademy - Codecademy provides a comprehensive, interactive course for learning C, complete with real-world projects and skill paths.
3	Coursera - Coursera, in collaboration with Duke University, offers a specialization in C programming, including hands-on projects and a certificate upon completion.
4	edX - This course, offered by edX, covers C programming with a focus on Linux, including professional certification.

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Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) Notional Learning Hour/30
12122106	Engineering Mechanics Lab	-	-	1	-	-	15	-	15	0.5

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration(in Hrs)			
		IAT 1	IAT 2	IAT 1+ IAT 2					
12122106	Engineering Mechanics Lab	--	--	--	--	--	25	25	50

Rationale:

Engineering mechanics is a branch of science that deals with the behaviour of solid bodies when subjected to external forces or loads and the effects of these forces on the bodies. Though traditionally software-focused, Computer and IT engineers increasingly interact with physical systems through areas like robotics, virtual reality, gaming, digital twin technology, and simulation. Engineering Mechanics introduces the physical principles of force, motion, and equilibrium, which are essential for the development of realistic simulation engines, AI-based mechanical system models, and integration of software with hardware systems. This subject helps build computational models of mechanical phenomena and enhances interdisciplinary competence for modern applications.

Lab Objectives:

1 To acquaint with basic principles of Centroid and its real-life significance
2 To familiarize with the concepts of force, moment, couple, resultant and system of coplanar and non-coplanar forces.
3 To familiarize with the concepts loads, beams, equilibrium conditions, friction and their real-life applications.
4 To understand the motion parameters required for quantification of Kinematics of Particle and Rigid body.
5 To understand the combination of force and motion parameters required for quantification of Kinetics of rigid body.
6 To acquaint with the basics of Robot kinematics

Lab Outcomes:

1	Demonstrate the understanding of Centroid locate the same.
2	Determine the resultant and equivalent force-couple system for a given system of forces.
3	Illustrate the concept of loads, supports, beams, conditions of equilibrium, and friction and apply the same in two dimensional systems with the help of FBD.
4	Determine the position, velocity, and acceleration of particle and rigid body using principles of kinematics for rectilinear, curvilinear, and general plane motion.
5	Apply the principles of force and acceleration, work-energy and impulse- momentum to particles in motion.
6	Establish the relation between robot joints and parameters

List of Experiments:

Minimum six experiments from the following list of which a minimum one should be from dynamics.

Sr. No.	List of Experiments	Hrs	CO mapping
1	Verification of Polygon law of coplanar forces (Universal force table apparatus)	01	CO2
2	Verification of the Principle of Moments (Bell crank lever)	01	CO2
3	Determination of Centroid of plane lamina made up of standard geometrical shapes	01	CO1
4	Determination of support reactions of a Simply Supported Beam.	01	CO3
5	Determination of coefficient of friction using inclined plane	01	CO3
6	Verification of the equations of equilibrium for non-concurrent non-parallel (General) force system.	01	CO3
7	Kinematics of particles. (Uniform motion of a particle, Projectile motion, motion under gravity)	01	CO4
8	Collision of elastic bodies (Law of conservation of momentum).	01	CO5
9	Kinetics of particles. (collision of bodies)	01	CO5

Sr No	List of Assignments / Tutorials	Hrs	CO mapping
01	Centroid of composite plane laminas (3 Numerical)	01	CO1
02	Resultant of coplanar and non-coplanar system of forces (2 Numerical)	01	CO2
03	Equilibrium of beam, rollers, bodies on inclined plane with friction and ladders with friction (6 Numerical).	03	CO3
04	Kinematics of particles and rigid bodies (7 Numerical)	03	CO4
05	Kinetics of particles (3 Numerical)	01	CO5
06	Homogeneous transformation, and Direct Kinematics of robot (5 Numerical)	02	CO6
07	Resultant of Co-planar system of forces for concurrent system of forces using C programming language.	02	CO1

08	Equilibrium of beam for support reactions using C programming language	02	CO3

Assessment:

Term Work: Term Work shall consist of at least 10 to 12 practicals' based on the above list. Also, Term work Journal must include at least 2 assignments.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

Practical & Oral Exam: An Oral & Practical exam will be held based on the above syllabus.

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Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30
12122107	Digital Logic & Computer Organization Architecture Lab	--	--	2	--	--	30	--	30	1

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		IAT-1	IAT- 2	IAT-1+ IAT-2				
12122107	Digital Logic & Computer Organization Architecture Lab	--	--	--	--	25	25	50

Lab Objectives:

1. Understand the basic structure and internal components of a computer system, including PC motherboard architecture (South Bridge and North Bridge).
2. Develop practical knowledge of number system conversions.
3. Design and implement logic circuits, including basic and universal gates, using hardware or simulation tools.
4. Build and verify basic combinational circuits, including adders, subtractors, multiplexers, and demultiplexers.

5. Explore and implement sequential circuits, such as flip-flops, counter and shift registers, for data storage and manipulation applications.
6. Provide exposure to arithmetic algorithms such as Booth's algorithm for binary multiplication.

Lab Outcomes: Students will be able

1. Identify and describe the architecture and internal components of a computer system, including the role of the South Bridge and North Bridge. (L1,L2)
2. Convert decimal numbers to binary, octal, and hexadecimal formats using programming lab, demonstrating understanding of number systems. (L3)
3. Design, implement, and test logic circuits, including basic gates (AND, OR, NOT, EX-OR) and universal gates (NAND, NOR) using hardware or simulation tools.(L3,L4)
4. Construct and verify combinational circuits, such as adders, subtractors, multiplexers, and demultiplexers for basic arithmetic and selection operations. (L3,L4)
5. Implement and analyze sequential circuits, including SR, JK, D, T flip-flops, counter and shift registers for data storage and transfer applications. (L3,L4)
6. Implement Booth's Algorithm for binary multiplication using software simulation to perform efficient arithmetic operations. (L3,L4)

List of Experiments.

NOTE: Programs can be executed on simulator or hardware boards.

Sr No	List of Experiments	Hrs
01	Study of PC Motherboard Technology (South Bridge and North Bridge), Internal Components and Connections used in computer system.	2
02	Write a program to convert Decimal to Binary, Octal, and Hexadecimal using C programming	2
03	Realization of Logic Gates (AND, OR, NOT, NAND, NOR, EX-OR) using basic electronic components or simulation tools (Multisim/Proteus/Logisim).	2

04	Implementation of SOP and POS expressions using Logic Gates.	2
05	Realize basic gates using universal gates using NAND	2
06	Realize basic gates using universal gates using NOR	2
07	Design and Implementation of Half-Adder and Full-Adder circuits using Logic Gates.	2
08	Design and Implementation of Half-Subtractor and Full-Subtractor circuits.	2
09	Study and Implementation of Multiplexer and Demultiplexer circuits.	2
10	Study and Implementation of Encoder and Decoder circuits.	2
11	Flip-Flop Simulation: SR, JK, D, T with Truth Tables	2
12	To implement synchronous up down counter	2
13	Design and Verify the 4-Bit Serial In - Parallel Out Shift Registers.	2
14	Implement Booth's Algorithm for Binary Multiplication (Software simulation).	2
15	Case study : Role of foundational computing concepts in building inclusive educational technology.	2

Sr No	List of Assignments / Tutorials	Hrs
01	Assignment Covers the topics first three modules of Digital Logic & Computer Architecture: Computer Fundamentals,Design of Combinational and Sequential Logic,Introduction of Computer Organization and Architecture.	2
02	Assignment Covers the topics first three modules of Digital Logic & Computer Architecture:Memory Organization,Data Representation and Arithmetic Algorithm,I/O Organization.	2

Text Books:

1. Thomas L. Floyd, Digital Fundamentals, Pearson Education, Latest Edition.

2. M. Morris Mano, Computer System Architecture, Pearson Education, 3rd Edition.
3. Charles H. Roth, Fundamentals of Logic Design, Cengage Learning, Latest Edition.

References:

1. R.P. Jain, Modern Digital Electronics, McGraw Hill, Latest Edition.
2. M. Morris Mano, Digital Logic and Computer Design, Pearson Education.
3. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, McGraw Hill.

Online Resources:

Sr. No.	Website Name
1	http://www.cburch.com/logisim/
2	https://www.labcenter.com/
3.	https://www.vlab.co.in/

Assessment:

Term Work: Term Work shall consist of at least 10 to 12 practicals' based on the above list. Also, Term work Journal must include at least 2 assignments.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

Practical & Oral Exam: An Oral & Practical exam will be held based on the above syllabus.

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30
12122108	Internet Technology Lab	--	--	2	--	--	30	--	30	1

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		IAT-1	IAT-2	IAT-1+ IAT 2				
12122108	Internet Technology Lab	--	--	--	--	25	25	50

Lab Objectives:

1 Understand and explore how web technologies (HTML, CSS, XML, JSON, UI tools) function in practical scenarios.
2 To design structured web pages using HTML elements, multimedia, and semantic tags.
3 To create interactive and validated web forms using HTML5 input types and attributes.
4 To apply CSS for styling, layout control, and implement animations and transformations using CSS3.
5 To work with XML and JSON data formats for data storage and transmission.
6 To explore the fundamentals of UI/UX design through Figma and create interactive web and mobile app prototypes.

Lab Outcomes: Students will be able to

1) Analyze and apply various web technologies to build basic interactive web components using appropriate tools and standards. (L1,L2,L3,L4)
2) Create accessible and semantically rich HTML web pages incorporating text, links, images, audio, and video elements.(L3, L4,L5,L6)
3) Develop user-friendly web forms with appropriate input types and implement client-side validations using HTML5 features. .(L3, L4,L5,L6)
4) Design visually appealing layouts using CSS3, including responsive design, transitions, and transformations. .(L3, L4,L5,L6)
5) Create, parse, and validate structured XML and JSON data, and understand their use in web communication. (L2,L3,L6)
6) Design and prototype user interfaces using Figma, applying core UI/UX principles for both web and mobile platforms. (L3, L4,L5,L6)

List of Experiments.

Sr No	List of Experiments	Hrs
01	**Experiment 1:** **Title:** Explore Working of Web Browsers and HTTP/HTTPS **Aim:** Understand and demonstrate basic HTTP request and response cycles using browser dev tools. **Tools:** Chrome/Firefox DevTools	2
02	**Experiment 2:** **Title:** Domain Name System (DNS) and Secure Protocols **Aim:** Use nslookup, dig, and test SSL/TLS via browser or openssl to explore DNS and HTTPS behavior.	2
03	**Experiment 3:** **Title:** Create a Personal Web Page using HTML **Aim:** Use basic tags, headings, paragraphs, links, and images to build a static web page.	2
04	**Experiment 4:** **Title:** Develop Forms with HTML5 Validations **Aim:** Create a form with input types (text, email, URL, number), use required, pattern, placeholder, etc.	2
05	**Experiment 5:** **Title:** HTML Image Gallery **Aim:** Create a photo gallery using <img> and grouping elements like <figure> and <figcaption>.	2

06	**Experiment 6:** **Title:** Embedding Multimedia in HTML5 **Aim:** Use <audio>, <video>, <iframe> to embed media files in a web page.	2
07	**Experiment 7:** **Title:** Apply CSS Styles to a Web Page **Aim:** Implement inline, internal, and external CSS. Style headings, paragraphs, and lists.	2
08	**Experiment 8:** **Title:** CSS Layout using Box Model, Margin, and Padding **Aim:** Demonstrate how margin, padding, borders, and box-sizing affect layout.	2
09	**Experiment 9:** **Title:** CSS3 Transitions and Transformations **Aim:** Create animations using transition, transform, and hover effects (scale, rotate, translate).	2
10	**Experiment 10:** **Title:** Design and Validate an XML Document **Aim:** Create a well-formed XML document with DTD or XSD for a book catalog or student list.	2
11	**Experiment 11:** **Title:** Work with JSON Data **Aim:** Create and parse JSON object using JavaScript. Compare with equivalent XML.	2
12	Experiment 12: **Title :** Explore Figma Interface **Aim:** Understand the Figma workspace, tools, and navigation**.**	2
13	**Experiment 13:** Title: Create Simple Shapes and Layout Aim: Practice using shape tools and alignment such as Draw rectangles, circles, and lines. Group shapes to form basic layout (e.g., card or banner).Use alignment and distribution tools	2
14	**Experiment 14:** **Title:** Create a Mobile App UI in Figma **Aim:** Use Figma to design wireframes, components, and a prototype of a mobile app interface.	2
15	**Experiment 15 : Mini Project**	2

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Sr No	List of Assignments / Tutorials	Hrs
01	BASIC OF INTERNET TECHNOLOGY	2
02	HTML AND HTML5	2
03	CSS AND CSS 3	2
04	XML AND JSON	2
05	FIGMA	2
06	CASE STUDY ON INTEGRATION OF HTML CSS XML AND JSON	2

Text Books:

1. Uttam Kumar Roy, *Web Technologies: HTML, JavaScript, PHP, Java, JSP, ASP.NET*, Oxford University Press, Latest Edition.
2. Jennifer Niederst Robbins, *Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics*, 5th Edition, O'Reilly Media.
3. H. M. Deitel, P. J. Deitel, A. B. Goldberg, *Internet & World Wide Web – How to Program*, 5th Edition, Pearson Education.
4. K. Meena, R. Sivakumar, *Web Technology: A Developer's Perspective*, Revised Edition, PHI Learning.
(Includes XML, DTD, Schema, and JSON basics in web development context.)

References:

1. **Elisabeth Freeman, Eric Freeman**, *Head First HTML and CSS*, 2nd Edition, O'Reilly Media.
2. **Matthew MacDonald**, *HTML5: The Missing Manual*, Latest Edition, O'Reilly Media.
3. **Elliotte Rusty Harold**, *XML in a Nutshell*, 3rd Edition, O'Reilly Media.
4. **Eric A. Meyer**, *CSS: The Definitive Guide*, 4th Edition, O'Reilly Media.
5. **Figma Team**, *Figma Learn Tutorials and Docs*, Latest Edition, https://help.figma.com.

Online Resources:

Sr. No.	**Website Name**
1.	FreeCodeCamp – Free hands-on courses with certification.
2.	W3Schools – Comprehensive tutorials with live editors for HTML, CSS, JS.
3.	JSON.org – Official page with structure and use-cases.
4.	XML Validation Tool – Online tool for validating XML and DTD/XSD.
5.	Figma Learn Hub – Official tutorials and documentation.

Assessment:

Term Work: Term Work shall consist of at least 10 to 12 practicals' based on the above list. Also, Term work Journal must include at least 2 assignments.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

Practical& Oral Exam: An Oral & Practical exam will be held based on the above syllabus.

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30)
12122109	C and C++ Programming Lab	--	--	2	--	--	30	--	30	1

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		IAT-1	IAT-2	IAT-1+ IAT 2				
12122109	C and C++ Programming Lab	--	--	--	--	25	25	50

Lab Objectives:

1. To introduce students to the fundamental programming constructs of C and provide hands-on experience with writing, compiling, debugging, and executing simple programs using an IDE.
2. To enable students to develop modular and efficient C programs by exploring functions, recursion, and arrays, enhancing their understanding of data management.
3. To familiarize students with advanced C programming concepts such as structures, pointers, dynamic memory allocation, for effective data storage and manipulation.
4. To provide comprehensive exposure to object-oriented programming in C++ focusing on classes, objects, constructors, destructors.
5. To deepen understanding of advanced object-oriented concepts in C++ including

inheritance, polymorphism, virtual functions, and abstract classes for designing flexible software solutions.

6. To guide students in designing and implementing an object-oriented system in C++ that integrates key programming concepts for practical application.

Lab Outcomes: At the end of the course, the student will be able to

1. Analyze and apply fundamental programming constructs in C using Code::Blocks IDE to develop, compile, debug, and execute programs that implement input/output operations, operators, and control flow structures such as branching, looping, and nested decisions.
2. Apply and evaluate the use of functions, recursion, and arrays (including strings) in C programming to design modular and efficient programs that demonstrate data management and manipulation.
3. Analyze and implement advanced C programming concepts including structures, pointers with dynamic memory allocation, manage complex data efficiently in real-world applications.
4. Apply and analyze core object-oriented programming concepts in C++ including classes, objects, constructors/destructors, and implement polymorphism to develop reusable and efficient code.
5. Analyze and implement advanced object-oriented programming concepts in C++ including various inheritance types, virtual functions for runtime polymorphism, and abstract classes with pure virtual functions to create flexible and extensible software designs.
6. Design, implement, and evaluate a C++ object-oriented program that models an object-oriented system by applying advanced concepts for efficient data handling and processing.

Suggested list of Experiments:

Sr No	List of Experiments	Hrs.
01	To understand the structure and features of the Code::Blocks Integrated Development Environment (IDE) and to use it effectively for writing, compiling, debugging, and executing C and C++ programs, which will serve as the foundational tool for all further experiments in the lab.	2
02	a) Program to demonstrate operations of Data Input and Output – getchar( ), putchar( ), scanf( ), printf( ), gets( ), puts( ) b) Program to demonstrate Operators-Arithmetic, Relational and logical, Assignment, Unary, Conditional, Bitwise, Comma, other operators.	2
03	Program to demonstrate Branching - If statement, If-else Statement, Multiway decision.	2
04	Program to demonstrate Nested control structure- Switch statement, Continue statement, Break statement, goto statement	2
05	Program to demonstrate Looping – for and nested for loop	2
06	Program to demonstrate Looping – while, do-while	2

07	a) Implement an iterative function for factorial/ Fibonacci etc. b) Implement a recursive function for factorial/ Fibonacci etc.	2
08	Program to demonstrate Array 1D	2
09	Program to demonstrate Array 2D	2
10	Program to demonstrate String and arrays of string.	2
11	Program to demonstrate Structure: Write a program to store and display information of a student/employee etc. using structures a) Define a structure, b) Read and store details, c) Display the stored information.	2
12	Program to demonstrate call by value and call by reference.	2
13	Program to demonstrate the use of classes and objects, constructors and destructors in C++	2
14	Program to demonstrate Single, multilevel, and hybrid inheritance using classes	2
15	Create a system that stores and displays student records including name, roll number, marks for 3 subjects, and computes total marks, average, and grade. Implement the following: 1. A base class Person with attributes: name, roll_no 2. A derived class Student with: Subject marks (e.g., marks[3]) 3. Member functions to input and display data 4. Functions to calculate total, average, and assign grade 5. Use constructors for initialization and destructors to display a message upon object destruction. 6. Use function overloading for displaying summary (e.g., detailed vs short view). 7. Implement operator overloading (e.g., == to compare two students by roll number or marks). 8. Use virtual function in a base class ResultCalculator and override in Student class. 9. Use an array of objects to manage multiple student records.	2

Sr No	List of Assignments / Tutorials	Hrs
01	Flowcharts for programs, input/output operations, operators, and control flow structures such as branching, looping, and nested decisions	2
02	Use of functions, recursion, storage classes, and arrays (including strings) in C programming	2
03	Structures, pointers with dynamic memory allocation, and file handling	2

04	Core object-oriented programming concepts in C++	2
05	Advanced object-oriented programming concepts in C++ including various inheritance types, virtual functions for runtime polymorphism, and abstract classes with pure virtual functions	2
06	C++ object-oriented program that models an object-oriented system by applying advanced concepts for efficient data handling and processing	2

Text Books

1. "Programming in C", by Pradeep Dey and Manas Ghosh, Oxford University Press.
2. "Object Oriented Programming with C++" by E. Balagurusamy, McGraw Hill Education.
3. "Basics of Computer Science", by Behrouz Forouzan, Cengage Learning.
4. "Programming Techniques through C", by M. G. Venkateshmurthy, Pearson Publications.
5. "Programming in ANSI C", by E. Balagurusamy, Tata McGraw-Hill Education.
6. "Let Us C", by Yashavant Kanetkar, BPB Publications.

Reference Books

1. "The C Programming Language" by Brian W. Kernighan and Dennis M. Ritchie,Prentice Hall.
2. "Programming: Principles and Practice Using C++" by Bjarne Stroustrup, Addison-Wesley
3. "C Programming: A Modern Approach" by K. N. King, W. W. Norton & Company.
4. "C Primer Plus" by Stephen Prata, Addison-Wesley Professional.
5. "Programming in C" by Stephen G. Kochan, Addison-Wesley Professional

Online Resources:

Sr. No.	Website Name
1	Learn C - This website offers a free, interactive tutorial to learn C programming, covering both basic and advanced topics.
2	Codecademy - Codecademy provides a comprehensive, interactive course for learning C, complete with real-world projects and skill paths.
3	Coursera - Coursera, in collaboration with Duke University, offers a specialization in C programming, including hands-on projects and a certificate upon completion.
4	edX - This course, offered by edX, covers C programming with a focus on Linux, including professional certification.

Assessment:

- **Term Work:** Term Work shall consist of at least 10 to 12 practicals based on the above list. Also, Term work Journal must include at least 2 assignments.

- **Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

- **Practical & Oral Exam:** An Oral & Practical exam will be held based on the above syllabus.

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Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credit (C) (Notional Learning Hour/30)
12122110	IDEA LAB -1 (Innovation Design Engineering and Apply)	1	--	2*	15	--	30	15	60	2

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		IAT-1	IAT-2	IAT-1+ IAT 2				
12122110	IDEA LAB - 1(Innovation Design Engineering and Apply)	--	--	--	--	50	50	100

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Rationale :

Aligned with the National Education Policy (NEP) 2020, the institution emphasizes experiential, interdisciplinary, and project-based learning through the IDEA Lab—a central hub for hands-on innovation.

To strengthen the undergraduate research ecosystem, the institution has adopted a theme-based academic model aligned with UN SGD. Each semester features six curated problem statements based on local need and aligned with core subjects in the same semester, enabling students to apply classroom knowledge to real-world challenges. Every student selects one problem and develops an individual, subject-integrated solution—enhancing both academic understanding and research skills.

The IDEA Lab supports this initiative with facilities for design thinking, prototyping, and product development. Students maintain a project logbook throughout the semester to track their progress and reflections.

To ensure academic accountability, a two-tier assessment framework is implemented:

- Project Assessment based on standardized IDEA Lab rubrics.
- Subject-Based Term Work Assessment focused on the application of same-semester subject knowledge in the project.

Lab Objectives:

1. To promote experiential and project-based learning that bridges theoretical knowledge with real-world problem-solving.
2. To encourage interdisciplinary integration by enabling students to apply concepts from multiple subjects within a single cohesive project.
3. To develop innovation and design thinking skills through hands-on activities and iterative solution development.
4. To foster critical thinking and creativity by engaging students in open-ended problems with multiple solution pathways.
5. To enhance communication, collaboration, and documentation skills essential for professional engineering practice.
6. To build an entrepreneurial and research mindset by guiding students to develop scalable, socially-relevant, and technically viable prototype

Lab Outcomes: Student will be able to

1. Recall and articulate key concepts from core and allied subjects relevant to the assigned project.
2. Explain the interdisciplinary nature of the problem and the role of each subject in addressing it.
3. Apply appropriate tools, techniques, and theoretical knowledge to develop project components.
4. Analyze problem constraints and user requirements to structure a feasible and efficient solution.
5. Evaluate multiple design options and justify the chosen solution based on technical and practical considerations.
6. Create a functional prototype or solution that demonstrates innovation, utility, and integration of interdisciplinary knowledge

1) Guidelines for IDEA Project

a) Project Guidelines (Interdisciplinary Project Execution in IDEA Lab)

- Each student works on an individual interdisciplinary project aligned with the semester theme.
- Faculty in-charges for the IDEA Lab are assigned according to the complexity of the project and the capacity of the respective departments.
- Faculty in-charges mentor both the academic and technical aspects, and track weekly progress.
- Project assessment will be rubric-based, ensuring depth, innovation, documentation, and ownership.
- Students shall convert the best solution into working model using various components of their domain areas and demonstrate.

- Faculty in-charges must attend relevant FDPs to ensure uniformity in mentoring and evaluation.

b) Guidelines for same semester Subject Concepts Applied within the Project

- Termwork for each subject will partially reflect how well a student applies subject-specific concepts in their interdisciplinary project.

- Internal assessment panel will collaborate to align project components with subject learning outcomes.

c) Role of Faculty In-Charges in IDEA Lab Projects

Faculty in-charges play a pivotal role in the success of interdisciplinary, theme-based projects under the IDEA Lab. Their responsibilities extend beyond technical supervision to include academic alignment, innovation facilitation, and active student engagement. Their key roles include:

1. **Motivating and Inspiring Students**
   - Encourage students to take ownership of their learning and projects.
   - Cultivate a mindset of curiosity, exploration, and social relevance.
   - Foster an environment where students feel empowered to take creative risks.
2. **Conducting Brainstorming and Ideation Sessions**
   - Organize structured brainstorming sessions at the start of the semester to help students define their problem statements and solution pathways.
   - Promote collaborative thinking, design exploration, and interdisciplinary integration.
3. **Arranging Guest Lectures and Expert Talks**
   - Identify and invite industry experts, researchers, and innovators for guest lectures aligned with the semester's theme or subject areas.
   - Facilitate exposure to real-world challenges, current trends, and future opportunities.
4. **Ensuring Uniqueness and Originality of Projects**
   - Actively review proposed ideas to ensure **no duplication of solutions** across students.
   - Encourage students to explore novel approaches, technologies, and perspectives.
5. **Promoting Discussion and Collaborative Learning**

- Create platforms for students to present, discuss, and receive peer and mentor feedback.
- Facilitate idea refinement through regular discussions and group engagement.

6. **Aligning Subject Content Beyond Syllabus**
   - Faculty in-charges must **align subject content beyond the syllabus of the same semester** with the **IDEA Lab theme and assigned problem statements**.
   - This ensures relevance, depth, and meaningful interdisciplinary integration.
7. **Same Semester Faculty Requirement**
   - Faculty in-charges must be teaching subjects in the **same semester** as the students' project to ensure seamless academic integration and contextual understanding.
8. **Monitoring and Documentation**
   - Oversee project logbook maintenance, milestone tracking, and submission of progress reports.
   - Provide ongoing feedback and ensure project alignment with learning outcomes.
9. **Coordination with Subject Faculty**
   - Work in collaboration with other subject faculty to help students embed theoretical and practical aspects of their coursework into the project.
   - Facilitate subject-term mapping and contribute to termwork assessment based on evidence.

2) Implementation Strategy

a) Project Implementation in IDEA Lab

Aspect	Implementation Strategy
Faculty in-charges	Faculty in-charges assigned based on project nature and department capacity.
Mentoring Role	Faculty in-charges oversee academic/technical development, interdisciplinary integration, and timely documentation.
Capacity Building	Faculty in-charges undergo workshops on design thinking, innovation, assessment rubrics, and outcome-based mentoring.
Assessment Contribution	Faculty in-charges contribute to 25 marks allocated for the IDEA Lab project termwork. The remaining assessments are conducted by the external examiner.
Recognition & Incentives	Faculty in-charges receive workload credits or are formally acknowledged in performance reviews.

b) Implementation of Subject-Term Work Mapping within Projects

Aspect	Implementation Strategy
Mapping Subject Outcomes	Faculty in-charges align their content beyond syllabus with the student's project by coordinating with the assigned project guide.
Independent Evaluation	Internal assessment panel evaluate students based on their application of subject-specific concepts within the project. This contributes to a separate 25 marks allocated for termwork based on subject application.
Evidence Sources	Evaluation is supported by project logbooks, subject-specific deliverables (e.g., tools, simulations, models), and review presentation inputs.
Outcome Assurance	Ensures practical demonstration of subject understanding and its integration into the interdisciplinary solution.

Implementation Notes:

- Guide faculty assess their course's contribution using specific evidence such as:
  - Logbooks
  - Subject-specific outputs (e.g., simulations, designs)
  - Paper publications or review presentations

2) Guidelines for Assessment

Two-tier rubrics are applied independently to evaluate subject concept application and innovation within the project.

a) Assessment of IDEA Lab Projects (Individual Interdisciplinary Projects) (25 Marks)

Presentation-Based Assessment Structure (Total: 25 Marks)

Assessment Month	Weightage	Marks
Month 1 (Formative 1)	20%	5 marks
Month 2 (Formative 2)	40%	10 marks
Month 3 (Formative 3)	40%	10 marks

Rubric-Based Evaluation Criteria

Criteria	Month 1 (5)	Month 2 (10)	Month 3 (10)
Problem Understanding	Connects problem to subjects	Defines interdisciplinary scope	Demonstrates deep conceptual grasp
Subject Knowledge Application	Identifies relevant concepts	Applies principles in design	Integrates multiple subject areas correctly
Innovation & Design Thinking	Proposes creative idea	Develops and tests feasible solution	Final solution shows originality and utility
Documentation & Presentation	Logbook initiated, plan presented	Mid-design log and visuals	Final report and demo completed
Progress & Ownership	Meets deadlines, shows planning	Demonstrates self-motivation	Completes project independently with reflection

b) Term Work Assessment of Subject Concepts Applied in Projects (25 Marks)

Applicable to All Subjects Integrated with Interdisciplinary Projects

To reflect meaningful application of subject knowledge, each subject will be assessed through the following rubric:

Criteria	Marks	Description
Subject Knowledge Application	8	Depth and accuracy of concept integration into the project

Criteria	Marks	Description
Practical Design or Tool Usage	5	Use of subject-specific hardware/software/simulation/tools
Documentation	4	Quality and clarity of subject-related logs and reports
Viva/Presentation	4	Ability to explain subject's relevance and role in the project
Continuous Engagement	4	Evidence of consistent participation via logbooks and feedback

c) Total Assessment Structure

Component	Marks	Assessed By
Termwork – Project Execution	25 Marks	Project Guide
Termwork – Application of Subject Concepts	25 Marks	IDEA Lab Panel
Viva Voce (Final Evaluation)	50 Marks	External Examiner

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30)
12412111	Workshop I	--	--	2	--	--	30	15	45	1.5

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		IAT-1	IAT-2	IAT-1+ IAT-2				
12412111	Workshop I	--	--	--	--	25	—	25

Lab Objectives:

1. To learn the basic concepts in electronic circuits.

2. To learn and perform steps of PCB fabrication.
3. To develop foundational skills in computer hardware assembly.
4. To understand maintenance, troubleshooting, and managing computer networks.
5. To explore and develop proficiency in using Google Workspace tools and to create and publish a

functional website using Google Sites.

6. To develop practical skills in using Microsoft Excel and to study and execute AI-powered features in Microsoft Excel.

Lab Outcomes: At the end of the course, the student will be able to

1. Able to understand basic components of electrical components.
2. Able to demonstrate the process of PCB fabrication.
3. Able to assembling and disassembling a personal computer.
4. Able to solve common trouble shooting problem and common hardware issues.
5. Able to navigate and utilize core google workspace and integrate google workspace tools into a google sites.
6. Able to use basic to advance excel function and to use AI-powered features in Excel.

Detailed Syllabus

Sr No	Name of Module	Detailed content	Hours	Lo
1	**Introduction to PCB**	Electronic Components and tools for measuring and debugging electronics circuits. ● Active and Passive components ● Breadboard to built simple circuits. ● Soldering Practices. ● Reading and interpreting circuit diagrams ● Multimeter ● Oscilloscope 8050 and DS0 ● Function generator ● Logic Probe/logic analyzer (demo) PCB Design and fabrication ● Wiring system ● Go-down wiring ● House Wiring ● Staircase wiring ● Introduction To PCB design Software ● Drawing a simple schematic ● PCB layout and routing techniques.	**6** **6**	**LO1,LO2**
		Self- Learning		

		1. Component Identification and Research (real –life example). 2. Resistor Color Code Practice (learn resistor color code system) 3. Datasheet Study (Download the datasheet for any 1 component and identify write configuration) 4. Breadboard Familiarization (Watch a tutorial or read a guide on how a breadboard works.)	**5**	
2	**Hardware and Networking**	Introduction to Computer Hardware ● Computer Fundamentals Introduction to computers Types of computer Components of computer Input/output devices Storage devices ● Computer Hardware Motherboard architecture Processor types and features RAM types and installation Power supply and units Assembling a computer BIOS/UEFI Configuration Common Troubleshooting issues Installation of LINUX/WIN 11 (DUAL) VM WARE (Installation) Bootable PD (Installation**)** Google Workspace and Google sites ● Introduction to google Workspace ● Gmail, Email etiquette, labels, filters ● Google Drive : Upload, organize, share ● Google Docs/slides: Collaborate in real time, insert images, comments and tables. ● Google Forms ● Getting Start with Google Sites ● Building basic website	**6** **4** **4**	**LO3** **LO4** **LO5** **LO6**

		• Creating Multiple pages Microsoft Excel For Engineers and integrate with AI • Excel interface, data entry, formatting basics • Formulas and fabrication • Charts and graphs • Data sorting and filtering • Getting started with Excel • Data Analysis and visualization • AI in Excel	**4**	
		Self Learning **1.** Study and Report on Motherboard Components and Layout **2.** Create a Maintenance Plan for a Personal Computer **3.** Research BIOS/UEFI Functions and Configuration Options (Provide screenshots and describe real-world use cases. **4.** Design a Small Office/Home Office **5.** Create and Share a Collaborative Google Doc **6.** Organize Files and Folders in Google Drive **7.** Design a Mini-Website for a School Club, Event, or Business Idea	**10**	

Reference Books

1. PCB Design for Beginners by Albert Kelly.
2. Computer Hardware and Networking by Rajiv Chopra.
3. Google Sheets for Beginners: A Practical Guide to Mastering Google Sheets by Nathan George.
4. Google Workspace User Guide by Oliver Kent.

Online Resources

Sr No	Reference
1	https://onlinecourses.swayam2.ac.in/cec25_cs10/preview Computer Fundamentals, By Prof. Sanjay Tanwani.
2	https://onlinecourses.swayam2.ac.in/nou25_cs01/preview -CIT-001: Fundamentals of Computer Systems, By Dr. Mangala Prasad Mishra
3	https://onlinecourses.swayam2.ac.in/aic20_sp59/preview -ESim - EDA tool for circuit design, simulation, analysis and PCB design, By Prof Kannan Moudgalya
4	https://onlinecourses.nptel.ac.in/noc25_ee163/preview -Electronic Systems Design: Hands-on Circuits and PCB Design with CAD, By Prof. Ankur Gupta
5	https://onlinecourses.swayam2.ac.in/imb25_mg206/preview Excel for Finance - From Basics to Advanced, By Dr. Premalatha K P

Suggested list of Experiments:

Sr No	List of Experiments	Hrs.
01	PCB Design and Fabrication.	6
02	Assembling and dissembling of computer. (Demonstration)	2
03	To solve Common Troubleshooting problem solving.	2
04	Installation of LINUX/WIN 11 (DUAL) (Demonstration)	2
05	To create a google form for simple survey or quiz.	2
06	To create grade sheets or expense tracker.	2
07	To built a basic Website and make resume and published on site.	2
08	To use excel and ChatGPT/Copilot.	2

Assessment for Term Work (25 marks)

- **Term Work Marks:** 25 Marks (Total marks)
- **Job and Manual**:- 20 Marks
- **Regularity and active involvement:-** 5 Marks

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Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
98461112	**Universal Human Values**	**2**	**-**	**-**	**30**		**-**	**30**	60	**2**

		Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT -1	IAT - 2	IAT-1+ IAT-2					
98461112	**Universal Human Values**	-	-	-	-	-	25	-	25

Rationale: The goal of the education system is to cultivate well-rounded individuals who are capable of rational thinking and action, as well as empathy and compassion. It strives to nurture ethical values and principles, shaping responsible citizens who can contribute to creating an inclusive, equitable, and diverse society, as envisioned by our Constitution. Education should focus not only on intellectual growth but also on developing social, ethical, and emotional intelligence. Ultimately, education is essential for unlocking human potential and fostering a just and fair society. A fair combination of holistic and multidisciplinary education would develop human beings wide

intellectual, deep aesthetic, social, physical, emotional, and moral in an integrated manner. UHV courses are intended to help students to develop a holistic, humane world vision for adopting fair technological advancements. The modules structured are to be discussed is universal, rational, and verifiable, hence leads to harmony.

Course Objectives:

1. To develop a holistic perspective based on self-exploration about them (human being),

2. To understand the meaning of harmony in relationship family with reverence and compassion

3. To explore a wide range of social networking ensuring mutual happiness and prosperity

4. To identify the urge to establish global peace and harmony to make the world a better place to live.

5. To understand the threats posed by human activities to biodiversity, and provide solutions

6. To develop understanding in implementing technologies to serve mankind.

Course Outcomes:

After successful completion of the course learner will be able:

1. Identify innate humanistic virtues and abilities as fundamentals to work as an individual.

2. Explore solutions to behavioral conflicts through family, a society in miniature with empathy.

3. Develop understanding to maintain human-human relationship for mutual happiness for building great teams.

4. Adapt for global pursuits in a peaceful co-existence with the entire mankind for global society uplift.

5. Acquire awareness of maintenance and conservation of biodiversity to provide sustainable solutions.

6. Evaluate the knowledge of 'Real Self ' augmenting universal human order to develop holistic technologies and creating congenial work environments.

Prerequisite: There is no prerequisite for this course.

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	There is no prerequisite for this course.		
I	Holistic Growth of Individual	Understanding the Human Being: Body, mind, and self – their roles and needs, Distinction between the self (conscious entity) and the body, Importance of self-reflection and self-awareness Developing clarity about personal goals and values, Emotional intelligence: managing thoughts and feelings. Lifestyle choices that support well-being Integrating knowledge with ethics and values **Self-Learning Topics**: Analyze yourself thoroughly and discover your personality traits: Behavioral, Habitual and Acquired traits and record the significance of the traits in handling diverse situations in your past and present life.	4 4	CO1
II	Self-Harmony & Family Values	Prosperity - a right identification of needs and fulfillment through right means What is *naturally acceptable* (permanent, universal) vs. what is acquired or conditioned. Family - a space for value cultivation and emotional support, Mutual fulfillment addressing Common Family Issues: Balancing individuality and togetherness, Misunderstandings due to Assumptions, Generational gaps and communication barriers. Trust empathy, and open communication in family relationships. Family as a Basic Unit of Society, Joint versus nuclear family structures and their social impact. **Self-learning Topics**: Importance of Respect and. Compassion in families, relations, neighborhood, how family harmony helps to progress and attain a worthy and respectable social and financial status. Togetherness and advancement, Conflict and	4 4	CO2

		resolution		
III	Social Equilibrium	Human-Human relationship, Respecting others and their perspectives, Understanding the difference between *intention* and *competence*. Vision of a universal human order (Sarvabhauma Vyavastha) based on trust and mutual prosperity. Promotion of dialogue, cooperation, and peaceful coexistence. Individuals and groups work together for common goals and shared well-being. Visualizing a universal harmonious order in society- Undivided Society, Universal Order from self to community Mutual Prosperity. Support and Empower marginalized communities **Self-Learning Topic:** A positive and unbiased Mediation and dialogue, and its importance Different communities' views for creating better communities & societies. Incidents happening around you which urgently require social equilibrium as a vision.	5 5	CO3
IV	Shared Values of Mankind	Values accepted and upheld by all human beings regardless of background, peaceful coexistence and global harmony. Role in addressing global challenges like conflict, inequality, and environmental crises, Philosophical and spiritual traditions worldwide. Human rights frameworks (e.g., Universal Declaration of Human Rights). Sensitizing individual towards Contemporary World Issues **Self Learning Topic:** India's relationships with other countries. Promoting peace and harmony hence preventing conflict situations. Conflict situations throughout the world where India as a one who maintained its integrity by following its traditional, philosophical and ethical standard.	6 6	CO4

IV	Human-Nature Relationship	Humans as caretakers of the Earth, not conquerors. Ethical choices like wildlife conservation, habitat preservation, and reducing pollution. Promoting humane treatment in agriculture, research, entertainment, and daily life. Sustainable living: reducing waste, recycling, and using renewable energy. Educating communities about the importance of biodiversity and ecosystem health. **Self-Learning Topics**: Practices adopted in ancient India for preserving the environment, Importance of rivers, trees, water mentioned in Indian scriptures and culture. Modern technologies/practices favoring ecosystem preservation. (Past Practices Vs, Present Practice)	6 6	CO5
VI	Integrating universal human values in the workplace	Meaningful and Purposeful Work: Encouraging dignity in all types of jobs. Human creativity and contribution to society. Equal opportunities without discrimination. Prioritizing human well-being over mere profit. Technical education is enriched with ethics and human-centric values. Ethical behavior includes not exploiting others for personal gain—whether as employers or consumers. Ability to identify and develop appropriate technologies and management patterns for production systems. Case studies of typical holistic technologies, management models and production systems. **Self-Learning Topics:** Contemporary workplace scenario Confronting challenges like globalization, technological advancement/disruption cultural diversity, workplace prejudice .unconscious bias. Hampering output and how universal human values helps erasing these complexities.	5 5	CO6

References:

1. Gaur, R. R., Sangal, R., & Bagaria, G. P. (2009). *A Foundation Course in Human Values and Professional Ethics*. New Delhi: Excel Books.
2. Ravindran, P. S. (2007). *Essence of Human Values and Professional Ethics*. Chennai: Sri Ramakrishna Math.
3. Gaur, R. R. (2011). *Human Values and Professional Ethics*. New Delhi: Dhanpat Rai Publishing Company.
4. Chitkara, M. G. (2002). *Education and Human Values*. New Delhi: A.P.H. Publishing Corporation.
5. Martin, M. W., & Schinzinger, R. (2005). *Ethics in Engineering* (4th ed.). New York: McGraw-Hill.
6. Gandhi, M. K. (1927). *The Story of My Experiments with Truth*. Ahmedabad: Navajivan Publishing House.
7. Vivekananda, S. (Compilation). (2001). *I and My Nation*. Kolkata: Advaita Ashrama.
8. AICTE (2020). *Towards a Holistic Development: A Collection of Good Practices in UHV*. New Delhi: All India Council for Technical Education.

Online References:

Sr. No.	Website Name
1.	https://uhv.org.in/

Term Work: 25 Marks

Assignments – 20 Marks

Attendance 5 Marks

Conduct Group Speaking Activities to explore and comprehend the basic human and global society issues.

(In group speaking activity, especially, conduct discussions on Contemporary World Issues, Contemporary workplace challenges enabling students to think and suggest solutions on humanitarian ground)

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List of Assignments (Answer the questions about in 500 words)

1. Explain the process, content, and natural outcome of self-exploration with a neat diagram and two examples from your life.

2. Analyze the impact of compassion on mental health. Describe the role of family in the development of an individual.

3. Describe the concept of an undivided society and the universal order and explain how both these can help to create a world family.

4. What do we mean by holistic technologies, management models, and production systems? How are these useful for mankind?

5. Explain the concept of co-existence in nature. How can this understanding help in addressing environmental issues?

6. Design a program to promote respect in the workplace where people treat each other with respect and have equal opportunities for growth.

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Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
98421113	Corporate Communication	1	-	-	15	-	-	15	30	1

		Theory					Term Work	Pract Exam	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT-1	IAT-2	IAT-1+ IAT 2					
98421113	Corporate Communication	20	20	40	40	1.5	-	-	80

Rationale:

The corporate communication course has been designed to train students for oral and written proficiency in an increasingly interconnected and digital corporate world. The engineers must be able to analyze intricate concepts & messages, understand communication theories, and develop practical skills in verbal, non-verbal, and digital communication. Effective communication skills are essential for corporates to express in panache inside organizations, with venture capitalist, strategic investors, potential clients, and everyday users. It helps to create a brand image and manage organization reputation

by open and transparent channels of communication through up skilling LSRW competencies (Listening, Speaking Reading and Writing)

. **Course Objectives -** The learners should be able to:

1. Effectively explore the dynamics of communication and navigate professional arenas
2. Competently acquire active listening skills by comprehending physical and digital content
3. Critically analyse communication barriers, audience and purpose to speak proficiently
4. Minutely comprehend extensive texts, technical and non-technical, to execute relevant tasks
5. Efficiently organize and create purposeful technical writing for professional transactions
6. Impactfully relate with other agencies with ethical standards to deliver synergistic solutions.

Course Outcomes - The learners will be able to:

1. Explore dynamics of communication for computer mediated communication in modern tech enabled workplaces
2. Acquire active listening skills by practicing technical and business Speech Acts via direct and digital mode.
3. Analyze barriers, methods, audience and purposes for mastering individual and team speaking in professional settings
4. Synthesize extensive technical and non-technical texts for reflective learning through reading and summarization.
5. Design purposeful and ethical technical and business content, presentation using ICT enabled media.
6. Advocate technical excellence and use of modern technological tools for ethical & sustainable community solutions.

Prerequisite: Basic knowledge of English language

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DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Basic knowledge of English language.		
I	Communication Dynamics	Foundations of Communication Dynamics: Objectives, Linear vs. Transactional Models Encoding, Decoding, and Feedback, , Interpersona Communication in Groups: Verbal interaction Meetings & Presentations, , Teleconferences & Calls an Non-Verbal Interactions: Proxemics, Haptic Oculesics, Kinesics Digital Interaction: virtual teams video calls Formal and Informal communication Communication Channels . Barriers: Physica Semantic Psychological & Emotional Barriers Cultural & Contextual Barriers Silos mentality Hierarchical layers, Rigid policies, unclear channels and outdated technology **Self Learning Topics** Corporate Communication Workplace & Outer Agencies Interna communications: Regular email updates company-wide newsletters and bulletin boards External Communication: Brand messaging, crisi communication, and stakeholder engagement.	5 5	CO1
II	Active Listening	Active Listening: Discussions, and note-taking techniques. Audio-book listening, Understanding	2	CO2

		colleagues' and clients during meetings Types of Listening Detailed Oriented Listening , Overview Listening and Reflective Listening **Self-Learning Topics** Listening kryptonite in Corporate Settings Technology overload (hello, constant notifications), Information overwhelm Multitasking Distraction, Tunnel Vision, Neglecting Nonverbal Cues, Technical vs. Human Disconnect Poor Documentation & Follow-Up, Interrupting & Rushing	2	
III	Conversational Proficiencies	Technical Communication Skills: Technical Discussion, delivering technical oral presentations inside and outside organizations, Explaining Engineering Concepts in Simple Terms, (Tips & Guidelines) Grooming and Self Development: Articulatory Speech Sounds ,Acoustic Speech Sounds ,Pronunciation of Accent Neutralization: Useful for professionals interacting with international clients, Virtual Meetings & online Discussion, Problem-Solving , Poster Presentation and Q&A **Self-Learning Topics:** Technical Terms: Ensuring correct articulation of IT jargon like "cache," "router," or "SQL.", Field Specific terms Record your own speaking imitating native accent and pronunciation and fluency, Engage in discussion with colleagues and family members to adopt an impressive & open communication style.	2 2	CO3

IV	Text Interpretation Expertise	Reading Proficiency Intensive Reading, Extensive ReadingSkimming,Scanning,SQ5R Method *(Survey, Question, Reading, Recording, Recall, Review and Revise)*Industry Related Articles and Report, .Summarizing text to Graphic Organizers (GO) Infographics ,Flow Charts , Mind Maps, SWOT analysis Gantt Charts, Venn Diagram Different Types of Organograms etc. Summarising text in point form. Leveraging Online Resources:Courses like IEEE English for Technical Professionals: White Papers; Modifiers and Qualifiers **Self-Learning** Grammar and Vocabulary Practice Verbal Ability Test (GRE , TOEFL, IELTS)	2 2	

V	Technical & Corporate Writing Skills	Seven Cs of Business Writing Completeness, Conciseness, Consideration, Concreteness, Clarity, Courtesy, Correctness. Format & Types of Formal Letters :Inquiry Letter Cover Letter, Offer Acceptance / Rejection Letter Grievance Letter Thank you Letter, Technical Writing for Professionals: Short And Long Reports Formatting Guidelines Tips For Text Chat Software Installation Guides Standard Operating Procedures (SOP) press Releases Legal and compliance writing: Data Privacy Policy , Compliance Reports and License Agreement **Self Learning** Studio activities : Digital Content Creation for Social Media and e-Commerce Platforms, Short videos, Blogs, Vlog Keynote speeches Podcast titles Landing pages Social media posts YouTube video description	3 3	
	Community	Communicating clearly with non-technical users and stakeholders, Building supportive networks Promoting innovation and problem-solving Participating in user groups or tech meetups. Gain encouragement and advice on technical or career		

VI	Communication and Ethics	challenges from Tech folk group Sustainability and Green IT Communication. Awareness of modern technology tools Transparency and Honesty Accountability Avoiding Misuse of Information Uphold **ethical standards** in all written, verbal, and digital communication. **Self Learning** Ethical use of technology, Sustainable Study Habits: Time Management and Responsibility. Linking with Tech folk (Ethical Hackers, Makers , founders)	1 1	
	Total		30	

References:

1. Communication Skills by Sanjay Kumar & Pushp Lata

2. Business Communication with Writing Improvement Exercises. Hemphill, McCormick & Hemphill

3. Business Communication: Building Critical Skills by Locker, Kitty O. Kaczmarek, Stephen Kyo

4. Effective Business Communication by Herta Murphy

5. Technical Communication: Principles and Practice by Raman and Sharma

6. Effective Technical Communication: A Guide for Scientists and Engineers by Rizvi

7. Oxford Guide to Effective Writing & Speaking by John Seely

8. English Grammar by Raymond Murphy

9. Word Power Made Easy by Norman Lewis

Online References:

Sr. No.	Website Name
1.	https://bbclearningenglish.org
2.	https://www.bbc.co.uk/learningenglish
3.	https://www.anmconsultants.com/role-communication-indian-corporate-culture/
4.	https://venngage.com/blog/white-paper-examples/

Test -I 20 marks
Test-II 20 Marks
Test -I - Independent speaking activity, where a student will deliver a 3 mins. prepared speech on a Technical topic related to his program and a two mins. Impromptu speech on general topics
.
Test -II - Group speaking activity, Effective presentations on well-known company case studies, Industry reports and articles . Group members limit, 4-5 students in each group.

End Semester Exam will be of 40 marks. It will be a written exam that will cover all six modules Question Paper will comprise a total of five questions each carrying 10 marks. Q.1 will be compulsory and should cover the maximum contents of the syllabus. Remaining questions will be mixed in nature (part (a) and part (b) of each question must be from different modules. For example, if Q.2 has part (a) from Module 3 then part (b) must be from any other Module randomly selected from all the modules)
A total of four questions need to be answered.

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Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
98422114	Corporate Communication Lab	-	-	2	-	-	30	-	30	1

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Exam	Total
		Internal assessment			End Sem. Exam			
		IAT-1	IAT-2	IAT-1+ IAT 2				
98422114	Corporate Communication Lab	--	--	--	--	25	--	25

Lab Objectives: The learners should be able to:

1. Effectively explore the dynamics of digital communication in academic and professional arenas.

2. Positively acquire active listening skills through Speech Acts in different modes.

3. Thoroughly analyse communication barriers, audience and purpose to speak effectively at the workplace.

4. Minutely demonstrate technical and non-technical text to comprehend and discern the exact purposes

5. Efficiently organize and create purposeful technical and business writings using ICT enabled media.

6. Successfully manage teams and individual tasks by applying ethical standards to execute the tasks.

Lab Outcomes: The learners will be able to:

1. Apply computer mediated communication principles for excellence in professional settings.

2. Test listening capabilities for advanced listening strategies using physical and digital modes.

3. Evaluate and present technical and non -technical ideas precisely to the audience in a confident way.

4. Demonstrate reading proficiencies through practicing extensive technical and business texts for developing new ideas.

5. Design digital, technical and business content for professional transactions.

6. Implement interpersonal skills and professional ethics to provide fair and collaborative community solutions for technical issues.

DETAILED SYLLABUS

Sr. No.	Module	Detailed Content	Hours	LO Mapping
0	Prerequisite	Basic knowledge of English language and ICT enabled media		
I	Communication Dynamics	Application of Communication Dynamics .Key Components of Strategic Communication,Shannon-Weaver Model at workplace. Corporate Communication in Select Indian Companies; A Case Study ,News Letter, Brand messaging	4	LO1
II	Active Listening	Detailed Oriented Listening and Applications: Technical or Business podcasts, Youtube lecture on academic		LO2

		stuff/ processes/ procedures/ Development Plans Overview Listening and Applications: Listen to an audio recording presentation, podcast Interviews and summarise in your words in an oral manner Reflective Listening: In daily conversation scenarios draw inferences from the speaker's statements. Discover the ability to understand the speaker's implied meaning rather than literal meaning. (5-10) situational statements in Professional Setting must be done)	4	
III	Conversational Proficiencies	Conversational Activities -I Self Introduction, Prepared Speech on Technical Topics and Impromptu Speech on General Topics Conversational Activities-II Simulation in communication : Role Play Activity for Conflict Resolution Negotiation , Handling complaints or angry customers through simulated phone or chat interactions. Conversational Activities -III customer Communication, Cross-Cultural communication, Marketing & Brand Communication Handling Q&A in Presentation	8	LO3
		Practice Verbal Ability Test (GRE TOEFL and IELTS for grammar and vocabulary		

IV	Text Interpretation Expertise	Prepare Diagram Organizers on: Summarising text to Graphic Organisers (GO) Infographics ,Flow Charts , Mind Maps, SWOT analysis Gantt Charts, Venn Diagram Different Types of Organograms etc. as per the situations in the organizational setting. Summarising text in point form after reading white paper , Industry reports and articles	4	LO4
V	Technical and Corporate writing	Technical content: Technical Blog Short And Long Reports (PPT using Canva) Installation Guides Writing Letters and eMails ,Inquiry Letter Cover Letter, Offer acceptance / Rejection Letter Grievance Letter Thank you Letter Standard Operating Procedures (SOP) Data Privacy Policy , Compliance Reports and License Agreement Press Release Content Creation for Social Media Content Management System - Wordpress to create, manage and publish content. e-Commerce Platforms Studio Activity: Blogs, Vlog Keynote speeches Podcast titles, Landing pages Social media posts (Ensure minimum 3 of these categories are to be covered as experiment)	6	LO5
VI	Community Communicatio n and Ethics	Local Area Visit (Nearby Banks ,Hospitals, stores, School , colleges Field Visits .Surveys ((Face to face, Kiosk /Mobile , QR Code/ SMS) & Feedback	4	LO6

		Analysis and Report Writing ,Providing solutions for Technical issues		

Reference Books:

1. Communication Skills by Sanjay Kumar & Pushp Lata

2. Business Communication with Writing Improvement Exercises. Hemphill, McCormick & Hemphill

3. Business Communication: Building Critical Skills by Locker, Kitty O. Kaczmarek, Stephen Kyo

4. Effective Business Communication by Herta Murphy

5. Technical Communication: Principles and Practice by Raman and Sharma

6. Effective Technical Communication: A Guide for Scientists and Engineers by Rizvi

7. Oxford Guide to Effective Writing & Speaking by John Seely

8. English Grammar by Raymond Murphy

9. Word Power Made Easy by Norman Lewis

Online Resources:

Sr. No.	Website Name
1.	https://bbclearningenglish.org
2.	https://www.bbc.co.uk/learningenglish
3.	https://www.anmconsultants.com/role-communication-indian-corporate-culture/

List of Experiments.

Sr. No	Name of Experiment	Hours

1.	Prepare a case study on Corporate level Communication in Select Indian Companies Tata Consultancy Services (TCS), Infosys,Reliance Industries,HCL Technologies, Wipro etc.	02
2	Listening Skill Activity Sheet containing minimum three types of listening activities from Lab Syllabus.(Using Language Lab & Open Source)	02
3	A.Continuous Evaluation of at least three types of the activities form Lab Syllabus for proficiency in oral communication/presentation	02
4.	a. Two Verbal Ability Test based on GRE, TOEFL,IELTS b. Summary report and Graphic Organizers for the relevant scenario or situation c. Powerpoint / Slide Preparation on Corporate Cases studies available online	02
5.	Three Types of Letter Writing in prescribed format (Full Block) along with impressive email messaging Digital Content Creation from Lab syllabus (Minimum two activities for writing skills should be done with documentation).	02
6.	Conduct field visits to small scale business community, Government and non Government Agencies Providing awareness about e-commerce platforms for startup and small stores.Also ensure the implementation of technical subject completely or partially for the smooth functioning. Conduct a Survey(Face to face, Kiosk /Mobile , QR Code/ SMS) or get a feedback from outside agencies regarding the future inputs for synergistic solutions	02

Term Work - 25

Experiments/Practicals

Six to Eight experiments from all six modules will be conducted using a language lab , open source and must be documented well for final submission as a part of term work at term end. **20 marks**

Attendance -5 Marks

Semester-II

Theme: Data-Driven Smart Solutions for Sustainable and Inclusive Communities

Grounded in the vision of the **United Nations Sustainable Development Goals (SDGs)**—particularly:

- **SDG 9** (Industry, Innovation and Infrastructure),
- **SDG 10** (Reduced Inequalities),
- **SDG 11** (Sustainable Cities and Communities),and

Keywords:

- Data-driven solutions
- Smart technologies
- Sustainable development
- Inclusive communities
- Digital innovation
- Climate-resilient infrastructure
- Social equity

Description:

This theme explores the transformative power of data, digital innovation in building communities that are inclusive, resilient, environmentally sustainable and advocates for the responsible use of technology to drive evidence-based decision-making to foster inclusive digital infrastructure, and ensure equitable access to services.

It highlights how data-driven smart solutions can enable cities and regions to tackle complex challenges— inequality, urbanization, and resource scarcity—while promoting human well-being and social equity.

The theme calls for scalable and ethical innovations,promotes cross-sector collaboration, participatory design, and open data ecosystems to empower communities—especially marginalized and underserved groups—to actively shape their futures.

Ultimately, **data-driven smart solutions** are not only tools for efficiency and growth, but also powerful enablers of **sustainable development, social justice, and long-term resilience**.

For UN**SDG 9 (Industry, Innovation and Infrastructure)**

The major **thrust areas** should focus on achieving data and digital innovation to build resilient, inclusive, and sustainable infrastructure and industrial growth.

These thrust areas directly support SDG 9 by:

- **Building resilient infrastructure** (urban planning, mobility, climate-resilient systems),
- **Promoting inclusive and sustainable industrialization** (MSME support, green zones), and
- **Fostering innovation** (startups, digital inclusion, data ecosystems).

For UNSDG 10 (Reduced Inequalities)

The major **thrust areas** should focus on Digital Inclusion for Marginalized Communities, Inclusive Urban Planning, Equity in Access to Health & Education, Gender-Inclusive Smart Policies, Accessible & Adaptive Civic Services

These thrust areas are designed to:

- **Reduce social and economic disparities** within and across communities,
- Ensure **equitable access to resources and opportunities** through technology,
- Promote **inclusive decision-making**, and
- Use data to **dismantle structural inequalities** in urban service delivery.

For UNSDG 11 **(Sustainable Cities and Communities),**

The major **thrust areas** should focus on Smart Urban Planning and Land Use Management, Smart and Sustainable Mobility, Efficient, Inclusive Public Services, Smart Waste Management, Community Engagement and Participatory Governance

These thrust areas directly support SDG 11 by promoting:

- **Inclusive, safe, and resilient urban development**,
- **Sustainable transport and resource-efficient infrastructure**, and
- **Stronger citizen participation** through smart governance and data democratization.

Local Problem Statements for Mira Road / Mira-Bhayander

1. Smart Water Distribution and Leakage Prevention

Mira Road is experiencing growing challenges in ensuring reliable and equitable water supply due to irregular distribution patterns and significant water loss from aging pipeline infrastructure. This results in widespread water wastage, supply inconsistencies across neighborhoods, and inefficient resource utilization. The water distribution network remains reactive and unsustainable, threatening the city's long-term water security and the well-being of its residents.

2. Traffic Congestion and Smart Mobility Challenges

Mira-Bhayandar is increasingly burdened by severe traffic congestion, particularly in high-density commercial and market areas, leading to delays, increased fuel consumption, and reduced quality of life for commuters. The city faces mounting challenges in ensuring safe, efficient, and sustainable transportation for its growing population.

3. Inefficient Waste Management and Public Cleanliness

Mira-Bhayandar faces persistent challenges in maintaining effective waste management and public cleanliness due to poor segregation practices, irregular waste collection, and inadequate infrastructure. These inefficiencies result in unhygienic conditions, overflowing bins, increased environmental pollution, and a growing burden on landfill sites and thus the city struggles to build a sustainable and clean urban environment.

4. Unregulated Noise Pollution in Sensitive Zones

Mira-Bhayandar is experiencing rising levels of unregulated noise pollution, particularly in traffic-congested corridors, densely populated residential areas, and near construction sites. Noise levels frequently exceed permissible limits set by regulatory authorities, leading to adverse health effects, reduced quality of life, and disruption in sensitive zones such as schools, hospitals, and residential neighborhoods. Thus noise pollution remains an overlooked yet growing environmental and public health concern in the city.

5. Underutilized Public Health and Civic Grievance Systems

In Mira-Bhayandar, public engagement with civic grievance redressal and health monitoring systems remains low due to inefficient, manual processes and lack of real-time communication. Existing complaint mechanisms are often slow, non-transparent, and disconnected from timely

resolution workflows, leading to citizen dissatisfaction and diminished trust in local governance. Thus the city struggles to provide responsive civic services and proactive public health management, ultimately affecting urban resilience and community well-being.

6. Low Community Participation in Environmental Initiatives

Environmental initiatives in Mira-Bhayandar—such as tree plantation drives, recycling programs, and energy conservation campaigns—frequently suffer from low levels of community participation. This is largely due to inadequate communication, lack of awareness, and the absence of accessible digital platforms that enable citizen engagement, volunteer coordination, and real-time tracking of environmental efforts. Strengthening public participation is essential for building an environmentally conscious and actively involved urban community.

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Course Code	Course Name	Teaching Scheme (Contact Hours Per week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
12111201	**Probability, Statistics, and Differential Equations**	**2**	**1**	**--**	**30**	**15**	**--**	**45**	**90**	**3**

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT- 2	IAT-1+ IAT 2					
12111201	**Probability, Statistics, and Differential Equations**	**20**	**20**	**40**	**60**	**2.5**	**25**	**--**	**125**

Rationale

This foundational course introduces essential mathematical concepts and techniques critical to computer engineering. Beginning with differential equations of first order and higher order, students learn to model and analyze dynamic systems, which is vital for understanding hardware behavior, signal processing, and system control. The study of double integrals equips students with tools for evaluating multi-dimensional problems, relevant in areas such as image processing and physical modeling of computer components. The course also covers probability distributions and statistics, enabling students to handle uncertainty and analyze data effectively—skills crucial for areas like network traffic analysis, machine learning, and performance evaluation. The inclusion of statistical techniques introduces methods for data inference and decision making, supporting optimization and quality assurance in software and hardware development. Finally, the course teaches numerical methods that provide practical algorithms to approximate solutions for complex problems that cannot be solved analytically, a necessity in simulations, algorithm design, and real-time computing applications.

Overall, this course provides computer engineering students with a strong mathematical foundation, blending theoretical understanding with practical applications to prepare them for advanced topics and real-world engineering challenges.

Course Objectives:

1. To introduce the formulation and solution of differential equations to model engineering systems.
2. To teach evaluation of double integrals over various regions to compute physical quantities.
3. To introduce probability models for random processes and events.
4. To develop skills to summarize and analyze data sets statistically.
5. To introduce inferential statistical methods for decision making.
6. To enable computational solution of mathematical problems through numerical techniques.

Course Outcomes:

1. Students will be able to solve differential equations to analyze dynamic behavior in computer hardware and networks.
2. Students will be able to evaluate double integrals to calculate parameters related to hardware design or image processing.
3. Students will be able to apply probability distributions to analyze uncertainties in computing systems.
4. Students will be able to interpret statistical measures to evaluate performance metrics of computer systems.
5. Students will be able to analyze data using hypothesis testing and regression to optimize software and hardware performance.
6. Students will be able to implement numerical methods to approximate solutions in algorithm design and simulations.

Prerequisite:

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1. Basics of integration and it's properties**.**
2. Linear differential equations

DETAILED SYLLABUS

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
I	Differential Equation	Exact differential Equations, Equations reducible to exact form by using integrating factors.	05	CO1
		Equation reducible to linear form, Bernoulli's equation.		
		Linear Differential Equation with constant coefficient-complementary function, particular integrals of differential equation of the type f(D)y = X where X is e^{ax} , sin(ax + b), cos(ax +b), x^m.		
		Self-learning topics: 1. Method of variation of parameter 2. Particular integrals for $e^{ax}V$ and xV. 3. Cauchy's homogeneous linear differential equation. 4. Legendre's differential equation. 5. Applications of first order and first degree and also Higher order differential equation.	10	
II	Multiple Integral	Beta and Gamma functions and its properties.	05	CO2
		Double integration-definition, Evaluation of Double Integrals. (Cartesian & Polar)		
		Change the order of integration (No Evaluation)		
		Self-learning topics:	10	

		1. Rectification of curves. (Cartesian, Polar and Parametric) 2. Application of double integrals to compute Area and Mass of lamina.		
III	Probability Distribution	Discrete distribution: Poisson distribution	05	CO3
		Continuous distribution: Uniform, Exponential and Normal distributions.		
		Self-learning Topics: 1. Skewness and Kurtosis of distribution (data). 2. Discrete distribution: Bernoulli and Binomial. 3. Conditional probability, joint probability, total probability and Bayes' theorem	10	
IV	Statistics	Discrete and continuous random variable with probability mass function and probability density function.	05	CO4
		Expectation, Variance, Moment generating function, Raw and central moments up to 4^{th} order.		
		Central limit theorem.		
		Self-learning Topics: 1. Time Series Analysis 2. Index Numbers 3. Decision Theory	10	
V	Statistical Techniques	Spearman's Rank correlation coefficient (R) (with repeated and non-repeated ranks)	05	CO5
		Lines of regression		
		Fitting of first- and second-degree curves.		
		Self-learning Topics: 1. Karl Pearson's Coefficient of correlation(r). 2. Fitting of exponential curve. 3. Fitting of logarithmic curve.	10	

		4. Covariance 5. Sampling theory for quantitative and qualitative samples.		
VI	Numerical Methods	Numerical integration-by (a) Trapezoidal (b) Simpson's 1/3rd (c) Simpson's 3/8th rule (all without proof)	05	CO6
		Interpolation by Newton's and Lagrange polynomials		
		Numerical solutions of transcendental equations by Newton Raphson method and Regula –Falsi method.		
		Self-learning topics: 1. Indeterminate forms, L- Hospital Rule, 2. Gauss Elimination Method, Gauss Jordan Method. 3. Maclaurin Series 4. Numerical solution of ordinary differential equation using (a) Euler's method (b) Modified Euler method, (c) Runge-Kutta fourth order method	10	

Text Books:

1. Operations Research, Hira and Gupta, S. Chand Publication.

2. Fundamentals of Statistics, S. C. Gupta.

3. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa.

4. Murray Spiegel, "Schaum's Outline of Probability and Statistics", 4th Edition, Tata McGraw-Hill.

References:

1. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons.

2. Probability, Statistics and Random Processes, T. Veerarajan, McGraw-Hill education.

3. Operations Research: An Introduction, Hamdy A Taha, Pearson.

4. Engineering Optimization: Theory and Practice, S.S Rao, Wiley-Blackwell

Online References:

Sr. No.	Website Name
1.	https://ocw.mit.edu/courses/res-6-012-introduction-to-probability-spring-2018/
2.	https://www.youtube.com/watch?v=KgItZSst2sU
3.	https://nptel.ac.in/courses/117103017
4.	https://ocw.mit.edu/courses/res-6-012-introduction-to-probability-spring-2018/
5.	https://archive.nptel.ac.in/courses/117/103/117103017/
6.	https://archive.nptel.ac.in/courses/111/102/111102111/
7.	https://www.youtube.com/playlist?list=PLyqSpQzTE6M_JcleDbrVyPnE0PixKs2JE

Term work (TW) for 25 marks:

1. Batch-wise tutorials are to be conducted.

2. Students must be encouraged to write SCILAB Programs in tutorial class only. Each Student has to write **at least 5 SCILAB tutorials** (including print out) and **at least 10** class tutorials on entire syllabus.

3. SCILAB Tutorials will be based on entire syllabus

The distribution of Term Work marks will be as follows –

1. Regularity and active involvement (Theory and Tutorial) 05 marks

2. Class Tutorials on entire syllabus 10 marks

3. SCILAB Tutorials 10 marks

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Course Code	Course Name	Teaching Scheme (Contact Hours Per Week)			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30
12111202	Modern Physics	2	--	--	30	–	–	30	60	2

Course Code	Course Name	Theory					Term work	Practical	Tutorial	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)				
		IAT- 1	IAT-2	IAT-1+ IAT 2						
12111202	Modern Physics	20	20	40	60	2.5	-	-	-	100

Rationale:

1 Engineering Physics provides a strong grounding in fundamental concepts like mechanics, electromagnetism, thermodynamics, and optics, which are essential for understanding the scientific basis of all engineering disciplines.
2. The syllabus supports key subjects in all branches—such as strength of materials in civil and mechanical, circuits in electrical and electronics, and semiconductor physics in computer and IT—ensuring a smooth transition to branch-specific learning.

3. Physics fosters logical thinking, mathematical modelling, and problem-solving skills that are crucial for engineering analysis, system design, and innovation in every branch of engineering.
4. Topics like quantum mechanics, nanoscience, and wave phenomena prepare students for future technologies and interdisciplinary fields such as AI, robotics, renewable energy, and smart infrastructure, relevant across all engineering domains.

Course Objectives:

1. To build a foundation of quantum mechanics needed for modern technology.
2. To demonstrate principles of interference in thin film and diffraction..
3. To provide students with a basic understanding of laser operation basics of Optical fiber and its use in communication technology.
4. To explain basic working principle of Image sensors and their use and fundamentals of image processing.
5. To introduce the basic principles of sensors and familiarize learners with their role and applications in modern technological systems.
6. To give exposure to the concept of Fermi level in semiconductors.

Course Outcomes: Student will be able to –

1. Learner will be able to RELATE the foundations of quantum mechanics with the development of modern technology
2. Learner will be able to DEVELOP understanding of interference and diffraction; connect it to few engineering applications.
3. Learner will be able to ILLUSTRATE and APPLY the use of laser and OFC in engineering applications
4. Learners will be able to MEASURE Chromaticity and ILLUSTRATE color matching Concept..
5. Learner will be able to IDENTIFY the fundamentals of sensors and their applications in Advanced Technology.
6. Learner will be able to CLASSIFY semiconductors and EXPLAIN variation of Fermi level with temperature and doping concentration.

Prerequisite: (For Theory Course):

1. Basic concepts of optics, including reflection, refraction, and interference using wave front analysis.

2. Application of Huygens' Principle and Snell's law in understanding light propagation.
3. Introduction to modern physics: dual nature of radiation, photoelectric effect, and matter waves.
4. Davisson–Germer experiment demonstrating wave nature of electrons.
5. Fundamentals of semiconductors: intrinsic and extrinsic types, electrical conductivity and resistivity.
6. Essential mathematical tools: vector algebra and partial differentiation used in physical analysis.

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
I	QUANTUM PHYSICS AND COMPUTING FUNDAMENTALS	Introduction (Matter waves, De Broglie hypothesis, Wave Packet). Concept of Phase velocity and group velocity and relation with particle velocity. Heisenberg Uncertainty Principle. Wave function; Physical interpretation of wave function. Schrodinger's time dependent wave equation; time independent wave equation; Particle trapped in one dimensional infinite potential well. Basics of Quantum Computing, Comparison of Classical computing & Quantum computing, Concept of Qubits, Quantum Superposition Quantum Entanglement.	06	CO 1
		Self-learning Topics: Quantum Tunneling and real-life examples Operators in Quantum Mechanics (basic idea) Quantum States and Measurement concept	06	

		Basic Quantum Gates (NOT, Hadamard, CNOT) Quantum Teleportation (concept only) Quantum Cryptography and secure communication		
II	OPTICS FOR ENGINEERS	Thin Film Interference: Introduction (division of amplitude & Stoke's relation) Interference in thin film of constant thickness in reflected light, Formation of colors in thin film; Interference in Wedge shaped film in reflected light; Formation of Newton's rings; Applications Diffraction: Introduction to Fraunhhofer diffraction at single slit, Amplitude equation of double slit, Diffraction Grating (N slits),	05	CO 2
		Self-learning Topics: Concept of Antireflecting coating, Highly reflecting films, Uses of Thin films, Measurement of optical flatness. Determination of refractive index of liquids using interference, Determination of wavelength of light using plane transmission grating and numerical,.	05	
III	PHOTONICS: LASERS, AND FIBER OPTIC SYSTEM	Laser: Spontaneous emission and Stimulated emission; Metastable state, Resonant cavity, Population inversion, three & four level lasers, types of pumping, Semiconductor Laser. Nd-YAG laser. Fiber optics: Structure of an optical fiber, Types: Single mode &	06	CO 3

		Multimode, Numerical Aperture for step index fiberModes of propagation, V number		
		Self-learning Topics: Attenuation, Losses in Optical fiber due to Physics structure and Transmission of signal Application: Optical fibre Transmission, Holography, Barcode reader, LiDAR, Memory reading and writing applications.	06	
IV	OPTICAL IMAGING	Imaging sensors CCD, CMOS. construction and working , Image formation .(Monochrome and Colour), Chromaticity diagram , Chromaticity coordinates, Colour Measurement & colour matching	04	CO 4
		Self-learning Topics: various optical imaging techniques, advantages and challenges of optical imaging, and the application of deep learning and advanced computational methods.	04	
V	PHYSICS OF SENSORS FOR IoT APPLICATIONS	Ultrasonic sensors: Concept of inverse piezoelectricity, Ultrasonic transducer as distance meter, Applications Light sensors: Photodiode & LDR (Principle, working & Applications) Hall sensor: (Principle of Hall effect, working & Applications)	04	CO 5
		Self-learning Topics: IR sensor: (Principle, working & Applications) Motion and proximity sensors – Accelerometers and gyroscopes	04	

VI	SEMICONDUCTORS FOR COMPUTING	Types of semiconductors, Fermi Dirac Distribution Function. Fermi level of Intrinsic and Extrinsic Semiconductors, Equation of conductivity with current flow, Formation of p-n junction, p-n junction in forward Bias, p-n junction in Reverse bias, Current- voltage curve for p-n junction diode. Basics of BJT and MOSFET.	05	CO 6
		Self-learning Topics: Applications of semiconductor devices in computing hardware, including memory and modern VLSI trends like FinFETs.	05	

Text Books:

1. A Text book of Engineering Physics -Dr. M. N. Avadhanulu, Dr. P. G. Kshirsagar, S. Chand,
1. Revised Edition 2014
2. Modern Engineering Physics - A. S. Vasudeva, S. Chand, Revised Edition 2013
3. Engineering Physics D. K Bhattacharya, Poonam Tandon, Oxford Higher Education, 1st Edition 2015-16
4. Engineering Physics -R. K. Gaur,S. L. Gupta, Dhanpat Rai Publications, 2012
5. Engineering Physics -V. Rajendran, McGraw Hill Educations, 2017
6. A Textbook of Nanoscience and Nanotechnology, T. Pradeep Tata McGraw Hill Education Pvt. Ltd., 2012

References:

1. Concepts of Modern Physics – Arther Beiser, Shobhit Mahajan, S. Choudhury, McGraw Hill, 7th Edition 2017
2. Fundamentals of optics - Francis A. Jenkins, Harvey E. White, McGraw Hill Publication, India, 4th Edition

3. Fundamentals of Physics, Halliday and Resnick, Wiley publication
4. Introduction to Electrodynamics, D. J. Griffiths, Pearson Publication
5. Handbook of Modern Sensors – Jacob Fraden, Springer, 5th Edition, 2016
6. Physics of Semiconductor Devices – S.M. Sze, Kwok K. Ng, Wiley, 3rd Edition
7. Introduction to Imaging Systems – R. H. Sherr, Springer, 1st Edition, 2006
8. Digital Image Processing – Rafael C. Gonzalez, Richard E. Woods, Pearson Education, 4th Edition, 2018

Online References:

Sr. No.	Website Name
1.	https://archive.nptel.ac.in/courses/115/102/115102124/
2.	https://archive.nptel.ac.in/courses/115/102/115102025/
3.	https://archive.nptel.ac.in/courses/115/105/115105132/
4	http://cs231n.stanford.edu/
5	https://www.mathworks.com/learn/tutorials/image-processing.html
6	https://www.analog.com/en/education/education-library.html

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)				
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) Notional Learning Hour/30
12121203	**Engineering Graphics**	2	-	-	30	-	-	30	60	2

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT-1	IAT-2	IAT-1+ IAT 2					
12121203	**Engineering Graphics**	20	20	40	60	2.5	--	--	100

Rationale:

Engineering Graphics develops spatial visualization and technical drawing skills essential for modern computing applications. It bridges the gap between digital systems and the physical world, supporting areas like embedded systems, IoT, and robotics. The course enhances understanding of 3D modeling, essential for AR/VR, digital twins, and simulation-based tools. It prepares students to work effectively in interdisciplinary teams involving hardware-software integration. Concepts like projections and solid modeling are foundational for CAD software, PCB design, and interface development. It supports UI/UX development for 3D applications, gaming, and visualization platforms. Engineering graphics aids in documenting and communicating design ideas clearly and accurately. Overall, it fosters analytical thinking and design communication, crucial for innovation in intelligent computing systems.

Course Objectives

1 To impart and inculcate proper understanding of the theory of projection.

2 To impart the knowledge to read and interpret a drawing.

3 To improve the visualization skill.

4 To enable students to represent three-dimensional objects on a two-dimensional surface in a way that accurately conveys their shape, size, and orientation.

5	To acquaint students with representing internal features of a three-dimensional object by way of section that accurately conveys their internal orientation.

Course Outcomes

1	Apply basic concepts of geometrical constructions to create engineering curves.
2	Apply the basic principles of projections in Projection of Lines and Planes
3	Apply the basic principles of projections in Projection of Solids.
4	Apply the basic principles of sectional views in Section of solids.
5	Apply the basic principles of projections in converting pictorial views into orthographic Views.
6	Apply the basic principles of projections in converting orthographic views into isometric drawing.

Detailed Syllabus

Module no.	Module Name	Detailed content	Teaching hours	CO
	Pre-requisite	To draw basic geometric shapes like circle, pentagon, hexagon, and square with different orientation. Divide a line, circle, etc. into equal number of parts.	01	
1	**Introduction to Engineering Drawing and Engineering curves**	**1.1** Introduction to Engineering Graphics and its significance in Engineering domain. **1.2** Types of Lines, Dimensioning Systems as per IS conventions. **1.3 Engineering Curves**: Basic construction of Conics, Cycloid, Involutes and Helix (cylinder only). **Self-learning topic:** - Explore the concepts of eccentricity, focus, vertex, axis, directrix - Explore other conics - ellipse, parabola and hyperbola using directrix-focus method	03 03	CO1
2	**Projections of Points, Lines and Planes**	**2.1 Projections of points** in all four quadrants as well as lying on the planes. **2.2 Projections of lines** inclined to both the reference planes (Excluding Traces of lines). Simple application-based problems on projection of lines. **2.3 Projection of planes** (only standard geometrical shapes like square, triangle, pentagon, circle, etc.) inclined to one of the reference planes only. **Self-learning topic:** - Explore the projection of lines for mixed quadrants - Explore the projection of planes for planes inclined to both the reference planes	05 05	CO2

3	**Projections of Solids**	**3.1** Projections of solids with the axis inclined to one reference plane include prism and cylinder **3.2** Projections of solids with the axis inclined to both reference planes include pyramid, and cone (Use change of position or Auxiliary plane method) **Self-learning topic:** - Explore the cuboid and tetrahedron solids inclined to one or both the reference planes. - Explore the applications of solid projection in machine components, structure, and packaging and manufacturing.	06 06	CO3
4	**Sections of Solids and Development of Surfaces**	**Sections of Solids** Sections of Prism, Pyramid, Cylinder, & Cone cut by plane perpendicular to only one reference plane. Use change of position or Auxiliary plane method. **Self-learning topics:** - Explore the development of lateral surface for regular solids - Prism, Pyramid, Cylinder, & Cone - Explore the real-life application of solids cut with section planes inclined to one plane.	04 04	CO4
5	**Orthographic and Sectional Orthographic Projections**	Fundamental concepts of orthographic and sectional orthographic projections like Positioning of quadrants, observer, horizontal, vertical and profile plane, symbol etc., Different orthographic views, First and Third angle method of projection, different section (cutting) plane, its representation, importance of sectional views, rib and web in section. Views of simple machine parts as per the first angle projection method recommended by I.S. for Orthographic and Sectional Orthographic projection **Self-learning topics:** - Explore the third angle method of projection for orthographic views. - Explore half sectional and offset sectional views - Practice simple machine components with half section and offset section	06 06	CO5
6	**Isometric Views**	Introduction to isometric projections and Fundamental concepts of Isometric projection - isometric and non-isometric lines, axes, and planes. Concept of isometric scale. Difference between isometric projection and isometric views. Conversion of orthographic views to isometric views **Self-learning topics:** - Explore the concepts of isometric scale and isometric projection - Practice isometric projection of simple objects using isometric scale - Explore the isometric views and projections of holes and slots on an inclined plane	05 05	CO6

Text Books:

1. N.D. Bhatt, "Engineering Drawing (Plane and solid geometry)", Charotar Publishing House Pvt. Ltd.
2. N.D. Bhatt & V.M. Panchal, "Machine Drawing", Charotar Publishing House Pvt. Ltd.

References:

1. Narayana, K.L. & P Kannaiah (2008), Textbook on Engineering Drawing, Scitech Publisher.
2. Prof. Sham Tickoo (Purdue University) & Gaurav Verma, "(CAD Soft Technologies).
3. Auto CAD 2012 (For engineers and Designers)", Dreamtech Press New Delhi.
4. Dhananjay A Jolhe, "Engineering Drawing" Tata McGraw Hill.

Online References:

Sr. No.	Website Name
1	https://archive.nptel.ac.in/courses/112/105/112105294/
2	https://nptel.ac.in/courses/112103019
3	https://archive.nptel.ac.in/courses/112/102/112102304/

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Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30)
12211204	**Data Structure**	3	--	--	45	--	--	45	90	3

		Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT-1	IAT-2	IAT-1+ IAT 2					
12211204	**Data Structure**	20	20	40	60	2.5	--	--	100

Rationale:

The Data Structures course enables students to design and implement efficient data handling techniques foundational for building **Data-Driven Smart Solutions for Sustainable and Inclusive Communities.** By applying linear and non-linear structures like arrays, linked lists, stacks, queues, trees, graphs, and hash tables, students develop real-

world systems that support resilient infrastructure (SDG 9)**,** inclusive digital access (SDG 10**)**, and sustainable urban services (SDG 11)**.**

Course Objectives:

1. Learn the purpose and significance of data structures, as well as their fundamentals.
2. Learn linear and nonlinear data structures, as well as how they are implemented.
3. Analyze the data structures, such as stacks, queues.
4. Learn the terminologies, types and various operations in Linked list.
5. Explore the fundamentals of Tree and learn about its operations and applications.
6. Explore the real time applications of various data structures.

Course Outcomes:

1. Recall and describe basic data structure concepts such as arrays, stacks, queues, linked lists, trees, graphs, and searching/sorting techniques.
2. Explain the operations and behavior of linear and nonlinear data structures like linked lists, stacks, queues, trees, and graphs.
3. Implement various data structures and associated algorithms to solve computational problems.
4. Analyze and compare the performance of algorithms using different data structures.
5. Evaluate appropriate data structures for solving real-world problems based on problem characteristics and performance trade-offs.
6. Design and develop efficient solutions for real-life applications using suitable data structures and algorithms.

Prerequisite: C Programming

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
0	**Prerequisite**	Concepts of Functions, Recursion, Arrays, Pointers, Structures and C programming constructs.		

I	**Introduction to Data Structures, Stacks and Queues**	Introduction to Data Structures, Concept of ADT, Types of Data Structures- Linear, Nonlinear, Static, Dynamic and Operations on Data Structures. Introduction to Stack, Abstract Data Type (ADT) of Stack, Stack Operations, Array-based Implementation of Stack Introduction to Queue, Abstract Data Type (ADT) of Queue, Queue Operations, Array-based Implementation of Queue, Types of Queues: Circular Queue, Priority Queue, Introduction of Double-Ended Queue (Deque).	**8**	**CO1, CO2**
		Self-learning Topics: Circular Queue vs Linear Queue: Memory Efficiency and Overflow Handling. Stack and Queue in Backtracking Algorithms (e.g., Maze Solving, Sudoku Solver) Priority Queue and Its Role in Operating System Scheduling Real-World Applications of Stack and Queue in Computer Systems	**10**	
II	**Linked Lists**	Introduction to Linked Lists, Representation of Linked Lists, Comparison: Linked List vs. Array,	**9**	

		Types of Linked Lists: Singly Linked List, Circular Linked List, Doubly Linked List, Insertion, deletion, update and copying operations with Singly linked lists, doubly linked lists and circular linked lists, Reversing a singly linked list.		**CO1, CO2**
		Self-learning Topics: Linked List Implementation of Stack, Linked List implementation of Queue, Circular Queue, Double Ended Queue, Priority Queue.	**9**	
III	**Trees**	Introduction to Trees: Terminology, Types of Binary trees. Non-recursive Preorder, in-order and post-order traversal. Creation of binary trees from the traversal of binary trees. Binary search tree: Traversal, searching, insertion and deletion in binary search tree. Threaded Binary Tree: Finding in-order successor and predecessor of a node in threaded tree. Insertion and deletion in threaded binary tree. AVL Tree: Searching and traversing in AVL trees. Tree Rotations: Right Rotation, Left Rotation. Insertion and Deletion in an AVL Tree.	**9**	**CO1, CO2**

		B-tree: Searching, Insertion, Deletion from leaf node and non-leaf node. B+ Tree, Digital Search Tree, Game Tree & Decision Tree		
		Self-learning Topics: Implementation of AVL and B+	**8**	
IV	**Graphs**	Introduction to Graphs: Undirected Graph, Directed Graph, graph terminology, Connectivity in Undirected and Directed Graphs. Spanning tree. Representation of graph: adjacency matrix, adjacency list, Transitive closure of a directed graph and path matrix. Traversals: Breadth First Search, Depth First Search.	**6**	**CO3**
		Self-learning Topics: Implementation of BFS, DFS	**4**	
V	**Searching**	Searching: Sequential Search, Binary Search. Hashing: Hash Functions: Truncation, Mid-square Method, Folding Method, Division Method. Collision Resolution: Open Addressing: Linear Probing, Quadratic Probing, Double Hashing, Separate Chaining Bucket Hashing.	**6**	**CO4, CO5**
		Self-learning Topics: Comparative Study and Implementation of		

		Searching Techniques in Data Structures	**4**	
VI	**Applications of Data Structures**	**Stacks:** Conversion of Arithmetic Expressions using Infix, Prefix and Postfix Notations, Reversing a String/List, Parentheses Checker. **Trees**: Representing expressions using of Expression tree and Huffman Encoding.	**7**	**CO5, CO6**
		Self-learning Topics: Application of Queues: Scheduling, Round Robin Scheduling **Applications of stack in Syntax** Parsing Application of Graphs in Social Network Analysis Trees in File System Organization Heaps in Priority-Based Task Scheduling, Trees in compilers and calculator	**10**	

Text Books:

1. Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, "Data Structures Using C", Pearson Publication.
2. Reema Thareja, " Data Structures using C", Oxford Press.
3. E. Balagurusamy, "Data Structure Using C", Tata McGraw-Hill Education India.
4. Richard F. Gilberg and Behrouz A. Forouzan, "Data Structures: A Pseudocode

Approach with C", 2ndEdition, CENGAGE Learning.

References:

1. Sahni Horowitz, Fundamentals of data structures in C, computer science press, 2008.
2. Jean Paul Tremblay, P. G. Sorenson, "Introduction to Data Structure and Its Applications",
   McGraw-Hill Higher Education
3. Narasimha Karumanchi, Data Structures And Algorithms, 5th Edition,CareerMonk, 2016.
4. Robert Kruse, C. L. Tondo, Bruce Leung, "Data Structures and Program Design in C",
   Pearson Publication.

Online References:

Sr. No.	Website Name
1	https://nptel.ac.in/courses/106/102/106102064/
2	Data Structure using C Programming - Course (swayam2.ac.in)

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Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30
12112205	Modern Physics Lab	--	--	1	--	--	15	--	15	0.5

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		IAT-1	IAT-2	IAT-1+ IAT-2				
12112205	Modern Physics Lab	--	--	--	--	25	--	25

Lab Objectives:

1. To BUILD a foundation of quantum mechanics needed for understanding and developing modern technology.
2. To DEMONSTRATE the principles of interference in thin films and relate them to optical phenomena.
3. To INTRODUCE the fundamentals of lasers and optical fibers along with their applications in communication technology.

4. To MEASURE and match colours using a colorimeter or spectrophotometer, and to capture and process microscopic images using optical microscopy techniques.
5. To UNDERSTAND the working principle of an ultrasonic distance meter and to MEASURE distances using ultrasonic wave propagation.
6. To provide students with a basic UNDERSTANDING of Semiconductors in the field of Basic Engineering.

Lab Outcomes:

LO1: Learners will be able to RELATE the foundations of quantum mechanics with the development of modern technology.

LO2: Learners will be able to DETERMINE the wavelength of light and EXPLAIN the interference phenomenon.

LO3: Learners will be able to ILLUSTRATE the use of lasers in applications and APPLY the fundamentals of fiber optics in modern communication technology.

LO4: Learners will be able to MEASURE colour, perform colour matching based on standards like CIE 1931, and understand the significance of colour in fields like display calibration and printing.

LO5: Learners will be able to OPERATE an ultrasonic sensor to measure distance accurately and EXPLAIN its working based on the time-of-flight principle of sound waves.

LO6: Learners will be able to have a fundamental UNDERSTANDING of semiconductors, including their properties, types, and applications in basic engineering.

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List of Experiments. (Minimum five experiments required)

Sr No	List of Experiments	Hrs	LO
01	Determination of Number of Lines in Diffraction Grating using He-Ne Laser	**01**	**LO2**
02	Determination of Radius of Curvature of Lens Using Newton's ring Set Up.	**01**	**LO2**
03	Determination of 'h' using LED/photocell	**01**	**LO1**
04	Determination of Divergence of LASER	**01**	**LO3**
05	Determination of Numerical of Aperture of OFC	**01**	**LO3**
06	Study of Hall Effect.	**01**	**LO5**
07	Measurement of Distance using Ultrasonic Distance Meter.	**01**	**LO5**
08	Colour Measurement and Colour Matching	**01**	**LO4**
09	Optical Microscopy Imaging and Image Processing	**01**	**LO4**
12	Study of IV characteristics of Photodiode	**01**	**LO6**
13	Study of IV characteristics of Semiconductor PN Junction Diode	**01**	**LO6**

Text Books and References:

1. Ajoy Ghatak – *Optics*
Excellent explanation of diffraction, laser interference, and grating equations.
2. C.L. Arora – *B.Sc. Practical Physics*
Practical procedure and observation format for the experiment.
3. Jenkins & White – *Fundamentals of Optics*
4. Gerd Keiser – *Optical Fiber Communications*
5. R.S. Sedha – *Applied Electronics*
6. Digital CMOS Design by Sung-Mo Kang

Online Resources:

Sr. No.	Website Name
1.	IEEE Xplore / Research Gate
2.	https://www.electronics-tutorials.ws/diode/diode_2.html
3.	https://circuitdigest.com.
4.	https://www.vlab.co.in/
5.	https://www.AMRITHA.vlab.co.in/

Assessment:

Term Work Marks: 25 Marks (Total marks) = 10 Marks (Experiment) + 10 Marks Project + 5 Marks (Attendance)

Project work: The project is to be completed within one semester. Students must execute the project as per the plan submitted at the beginning of the semester. The project outcome can be a working model, a simulation model, or a study report leading to the anticipated conclusion. Evaluation will be based on the quality of work and adherence to the submitted plan. A proper assessment rubric will be used for awarding marks.

R-2025- FE Computer Engineering

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) Notional Learning Hour/30
12122206	**Engineering Graphics Lab**	-	-	2	-	-	30	-	30	1

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT-1	IAT-2	IAT-1+ IAT 2					
12122206	**Engineering Graphics Lab**	--	--	--	--	--	25	25	50

Lab Objectives:

1 To impart and inculcate proper understanding of the theory of projection.

2 To impart the knowledge to read and interpret a drawing.

3 To improve the visualization skill.

4 To enable students to represent three-dimensional objects on a two-dimensional surface in a way that accurately conveys their shape, size, and orientation.

5 To acquaint students with representing internal features of a three-dimensional object by way of section that accurately conveys their internal orientation.

6 To impart basic AutoCAD skills.

Lab Outcomes:

1 Apply the concepts of Draw, Modify and basic concepts of ACAD to draw basic geometries and diagrams of simple engineering parts.

2	Apply the concepts of layers, and dimensions to create engineering drawing for a part drawing.
3	Create, Annotate, Edit and Plot drawings using basic AutoCAD commands and features.
4	Apply the basic principles of projections in 2D drawings using a CAD software.
5	Apply basic AutoCAD skills to draw different views of a 3D object.
6	Apply basic AutoCAD skills to draw the isometric view from the given two views.

List of Experiments:

Component: 01 – ACAD Print outs (activities to be completed in the CAD Laboratory - All printouts to be the part of Term Work.)

Sr. No.	List of Experiments	Hrs	CO mapping
1	Redrawing simple machine parts as given (05 problems)	04	CO1, CO2, and CO3
2	Orthographic projections (with and without section) (05 problems)	04	CO4 and CO5
3	Isometric Drawing – 3 problems.	04	CO6

Component: 02 – Drawing Sheets

01	Two problems on Engineering Curves	02	CO1
02	Two problems each on Projection of Lines and Planes	02	CO2
03	Two problems on Projection of Solids	02	CO3
04	Two problems on Section of Solids with DLS	02	CO4
05	Two problems each on Orthographic and Sectional Orthographic projection	02	CO5
06	Two problems on Isometric projection	02	CO6

Component: 03 – A3 size Sketch book

Sr No	List of Assignments	Hrs	CO mapping
01	Engineering Curves. (2 problems)	01	CO1
02	Projection of Lines and Planes (2 problems each)	02	CO2
03	Projection of solids. (2 problems)	02	CO3
04	Section of solids (2 problems)	02	CO4
05	Sectional Orthographic and Orthographic Projections (2 problems each)	04	CO5
06	Isometric Drawing. (3 problems)	03	CO6

Assessment:

Term Work: Term Work shall include all the drawings, assignments, and printouts listed above.

Term Work Marks: 25 Marks (Total marks) = 10 Marks (Drawing sheets and ACAD printouts) + 10 Marks (Assignments) + 5 Marks (Attendance)

Practical& Oral Exam: Practical exam on ACAD will be held based on the above syllabus.

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30
12122207	Modern Programming Paradigms Lab	2	--	2	30	--	30	--	60	2

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		IAT-1	IAT-2	IAT-1+ IAT 2				
12122207	Modern Programming Paradigms Lab	--	--	--	--	25	25	50

Lab Objectives:

1. To **demonstrate** the basic syntax and execution of programs using Python, Go, and TypeScript in a configured development environment.
2. To **apply** Git version control and command line operations for efficient project management and code organization.
3. To **develop** a basic REST API using Python and Flask that returns JSON responses for client requests.
4. To **implement** a REST API in Go using concurrency features like Goroutines and Channels, demonstrating JSON data handling.
5. To **design** a simple web interface using TypeScript integrated with HTML and CSS, and connect it to a Node.js server.
6. To **integrate** a backend API (Flask or Go) with a TypeScript frontend and demonstrate complete data communication in a full-stack application.

Lab Outcomes: Students will be able to

1. **write** and **execute** simple programs in Python, Go, and TypeScript using VS Code and terminal tools.
2. **initialize**, **manage**, and **submit** code projects using Git and command line tools on local and remote repositories.
3. **create** a Flask-based REST API and **test** its functionality using Postman.
4. **develop** a concurrent REST API in Go that provides JSON responses to client requests.
5. Students will be able to **build** an interactive frontend with TypeScript and **develop** a basic server using Node.js and Express.
6. **connect**, **fetch**, and **display** data between backend APIs and frontend applications, achieving functional integration.

Prerequisite : Internet Technology, c & c++

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	LO Mapping
0	Prerequisite	Introduction to Programming: Understanding basic concepts like algorithms, flowcharts, and pseudocode. Problem-Solving Skills: Ability to approach problems methodically and apply logical thinking to develop solutions.	--	--
I	Introduction to Modern Programming Languages	Overview of Programming Paradigms: Scripting, Compiled, Strongly Typed Introduction to Modern Languages: • Python for Scripting and APIs • Go (Golang) for Concurrency and System Applications • TypeScript for Frontend and Type-Safe JavaScript Development Comparison of Language Syntax, Performance, Use-Cases Development Environment Setup: VS Code, Terminals, Compilers	4	LO1

II	**Git, Project Structure & CLI Basics**	Introduction to Version Control Systems Git Fundamentals: Initialization, Add, Commit, Push, Pull Working with GitHub: Repositories and Collaboration Command Line Basics (Windows/Linux) Structuring Code Projects for Scalability	5	LO2
III	**Python for Scripting & Flask API Development**	Python Refresher: Variables, Data Types, Control Flow, Functions File Handling and Automation Scripting Introduction to APIs and HTTP Protocol Basics Flask Framework for API Development: • Setting Up Flask • Creating Routes and Returning JSON Data • API Testing with Postman	6	LO3
IV	**Golang & REST API Development**	Golang Syntax and Programming Constructs Concurrency Concepts: Goroutines and Channels Building REST APIs using net/http Package JSON Handling in Go Comparative Study: Python Flask API vs Go REST API	6	LO4

V	**TypeScript & Node.js Basics**	Introduction to JavaScript Limitations and TypeScript Advantages TypeScript Fundamentals: Types, Interfaces, Classes Basic HTML/CSS for UI Development Integrating TypeScript with HTML Node.js and Express Basics for Server-Side Development	5	LO5
VI	**Integration Project – Backend and Frontend Combination**	Integrating Flask/Go Backend APIs with TypeScript Frontend Using Fetch API/Axios for Data Retrieval Dynamic Data Display on Web Interface Project Structuring for Full Stack Applications Basic Deployment Practices (Localhost)	4	LO6

List of Experiments.

Sr No	List of Experiments	Hrs
1	**Write programs to understand** 1. Install Python, Go, Node.js, and Visual Studio Code. 2. Write and Execute a "Hello World" Program in Python, Go, and TypeScript 3. Demonstrate Basic Data Types and Variables in all three languages 4. Implement a simple program for user input and output in Python, Go, and TypeScript 5. Compare Syntax for Conditional Statements (if-else) across Python, Go, and TypeScript.	4

2	**Write programs to understand** 1. Initialize a Git Repository and Create the First Commit 2. Create a GitHub Repository and Push Local Code to Remote 3. Demonstrate Basic Git Operations: git add, git commit, git status, git push, git pull 4. Navigate Directories using CLI (cd, ls/dir, mkdir, rm) on Windows/Linux 5. Design a Standard Project Structure for Python, Go, and TypeScript Projects.	5
3	**Write programs to implement** 1. Write a Python Script for Basic Arithmetic Operations with User Input 2. Develop a Python Script to Organize Files Based on File Extensions 3. Create a Flask API with a Single Route Returning JSON Data 4. Extend the Flask API with POST and GET Methods for Handling User Data 5. Test the Flask API using Postman and Analyze the API Responses	6
4	**Write programs to implement** 1. Write Basic Go Programs Demonstrating Variables, Data Types, and Loops 2. Implement a Go Program Using Goroutines to Run Multiple Tasks Concurrently 3. Demonstrate the Use of Channels for Communication Between Goroutines 4. Build a Simple REST API in Go Returning JSON Data Using net/http Package 5. Compare Response Time of Go API vs Python Flask API using curl or Postman	6
5	**Write programs to implement** 1. Write TypeScript Programs Demonstrating Type Annotations and Interfaces 2. Create a Basic HTML Page with TypeScript Performing DOM Manipulation 3. Develop a Simple Calculator or Form Validation Logic using TypeScript 4. Set Up a Node.js Server using Express and Return Static JSON Data 5. Create an Express API Handling GET and POST Requests in TypeScript	**5**
6	**Write programs to implement** 1. Connect Flask API with TypeScript Frontend Using Fetch API 2. Connect Go REST API with TypeScript Frontend and Display JSON Data 3. Implement Error Handling for Failed API Calls in Frontend 4. Demonstrate Complete Data Flow from Backend to Frontend (Full Stack Integration) 5. Team Presentation of Working Integrated Application	**4**

Sr No	List of Assignments / Tutorials	Hrs
1	Introduction to Modern Programming Languages	2
2	Git, Project Structure & CLI Basics	2
3	Python for Scripting & Flask API Development	2
4	Golang & REST API Development	2
5	TypeScript & Node.js Basics	2
6	Python for Scripting & Flask API Development	2

Text Books:

1. **Mark Lutz, Learning Python, 5th Edition, O'Reilly Media.**
   (Comprehensive coverage of Python fundamentals, advanced data types, and functional programming.)
2. **Alan A. A. Donovan, Brian W. Kernighan, The Go Programming Language, Addison-Wesley.**
   (Fundamental guide for Go language syntax, concurrency, and system programming principles.)
3. **Yakov Fain, Anton Moiseev, TypeScript Quickly, Manning Publications.**
   (Beginner to intermediate resource for TypeScript fundamentals, interfaces, classes, and project integration.)
4. **Jennifer Robbins, Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics, O'Reilly Media.**
   (Essential introduction to modern web development, covering HTML, CSS, JavaScript, and visual design.)

References:

1. **Luciano Ramalho**, *Fluent Python*, 2nd Edition, O'Reilly Media.
   Miguel Grinberg, Flask Web Development: Developing Web Applications with Python, O'Reilly Media.
   (Step-by-step guide to building RESTful APIs and web applications using Flask framework.)
2. **Mihalis Tsoukalos, Mastering Go, Packt Publishing.**
   (Advanced resource for Go programming with in-depth coverage of concurrency, networking, and real-world applications.)

3. **Scott Chacon, Ben Straub, Pro Git, 2nd Edition, Apress.**
(Comprehensive explanation of Git version control, collaboration workflows, and repository management.)
4. **Mario Casciaro, Luciano Mammino, Node.js Design Patterns, Packt Publishing.**
(In-depth exploration of Node.js architecture, design patterns, and production-grade backend development.)

Online Resources:

Sr. No.	**Website Name**
1.	**Official Python Documentation** – https://www.python.org/doc/
2.	**Flask Framework Documentation** – https://flask.palletsprojects.com/
3.	**Official Go Documentation** – https://go.dev/doc/
4.	**Interactive Tour of Go** – https://tour.golang.org/
5.	**TypeScript Documentation** – https://www.typescriptlang.org/docs/
6.	**Node.js Documentation** – https://nodejs.org/en/docs
7.	**Git Documentation** – https://git-scm.com/doc

Assessment:

Term Work: Term Work shall consist of at least 12 to 15 practicals' based on the above list. Also, Term work Journal must include at least 2 assignments.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

Practical& Oral Exam: An Oral & Practical exam will be held based on the above syllabus.

R-2025- F.E Computer Engineering

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week)			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30)
12122208	IDEA LAB - 2(Innovation Design Engineering and Apply)	1	--	2*	15	--	30	15	60	2

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical / Oral	Total
		Internal assessment			End Sem. Exam			
		IAT-1	IAT-2	IAT-1+ IAT 2				
12122208	IDEA LAB - 2(Innovation Design Engineering and Apply)	--	--	--	--	50	50	100

Rationale :

Aligned with the National Education Policy (NEP) 2020, the institution emphasizes experiential, interdisciplinary, and project-based learning through the IDEA Lab—a central hub for hands-on innovation.

To strengthen the undergraduate research ecosystem, the institution has adopted a theme-based academic model aligned with UN SGD. Each semester features six curated problem statements based on local need and aligned with core subjects in the same semester, enabling students to apply classroom knowledge to real-world challenges. Every student selects one problem and develops an individual, subject-integrated solution—enhancing both academic understanding and research skills.

The IDEA Lab supports this initiative with facilities for design thinking, prototyping, and product development. Students maintain a project logbook throughout the semester to track their progress and reflections.

To ensure academic accountability, a two-tier assessment framework is implemented:

- Project Assessment based on standardized IDEA Lab rubrics.
- Subject-Based Term Work Assessment focused on the application of same-semester subject knowledge in the project.

Lab Objectives:

1. To promote experiential and project-based learning that bridges theoretical knowledge with real-world problem-solving.
2. To encourage interdisciplinary integration by enabling students to apply concepts from multiple subjects within a single cohesive project.
3. To develop innovation and design thinking skills through hands-on activities and iterative solution development.
4. To foster critical thinking and creativity by engaging students in open-ended problems with multiple solution pathways.
5. To enhance communication, collaboration, and documentation skills essential for professional engineering practice.
6. To build an entrepreneurial and research mindset by guiding students to develop scalable, socially-relevant, and technically viable prototype

Lab Outcomes: Student will be able to

1. Recall and articulate key concepts from core and allied subjects relevant to the assigned project.
2. Explain the interdisciplinary nature of the problem and the role of each subject in addressing it.
3. Apply appropriate tools, techniques, and theoretical knowledge to develop project components.
4. Analyze problem constraints and user requirements to structure a feasible and efficient solution.
5. Evaluate multiple design options and justify the chosen solution based on technical and practical considerations.
6. Create a functional prototype or solution that demonstrates innovation, utility, and integration of interdisciplinary knowledge

1) Guidelines for IDEA Project

a) Project Guidelines (Interdisciplinary Project Execution in IDEA Lab)

- Each student works on an individual interdisciplinary project aligned with the semester theme.
- Faculty in-charges for the IDEA Lab are assigned according to the complexity of the project and the capacity of the respective departments.
- Faculty in-charges mentor both the academic and technical aspects, and track weekly progress.
- Project assessment will be rubric-based, ensuring depth, innovation, documentation, and ownership.
- Students shall convert the best solution into working model using various components of their domain areas and demonstrate.
- Faculty in-charges must attend relevant FDPs to ensure uniformity in mentoring and evaluation.

b) Guidelines for same semester Subject Concepts Applied within the Project

- Termwork for each subject will partially reflect how well a student applies subject-specific concepts in their interdisciplinary project.
- Internal assessment panel will collaborate to align project components with subject learning outcomes.

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c) Role of Faculty In-Charges in IDEA Lab Projects

Faculty in-charges play a pivotal role in the success of interdisciplinary, theme-based projects under the IDEA Lab. Their responsibilities extend beyond technical supervision to include academic alignment, innovation facilitation, and active student engagement. Their key roles include:

1. **Motivating and Inspiring Students**
   - Encourage students to take ownership of their learning and projects.
   - Cultivate a mindset of curiosity, exploration, and social relevance.
   - Foster an environment where students feel empowered to take creative risks.
2. **Conducting Brainstorming and Ideation Sessions**
   - Organize structured brainstorming sessions at the start of the semester to help students define their problem statements and solution pathways.
   - Promote collaborative thinking, design exploration, and interdisciplinary integration.
3. **Arranging Guest Lectures and Expert Talks**
   - Identify and invite industry experts, researchers, and innovators for guest lectures aligned with the semester's theme or subject areas.
   - Facilitate exposure to real-world challenges, current trends, and future opportunities.
4. **Ensuring Uniqueness and Originality of Projects**
   - Actively review proposed ideas to ensure **no duplication of solutions** across students.
   - Encourage students to explore novel approaches, technologies, and perspectives.
5. **Promoting Discussion and Collaborative Learning**
   - Create platforms for students to present, discuss, and receive peer and mentor feedback.
   - Facilitate idea refinement through regular discussions and group engagement.
6. **Aligning Subject Content Beyond Syllabus**
   - Faculty in-charges must **align subject content beyond the syllabus of the same semester** with the **IDEA Lab theme and assigned problem statements**.

- This ensures relevance, depth, and meaningful interdisciplinary integration.

7. **Same Semester Faculty Requirement**
   - Faculty in-charges must be teaching subjects in the **same semester** as the students' project to ensure seamless academic integration and contextual understanding.
8. **Monitoring and Documentation**
   - Oversee project logbook maintenance, milestone tracking, and submission of progress reports.
   - Provide ongoing feedback and ensure project alignment with learning outcomes.
9. **Coordination with Subject Faculty**
   - Work in collaboration with other subject faculty to help students embed theoretical and practical aspects of their coursework into the project.
   - Facilitate subject-term mapping and contribute to termwork assessment based on evidence.

2) Implementation Strategy

a) Project Implementation in IDEA Lab

Aspect	Implementation Strategy
Faculty in-charges	**Faculty in-charges assigned based on project nature and department capacity.**
Mentoring Role	**Faculty in-charges oversee academic/technical development, interdisciplinary integration, and timely documentation.**
Capacity Building	**Faculty in-charges undergo workshops on design thinking, innovation, assessment rubrics, and outcome-based mentoring.**
Assessment Contribution	**Faculty in-charges contribute to 25 marks allocated for the IDEA Lab project termwork. The remaining assessments are conducted by the external examiner.**
Recognition & Incentives	**Faculty in-charges receive workload credits or are formally acknowledged in performance reviews.**

b) Implementation of Subject-Term Work Mapping within Projects

Aspect	Implementation Strategy
Mapping Subject Outcomes	**Faculty in-charges align their content beyond syllabus with the student's project by coordinating with the assigned project guide.**
Independent Evaluation	**Internal assessment panel evaluate students based on their application of subject-specific concepts within the project. This contributes to a** separate 25 marks allocated for termwork based on subject **application.**
Evidence Sources	**Evaluation is supported by project logbooks, subject-specific deliverables (e.g., tools, simulations, models), and review presentation inputs.**
Outcome Assurance	**Ensures practical demonstration of subject understanding and its integration into the interdisciplinary solution.**

Implementation Notes:

- Guide faculty assess their course's contribution using specific evidence such as:
  - Logbooks
  - Subject-specific outputs (e.g., simulations, designs)
  - Paper publications or review presentations

2) Guidelines for Assessment

Two-tier rubrics are applied independently to evaluate subject concept application and innovation within the project.

a) Assessment of IDEA Lab Projects (Individual Interdisciplinary Projects) (25 Marks)

Presentation-Based Assessment Structure (Total: 25 Marks)

Assessment Month	Weightage	Marks
Month 1 (Formative 1)	20%	5 marks
Month 2 (Formative 2)	40%	10 marks

Assessment Month	Weightage	Marks
Month 3 (Formative 3)	40%	10 marks

Rubric-Based Evaluation Criteria

Criteria	Month 1 (5)	Month 2 (10)	Month 3 (10)
Problem Understanding	Connects problem to subjects	Defines interdisciplinary scope	Demonstrates deep conceptual grasp
Subject Knowledge Application	Identifies relevant concepts	Applies principles in design	Integrates multiple subject areas correctly
Innovation & Design Thinking	Proposes creative idea	Develops and tests feasible solution	Final solution shows originality and utility
Documentation & Presentation	Logbook initiated, plan presented	Mid-design log and visuals	Final report and demo completed
Progress & Ownership	Meets deadlines, shows planning	Demonstrates self-motivation	Completes project independently with reflection

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b) Term Work Assessment of Subject Concepts Applied in Projects (25 Marks)

Applicable to All Subjects Integrated with Interdisciplinary Projects

To reflect meaningful application of subject knowledge, each subject will be assessed through the following rubric:

Criteria	Marks	Description
Subject Knowledge Application	8	Depth and accuracy of concept integration into the project
Practical Design or Tool Usage	5	Use of subject-specific hardware/software/simulation/tools
Documentation	4	Quality and clarity of subject-related logs and reports

Criteria	**Marks**	**Description**
Viva/Presentation	4	Ability to explain subject's relevance and role in the project
Continuous Engagement	4	Evidence of consistent participation via logbooks and feedback

c) Total Assessment Structure

Component	Marks	Assessed By
Termwork – Project Execution	25 Marks	Project Guide
Termwork – Application of Subject Concepts	25 Marks	IDEA Lab Panel
Viva Voce (Final Evaluation)	50 Marks	External Examiner

R-2025- F.E Computer Engineering

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits(C) (Notional Learning Hour/30
12212209	Data Structure Lab	--	--	2	--	--	30	--	30	1

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		IAT-1	IAT-2	IAT-1+ IAT 2				
12212209	Data Structure Lab	--	--	--	--	25	25	50

Lab Objectives:

1. Learn about the purpose and importance of data structures, as well as their principles.

2. Understand linear and nonlinear data structures, as well as their implementation.
3. Analyze data structures, such as stacks and queues.
4. Study the terminologies, types, and various operations in linked lists.
5. Discover the principles of Tree, including its operations and uses.
6. Investigate the real-time uses of different data structures.

Lab Outcomes:

1) Classify and apply linear and non-linear data structure concepts to real-world problem solving, as well as performing operations such as insertion, deletion, and traversal.
2) Explore data structures like Stacks, learn about their operations, and apply them to solve issues in a variety of domains.
3) Examine queue data structures and apply them to use in diverse real-world applications.
4) Apply the concept of linked lists to evaluate problems in a variety of applications
5) Analyze and apply the concepts of Trees and their applications in real life problem solving.
6) Demonstrate the ability to analyze, construct, implement, and use data structures to solve real-world problems and evaluate their effectiveness.

List of Experiments.

Sr No	List of Experiments	Hrs
01	Implementation of Insertion and deletion in a specific position in an Array using Function.	2
02	Implementation of recursive program.	2
03	Array Implementation of Stack.	2
04	Array Implementation of Linear Queue.	2
05	Array Implementation of Circular Queue.	2
06	Implement Singly Linked List.	2

07	Implement Doubly Linked List.	2
08	Implementation of Double Ended Queue using Linked List.	2
09	Implementation of Stack using Linked list	2
10	Implementation of Binary Search Tree and its traversal methods.	2
11	Program to count Number of leaf nodes, find the biggest and smallest and height of the tree.	2
12	Implementation of Reversing a List using Stack.	2
13	Convert an Infix expression to Postfix expression using stack ADT.	2
14	Program to Evaluate Postfix Expression using Stack ADT.	2
15	Implementation of DFS and BFS	2

Sr No	List of Assignments / Tutorials	Hrs.
01	Assignment covers the topics from first three units (Introduction, Stack and Queue) limited to three Questions	2
02	Assignment covers the topics from Last three units (Linked list, Tree and Application of Data Structures) limited to three Questions	2

Text Books:

1. Reema Thareja, “Data Structures using C”, Oxford Press.
2. Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, “Data Structures Using C”, Pearson Publication.
3. Ellis Horowitz, Sartaj Sahni, Fundamentals of Data Structures, Galgotia Publications; 2010.
4. E. Balagurusamy, “Data Structure Using C”, Tata McGraw-Hill Education India.

References:

1. Narasimha Karumanchi, Data Structures And Algorithms, 5th Edition,CareerMonk, 2016.
2. Jean Paul Tremblay, P. G. Sorenson, "Introduction to Data Structure and Its Applications",McGraw-Hill Higher Education.
3. Robert Kruse, C. L. Tondo, Bruce Leung, "Data Structures and Program Design in C", Pearson Edition.

Online Resources:

Sr. No.	Website Name
1.	https://nptel.ac.in/courses/106/102/106102064/
2.	Data Structure using C Programming - Course (swayam2.ac.in)

Assessment:

Term Work: Term Work shall consist all practical's based on the above list. Also, Term work Journal must include at least 2 assignments per subject.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

Practical& Oral Exam: An Oral & Practical exam will be held based on the above syllabus.

R-2025- F.E. Computer Engineering

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30)
12412210	Workshop II	--	--	2	--	--	30	15	45	1.5

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		IAT-1	IAT-2	IAT-1+ IAT 2				
12412210	Workshop II	--	--	--	--	25	–	25

Lab Objectives:

1. To introduce students to basic IOT and embedded systems by programming a NODE MCU ESP8266 micro controller to blink an LED.
2. To understand the basic working principle infrared (IR) sensors and role in detecting line contrast.
3. To introduce students to fundamental robotics concepts through the assembly and programming of a basic line following robot.
4. To understand flight dynamics, sensor integration, remote control systems, and applications of

drones in real-world.

5. To familiarize student with component and operation of 3D printer.
6. Identify different types of 3D printers (FDM, SLA, SLS) and their components.

Lab Outcomes: At the end of the course, the student will be able to

1. Able to collect data from sensors and control actuators using boards like Arduino, NodeMCU, or Raspberry Pi.
2. Able to Write and implement code to control robotic motion using microcontrollers like Arduino, Raspberry Pi, or other platforms.
3. Able to design, implement, and test a line following robot that autonomously follows a predefined path using infrared (IR) sensors.
4. Able to Perform printer setup, filament loading, calibration, and execute the printing process successfully.
5. Able to understand the fundamentals of additive manufacturing and to fabricate a physical 3D model using Fused Deposition Modeling (FDM) technology.
6. Able to operate a drone using a remote controller and execute programmed missions using waypoint navigation.

Detailed Syllabus

Sr No	Name of Module	Detailed content	Hours	Lo
1	**Introduction to IOT and Embedded system**	Programming a NodeMCU ESP8266 microcontroller to blink an LED. ● Introduction to NODE MCU and IOT. ● Circuit setup and IDE configuration. ● Setting up Arduino IDE for ESP8266. ● Experimenting Variation and Discussion	**6**	**LO1**
		Self Learning Connect the DHT sensor to the NodeMCU.	**4**	

		Write and upload a program using Arduino IDE to read temperature data. Write and upload a program using Arduino IDE to read temperature data. Send the data to Thing Speak (or any IoT dashboard). Visualize the readings on a real-time graph.		
2	**Introduction to Robotics**	Programming a basic line following robots ● Introduction to robotics and components ● Assembling a line following robots ● Programming the robot. ● Testing and evaluation.	**8**	**LO2** **LO3**
		Self Learning Build and Control a Basic Line-Following Robot (Modify the code to adjust speed based on curves.)	**4**	
3	**Introduction to 3D Printing**	To design and print your first object ● Introduction and basics. ● 3d modelling ● Slicing and preparing the print ● Printing and reviewing.	**8**	**LO5** **LO6**
		Self learning Explore process parameter of 3d printer Explore 2d and 3d drafting and modelling	**4**	
4	**Introduction to drone technology**	Introduction to drone ● Components familiarizations ● Drone assembly ● Calibration and coding upload ● Flight testing and troubleshooting Self Learning Studying basic principle of drone Studying drone programming Basic drown fundamentals	**8** **3**	**LO4**

Reference Book

1. IoT: Building Arduino-Based Projects by Peter Waher.
2. Robotics: Modelling, Planning and Control by Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo.
3. 3D Printing: A Practical Guide for Librarians by Sara Russell Gonzalez, Denise Beaubien Bennett.
4. Make: DIY Drones for the Evil Genius by Ian Cinnamon.

Online Resources

Sr No	Reference
1	https://onlinecourses.nptel.ac.in/noc21_cs17 -Introduction to internet of things, by Prof. Sudip Misra , IIT Kharagpur
2	https://onlinecourses.nptel.ac.in/noc21_cs08 -Embedded Systems Design, By Prof. Anupam Basu, IIT Kharagpur
3	https://onlinecourses.nptel.ac.in/noc25_ae30/preview -Drone Systems and Control, By Prof. Suresh Sundaram, Dr. Rudrashis Majumder
4	https://onlinecourses.swayam2.ac.in/ntr25_ed66/preview - 3D Printing and Design for Educators, By Dr. Sharad K. Pradhan

Suggested list of Experiments:

Sr No	List of Experiments	Hrs.
01	Blinking LED with Node MCU.	6
02	Built and test basic Line following robot	8
03	Design and Print your first object.	8
04	To assemble and understand working of mini drone.	8

Assessment for Term Work (25 marks)

- **Term Work Marks:** 25 Marks (Total marks)
- **Job and Manual**:- 20 Marks
- **Regularity and active involvement:-** 5 Marks

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned					Total Credits (C)
		L	T	P	L	T	P	SL	Notional Learning Hour	(Notional Learning Hour/30
98441211	Indian Knowledge System	2	-	-	30		-	30	60	2

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT -1	IAT -2	IAT-1+ IAT-2					
98441211	Indian Knowledge System	20	20	40	60	2.5	--	--	100

Rationale:

The Indian Knowledge System (IKS) is vital for preserving India's rich cultural heritage, fostering holistic and sustainable practices, and integrating ancient wisdom with modern science to address contemporary challenges and enrich global knowledge.

Course Objectives:

1. To explore and understand the evolution of Indian scientific thought
2. To evaluate the historical and modern educational systems in our country.
3. To analyse sustainable practices in in ancient India.
4. To know the richness of Indian Arts and Culture
5. To understand the contributions of Indian Scientists and Nobel Laureates
6. To understand the principles of good governance.

Course Outcomes:

1. Recognize the sources and concepts of the Indian knowledge system
2. Learn about our history of Indian ancient knowledge and its significance in the current scenario.
3. Demonstrate sustainable development in various fields like Science, Technology, agriculture, industry, architecture performing arts, etc.
4. Understand and appreciate the rich heritage that resides in literature
5. Learn about the ancient Bhartiya education system in comparison with the modern era
6. Showcase the multi-dimensional nature of IKS and its importance in modern

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	1. Students should have the foundational knowledge and skills necessary for a comprehensive understanding of IKS 2. Students should be familiar with the Indian Culture, Language, and History of Science and		

		Technology in India.		
I	**Introduction to The Indian Knowledge System (I.K.S.)**	Basic knowledge and scope of IKS, IKS in ancient India and modern india,, Preservation of culture, tradition and Dharma through education. Sources of Education, Aim of Education, Curriculum, methods of learning, Reviving, Knowledge (Ancient Scientific Discoveries) **Self-Learning Topics: Macaulay's Education Policy and Max Mullar Ideology in destroying Indian Tradition**	5 5	CO2
II	**Development of Scientific Thoughts in Ancient India**	Development in Science, Technology, Astronomy, Mathematics, and Life Sciences – Life Science, Physiology, Ayurveda, etc. Discoveries during Ancient times **Self-Learning Topics: Technological Innovations in Ancient India, Architecture and Engineering**	5 5	CO1
III	**Development of Arts & Culture in India**	Development of Arts & Culture in India, Introduction to Ancient Architecture (Arts, Forts, Paintings, Sculpture, Temple architecture, etc.), Development in performing arts & culture: Music, Art of singing, Art of dancing, Natyakala, Cultural traditions and Folk arts **Self-Learning Topics: Origin and Evolution of Indian Classical Music and Dance, Natyashastra by Bharata Muni, Handicrafts and Decorative Arts**	5 5	CO4
IV	**Good Governance in Ancient India**	Introduction to Indian religions,Moral and Ethical Governance,Vishva Kalyan through Vasudhaiva Kutumbkam,Principles of Good	5	CO6

		Governance about Ramayana, Mahabharat, Artha Sastra and Kauṭilyan State,Scientific Explanation of Vedic or traditional system of society for Good Governance **Self-LearningTopics:Governance Models and Kingdoms, Court System and Judges, Crime, Punishment & Fairness**	5	
V	**Contribution of Indian Scientist & Nobel Laureates**	Baudhayan, Aryabhatta, Brahmgupta, Bhaskaracharya, Varahamihira, Nagarjuna, Susruta, Kanada & Charak Rabindranath Tagore, C.V. Raman, Har Gobind Khorana, Mother Teresa, Subrahmanyan Chandrasekhar, Amartya Sen, V.S. Naipaul, Venkatraman Ramakrishnan, Kailash Satyarthi and Abhijit Banerjee **Self-Learning Topics: Indian Contributions to Global Science**	5 5	CO5
VI	**Sustainable Practices in Ancient India**	Agriculture, waste management, water conservation, forest conservation, architecture, urban planning, biodiversity preservation, etc Yoga, Pranayama, and meditation for health and well-being. **Self-Learning Topics: Vaastu Shastra Principles, Minimalism and Non-materialism**	5 5	CO3
		Total	**60**	

Text Books:

1. A.K Bag, History of technology in India (Set 3 vol), Indian Nation Science Academy, 1997.
2. An Introduction to Indian Knowledge Systems: Concepts and Applications, B Mahadevan, V R Bhat, and Nagendra Pavana R N; 2022 (Prentice Hall of India).
3. Ancient Indian Knowledge: Implications To Education System, Boski Singh; 2019
4. India's Glorious Scientific Tradition by Suresh Soni; 2010 (Ocean Books Pvt. Ltd.)
5. Indian Art: Forms, Concerns, and Development in Historical Perspective (History of Science, Philosophy and Culture in Indian Civilization), General Editor: D.P. Chattopadhyaya, Ed. By. B.N. Goswamy; 1999 Munshiram Manoharlal Publishers Pvt. Ltd.
6. Indian Knowledge Systems: Vol I and II, Kapil Kapoor and A K Singh; 2005 (D.K. Print World Ltd).
7. Pandey, K.K. Kriya Sarira Comprehensive Human Physiology, Chaukhambha Sanskrit series, Varanasi, 2018
8. Shukla Vidyadhar & Tripathi Ravidatt, Aayurved ka Itihas evam Parichay, Chaukhambha Sanskrit Sansthaan, New Delhi, 2017
9. Textbook on The Knowledge System of Bharata by Bhag Chand Chauhan; 2023 (Garuda Prakashan) 6. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati; 2006
10. Traditional Knowledge System in India, Amit Jha
11. J. K. Bajaj and M. D. Srinivas, Timeless India Resurgent India, Centre for Policy Studies, Chennai, 2001.

Online References:

Sr. No.	Website Name
1.	https://swayam.gov.in/explorer?searchText=iks
2.	https://iksindia.org/book-list.php
3.	https://iksindia.org/index.php

R-2025- F.E Computer Engineering

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30
98462212	NSS & Civil Defense	-	-	4	-	-	60	-	60	2

*:Students need to complete 60 hours throughout the semester as it is not possible to get 4 hours /week due to the dynamic schedule of the Government agencies.

		Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT-1	IAT-2	IAT-1+ IAT 2					
98462212	NSS & Civil Defense	--	--	--	--	--	25	--	25

Rationale :

The National Service Scheme (NSS) is a central sector scheme of the Government of India aimed at developing the personality of students through community service. The NSS syllabus is designed with a strong rationale that aligns with the educational, social, and developmental goals of the nation.The NSS syllabus promotes the all-round development of students by instilling values such as discipline, leadership, empathy, and teamwork. It encourages experiential learning beyond the classroom, complementing academic education.

Course Objectives:

1. To Introduce National Service Scheme to learners and explain how it is used in current social studies.
2. To make the students aware of the need of having a foundation in social science and NSS.
3. To develop the personality of NSS volunteers through community service. It can enhance the personal growth and social skills of students.
4. To introduce students to social concepts and issues in society, as well as to get involved in resolving social issues.
5. To equip NSS volunteers with basic skills in civil defence, first aid, fire safety, and crowd management, enabling them to act as first responders during emergencies.
6. To build awareness, preparedness, and responsiveness among NSS volunteers to effectively assist in disaster situations.

Course Outcomes:

1. **Describe** the fundamentals and history of the National Service Scheme (NSS), with specific reference to its role in social work and nation-building.
2. **Demonstrate** understanding of NSS-related procedures, including organizational structure, volunteer enrollment, and activity planning.
3. **Participate** in community-based social service activities such as voter awareness drives, campus cleanup, tree plantation, and cyber safety campaigns.
4. **Develop** leadership, team-building, and project management skills through planning and executing NSS activities.
5. **Explain** the basic concepts of civil defence and disaster response mechanisms.
6. **Apply** practical skills in fire safety, first aid, and emergency management during simulated and real-life situations.

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
0	Prerequisite			
I	Leadership & Personality development	Meaning, definition, qualities, and characteristics of a Leader. Meaning of personality,Dimensions of personality. Personality and Leadership nexus. Universal Human Values and Ethics for youths,	6	Co1

		Sustainable Development Goals		
II	Activity Based Programmes	(Colleges can plan various social activities for learners and make a detailed report) Activities can be conducted throughout the academic year .Evaluation will be based on record keeping of the attendance of the learner.	10	CO2
III	Awareness based Programmes	Awareness Programmes such as Rally,Seminar, Workshops, poster making, theme based rangoli making , essay writing, slogan writing, quizzes ,Celebration of National and International days, Personality Development Programmes, Group Activities, etc.,	10	CO3
IV	Area Based Projects	Visit to Adopted villages, Swatchatha \Programme, Visit and Conserving Ancient monuments and heritage site, Socio Economic Survey of village/slum, Nature Camp, Environmental Education, Women Empowerment Programme, Health and hygiene programmes and Blood donation, Legal awarenessProgramme, Literacy Programme, Cyber theft awareness Water Conservation Programme and RWH,One Day Special Camp in a village (preferably in adopted village/Adopted areas/Slums/MR Schools etc).	14	CO4
V	Introduction to Civil Defence and Disaster Management	Definition and objectives of civil defence,Structure and functions of the Civil DefenceOrganization, Types of disasters: natural and man-made, Phases of disaster management: prevention, preparedness, response, recovery, NDMA (National Disaster Management Authority) and its role,Role of youth in disaster management	10	CO5
VI	Basics of Fire Safety and First Aid	Types of fires and fire extinguishers, Basic fire-fighting techniques, First aid for common injuries: bleeding, fractures, burns, CPR, Emergency	10	CO6

		numbers and response protocol, Evacuation techniques		
		Total	60	

Text Books:

1. National Service Scheme Manual 2006, Government of India

2. Salunkhe P.B. Ed, Chhatrapati Shahu the Pillar of Social Democracy

3. National Service Scheme Manual, Govt. of India

4. Training Programme on National Programme Scheme TISS

5. Orientation Courses for N.S.S. Programme Officers, TISS

Online References:

Sr. No.	Website Name
1.	https://nssmu.in
2.	https://nss.gymkhana.iitb.ac.in/home

Assessment:

Termwork (TW) for 25 marks:

- Term Work (TW) will comprise a report submitted by the students, detailing the 60 hours of social service completed during the semester as per the assigned projects and activities.