**R-2025- F.E Electronics and Computer Science**

# F. E. Syllabus

R-2025- F.E (Sem-I) Electronics and Computer

# SEM I

R-2025- F.E (Sem-I) Electronics and Computer

## ECS-Semester-1

## Theme: "Smart & Sustainable mechanism for Metropolitan Cities."

Aligned with UNSDG Goals: -

- SDG 3: Good Health and Well-being
- SDG 4: Quality Education
- SDG 7: Affordable and Clean Energy
- SDG 9: Industry, Innovation, and Infrastructure
- SDG 11: Sustainable Cities and Communities

**Keywords:** Energy conservation, Water management, Waste handling, Environmental monitoring, efficient resource management in housing societies.

## Description:

This semester's theme, "**Smart & Sustainable Mechanisms for Metropolitan Cities**," explores the integration of intelligent technologies and environmentally conscious practices to create efficient, resilient, and livable urban environments. It focuses on how electronics, computing, and applied sciences can be leveraged to address the complex challenges faced by large urban centers. This includes developing innovative solutions that optimize resource consumption **"Smart** "while ensuring long-term ecological balance and societal well-being **"Sustainable"**. The theme aims to equip students with the skills to design systems that contribute to a higher quality of life, reduced environmental impact, and enhanced urban resilience in metropolitan areas.

Students will tackle real-world urban challenges such as energy conservation, water management, waste handling, environmental monitoring, and efficient resource management in housing societies. Through interdisciplinary projects, students will connect theoretical knowledge with practical applications, fostering early-stage engineering thinking and preparing them to develop impactful solutions for sustainable urban development.

## Problem Statement:

1. Metropolitan areas like Mira Bhayandar face a major challenge with energy waste in common building areas (entrances, lobbies) due to continuously operating traditional lighting. This leads to high costs, light pollution, and a larger carbon footprint,

Undermining urban sustainability**. (UNSD Goal 11: Sustainable Cities and Communities)**

2. Despite growing adoption of residential solar panels in metropolitan areas like Mira Bhayandar, homeowners lack affordable, real-time monitoring tools for DC power output. This prevents them from effectively tracking energy contribution, identifying inefficiencies, or valuing their clean energy, hindering informed energy management and devaluing renewable investments. (**UNSD Goal 7: Affordable and Clean Energy)**

3. Metropolitan areas like Mira Bhayandar face significant traffic congestion and safety issues due to inefficient traffic control systems. This leads to increased travel times, accident risks, and fuel consumption/emissions, undermining urban mobility, economic productivity, and overall smart/sustainable city development. **(UNSD Goal 11: Sustainable Cities and Communities)**

4. In metropolitan areas like Mira Bhayandar, urban air pollution in public parks poses an invisible threat. The lack of accessible, real-time air quality information prevents public awareness of health risks during outdoor activities, impacting public health and undermining sustainable urban living initiatives. (**UNSD Goal 3: Good Health and Well-being)**

5. In metropolitan areas, escalating parking demand leads to wasted time, fuel, and increased traffic congestion/emissions due to a lack of real-time occupancy information. This hinders efficient urban mobility and undermines smart, sustainable city infrastructure. **(UNSD Goal 9: Industry, Innovation, and Infrastructure)**

6. In dense metropolitan areas like Mira Bhayandar, homes and small businesses lack fundamental, low-cost security monitoring for entry points. This creates vulnerabilities to unauthorized entry, resulting in property loss, disruption, and a diminished sense of safety, as conventional systems are often too expensive or complex for smaller establishments. **(UNSD Goal 11: Sustainable Cities and Communities)**

*R-2025- F.E (Sem-I) Electronics and Computer Science*

| 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 | |
| 13111101 | 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-I | IAT-II | Total | | | | | |
| 13111101 | Linear Algebra and Calculus | 20 | 20 | 40 | 60 | 2.5 | 25 | -- | 125 |

**Rationale:**

Mathematical concepts such as matrices, linear equations, eigenvalues, and eigenvectors are fundamental in modeling, analyzing, and solving engineering problems in Electronics and Computer Science. Matrices enable efficient data representation and manipulation critical to circuit analysis, digital signal processing, and computer graphics. Systems of linear equations frequently arise in electrical network design and algorithm optimization, allowing students to develop practical engineering solutions. Eigenvalues and eigenvectors play a key role in analyzing system stability, vibrations in electronic circuits,

and dimensionality reduction techniques used in machine learning and data analysis. The principles of similarity and diagonalizability simplify complex matrix operations, making it easier to solve differential equations in control systems and signal processing. Partial differentiation helps analyze multivariable functions essential for optimizing device characteristics and tuning algorithms under varying conditions, which is crucial in electronics and software performance optimization. The study of analytic functions in complex variables provides powerful tools to model electromagnetic waves, signal propagation, and AC circuit behaviour, bridging theory with practical communication and computing applications. Together, these mathematical foundations equip Electronics and Computer Science students with the critical analytical and problem-solving skills necessary for understanding and innovating in their fields.

**Course Objectives:**

1. To understand matrix operations and their applications in engineering.
2. To formulate and solve systems of linear equations in engineering contexts.
3. To understand eigenvalues and eigenvectors in system analysis.
4. To understand matrix diagonalization for simplifying complex systems in filter design and digital signal processing (DSP).
5. To introduce partial differentiation for analyzing functions with multiple variables, common in electromagnetic field theory.
6. To understand analytic functions and their properties for applications in signal modulation and AC circuit analysis.

**Course Outcomes:**

1. Students will be able to apply matrix operations and use SCILAB to solve engineering problems such as circuit analysis and image processing.
2. Students will be able to solve systems of linear equations and use SCILAB to analyze electrical networks and optimize computer algorithms.
3. Students will be able to use eigenvalues and eigenvectors and use SCILAB to analyze stability in control systems and to perform data dimensionality reduction in computer science.

4. Students will be able to diagonalize matrices and use SCILAB to simplify solving linear differential equations and enhance computational efficiency in signal processing.
5. Students will be able to apply partial differentiation and use SCILAB to optimize multivariable systems such as circuit parameters and algorithmic performance tuning.
6. Students will use analytic functions and use SCILAB to model and analyze electrical impedance and wave propagation in electronics and computer science.

**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 numbers.

**DETAILED SYLLABUS:**

| Sr. No. | Name of Module | Detailed Content | Hrs | CO Mapping |
|---|---|---|---|---|
| I | Matrices | Types of Matrices (Symmetric, Skew- symmetric, Hermitian, Skew-Hermitian, unitary, orthogonal matrices and properties of matrices).<br>Rank of a matrix using Echelon form, reduction to normal form and PAQ form.(3X3)<br>Application of matrices to Coding and De-coding. | 05 | CO1 |
| | | **Self-learning Topics:**<br>1. PAQ form for rectangular matrices.<br>2. Reduction to normal form.<br>3. Theorems on sum of symmetric and skew symmetric matrices and similar theorems.<br>4. Properties of transpose, conjugate of matrices | 08 | |

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|---|---|---|---|---|
| II | System of Linear Equations | System of linear homogeneous and non–homogeneous equations, their consistency and solutions using rank.<br>Linear dependence and independence of vectors. Linear combination of vectors<br>Solution of a system of linear algebraic equations, by (i) Gauss Jacobi Iteration Method, (ii) Gauss Seidel Iteration Method. | 05 | CO2 |
| | | **Self-learning Topics:**<br>1. Vector Spaces<br>2. Linear Transformations.<br>3. Rank -Nullity theorems. | 08 | |
| III | Eigenvalues and Eigenvectors | Eigenvalues & Eigenvectors of all types of matrices (symmetric, skew symmetric, orthogonal, triangular) and its properties (without proof).<br>Cayley-Hamilton Theorem (without proof), verification and reduction of higher degree polynomials. | 05 | CO3 |
| | | **Self-learning Topics:**<br>1. Quadratic forms.<br>2. Reduction to quadratic forms<br>3. Rank, signature and index of a quadratic form. | 08 | |
| IV | Similarity and diagonalization of matrix | Similar matrices, diagonalizable matrices, orthogonally diagonalizable matrices and functions of square matrix.<br>Minimal polynomial, Derogatory and non-derogatory matrices.<br>Singular value decomposition (SVD) | 05 | |
| | | **Self-learning Topics:**<br>1. Functions of Square Matrix | 07 | |

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|---|---|---|---|---|
| | | 2. Orthogonally diagonalization. | | |
| V | Partial Differentiation | Function of two and three variables, Partial derivatives of first and higher order. Differentiation of composite function.<br>Maxima and Minima of a function of two independent variables.<br>Lagrange's Multiplier method with one condition. | 05 | CO5 |
| | | **Self-learning Topics:**<br>1. Euler's Theorem on Homogeneous functions with two independent variables.<br>2. Euler's Theorem on Homogeneous functions with three independent variables.<br>3. Deductions from Euler's Theorem.<br>4. Total differentials<br>5. Implicit Functions | 07 | |
| 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)<br>Milne-Thomson method to determine analytic function f(z) when real (u)or imaginary part (v) is given.<br>Harmonic function, Harmonic conjugate, and orthogonal trajectories. | 05 | CO6 |

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| | | **Self-learning Topics:**<br>1. Expansion of $\sin^n\theta$, $\cos^n\theta$ in terms of sines and cosines of multiples of θ and Expansion of $\sin n\theta$, $\cos n\theta$ in powers of $\sin\theta$, $\cos\theta$.<br>2. Powers and Roots of a complex number.<br>3. Logarithm of Complex Number<br>4. Inverse Hyperbolic Functions.<br>5. Separation of real and imaginary parts of all types of Functions. | 07 | |
| Total | | | 75 | |

**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
4. Computation", New Age International Publishers, 6th Ed., 2007.
5. Bali N.P and Goyal M.: "A Textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
6. Williams G.: "Linear Algebra with Applications", Jones Bartlett Publishers Inc., 6th Ed., 2017.

7. Wylie C. R, Barrett L.C..: "Advanced Engineering Mathematics" McGraw Hill Book Co., New York, 6th Ed., 2017.
8. Ramana B.V.: "Higher Engineering Mathematics", Tata McGraw-Hill Publishing Company Limited, 1st Ed., 2006.
9. Gupta C.B, Sing S.R and Mukesh Kumar: "Engineering Mathematics for Semester I and II", Mc- Graw Hill Education, 2015.
10. Lay D. C: "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.
11. 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/ |

| 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 | |
| 13111102 | Basics of Semiconductor Physics | 2 | -- | -- | 30 | -- | -- | 30 | 60 | 2 |

| Course Code | Course Name | Theory | | | | | Term work | Pract / Oral | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Exam Duration (in Hrs) | | | |
| | | IAT1 | IAT2 | Total | | | | | |
| 13111102 | Basics of Semiconductor Physics | 20 | 20 | 40 | 60 | 2.5 | -- | -- | 100 |

**Rationale:**

The syllabus for Electronics and Telecommunication Engineering (EXTC) and Electronics and Computer Science (ECS) branches is structured to provide a strong theoretical and practical foundation in semiconductor physics, electronic devices, circuit analysis, and emerging technologies. Core topics such as diodes, transistors, FETs, and nanotechnology are included to help students understand the working principles of modern electronic systems. The inclusion of device applications and modern trends like MOSFETs and Hall Effect ensures students are aligned with current industry practices and prepared for advanced studies in communication systems, embedded electronics, and computational electronics.

**Course Objectives:**

1. To introduce the fundamental concepts of semiconductors and carrier behaviour in intrinsic and extrinsic materials.
2. To explain the working principles and characteristics of p-n junction diodes.
3. To familiarize students with the construction, types, and applications of special-purpose diodes.
4. To study the operation, characteristics, and switching behaviour of Bipolar Junction Transistors (BJTs).
5. To understand the structure, functioning, and application of Field Effect Transistors (JFETs and MOSFETs).
6. To introduce nanotechnology concepts, material properties at the nanoscale, and their applications in electronics.

**Course Outcomes:**

1. **EXPLAIN** how charge carriers behave in intrinsic and extrinsic semiconductors and **CALCULATE** their concentrations using basic formulas.
2. **DESCRIBE** how a p-n junction is formed, **DERIVE** the diode equation, and **ANALYZE** how current and voltage change in different bias conditions.
3. **CLASSIFY** different special-purpose diodes and **EXPLAIN** how they work and where they are used.
4. **INTERPRET** how BJTs work in different circuits and **EXPLAIN** their role in amplification and switching.
5. **COMPARE** JFET and MOSFET structures and **APPLY** MOSFETs in simple switching applications.
6. **SUMMARIZE** the basics of nanotechnology and **IDENTIFY** how it's used in making modern electronic devices.

**DETAILED SYLLABUS:**

| Sr. No. | Name of Module | Detailed Content | Hours | CO Mapping |
|---|---|---|---|---|
| | **Prerequisite** | Basic understanding of atomic structure and energy bands in solids<br>Knowledge of conductors, insulators, and semiconductors<br>Familiarity with Ohm's Law, resistance, and electrical circuits Concept of current, voltage, power, and energy in electrical systems<br>Basic idea of magnetic fields and electromagnetic induction | | |
| 1 | Introduction to Semiconductors | Direct and Indirect Semiconductors, Carrier Concentration in Intrinsic Semiconductors, Fermi Level of Intrinsic Semiconductors, Variation of Fermi Level of Intrinsic Semiconductors with respect to Temperature, Extrinsic Semiconductors, Fermi Level of Extrinsic Semiconductors, Variation of Fermi Level of Extrinsic Semiconductors with respect to Temperature and Impurity Concentration, Equation of Conductivity with Current Flow, Hall Effect, Calculation of Hall Voltage. | 14 | CO1 |
| | | **Self-Learning:**<br>Energy band diagrams of metals, insulators, and semiconductors<br>Drift current and diffusion current in semiconductors<br>Applications of Hall Effect in sensor design and material characterization | 14 | |

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|---|---|---|---|---|
| | | Real-life examples of intrinsic and extrinsic semiconductors (e.g., Silicon, Germanium, GaAs), Basics of semiconductor material fabrication (crystal growth, doping techniques) | | |
| 2 | Junction Diode Physics and Characteristics | Formation of p-n junction, calculation of barrier potential Diode equation, p-n junction in forward Bias, p-n junction in Reverse bias, Current-voltage curve for p-n junction diode, Derivation of barrier potential. | 16 | CO2 |
| | | **Self-Learning:** Breakdown mechanisms in p-n junctions: Zener and Avalanche breakdown Diode dynamic (AC) resistance and static (DC) resistance Capacitance effects in p-n junctions (transition and diffusion capacitance) Applications of diodes in logic circuits and voltage multipliers. | 16 | |
| 3 | Functional Diodes and Optoelectronic Devices | Study of concept and working of various important diodes such as Zener diode, Light Emitting Diode (LED), Photodiode, Solar Cell, Varactor diode, Gunn diode, Tunnel diode, Schottky diode, PIN diode, Avalanche diode, Laser diode, Shockley diode, and Step Recovery diode. | 03 | CO3 |
| | | **Self-Learning:** Material science behind LED color variations (bandgap and emission spectrum), photodiode response time and noise characteristics, applications of varactor diodes in frequency modulation and tuning circuits, negative resistance property in Gunn and Tunnel diodes, PIN | 03 | |

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| | | diode usage in RF attenuators and switches, use of avalanche diodes in ESD (Electrostatic Discharge) protection circuit. | | |
| 4 | Transistor Operation and Applications | BJT Structure and Operation - BJT structure, Modes of operation, CE I-V characteristics BJT Amplification and Switching - Current gain, BJT as a switch. | 03 | CO4 |
| | | **Self-Learning:** Configurations (CB, CE, CC) and their comparisons, load line analysis and Q-point stability, transistor biasing techniques and their practical importance BJT switching speed and delay factors, real-life applications of BJT in amplifier and logic circuits. | 03 | |
| 5 | Field Effect Transistors | Field Effect Transistors – Introduction to FETs, types of FETs: JFET and MOSFET, structure and operation. Detailed study of MOSFETs – MOSFET structure, enhancement mode and depletion mode operation, threshold voltage. Applications of MOSFET – MOSFET as a switch. | 04 | CO5 |
| | | **Self-Learning:** Comparison between JFET and MOSFET characteristics, graphical analysis of transfer and output characteristics of FETs, significance of threshold voltage in switching applications, CMOS basics and role of MOSFETs in CMOS logic circuits. | 04 | |
| 6 | Nanotechnology | Introduction to Nanotechnology, Properties (optical, Electrical, Structural, Mechanical) Importance of surface to Volume ratio, nanofabrication techniques such as chemical vapor deposition, Application: Lithography, Single | 05 | CO6 |

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|---|---|---|---|---|
| | | Electron Transfer (SET), Spin Valves. | | |
| | | **Self-Learning:** Difference between bulk and nanoscale materials, effect of reduced dimensions on physical properties, classification of nanomaterials (0D, 1D, 2D, 3D), role of quantum confinement in optical and electrical behavior of nanomaterials, real-world applications of SET and spintronics devices, basics of nanolithography and its use in semiconductor industries. | 05 | |
| | Total | | 60 | |

**Text Books:**

1. Engineering Physics by D.K Bhttacharya, PoonamTandon - Oxford University Press
2. Solid State Electronic Devices – B. G. Streetman – Pearson
3. Electronic Devices and Circuits – Homas Floyd – Pearson
4. Electronic Devices and Circuits – David A. Bell – Oxford University

**References:**

1. Semiconductor Physics and Devices – Basic Principles – Donald Neamen – McGraw Hill
2. Physics of Semiconductor Devices - S.M. Sze, Kwok K. Ng - John Wiley & Sons
3. Electronic Devices and Circuit Theory - R. Boylestad, L Nashelsky - Pearson

**Online References:**

| Sr. No. | Website Name |
|---|---|
| **1.** | https://archive.nptel.ac.in/courses/108/108/108108122/ |
| **2.** | https://onlinecourses.nptel.ac.in/noc22_ee97/preview |
| **3.** | https://www.optima.ufam.edu.br/SemPhys/Downloads/Neamen.pdf |

| 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 |
| 13121103 | **Basic Electrical and Electronics Engineering** | 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 2 | Total. | | | | | |
| 13121103 | **Basic Electrical and Electronics Engineering** | 20 | 20 | 40 | 60 | 2.5 | -- | -- | 100 |

**Rationale:** This course provides foundational knowledge of electrical and electronic principles essential for all engineering disciplines. It covers basic circuit theory, electrical machines, and electronic components like diodes, transistors. Understanding these fundamentals enables

students to analyze and troubleshoot simple electrical systems and prepares them for advanced topics in automation, communication, and embedded systems. The course supports interdisciplinary learning and develops essential problem- solving skills for real-world engineering applications.

**Course Objectives:**

1. To enable students to **understand** the fundamental concepts of direct current (DC) circuits, including Ohm's Law, Kirchhoff's Laws, and basic circuit components, and apply them to analyze and solve simple electrical networks.
2. To enable students to **explore** the principles of alternating current (AC) in single-phase and three-phase circuits, including the concepts of RMS value, power factor, and power measurement.
3. To enable students to **identify** the construction, working principle, and applications of a single-phase transformer, along with its efficiency
4. To enable students to **relate** the principles of electromagnetic induction to the operation of various electrical machines like DC machines, induction motors
5. To enable students to **promote** understanding of the working principles and applications of semiconductor devices like diodes and transistors, and their role in amplifier circuits.
6. To enable students to **encourage** to understand the basics of digital systems, including number systems and logic gates, to build a strong foundation in digital electronics

**Course Outcomes:**

1. **Apply** Ohm's Law, Kirchhoff's Laws, and network theorems like Thevenin's, Norton's, and Superposition to analyze DC circuits in electronic systems
2. **Analyze** single and three-phase AC circuits using phasor diagrams, impedance, and power factor to evaluate voltage, current, and power in various configurations.
3. **Explain** the construction, working principle, and equivalent circuit of a single-phase transformer, including its performance parameters such as efficiency
4. **Illustrate** the construction, working principles, and applications of basic electrical machines such as DC machines and AC motors.
5. **Evaluate** the characteristics and applications of semiconductor devices such as PN junction diode, Zener diode, and BJT in electronic circuits.
6. **Demonstrate** the operation of basic digital circuits using logic gates, Boolean algebra.

**DETAILED SYLLABUS:**

| Sr. No. | Name of Module | Detailed Content | Hours | CO Mapping |
|---|---|---|---|---|
| | **Prerequisite** | Resistance, inductance, capacitance, series and parallel connection of resistance, concept of voltage, current, power and energy and its units, magnetic circuit, mmf, magnetic field strength, reluctance. | | |
| 1 | DC Circuits | D.C. circuits and network simplification: series and parallel circuits, Kirchhoff's laws, mesh and nodal analysis. star-delta transformation, Mesh and Nodal Analysis, Source transformation Superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem | 14 | CO1 |
| | | **Self Learning:** Basic electrical quantities: voltage, current, resistance, and power. Ohm's Law, Kirchhoff's laws, and sign conventions Algebra and solving linear equations, basic network terms (node, branch, loop) | 14 | |
| 2 | AC circuits (Single phase and Three Phase system) | Generation of alternating voltage & current (AC), fundamentals of AC - waveforms, Phasor representation of AC quantities, definitions of time period, amplitude, frequency, phase, RMS value and average value, Peak factor and Form Factor. R, L, C in AC circuits, Series RL, RC and RLC circuits- phase difference and power factor, phasor diagram, series-parallel circuits, active, reactive, apparent power, series resonance. | 16 | CO2 |

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|---|---|---|---|---|
| | | Generation of three-phase voltages, voltage & current relationships in star and delta connections. | | |
| | | **Self Learning:**<br>**AC Waveforms & Parameters** – Sine wave, frequency, time period, amplitude<br>**Phasor Representation** – Vector form of AC quantities<br>**RMS & Average Values** – Definitions, formulas, practical significance<br>**Peak Factor & Form Factor** – Understanding waveform shapes | 16 | |
| 3 | Single Phase Transformers | Working principle of single-phase transformer, emf equation of a transformer, transformer losses, actual (practical) and ideal transformer, overview of efficiency | 03 | CO3 |
| | | **Self Learning:**<br>Working principle and EMF equation of a transformer Transformer losses: core and copper lossesIdeal vs. practical transformer. Transformer efficiency and load conditions.<br>Role of transformers in power systems. | 03 | |
| 4 | Electrical Machines | Construction, principle of operation, classification of DC machines, applications of DC generator, DC motor, equation of generated emf/back emf Fundamental principles of rotating machines, construction, working principle andapplication of stepper and servo motor | 03 | CO4 |

| | | | | |
|---|---|---|---|---|
| | | **Self Learning :**<br>Construction, operation, and classification of DC machines<br>EMF and back emf equations in DC machines<br>Basics of rotating machines<br>Stepper and servo motors: construction, working, applications | 03 | |
| 5 | Semiconductor Devices | Semiconductor Basics, Construction, operation and characteristics of PN junction diode, zener diode and bipolar junction transistor. | 04 | CO5 |
| | | **Self Learning**<br>Semiconductor fundamentals: types and properties<br>PN junction diode: construction, operation, and I-V characteristics<br>Zener diode: construction, operation, and voltage regulation<br>Bipolar Junction Transistor (BJT): structure, working, and characteristics | 04 | |
| 6 | Fundamentals of digital circuits | Number System: Binary, octal, decimal, hexadecimal, their conversion, and arithmetic (binary addition, subtraction using 1's & 2's complement)<br>Logic Gates: AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR universal gates. Boolean algebra, DE Morgan's theorem | 05 | CO6 |
| | | **Self Learning:**<br>Number systems and conversions<br>Binary addition and subtraction (1's & 2's complement)<br>Boolean algebra basics | 05 | |
| | Total | | 90 | |

**Text Books:**

1. B. L. Theraja – Textbook of Electrical Technology, Prentice Hall of India (PHI)
2. B.R Patil – Basic Electrical Engineering, Oxford Higher Education
3. V. N. Mittal and Arvind Mittal – Basic Electrical Engineering, Tata McGraw Hill
4. V. K. Mehta – Principles of Electronics, S. Chand Publishing, New Delhi 7
5. R. S. Sedha – A Textbook of Applied Electronics, S. Chand Publishing, New Delhi
6. Digital Fundamental, 8th edition, Floyd and Jain, Pearson Education India, 2005
7. Electric Motors and Drives Fundamentals, Types and Applications, 3 rd Edition, Austin Hughes, Newnes Publisher.

**References:**

1. Introduction to Electrical Engineering, M. Naidu, S. Kamakshaiah, McGraw-Hill Education, 2004
2. S. N. Singh, "Basic Electrical Engineering" PHI, 2011
3. Electrical and Electronic Technology, 10th edition Edward Hughes, Pearson Education.

**Online References:**

| Sr. No. | Website Name |
|---|---|
| 1. | https://nptel.ac.in/courses/108108076 |
| 2. | https://www.nesoacademy.org/ec/04-analog-electronics/02-semiconductor-diode/01-p n-junction-diode-no-applied-bias |
| 3. | https://onlinecourses.nptel.ac.in/noc21_ee55/preview |
| 4. | https://onlinecourses.nptel.ac.in/noc20_ee60/preview |
| 5. | https://archive.nptel.ac.in/courses/108/105/108105113/ |

| 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 |
| 13121104 | Engineering Graphics & Design | 2 | - | - | 30 | - | - | 30 | 60 | 2 |

| Course Code | Course Name | Theory | | | | | Term work | Pract / Oral | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Exam Duration (in Hrs) | | | |
| | | IAT1 | IAT2 | Total | | | | | |
| 13121104 | Engineering Graphics & Design | 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 SYALLABUS**

| Module no. | Module Name | Detailed content | Teaching hours | CO |
|---|---|---|---|---|
| | **Prerequisite** | To draw basic geometric shapes like circle, pentagon, hexagon, and square with different orientation. | 01 | |
| | | Divide a line, circle, etc. into equal number of parts. | | |

| | | | | |
|---|---|---|---|---|
| **1** | **Introduction to Engineering Drawing and Engineering curves** | Introduction to Engineering Graphics and its significance in the Engineering domain.<br>Types of Lines, Dimensioning Systems as per IS conventions.<br>**Engineering Curves**: Basic construction of Conics, Cycloid, Involutes and Helix (cylinder only). | 03 | CO1 |
| | | **Self-learning topic:**<br>- Explore the concepts of eccentricity, focus, vertex, axis, directrix<br>- Explore other conics - ellipse, parabola and hyperbola using directrix-focus method | 03 | |
| **2** | **Projections of Points, Lines and Planes** | **2.1 Projections of points** in all four quadrants as well as lying on the planes.<br>**2.2 Projections of lines** inclined to both the reference planes (Excluding Traces of lines). Simple application-based problems on projection of lines.<br>**2.3 Projection of planes** (only standard geometrical shapes like square, triangle, pentagon, circle, etc.) inclined to one of the reference planes only. | 05 | CO2 |
| | | **Self-learning topic:**<br>- Explore the projection of lines for mixed quadrants<br>- Explore the projection of planes for planes inclined to both the reference planes | 05 | |
| **3** | **Projections of Solids** | **3.1** Projections of solids with the axis inclined to one reference plane include prism and cylinder<br>**3.2** Projections of solids with the axis inclined to both reference planes include pyramid, and cone<br>(Use change of position or Auxiliary plane method) | 06 | CO3 |

| | | | | |
|---|---|---|---|---|
| | | **Self-learning topic:**<br>- Explore the cuboid and tetrahedron solids inclined to one or both the reference planes.<br>- Explore the applications of solid projection in machine components, structure, and packaging and manufacturing. | 06 | |
| **4** | **Sections of Solids and Developmen t of Surfaces** | **Sections of Solids**<br>Sections of Prism, Pyramid, Cylinder, & Cone cut by plane perpendicular to only one reference plane. Use change of position or Auxiliary plane method.. | 04 | CO4 |
| | | **Self-learning topics:**<br>- Explore the development of lateral surface for regular solids - Prism, Pyramid, Cylinder, & Cone<br>- Explore the real-life application of solids cut with section planes inclined to one plane | 04 | |
| **5** | **Orthographi c and Sectional Orthographi c 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.<br>Views of simple machine parts as per the first angle projection method recommended by I.S. for Orthographic and Sectional Orthographic projection | 06 | CO5 |
| | | **Self-learning topics:**<br>- Explore the third angle method of projection for orthographic views.<br>- Explore half sectional and offset sectional views<br>- Practice simple machine components with half section and offset section | 06 | |

| | | | | |
|---|---|---|---|---|
| **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.<br>Conversion of orthographic views to isometric views | 05 | CO6 |
| | | **Self-learning topics:**<br>- Explore the concepts of isometric scale and isometric projection<br>- Practice isometric projection of simple objects using isometric scale<br>- Explore the isometric views and projections of holes and slots on an inclined plane | 05 | |
| **Total** | | | | |

**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/ |

*R-2025- F.E(Sem I) Electronics and Computer Science*

| 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 | |
| 13121105 | 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 -I | IAT- II | (Total) | | | | | |
| 13121105 | 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.

**Prerequisite: Nil.**

**Detailed Syllabus:**

| M. No. | Module Name | Detail Topics | Hours | CO Mapping |
|---|---|---|---|---|
| **0** | **Prerequisite** | • Basic familiarity with **fundamental mathematical** and **logical reasoning skills**.<br>• **Understanding of basic computer operations** – such as using a keyboard, mouse, operating systems, and file handling.<br>• **Logical thinking and problem-solving ability** – including flowcharting, algorithmic thinking, and basic decision-making.<br>• **Basic English comprehension skills** – to read and write code, understand syntax, and follow programming logic. | -- | -- |

| | | | | |
|---|---|---|---|---|
| | | • Program Development Life Cycle (PDLC) - Structure of a C Program, Compilation, Execution<br>• Concepts of Structured Programming in C<br>• Data Types, Program Statements, Token, Identifiers, Keywords, Constants, Assignment, Declaration and Initialization, Variables, Operators and Expressions, Lvalue and Rvalues,<br>• Input/Output Functions, Type Conversion and Typecasting<br>• Control Structures: if, else, switch-case, loops (for, while, do-while), break, continue, goto | | |
| | | **Self-Learning Topics:**<br>• Write-up on history and evolution of programming languages<br>• Practicing Non-Formatted Input & Output functions – getchar( ), putchar( ), getch( ), getche( ), putch( ), fgets( ), puts( )<br>• Practicing Formatted Input & Output functions – printf( ) - % Format specifiers, formatting the output, escape sequences, Runtime adjustment and precision – Input Function scanf() – format specifiers, formatted input.<br>• Preprocessor Directives in C<br>• Implement pattern generation programs and logic puzzles<br>• Research: Role of C in Embedded Systems<br>• 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** | **CO1** |

| | | | | |
|---|---|---|---|---|
| **2** | **Functions, Arrays, and Strings** | • **Functions:** Prototype Declaration, Definition, Function Calling, Passing Parameters to the Function, Scope of Variables, Call by Value/Reference<br>• **Storage Classes**, Recursive Functions, Recursion Vs Iteration<br>• **Arrays**: 1D, 2D Arrays – Declaration, Initialization, Accessing Array Elements, Operations on Arrays, Applications<br>• **Strings**: Declaration, Initialization, String Operations, Array of Strings, String manipulation Functions in string.h | **8** | **CO2** |
| | | **Self-Learning Topics:**<br>• Sorting an array, Binary searching<br>• Declaration and Initialization of a Multidimensional Array<br>• Matrix addition, multiplication<br>• Arrays of strings: Two-dimensional character array<br>• Passing Arrays to Functions<br>• Character manipulation in the String using character functions in <ctype.h><br>• Implement recursive solutions (e.g., Fibonacci, Tower of Hanoi)<br>• Comparison of recursion and iteration (mini presentation)<br>• Industry application: Use of arrays/strings in data processing | **8** | **CO2** |
| **3** | **Pointers, Structures, and File Handling** | • **Pointers:** Basics, address operator(&), Declaring & initializing Pointer Variables, Indirection Operator and Dereferencing, Pointer Expressions | **7** | **CO3** |

| | | | | |
|---|---|---|---|---|
| | | and Pointer Arithmetic, Types of Pointers, Pointer to Pointers, Pointers and Arrays<br>• **Dynamic Memory Allocation** (malloc, calloc, realloc, free)<br>• **Structures and Unions**, Declaring Structures and Structure Variables, Accessing the members of a structure, Initialization of Structures, Copying and comparing Structures, typedef, Nested Structures, Arrays of Structures, Arrays within the Structure, Structures and Functions<br>• **Files**: File operation- Opening, Closing, Creating, Reading, File Modes, File I/O Functions, Processing text Files. | | |
| | | **Self-Learning Topics:**<br>• Call by address using pointers, returning more than one value from a function, returning pointer from a function, structures and pointers,<br>• Structure versus Union, Enumeration types<br>• Processing binary files<br>• Write mini programs for file encryption/decryption<br>• Technical write-up: Memory leaks and how to avoid them<br>• Tools: Memory debugging using Valgrind (demonstration/presentation) | **7** | **CO3** |
| **4** | **Introduction to Object-Oriented Programming (C++)** | • Differences between Procedural and Object-Oriented Programming<br>• Introduction to C++, Structure of a C++ Program<br>• Classes and Objects, Standard input and output stream objects, Access Specifiers, Data hiding and Encapsulation, Array of Objects | **7** | **CO4** |

| | | | | |
|---|---|---|---|---|
| | | • Constructors and Destructors<br>• Friend Functions, Inline Functions | | |
| | | **Self-Learning Topics:**<br>• Explore syntax differences between C and C++<br>• Implement class-based programs (Employee Management System, Account Management banking system, Addition of Complex Numbers, student management)<br>• Defining the member functions outside the class<br>• Research: Applications of OOP in industry tools (e.g., game development, simulations) | **7** | **CO4** |
| **5** | **Advanced OOP Concepts (C++)** | • **Polymorphism:** Overloading Operators, Operator Overloading using Friend Function, Function Overloading and Compile Time Binding<br>• **Inheritance:** Creating a Parent-Child relationship between Classes, Types of Inheritance, Implementing Multilevel and Hybrid Inheritance, Virtual Base Class, Function Overriding<br>• Virtual functions and runtime polymorphism<br>• Pure Virtual Functions and Abstract Classes, Interfaces<br>• Function Overloading vs Function Overriding | **8** | **CO5** |
| | | **Self-Learning Topics:**<br>• Working of Constructors with Multiple Inheritance Creating a "String" data type – An example using Operator and function overloading<br>• Create inheritance-based applications (e.g., employee hierarchy system)<br>• Mini project proposal based on OOP concepts<br>• Read and summarize advanced topics like Templates or Exception Handling | **8** | **CO5** |

| | | | | |
|---|---|---|---|---|
| **6** | **Industry Applications and Programming Practices** | • Best Practices in Programming: Modularization, Comments, Code Reusability<br>• Debugging Techniques, Error Handling<br>• Applications in Embedded & Real-Time Systems<br>• Introduction to Competitive Programming – Objectives, How it works, Benefits, platforms<br>• Overview of Software Development Life Cycle (SDLC)<br>• MISRA C and MISRA C++ Safe Coding Rules<br>• Role of C/C++ in current technologies (AI, IoT, Game Development, System Software) | **7** | **CO6** |
| | | **Self-Learning Topics:**<br>• Research paper or technical write-up on advanced use of C/C++ (e.g., real-time systems, kernel dev)<br>• Online platform practice (e.g., HackerRank, Codeforces, CodeChef, etc.)<br>• Seminar/presentation on any emerging tech using C/C++ | **7** | **CO6** |

**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. |

*R-2025- FE Electronics and Computer Science*

| 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 |
| **13112106** | Basics of Semiconductor 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 | Total | | | | |
| **13112106** | Basics of Semiconductor 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 understand the physical significance of the gradient, divergence, and curl operators in vector calculus through simple examples.
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:**

1. Learners will be able to RELATE the foundations of quantum mechanics with the development of modern technology.
2. Learners will be able to DETERMINE the wavelength of light and EXPLAIN the interference phenomenon.
3. Learners will be able to ILLUSTRATE the use of lasers in applications and APPLY the fundamentals of fiber optics in modern communication technology.
4. Learners will be able to use a computational tool (e.g., **MATLAB** or **Python**) for CALCULATING the gradient, divergence, and curl of predefined fields.
5. 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.
6. Learners will be able to have a fundamental UNDERSTANDING of semiconductors, including their properties, types, and applications in basic engineering.

**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** | Physical Significance of Gradient, Divergence, and Curl | **01** | **LO4** |
| **07** | Study of Hall Effect. | **01** | **LO5** |
| **08** | Measurement of Distance using Ultrasonic Distance Meter. | **01** | **LO5** |
| **09** | Study of I-V characteristics of Photodiode | **01** | **LO6** |
| **10** | 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/ |

**Assessment:**

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

*R-2025- F.E (Sem 1) Electronics and Computer Science*

| 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 |
| 13122107 | Basic Electrical and Electronics Engineering 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 | Total. | | | | | |
| 13122107 | Basic Electrical and Electronics Engineering Lab | - | - | - | - | - | 25 | 25 | 50 |

**Pre-requisite:** Fundamentals of Physics and Mathematics

**Lab Objectives:**

**Lab course aims to**

1. To impart the basic concept of network analysis and its application
2. To provide the basic concept of AC circuit analysis and its application
3. To illustrate the operation of the transformer and machines
4. To demonstrate the behavior and application of special purpose diodes and transistors.
5. To implement and analyze transistor configuration
6. To introduce logic gates

**Lab Outcomes:**

1. Apply and experimentally verify various network theorems in DC circuits to analyze and simplify electrical networks.
2. Perform experiments on AC circuits to evaluate power factor and analyze phase relationships between voltage and current.
3. Demonstrate transformer operation and identify practical applications
4. Illustrate the performance and applications of motors in automation and peripheral devices.
5. Implement and analyze diode behavior.
6. Demonstrate basic logic gates and implement them using universal gates.

**DETAILED SYLLABUS**

| Sr. No. | List of Experiments | Hours | LO Mapping |
|---|---|---|---|
| **Prerequisite** | **Fundamental Mathematics and Physics** | | |
| 1 | Introduction to Laboratory Safety and Usage of Electrical Measuring Instruments | 2 | LO1 |
| 2 | Verification of Mesh and Nodal analysis. | 2 | LO1 |

| | | | |
|---|---|---|---|
| 3 | To verify the equivalence between Star and Delta networks. | 2 | LO1 |
| 4 | Verification of DC network Theorems (Superposition. Norton's and Thevenin's) | 2 | LO1 |
| 5 | To verify the equivalence of a Voltage Source in series with resistance and a Current Source in parallel. | 2 | LO1 |
| 6 | Measurement of electrical parameters for alternating sinusoidal voltage (AC) | 2 | LO2 |
| 7 | To calculate and compare Measurement of Active, Reactive and Apparent Power in AC Circuit | 2 | LO2 |
| 8 | Observe three-phase voltage relationships in star and delta connections using simulation tools. | 2 | LO2 |
| 9 | To simulate and analyze the performance of single-phase transformer | 2 | LO3 |
| 10 | Study of DC machines | 2 | LO4 |
| 11 | Forward & reverse bias characteristics of PN junction diode | 2 | LO5 |
| 12 | Observe LED behavior and test various LED configurations for digital indicators. | 2 | LO5 |
| 13 | Construct a BJT-based switch circuit | 2 | LO5 |
| 14 | Study of application of Zener diode as Voltage Regulator | 2 | LO5 |
| 15 | To simulate the implementation of Basic logic gates using universal gates | 2 | LO6 |

**Online Resources:**

| Sr. No. | Website Name |
|---|---|
| 1. | https://www.allaboutcircuits.com/ |
| 2. | https://www.tinkercad.com/ |
| 3. | https://www.circuitlab.com/ |

| Sr No | List of Assignments / Tutorials | Hrs |
|---|---|---|
| 1 | Application and Analysis of DC Network Theorems: A Study through Theoretical Concepts and Numerical Problems | 2 |
| 2 | Comparative Analysis of DC Network Theorems and Their Extension to Single and Three-Phase AC Circuits: A Theoretical and Numerical Approach | 2 |
| 3 | Theoretical Understanding of Single-Phase Transformers: Principles, Construction, and Role in Modern Power Systems | 2 |
| 4 | Theoretical Insights into Electrical Machines: Working Principles, Construction, and Applications in Modern Industry | 2 |
| 5 | Industrial Applications of Semiconductor Devices: A Study on Diodes and Transistors in Power and Communication Systems | 2 |
| 6 | Design and Application of Basic Digital Circuits: A Study on Logic Gates, Boolean Algebra, and Real-World Implementations | 2 |
| 7 | Case Study 1: Integrated Power System Design: Analysis of DC and AC Circuits with Single-Phase Transformers and Electrical Machines for Smart Residential Applications | 2 |
| 8 | Case study 2: Application of Semiconductor Devices and Digital Electronics in Industrial Automation and Control of Electrical Machines | 2 |

## Assessment:

**Term Work:** Term Work shall consist of at least 8 to 10 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 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 |
| 13122108 | Engineering Graphics & Design 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 | Total. | | | | | |
| 13122108 | Engineering Graphics & Design 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 / Tutorials | 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 consist of at least 06 practicals based on the above list. Also, Term work Journal must include all the assignments 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.**

*R-2025- F.E. (Sem I) Electronics and Computer Science*

| 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) |
| **13122109** | 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 | Total | | | | |
| **13122109** | 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, storage classes, and arrays, enhancing their understanding of

data management.

3. To familiarize students with advanced C programming concepts such as structures, pointers, dynamic memory allocation, and file handling for effective data storage and manipulation.
4. To provide comprehensive exposure to object-oriented programming in C++ focusing on classes, objects, constructors, destructors, friend functions, and function/operator overloading.
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, storage classes, 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, and file handling to manage and persist complex data efficiently in real-world applications.
4. **Apply and analyze** core object-oriented programming concepts in C++ including classes, objects, constructors/destructors, friend and inline functions, and implement polymorphism through function and operator overloading 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( )<br>b) Program to demonstrate Operators-Arithmetic, Relational and logical, Assignment, Unary, Conditional, Bitwise, Comma, other operators. | 2 |
| **03** | a) Program to demonstrate Branching - If statement, If-else Statement, Multiway decision.<br>b) Program to demonstrate Looping – while, do-while, for | 2 |
| **04** | Program to demonstrate Nested control structure- Switch statement, Continue statement, Break statement, Goto statement | 2 |
| **05** | Program to demonstrate Function, Passing Arguments to a Function (call by value and call by reference). | 2 |
| **06** | a) Implement an iterative function for factorial/ Fibonacci etc.<br>b) Implement a recursive function for factorial/ Fibonacci etc. | 2 |
| **07** | Program to demonstrate Storage Classes –Auto, Extern, Static, Register. | 2 |
| **08** | Program to demonstrate Array 1D and Array 2D. | 2 |
| **09** | Program to demonstrate String and arrays of string. | 2 |
| **10** | 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 |
| **11** | Implementation of Pointers, Pointer Arithmetic, and Dynamic Memory Allocation in C | 2 |
| **12** | Program to demonstrate files:<br>Write a program to maintain a simple student/employee etc. database using file handling.<br>a) Open a file to store student records,<br>b) Implement functions to add, update, and display records.<br>c) Ensure data persistence by saving changes to the file. | 2 |

| | | |
|---|---|---|
| **13** | Program to demonstrate the use of classes and objects, constructors and destructors in C++ and implementation of Friend functions and inline functions, Array of objects | 2 |
| **14** | Program to demonstrate function overloading and operator overloading | 2 |
| **15** | a) Program to demonstrate Single, multilevel, and hybrid inheritance using classes<br>b) Virtual functions and runtime polymorphism | 2 |
| **16** | Program to demonstrate use abstract classes and interfaces (pure virtual functions) | 2 |
| **17** | 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:<br>1. A base class Person with attributes: name, roll_no<br>2. A derived class Student with: Subject marks (e.g., marks[3])<br>3. Member functions to input and display data<br>4. Functions to calculate total, average, and assign grade<br>5. Use constructors for initialization and destructors to display a message upon object destruction.<br>6. Use function overloading for displaying summary (e.g., detailed vs short view).<br>7. Implement operator overloading (e.g., == to compare two students by roll number or marks).<br>8. Use virtual function in a base class ResultCalculator and override in Student class.<br>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.

*R-2025- FE(Sem I) Electronics and Computer Science*

| 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) |
| 13122110 | IDEA LAB - I (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 I | IAT-2 | Total | | | | |
| 13122110 | IDEA LAB - I (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

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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.

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- 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**

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- 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** | **Recognition & Incentives** |

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**Faculty in-charges contribute to 25 marks allocated for the IDEA Lab project termwork. The remaining assessments are conducted by the external examiner.**

**Faculty in-charges receive workload credits or are formally acknowledged in performance reviews.**

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**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.** |

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**Implementation Notes:**

- Guide faculty assess their course's c4ontribution 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 |



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**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 |

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| **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 |

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*R-2025- F.E. (Sem-I) Electronics and Computer Science*

| 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) |
| 13412111 | 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-I | IAT-II | Total | | | | |
| 13412111 | 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 assemble and disassemble a personal computer.
4. Able to solve common trouble shooting problems and common hardware issues.
5. Able to navigate and utilize core google workspace and integrate google workspace tools into 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.<br>● Active and Passive components<br>● Breadboard to built simple circuits.<br>● Soldering Practices.<br>● Reading and interpreting circuit diagrams<br>● Multimeter<br>● Oscilloscope 8050 and DS0<br>● Function generator<br>● Logic Probe/logic analyzer (demo)<br>PCB Design and fabrication<br>● Wiring system<br>● Go-down wiring<br>● House Wiring<br>● Staircase wiring<br>● Introduction To PCB design Software<br>● Drawing a simple schematic<br>● PCB layout and routing techniques. | **6**<br>**6** | **LO1,LO2** |
| | | Self- Learning<br>1. Component Identification and Research (real –life example).<br>2. Resistor Color Code Practice ( learn | **5** | |

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

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

| 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 |

**Suggested list of Experiments:**

**Assessment for Term Work (25 marks)**

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

*R-2025- F.E (Sem-I). Electronics and Computer Science*

| 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 | Total | | | | | |
| 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<br>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)<br>**Self-Learning Topics: Macaulay's Education Policy and Max Mullar Ideology in destroying Indian Tradition** | 5<br>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<br>**Self-Learning Topics: Technological Innovations in Ancient India, Architecture and Engineering** | 5<br>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<br>**Self-Learning Topics: Origin and Evolution of Indian Classical Music and Dance, Natyashastra by Bharata Muni, Handicrafts and Decorative Arts** | 5<br>5 | CO4 |
| IV | **Good Governance in Ancient India** | Introduction to Indian religions,Moral and Ethical Governance,Vishva Kalyan through Vasudhaiva Kutumbkam,Principles of Good Governance about Ramayana, Mahabharat, Artha Sastra and Kauṭilyan State,Scientific Explanation of Vedic or traditional system of society for Good Governance | 5 | CO6 |

| | | | | |
|---|---|---|---|---|
| | | **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<br>**Self-Learning Topics: Indian Contributions to Global Science** | 5<br>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.<br>**Self-Learning Topics: Vaastu Shastra Principles, Minimalism and Non-materialism** | 5<br>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 (Sem-II) Electronics and Computer

# SEM II

## ECS-Semester-II

## Theme: "Connected Communities through Intelligent Systems and Sustainable Design."

Aligned with UNSDG Goals: -

- **UNSDG 3**: Good Health and Well-being
- **UNSDG 6**: Clean Water and Sanitation
- **UNSDG 7**: Affordable and Clean Energy
- **UNSDG 9**: Industry, Innovation and Infrastructure
- **UNSDG 11**: Sustainable Cities and Communities
- **UNSDG 16**: Peace, Justice, and Strong Institutions

**Keywords:** Digital entry system, FSM (Finite State Machine), Keypad access, Affordable security, Residential automation, Community safety, Sustainable Cities

## Description:

The theme **"Connected Communities through Intelligent Systems and Sustainable Design"** emphasizes the development of low-cost, scalable technologies that foster smarter and more inclusive suburban living. In suburban areas across Mumbai—such as Mira Road, Dombivli, Vasai, and Kurla communities face everyday challenges ranging from insecure entry systems in housing societies, to unmanaged traffic signals, water overflow in tanks, and food wastage in schools and hostels. These localized issues, often overlooked, stem from a lack of simple, tech-enabled solutions rooted in community needs. By integrating digital logic, sensor-based automation, and Python-driven control systems, students work toward solving these real-world problems. This theme directly supports UN Sustainable Development Goals focused on clean energy, sustainable cities, quality education, clean water, and community well-being—driving engineering practice toward socially responsible innovation.

## Problem Statements:

1. In many densely populated suburban and urban areas, residential communities often lack automated entry systems. Manual gate operations and the high cost of commercial security solutions pose challenges for these neighborhoods in adopting modern and efficient security measures.

2. Intersections in many suburban and urban areas often experience traffic congestion and safety issues due to outdated or manually operated traffic control systems. This results in irregular traffic flow, longer commute times, and a higher risk of accidents.

3. In areas with unreliable electricity supply, such as Vasai and Nalasopara, streetlights are frequently left on during daylight hours due to the lack of automated control systems. This results in unnecessary energy wastage and higher maintenance and operational costs.

4. In many urban neighborhoods, overflow from overhead water tanks is a common problem, causing substantial water wastage and potential structural damage due to dampness.

5. Educational institutions in many areas struggle to maintain timely class schedules due to dependence on manual bell systems. This often leads to time mismanagement and interruptions in the academic routine.

6. In many suburban regions, students who commute by bicycle often encounter a lack of secure parking facilities on educational campuses. The absence of proper locking infrastructure raises the risk of theft and discourages the use of environmentally friendly transportation options.

*R-2025- F.E(SemII) Electronics and Computer Science*

| 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 | |
| 13111201 | 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-II | Total | | | | | |
| 13111201 | Probability, Statistics, and Differential Equations | 20 | 20 | 40 | 60 | 2.5 | 25 | -- | 125 |

**Rationale**

This course equips first-year Electronics and Computer Science Engineering students with fundamental mathematical concepts and techniques essential for their engineering studies. Beginning with differential equations, students learn to model and analyze dynamic systems commonly encountered in electronics and computing. The topic of double integrals introduces the ability to evaluate multi-dimensional quantities relevant to physical and computational problems. Incorporating probability distributions and statistics, the course enables students to handle randomness and analyze data effectively, which is vital in fields like communication systems, machine learning, and system

performance evaluation. The section on statistical techniques develops skills in inference and decision-making using real-world data. Lastly, the course covers numerical methods that provide computational tools to approximate solutions to complex mathematical problems, supporting simulation, algorithm design, and optimization in engineering applications.

Overall, this course lays a strong foundation by blending theory and application, preparing students for advanced topics and practical challenges in Electronics and Computer Science Engineering. 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 modeling and solving differential equations for engineering applications.
2. To teach evaluation of double integrals for multi-dimensional engineering problems.
3. To introduce key probability distributions for modeling uncertainty in engineering systems.
4. To develop skills in summarizing and interpreting engineering data sets.
5. To introduce inferential statistical methods for data-driven engineering decisions.
6. To equip students with numerical techniques for computational problem solving.

**Course Outcomes:**

1. Students will be able to solve differential equations and use SCILAB to model circuits and dynamic processes.

2. Students will be able to evaluate double integrals and use SCILAB to calculate physical quantities and data distributions.

3. Students will be able to apply probability distributions and use SCILAB to analyze noise and error rates.

4. Students will be able to interpret and use SCILAB statistical data to assess system performance and reliability.

5. Students will be able to analyze data and use SCILAB using hypothesis testing and regression techniques.

6. Students will be able to implement and use SCILAB numerical methods to approximate solutions in simulations and algorithms.

**Prerequisite:**

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:**<br>1. Method of variation of parameter<br>2. Particular integrals for $e^{ax}V$ and xV.<br>3. Cauchy's homogeneous linear differential equation. | 10 | |

| | | | | |
|---|---|---|---|---|
| | | 4. Legendre's differential equation.<br>5. Applications of first order and first degree and also Higher order differential equation. | | |
| 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:**<br>1. Rectification of curves. (Cartesian, Polar and Parametric)<br>2. Application of double integrals to compute Area and Mass of lamina. | 10 | |
| III | Probability Distribution | Discrete distribution: Poisson distribution | 05 | CO3 |
| | | Continuous distribution: Uniform, Exponential and Normal distributions. | | |
| | | **Self-learning Topics:**<br>1. Skewness and Kurtosis of distribution (data).<br>2. Discrete distribution: Bernoulli and Binomial.<br>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:**<br>1. Time Series Analysis<br>2. Index Numbers | 10 | |

| | | | | |
|---|---|---|---|---|
| | | 3. Decision Theory | | |
| 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:**<br>1. Karl Pearson's Coefficient of correlation(r).<br>2. Fitting of exponential curve.<br>3. Fitting of logarithmic curve.<br>4. Covariance<br>5. Sampling theory for quantitative and qualitative samples. | 10 | |
| 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:**<br>1. Indeterminate forms, L- Hospital Rule,<br>2. Gauss Elimination Method, Gauss Jordan Method.<br>3. Maclaurin Series<br>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

*R-2025- F.E (Sem II)Electronics and Computer Science*

| Course Code | Course Name | Teaching Scheme (Contact Hours Per Week) | | | Teaching Scheme (Contact Hours Per Semester) | | | | | Total Credits (C) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | L | T | P | SL | Notional Learning Hour | ( Notional Learning Hour/30 ) |
| 131112 02 | Engineering Chemistry for Electronics | 2 | - | -- | 30 | -- | -- | 30 | 60 | 2 |

| Course Code | Course Name | Theory | | | | | Term work | Pract / Oral | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Exam Duration (in Hrs) | | | |
| | | IAT1 | IAT2 | Total | | | | | |
| 131112 02 | Engineering Chemistry for Electronics | 20 | 20 | 40 | 60 | 2.5 | -- | -- | 100 |

**Rationale:**

1. Chemical science has contributed in many ways to most of the Engineering branches where "Applied Chemistry" is the modern approach to learn impact of Technology on habitat and can be common to all Core Groups,
2. "Engineering Materials" can be prerequisites to impact of corrosion on metals as many civil engineering materials is the important area of concern.
3. "advanced polymers and ceramics" are the matter of general approach to all but especially to electronics group as an emerging development in this sector
4. Chemical science has contributed in many ways to most of the Engineering branches where "Applied Chemistry" such as water, polymers, corrosion, electro chemistry, alloys and ceramics, can be prerequisites to many subjects of all core groups from the perspective of applications as a build material for structural as well as maintenance component in electronics.

**Course Objectives**:

**1.** To study effect of hardness of water on various materials used in electronics.
**2.** To introduce important properties of polymers as Engineering material.
**3.** To study the effect of corrosion by different mechanisms on metals and methods of corrosion control
**4.** To study electrochemistry for give a general idea on various basic theories used in electronics.
**5.** To recognize importance of alloys and can apply the phase rule on it to study the effect of temperature and composition
**6.** To study the ceramics as an important part as a structural component used in electronics.

**Course Outcomes:** Student will be able to –

1. determine the hardness of water and various method of water hardness removal.

2. use the polymers for specific engineering applications on the basis of the properties.
3. understand the causes of corrosion and apply different methods to minimize corrosion.
4. determine the electrochemical reactions and their impact.
5. understand the various alloys and to Interpret various phase transformations of alloy using thermodynamics.
6. Understand the role, purpose and use of ceramics as a structural component used in electronics.

**Prerequisite: (For** Theory **Course**)

1. Knowledge about basic concept of hardness of water.
2. Knowledge of basic properties of polymers.
3. Knowledge of basic concept of electrochemistry and corrosion mechanism.
4. Knowledge of concepts of nanomaterial.
5. Knowledge of basic difference of ferrous and nonferrous alloys.
6. Knowledge of constituents of materials used in electronics equipment.

**DETAILED SYLLABUS: total six module for each subject (15 Weeks)**

| Sr. No. | Name of Module | Deta<br><br>iled Content | Hours | CO Mapping |
|---|---|---|---|---|
| 0 | Prerequisite | Knowledge about basic concept of hardness of water, properties of polymers, concepts of Electrochemistry and corrosion mechanism, nanomaterials and its application, properties of metals and nonmetals and purpose of making alloys, | | |

| | | | | |
|---|---|---|---|---|
| | | Constituents of materials used in electronics equipment. | | |
| I | Water | 1. Impurities in water, Hardness of water<br>2. Determination of hardness of water by EDTA method and numerical problems,<br>3. softening method of water and numerical based on it –i) Ion exchange process ii) electro dialysis iii) reverse osmosis iv) ultrafiltration.<br>4. Definition, significance and numerical problems based on BOD and COD. | 05 | CO1 |
| | | **Self-learning Topics:**<br>**1.** Industrial water treatment in semiconductor manufacturing.<br>**2.** Environmental impact of electronic industry wastewater.<br>**3.** Water purification technologies in PCB fabrication.<br>**4.** BOD & COD monitoring in electronics waste management.<br>**5.** Innovations in reverse osmosis and nano-filtration systems. | 05 | |

| | | | | |
|---|---|---|---|---|
| II | Advanced polymers. | **1.** Macro-molecular science, i) basic concept of polymers, ii) Chemical bonding in polymers, iii) Classification of Polymers.<br>**2.** Properties of Polymers: - i) Molecular weight - Number average molecular weight, Weight average molecular weight, Numerical, ii) Crystallinity - Crystalline and amorphous polymers – Glass transition temperature.<br>**3.** Advanced polymers: i) Conducting polymers: ICP, DCP, ECP, Coordination conducting polymers, ii) Application of conducting polymers. | 05 | CO2 |
| | | **Self-learning Topics:**<br>**1.** Conducting polymers in flexible electronics<br>**2.** Application of intrinsically conductive polymers (ICPs) in sensors and OLEDs.<br>**3.** Biodegradable polymers in electronic packaging<br>**4.** Glass transition temperature and its role in 3D printing of electronic devices | 05 | |

| | | | | |
|---|---|---|---|---|
| | | **5.** Polymer nanocomposites in EMI shielding. | | |
| III | Corrosion | **1.** Introduction: Definition, Types of Corrosion – i) Dry or Atmospheric Corrosion, ii) Wet or Electrochemical corrosion (In Acidic medium, In Neutral medium)<br>**2.** Factors affecting rate of corrosion: i) Position of metal in galvanic series, ii) Purity of Metal, iii) Nature of Corrosion product, iv) Temperature, v) pH of medium, vi) concentration of medium, vii) moisture, viii) Relative Cathodic and Anodic area, ix) overvoltage<br>**3.** Methods to control corrosion: i) Selection of metal, ii) Proper Designing, iii) Cathodic protection, iv) Use of Corrosion Inhibitors, v) Metallic Coating- metal cladding, galvanization, tinning, metal spraying | 05 | CO3 |
| | | **Self-learning Topics:**<br>**1.** Corrosion issues in microelectronics and circuit boards<br>**2.** Corrosion protection in wearable electronics. | 05 | |

| | | | | |
|---|---|---|---|---|
| | | **3.** Nano coatings and corrosion-resistant materials in sensors.<br>**4.** Electrochemical corrosion testing techniques.<br>**5.** Corrosion in lithium-ion batteries. | | |
| IV | Important Engineering materials: Nano materials: | **1.** Nano materials: fullerene – properties and uses<br>**2.** carbon nano tubes- properties, method of preparation.<br>**3.** applications of CNTs | 04 | CO4 |
| | | **Self-learning Topics:**<br>**1.** Applications of carbon nanotubes in VLSI and NEMS/MEMS.<br>**2.** Fullerene-based drug delivery and biosensors.<br>**3.** Synthesis methods for nanomaterials (sol-gel, hydrothermal).<br>**4.** Toxicological impact of nanomaterials in electronics.<br>**5.** Graphene in transparent electronics and photonics. | 04 | |
| V | Alloys | Alloys:<br>**1.** Ferrous alloys – i) Plain-carbon steels ii) Heat and Shock resisting steels iii) Stainless steels iv) Effect | 06 | CO5 |

| | | | | |
|---|---|---|---|---|
| | | of the alloying element- Ni, Cr, Co, Mn, Mo, W and V.<br>**2.** Non Ferrous alloys: A) Aluminum alloys – Composition, properties and uses of i) Duralumin, ii) Magnalium B) Copper alloys – Composition, properties and uses of a) Brass – i) Dutch Metal ii) German Silver b) Bronze – i) Gun metal ii) Nickel bronze. C) Alloys of Pb – Composition, properties and Uses of i) Wood's metal ii) Tinman's solder.<br>**3.** Numerical: i) based on Composition, ii) based on density iii) based on weight of an alloy.<br>**4.** Smart alloys: Types, composition and application of smart alloys in electronics | | |
| | | **Self-learning Topics:**<br>**1.** Smart alloys in actuators and MEMS devices.<br>**2.** Ferrous vs. non-ferrous alloys in electronics heat sinks.<br>**3.** Solder alloys in surface mount technology (SMT).<br>**4.** Effect of alloying elements on electrical conductivity. | 06 | |

| | | | | |
|---|---|---|---|---|
| | | **5.** Shape memory alloys in micro positioning systems. | | |
| VI | Important Electronics Engineering materials | **1.** Introduction,<br>**2.** Materials required in electronics component: i) Silicon and related materials, **ii)** Germanium and related materials, iii) Gallium compounds, iv) Carbon based materials, v) Conductive and insulating materials, vi) Magnetic materials<br>**3.** Etching materials: i) Hydrofluoric acid ii) Phosphoric acid, iii) Chlorine and fluorine based gases. | 05 | CO6 |
| | | **Self-learning Topics:**<br>**1.** Silicon purification process in IC fabrication.<br>**2.** Gallium arsenide and its use in RF and microwave devices.<br>**3.** Germanium-based materials for IR detection.<br>**4.** Magnetic materials in transformers and storage devices.<br>**5.** Etching gases and safety protocols in cleanrooms. | 05 | |

**References:**

1. Engineering Chemistry, Jain and Jain, Dhanpat Rai Publication
2. A textbook of Engineering Chemistry, S. S. Dara, S. Chand and Company
3. Polymer science: Vasant Gowarikar, Wiley Estern Ltd, new Delhi
4. Green Chemistry: V. K. Ahluwalia
5. Textbook of Polymer science: F.W. Billmeyer
6. Fundamentals of Polymer science & Engineering- Anilkumar & S K Gupta, Tata McGraw Hill, New Delhi
7. Engineering Chemistry, O. G. Palana, Tata McGraw Hill Publication
8. Environmental Chemistry, A. K. De, Tenth edition, New Age International,
9. P. W. Atkins, Physical Chemistry, Oxford University Press, 7th edition. 5. J. D. Lee Concise Inorganic Chemistry, Oxford University Press, 5 th edition

**Online References:**

| Sr. No. | Website Name |
|---|---|
| 1. | https://archive.nptel.ac.in/courses/103/106/105106205/ |
| 2. | https://courses.nptel.ac.in/noc20ch41/preview |
| **3.** | https://www.researchgate.net/ |
| **4.** | https://www.sciencedirect.com/topics/engineering/polymer-material |
| **5..** | https://www.sciencedirect.com/topics/chemistry/nanomaterial |

| 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 |
| 13121203 | 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 | Total. | | | | | |
| 13121203 | 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. Engineering Mechanics plays a vital role for students of Electronics - Telecommunication and Computer Science - Engineering by bridging the gap between software, electronics, and the physical world. It supports the understanding of mechanical behaviour in electromechanical systems such as sensors, actuators, antennas, and robotic communication systems. With the growing integration of IoT, embedded systems, and cyber-physical technologies, a solid grasp of mechanics is essential for designing reliable, efficient, and physically robust systems. The subject contributes to vibration analysis, structural hardware design, and the simulation of physical behaviours, enabling students to develop smart, adaptive systems in advanced applications like automation, control systems, AR/VR, and digital twins.

**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 Outcome**

| | |
|---|---|
| 1 | Demonstrate the understanding of Centroid and MI 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<br>Velocity, acceleration, displacement, Uniform velocity and accelerated motion, Law of conservation of Energy, Law of conservation of Momentum, work-energy principle, impulse and momentum principle, and Co-efficient of restitution | 01 | |
| **1** | **Centroid** | i. Characteristics, and real-life significance for Centroid<br>ii. Centroids of primary geometrical shapes and plane laminas | 03 | CO1 |
| | | **Self-learning topic:**<br>- Centroid for area with sector and real-life application<br>- Exploring Moment of Inertia for primary geometrical shapes and plane laminas | 03 | |
| **2** | **Force and System of Forces** | i. Principle of transmissibility, Moment of force about a point and concept of couple<br>ii. Classification of force systems<br>iii. Resultant of coplanar system of forces and Varignon's Theorem<br>iv. Resultant of non-coplanar system of forces | 05 | CO2 |

| | | | | |
|---|---|---|---|---|
| | | **Self-learning topic:**<br>- Exploring force and a couple system and real-life application of a force and a couple system<br>- Resultant of non-coplanar parallel and general system of forces | 05 | |
| **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<br>ii. Equilibrium of beams, rollers, and system of bodies<br>iii. Laws of friction. Cone of friction. angle of repose, and angle of friction<br>iv. Application of equilibrium with friction on blocks on horizontal and inclined planes and ladders | 07 | CO3 |
| | | **Self-learning topic:**<br>- Equilibrium of connected bodies (beam and sphere), two force and three force members, beams connected using internal hinges<br>- 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<br>ii. Introduction to General plane motion, problem based on Instantaneous centre (ICR) method for general plane motion (up to 2 linkage mechanism and roller) | 06 | CO4 |

| | | | | |
|---|---|---|---|---|
| | | **Self-learning topic:**<br>- Application of motion graph for real-life problems<br>- ICR for rollers, wheels and three links problems<br>- ICR for system of rigid bodies | 06 | |
| **5** | **Kinetics of particles** | i. Introduction to D'Alembert's Principle (DAP), inertia force, dynamic equilibrium, Work done by active forces, impact and collision<br>ii. Problems on DAP (single and double block), and WEP (single block) | 04 | CO5 |
| | | **Self-learning topic:**<br>- Application of WEP to the real-life problems<br>- Explore the concept of impact and collision for rigid bodies | 04 | |
| **6** | **Introduction to Robot Kinematics** | i. Fundamental of Robot Mechanics, Degree of Freedom, D-H Parameters, robot kinematics (Forward)<br>ii. Homogeneous transformation (limited to 2 DOF Serial robot) | 04 | CO6 |
| | | **Self-learning topic:**<br>- Derive and Analyze - Manual derivation of forward kinematics using D-H parameters<br>- Explore online simulation tools such as MATLAB Robotics Toolbox Online and refer https://kinematicsplayground.org/<br>- Solve 2 numerical problems involving: Assigning D-H parameters and finding of | 04 | |

| | | | | |
|---|---|---|---|---|
| | | end-effector pose using transformation matrices | | |
| **Total** | | | 60 | |

**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/ |

*R-2025- F.E (Sem II)Electronics and Computer Science*

| 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/45 |
| 13211204 | Digital Electronics | 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 | Total | | | | | |
| 13211204 | Digital Electronics | 20 | 20 | 40 | 60 | 2.5 | -- | -- | 100 |

**Course Objectives:**

1. To enable students to **understand and simplify** logic functions using Boolean algebra, De Morgan's Theorems, and Karnaugh maps.
2. To enable students to **design and analyze** combinational circuits like adders, multiplexers, encoders, decoders, and comparators.
3. To enable students to **explain and analyze** sequential circuits including latches, flip-flops, counters, and shift registers.
4. To enable students to **compare and classify** different memory types such as ROM, RAM, EPROM, EEPROM, static and dynamic RAM.

5. To enable students **to design FSMs** (Moore and Mealy models) and study asynchronous circuits and hazards.
6. To enable students to **understand and apply** data converters ( ADC/DAC) and PLDs like PAL, PLA, CPLD and FPGA

**Course Outcomes:**

1. **Formulate and simplify** logic expressions using Boolean algebra, De Morgan's theorems, and Karnaugh maps.
2. **Design and implement** combinational logic circuits such as adders, subtractors, multiplexers, encoders, decoders, and comparators.
3. **Analyze the operation** of sequential circuits including latches, flip-flops, counters, shift registers, and finite state machines (FSMs).
4. **Differentiate** various types of memory (ROM, RAM, EPROM, EEPROM) and explain timing parameters like setup time, hold time, and propagation delay.
5. **Explain and evaluate** the operation of programmable logic devices (PLDs) such as PAL, PLA, CPLD, and FPGA for digital logic implementation.
6. **Interpret and compare** the working of different types of ADCs and DACs, including their circuit structures and applications.

**DETAILED SYLLABUS:**

| Sr. No. | Name of Module | Detailed Content | Hours | CO Mapping |
|---|---|---|---|---|
| 0 | **Prerequisite** | Binary number system and codes, binary arithmetic | | |
| 1 | Implementation of Logic Functions | Formulating a logic function, Sum of Products (SOP), Product of Sums (POS), Minimization using Boolean Algebra, De Morgan's | 07 | CO1 |

| | | | | |
|---|---|---|---|---|
| | | Theorems, Minimization using Karnaugh map (up to 4 variables). | | |
| | | **Self-Learning:**<br>● Practice drawing **truth tables** and converting to **SOP/POS**<br>● Use **Boolean laws** to simplify given expressions.<br>● Practice **K-map** grouping with different minterm combinations<br>● Solve MCQs or logic circuit design problems from textbooks or online platforms. | 07 | |
| 2 | Combinational Circuit Design | Introduction to combinational circuits, Adder, Substractor, Multiplexer (16:1, 8:1, 4:1), De-multiplexer, Decoder (3:8 and 5:12) and Encoder (Priority Encoder), Code converters, Comparator(2-bit), ALU.<br>Static and dynamic hazards in combinational circuits | 08 | CO2 |
| | | **Self-Learning:**<br>● **D**esign a **N:1 multiplexer** / **1:N De-Multiplexer** and write the truth table. Implement a **Half**/ **full adder using two half adders** and logic gates. Implement same with Multiplexer.<br>● Construct a **priority encoder** for 4 inputs. Identify and remove **static hazard** from the expression:<br>Y=A′B+ABY = | 08 | |

| | | | | |
|---|---|---|---|---|
| | | A'B + BY=A′B+AB.<br>● Take some 3-4 digit binary numbers and convert them into Gray code**.** | | |
| 3 | Flip-Flops And Memories | Storage elements: Latches and Flip-flops (S-R, J-K, D, T Flip-flop), Master Slave Flip-flop. Triggering, Propagation delay time, setup time, hold time.<br>Memories – ROM, RAM, EPROM, EEPROM – Volatile and non-volatile – Static and dynamic RAM | 08 | CO3 |
| | | **Self-Learning:**<br>● **Understand and compare** different flip-flops (S-R, J-K, D, T, Master-Slave) with their symbols, truth tables, and timing diagrams.<br>● **Learn key timing parameters**: triggering types, propagation delay, setup time, and hold time through diagrams and examples.<br>● **Study memory types**: ROM, RAM, EPROM, EEPROM, and classify them as **volatile or non-volatile**, **static or dynamic**.<br>● **Compare SRAM and DRAM** in terms of working, speed, cost, and usage in real systems (e.g., cache vs main memory). | 08 | |

| | | | | |
|---|---|---|---|---|
| 4 | Sequential Circuit | Synchronous and Asynchronous counters, Shift registers and their applications, Analysis of Moore and Mealy Type Finite State Machines (FSM), State Reduction Introduction to Asynchronous Sequential circuits, Essential hazards in asynchronous sequential circuits | 08 | CO4 |
| | | **Self-Learning:**<br>● **Synchronous vs Asynchronous Counters** – Working and differences.<br>● **Shift Registers** – Types and simple applications.<br>● **Moore vs Mealy FSMs** – State diagrams and differences.<br>● **State Reduction** – Basics of minimizing FSM states.<br>● **Asynchronous Circuits & Hazards** – Introduction and essential hazard types. | 08 | |
| 5 | Programmable Devices | Structure of Programmable Logic Devices (PLDs), Function implementation with PAL and PLAs, Numerical on PLA and PLA. Introduction to CPLD and FPGA | 07 | CO5 |
| | | **Self-Learning:**<br>● **Structure of PLDs** – Basic architecture and types<br>● **PAL and PLA** – Difference, structure, and function implementation.<br>● **Numerical on PAL/PLA** – Logic realization examples. | 07 | |

| | | | | |
|---|---|---|---|---|
| | | ● **Introduction to CPLD and FPGA** – Features and applications | | |
| 6 | Introduction to Logic Family Analog And Digital Interface | Characteristic parameters of logic families: Voltage and Current parameters, Fan in, Fan out, Noise margin, Power Dissipation, Propagation Delay TTL NAND gate and its transfer characteristics, CMOS inverter and transfer characteristics, comparison of TTL and CMOS logic families<br>Analog to digital converters –Successive approximation method – Counter type converter.<br>Digital to analogue converters – Binary weighted D/A converter – R/2R ladder network converter | 07 | CO6 |
| | | **Self-Learning:**<br>● **Types of A/D Converters** – Parallel Comparator, Dual Slope, Successive Approximation, Counter Type<br>● **Types of D/A Converters** – Binary Weighted, R/2R Ladder Network<br>● **Basic Concept of Bus Standards** – Purpose, examples (e.g., data, address, control buses)<br>**Case Study 1:** Comparative Analysis of TTL and CMOS Logic Families in Low-Power Digital Applications<br>**Case Study 2: Design** and Implementation of Digital | 07 | |

| | | | | |
|---|---|---|---|---|
| | | Systems Using Combinational and Sequential Logic Circuits<br>**Case Study 3:** State Machine Optimization: Moore vs. Mealy FSMs in Real-Time Applications<br>**Case Study 4:** Simulation and Performance Evaluation of ADC and DAC Circuits Using SPICE/HDL Tools | | |
| | Total | | 90 | |

**Text Books:**

1. John F. Wakerly, "Digital Design Principles and Practice"- Pearson Publications, 4th edition.
2. Morris Mano, Michael D. Ciletti, " Digital Design with introduction to Verilog HDL" Pearson, 5th edition
3. John M. Yarbrough, "Digital Logic Applications and Design" – Thomson Publications .
4. Stephen Brown and ZvonkoVranesic, "Fundamentals of digital logic design with Verilog design", McGraw Hill, 3rd Edition.
5. Roth and Kinney, "Fundamentals of Logic Design", Cengage learning,7th edition

**Reference Books:**

**1.** J. Bhaskar, A Verilog HDL Primer, Third Edition, Star Galaxy Publishing [8] Sameer Palnitkar, "Verilog HDL: A guide to digital design and synthesis"
**2.** William I. Fletcher, "An Engineering Approach to Digital Design", Prentice Hall of India

**Online References:**

| Sr. No. | Website Name |
|---|---|

| | |
|---|---|
| **1.** | https://onlinecourses.nptel.ac.in/noc20_ee32/preview |
| **2.** | https://archive.nptel.ac.in/content/storage2/courses/106108099//Digital%20Systems.pdf |

*R-2025- F.E (Sem II)Electronics and Computer Science*

| 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) |
| 13112205 | Engineering Chemistry for Electronics 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 | Total. | | | | | |
| 13112205 | Engineering Chemistry for Electronics Lab | - | - | - | - | - | 25 | -- | 25 |

**Lab Objectives:**

1. To apply knowledge acquired during the theory class in carrying out the experiments for qualitative and quantitative determination.

2. To analyze experimental results and write laboratory report.

**Lab Outcomes:** After completion of experiment, the learners will be able to

1. Estimate the type of water hardness and calculate it.
2. Synthesize UF/PF resin at laboratory level.
3. Learn the effect of various factors on the rate of corrosion.
4. Understand the significance of electrochemistry principles
5. Learn various volumetric quantitative analytical techniques to determine % of elements from alloy samples and concept of smart alloys used in electronics
6. Learn various instrumental quantitative analytical techniques to determine % of elements from alloy samples and concept of smart alloys used in electronics.

**List of Experiments:**

| Sr No | List of Experiments | Hrs |
|---|---|---|
| **01** | Determination of Total, Temporary and Permanent hardness of water by EDTA method | **01** |
| **02** | Estimation of chloride content in the given water sample. | **01** |
| 03 | Synthesis of Urea formaldehyde Resin. | **01** |
| 04 | Synthesis of Phenol formaldehyde resin. | **01** |
| 05 | To compare the rate of corrosion of various metals in acidic medium. | **01** |
| 06 | Determination of % purity of iron. | **01** |
| 07 | Determination of Sn from soldiers volumetrically. | **01** |
| 08 | Determination of unknown concentration of Cu in the given sample by colorimetry | **01** |

| | | |
|---|---|---|
| 09 | Determination of unknown concentration of Fe in the given sample by colorimetry | **01** |
| 10 | Determine the unknown PH of sample by PH meter | **01** |
| | | |

**List of assignments:**

| Sr No | List of Assignments | Hrs |
|---|---|---|
| **01** | Numerical on determination of hardness of water and on determination of BOD and COD | **01** |
| 02 | Short note on advanced polymers used in electronics. | **01** |
| 03 | Short note on various corrosion control techniques | **01** |
| 04 | Short note on CNT. | **01** |
| 05 | Short note on smart alloys: some examples of smart polymers with their properties and uses. | **01** |

| | | |
|---|---|---|
| 06 | Short note on Etching materials. | **01** |

**References:**

1. Engineering Chemistry, Jain and Jain, Dhanpat Rai Publication
2. A textbook of Engineering Chemistry, S. S. Dara, S. Chand and Company
3. Polymer science: Vasant Gowarikar, Wiley Eastern Ltd, new Delhi
4. Green Chemistry: V. K. Ahluwalia
5. Textbook of Polymer science: F.W. Billmeyer
6. Fundamentals of Polymer science & Engineering- Anilkumar & S K Gupta, Tata McGraw Hill, New Delhi
7. Engineering Chemistry, O. G. Palana, Tata McGraw Hill Publication
8. Environmental Chemistry, A. K. De, Tenth edition, New Age International,
9. P. W. Atkins, Physical Chemistry, Oxford University Press, 7th edition. 5. J. D. Lee Concise Inorganic Chemistry, Oxford University Press, 5 th edition.

**Online Resources:**

| Sr. No. | Website Name |
|---|---|
| 1. | https://archive.nptel.ac.in/courses/103/106/105106205/ |
| 2. | https://courses.nptel.ac.in/noc20ch41/preview |
| 3. | https://www.researchgate.net/ |
| 4. | https://www.sciencedirect.com/topics/engineering/polymer-material |
| 5. | https://www.sciencedirect.com/topics/chemistry/nanomaterial |

**Assessment:**

**Term Work:** Term Work shall consist of at least 10 practical based on the above list. Also, Term work Journal must include at least 6 assignments.

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

| 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 |
| 13122206 | Engineering Mechanics 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 | Total. | | | | | |
| 13122206 | Engineering Mechanics Lab | -- | -- | -- | -- | -- | 25 | 25 | 50 |

**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) | 02 | CO2 |
| 2 | Verification of the Principle of Moments (Bell crank lever) | 02 | CO2 |
| 3 | Determination of Centroid of plane lamina made up of standard geometrical shapes | 02 | CO1 |
| 4 | Determination of support reactions of a Simply Supported Beam. | 02 | CO3 |
| 5 | Determination of coefficient of friction using inclined plane | 02 | CO3 |
| 6 | Verification of the equations of equilibrium for non-concurrent non-parallel (General) force system. | 02 | CO3 |
| 7 | Kinematics of particles. (Uniform motion of a particle, Projectile motion, motion under gravity) | 02 | CO4 |
| 8 | Collision of elastic bodies (Law of conservation of momentum). | 02 | CO5 |
| 9 | Kinetics of particles. (collision of bodies) | 02 | 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 06 practicals based on the above list. Also, Term work Journal must include all the assignments listed above.

**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. Electronics and Computer Science*

| 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 | |
| **13122207** | Programming Lab (Python) | 2 | -- | 2 | 30 | -- | 30 | -- | 60 | 2 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term work | Practical / Oral | Tut. | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | IAT-1 | IAT-2 | Total | | | | | |
| **13122207** | Programming Lab (Python) | -- | -- | -- | -- | 25 | 25 | -- | 50 |

**Lab Objectives:** To familiarize learners with Python's basic syntax, variables, data types, operators, and input/output functions.

1. To reinforce the understanding and application of conditional statements, loops, and functions in Python programming.
2. To instill learners on file handling, exception management, and Python packaging.
3. To introduce object-oriented programming principles and their application in Python.
4. To explore advanced topics such as regular expressions, pattern matching, and GUI development.
5. To introduce and demonstrate the use of popular Python libraries for data handling.

**Lab Outcomes:** After completion of experiment, the learners will be able to

1. Demonstrate the proficiency in basic python programming or create and perform various operations on data structures like list, tuple dictionaries and strings.
2. Apply Control Flow and Functions for efficient coding to solve problems.
3. Demonstrate proficiency in handling file operations, managing exceptions, and developing Python packages and executable files for modular programming.
4. Illustrate the concept of Object-Oriented Programming used in python.
5. Design Graphical User Interface (GUI) applications, utilizing appropriate Python libraries to create user-friendly interfaces.
6. Investigate and apply popular python libraries to conduct efficient data handling tasks.

**Prerequisite:**

1. Logical Thinking & Problem Solving: Ability to break down problems into smaller parts. Basic understanding of flowcharts or algorithmic thinking.
2. Mathematical Reasoning: Basic arithmetic operations (addition, subtraction, multiplication, division).
3. Understanding of variables, functions, and formulas (from school-level math).
4. Analytical Skills: Ability to spot patterns, debugs issues, and evaluates outputs.

**DETAILED SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hours | CO Mapping |
|---|---|---|---|---|
| **0** | Prerequisite | Comment (Prerequisite syllabus should not be considered for paper setting) | **01** | |
| **1** | Introduction to Python | 1.1 Evolution of Python & its role in modern tech stacks, Python in web development, data science, automation, AI.<br>1.2 Basic Syntax and Data Types - Variables and data types, Operators, Input and output, | **05** | **CO1** |

| | | | | |
|---|---|---|---|---|
| | | 1.3 Real-world data modeling with Python data types (int, float, str, list, tuple, dict, set)<br>1.4 Operators with hands-on examples from finance, gaming, etc., Industry Task: Build a basic expense tracker using lists and dictionaries | | |
| **2** | Control Flow and Functions | 2.1 Conditional Statements: if-elif-else in decision- based apps<br>2.2 Loops (for, while) in automation & report generation,<br>2.3 Loop control: break, continue, pass<br>2.4 Functions- Defining functions, Parameters and return values, Scope and lifetime of variables | **05** | **CO2** |
| **3** | File Handling, Packaging, and Debugging | 3.1 File Handling- Reading and writing files,<br>3.2 Exception handling<br>3.3 Creating Python Packages, Modules and executable files<br>3.4 Dealing with Syntax Errors, Runtime Errors and Scientific Debugging | **05** | **CO3** |
| **4** | Object-Oriented Programming (OOP) in Python | 4.1 Introduction to OOP: Classes and objects,<br>4.2 Encapsulation, inheritance, and polymorphism<br>4.3 Creating Classes and Objects: Class attributes and methods Constructor and destructor.<br>4.4 Type of Inheritance: Single, multiple and multilevel inheritance | **05** | **CO4** |

| | | | | |
|---|---|---|---|---|
| **5** | Advanced Python Concepts | 5.1 Regular Expressions, Pattern matching, Regex functions in Python<br>5.2 GUI Development using any Python GUI framework | **05** | **CO5** |
| **6** | Python Libraries | 6.1 Introduction to Popular Libraries<br>6.2 NumPy for numerical computing,<br>6.3 Pandas for data manipulation.<br>6.4 Matplotlib for data visualization functional ceramics, ceramic coatings. | **05** | **CO6** |

**Text Books:**

1. Core Python Programming, Dr. R. Nageswara Rao, Second Edition, Dreamtech Press.
2. Beginning Python: Using Python 2.6 and Python 3.1. James Payne, Wrox Publication.
3. Python Programming, Anurag Gupta and G. P. Biswas, First Edition,McGraw-Hill

**Reference Books:**

1. Learn Python the Hard Way, Zed Shaw, Third Edition, Addison-Wesley.
2. Python Projects, Laura Cassell,Alan Gauld, First Edition, Wrox Publication.
3. Introduction to computing and problem-solving using python, Balagurusamy, First Edition, McGraw Hill Education.

**Online Resources:**

| Sr. No. | Website Name |
|---|---|
| 1. | https://nptel.ac.in/courses/106106145 |
| 2. | https://onlinecourses.swayam2.ac.in/cec22_cs20/preview |
| 3. | https://www.researchgate.net/ |

| | |
|---|---|
| 4. | https://www.sciencedirect.com/science/article/pii/S2666920X24001127 |
| 5. | https://www.sciencedirect.com/search?qs=python%20programming |

**Suggested List of Experiments: (Expected Minimum 15 Experiments to be performed)**

| 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 python programs, which will serve as the foundational tool for all further experiments in the lab. | **02** |
| 02 | Personalized Greeting Generator - Write a python code to generate Personalized Greeting. | **02** |
| 03 | Calculating Areas of Geometric Figures - Write a python program to calculate areas of any geometric figures like circle, rectangle and triangle. | **02** |
| 04 | Calculating Gross Salary of an Employee: Write a Python program to calculate the gross salary of an employee. The program should prompt the user for the basic salary (BS) and then compute the dearness allowance (DA) as 70% of BS, the travel allowance (TA) as 30% of BS, and the house rent allowance (HRA) as 10% of BS. Finally, it should calculate the gross salary as the sum of BS, DA, TA, and HRA and display the result. | **02** |
| 05 | Task List Manager: Develop a Python program to manage a task list using lists and tuples, including adding, removing, updating, and sorting tasks. | **02** |
| 06 | Student Record Keeper: Write a Python program to create, update, and manipulate a dictionary of student records, including their grades and attendance. | **02** |
| 07 | Triangle Pattern Generator Using Loops: Write a Python program to print a triangle pattern (give any), emphasizing the transition from C to Python syntax. | **02** |

| | | |
|---|---|---|
| 08 | Number Type Identifier: Develop a Python program that takes a numerical input and identifies whether it is even or odd, utilizing conditional statements and loops. | **02** |
| 09 | **Grade Evaluator:** Develop a Python program that takes marks and evaluates grade using if-elif-else | **02** |
| 10 | **Fibonacci Sequence Generator:** Write a Python program to generate the first N terms of the Fibonacci series using loops. | **02** |
| 11 | Multiplication Table Generator: Write a Python program to take a numerical input from the user and generate its multiplication table using loops. | **02** |
| 12 | Extracting Words from Text File: Develop a Python program that reads a text file and prints words of specified lengths (e.g., three, four, five, etc.) found within the file. | **02** |
| 13 | Basic Exception Handling: Write a Python program that takes two numbers as input and performs division. Implement exception handling to manage division by zero and invalid input errors gracefully. | **02** |
| 14 | Online ATM System: Develop classes for ATM. Include methods for withdraw, deposit and check balance. | **02** |
| 15 | Password Strength Checker: Write a Python script that prompts the user to enter a password. Use regular expressions to validate the password based on these criteria: At least 8 characters long, Contains at least one uppercase letter, one lowercase letter, one digit, and one special character. | **02** |

**Assessment:**

**Term Work:** Term Work shall consist of at least 15 practical based on the above list. Also, Term work Journal must include 1 mini project based on above syllabus.

**Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (mini project) + 5 Marks (Attendance).

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

*R-2025- FE(Sem II) Electronics and Computer Science*

| 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) |
| 13122208 | IDEA LAB - II (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 | Total. | | | | |
| 13122208 | IDEA LAB - II (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.** |

| Aspect | Implementation Strategy |
|---|---|
| **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.** |

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**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.** |

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**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

## 1) 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 |

| **Criteria** | **Month 1 (5)** | **Month 2 (10)** | **Month 3 (10)** |
|---|---|---|---|
| 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 |
| 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 |

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

*R-2025- FE(Sem II) Electronics and Computer Science*

| 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 |
| 13212209 | **Digital Electronics 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 | Total. | | | | |
| 13212209 | **Digital Electronics Lab** | -- | -- | -- | -- | 25 | 25 | 50 |

**Pre-requisite:** Binary number system and codes, binary arithmetic

**Lab Objectives:**

**Lab course aims to**

1. To enable students to minimize real-world Boolean functions with multiple inputs using standard simplification techniques.
2. To enable students to design, implement, and verify basic combinational circuits such as adders, subtractors, multiplexers, demultiplexers, encoders, decoders, comparators, and code converters.
3. To enable students to analyze the operation and timing of flip-flops and memory elements, fostering technical and analytical skills.
4. To enable students to design and analyze counters, shift registers, and finite state machines.
5. To enable students to study the structure of PLDs and implement logic functions using PAL, PLA, CPLD, and FPGA.
6. To enable students to study the characteristics of logic families and analyze the performance of A/D and D/A converters using various circuit techniques.

**Lab Outcomes:**

1. Apply Boolean algebra and graphical techniques for logic simplification.
2. Design and implement basic combinational logic circuits.
3. Analyze and implement sequential circuits including FSMs.
4. Simulate and evaluate the performance of logic circuits and data converters.
5. Understand and compare the characteristics of digital logic families.
6. Implement logic functions using programmable logic devices and reconfigurable hardware.

**DETAILED SYLLABUS**

| Sr. No. | List of Experiments | Hours | LO Mapping |
|---|---|---|---|
| **Prerequisite** | Binary number system and codes, binary arithmetic | | |
| 1 | To minimize Boolean expressions using Boolean algebra rules. | 2 | LO1 |
| 2 | To implement logic functions using Sum of Products (SOP)/Product of Sum (POS) form. | 2 | LO1 |
| 3 | Implementation and Verification of Half Adder and Full Adder | 2 | LO2 |
| 4 | Design and Implementation of 4:1, 8:1, and 16:1 Multiplexers | 2 | LO2 |
| 5 | Implementation of 2-bit Binary Comparator | 2 | LO2 |
| 6 | Design and Verification of a Parity Generator | 2 | LO2 |
| 7 | Design and implementation of synchronous counters | 2 | LO3 |
| 8 | To perform state reduction and simplification of Finite State Machines (FSMs) for efficient sequential circuit design. | 2 | LO3 |
| 9 | Implementation of logic functions using Programmable Array Logic (PAL) | 2 | LO6 |
| 10 | Implementation and simplification of Boolean functions using Programmable Logic Array (PLA) | 2 | LO6 |
| 11 | Analysis of Characteristic Parameters of TTL and CMOS Logic Families | 2 | LO5 |
| 12 | Transfer Characteristics of TTL NAND Gate and CMOS Inverter | 2 | LO5 |

| | | | |
|---|---|---|---|
| 13 | Simulation of Successive Approximation Analog to Digital Converter (ADC) | 2 | LO4 |
| 14 | Simulation of R-2R Ladder Digital to Analog Converter (DAC) | 2 | LO4 |
| 15 | **Presentation / Case Study Topic**<br><br>**"Design and Analysis of Digital Circuits: From Logic Families to Data Conversion Techniques"**<br><br>**Comparative study of TTL and CMOS logic families**<br><br>**Implementation and behavior of combinational and sequential circuits**<br><br>● **State machine design and state reduction techniques.**<br><br>● **Role of PLDs, CPLDs, and FPGAs in digital design.**<br><br>● **A/D and D/A conversion methods (Successive Approximation, Counter-type, R-2R Ladder, etc.).**<br><br>● **Real-world relevance through analysis of performance parameters, hazards, and applications** | 2 | LO1-LO6 (Integrated) |

**Recommended Books:**

1. Morris Mano, Michael D. Ciletti, " Digital Design with introduction to Verilog HDL" Pearson, 5th edition
2. Sameer Palnitkar, "Verilog HDL: A guide to digital design and synthesis"
3. William I. Fletcher, "An Engineering Approach to Digital Design", Prentice Hall of India

**Online Resources:**

| Sr. No. | Website Name |
|---|---|
| 1. | CircuitVerse - Online Digital Logic Circuit Simulator |
| 2. | Online circuit simulator & schematic editor – Circuit Lab |

## Assessment:

**Term Work:** Term Work shall consist of at least 8 to 10 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:** A practical/ Oral exam will be held based on the above syllabus.

*R-2025- F.E.( Sem-II) Electronics and Computer Science*

| 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) |
| 13412210 | 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-I | IAT-II | Total | | | | |
| 13412210 | 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 of 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 the real-world.

5. To familiarize students with the components and operation of 3D printers.
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.<br>● Introduction to NODE MCU and IOT.<br>● Circuit setup and IDE configuration.<br>● Setting up Arduino IDE for ESP8266.<br>● Experimenting Variation and Discussion | **6** | **LO1** |
| | | Self Learning<br>Connect the DHT sensor to the NodeMCU. | **4** | |

| | | | | |
|---|---|---|---|---|
| | | Write and upload a program using Arduino IDE to read temperature data.<br>Write and upload a program using Arduino IDE to read temperature data.<br>Send the data to Thing Speak (or any IoT dashboard).<br>Visualize the readings on a real-time graph. | | |
| **2** | **Introduction to Robotics** | Programming a basic line following robots<br>● Introduction to robotics and components<br>● Assembling a line following robots<br>● Programming the robot.<br>● Testing and evaluation. | **8** | **LO2**<br>**LO3** |
| | | Self Learning<br>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<br>● Introduction and basics.<br>● 3d modelling<br>● Slicing and preparing the print<br>● Printing and reviewing. | **8** | **LO5**<br>**LO6** |
| | | Self learning<br>Explore process parameter of 3d printer<br>Explore 2d and 3d drafting and modelling | **4** | |

**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 the 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 |
| 98461211 | Universal Human Values | 2 | - | - | 30 | | - | 30 | 60 | 2 |

| Course Code | Course Name | Theory | | | | | Term work | Pract / Oral | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Exam Duration (in Hrs) | | | |
| | | IAT1 | IAT2 | Total | | | | | |
| 98461211 | 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.

**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<br><br>**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<br><br>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.<br><br>**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 resolution | 4<br><br>4 | CO2 |

| | | | | |
|---|---|---|---|---|
| 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<br><br>**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<br><br>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<br><br>**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<br><br>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. | 6 | CO5 |

| | | | | |
|---|---|---|---|---|
| | | **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 | |
| 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.<br><br>**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<br><br>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)*

**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 be 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.

*R-2025- F.E -(Sem-II) Electronics and computer Science*

| 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 | |
| 98421212 | Enterprise Communication and Corporate Culture | 1 | - | - | 15 | | - | 15 | 30 | 1 |

| | | Theory | | | | | Term Work | Pract Exam | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Exam Duration (in Hrs) | | | |
| | | IAT 1 | IAT 2 | Total | | | | | |
| 98421212 | Enterprise Communication and Corporate Culture | 20 | 20 | 40 | 40 | 2 | - | - | 80 |

**Rationale:**

The course equips electronics and telecom engineers with effective technical and persuasive oral and written proficiencies essential for the environment to create high tech systems and services, Students will learn to decode complex technical ideas and messages, grasp foundational communication models, and develop hands-on expertise in verbal, nonverbal, and digital communication channels. These abilities are vital for professionals to interface with government bodies, private investors, infrastructure partners, and the general public. It helps enhance both a firm's brand identity and its reputation as these interactions are critical for the planning, implementation of various project ideas The curriculum strengthens all four LSRW competencies—Listening, Speaking, Reading, and Writing—to ensure engineers with the proficiency required to convey technical and non-technical information with accuracy, assurance, and professionalism in diverse professional contexts.

. **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 and adapt the dynamics of communication to navigate modern professional arenas.
2. Acquire active listening skills by practicing technical and business Speech Acts using direct and digital mode.
3. Analyze barriers, methods, audience and purposes for mastering individual and team speaking in professional & business settings.
4. Synthesize extensive technical and business texts for reflective learning through reading and summarization.
5. Design purposeful and ethical technical and business content, presentation using ICT enabled media.
5. Advocate technical excellence to propagate ethical & sustainable community solutions with a career oriented approach.

**Prerequisite:** Basic knowledge of English language

*R-2025- F.E -(Sem-II) Electronics and computer Science*

**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, Interpersonal Communication in Groups: Verba interaction : Meetings & Presentations, Teleconferences & Calls and Non-Verba Interactions: Proxemics, Haptics Oculesics Kinesics Digital Interaction: virtual teams, vide calls. Formal and Informal Communicatio Channels . Barriers: Physical Semanti Psychological & Emotional Barriers, Cultural & Contextual Barriers Silos mentality, Hierarchica layers, Rigid policies, unclear channels, an outdated technology.<br>**Self Learning Topics**: Communication a Workplace & Outer Agencies Interna communications: Regular email updates, Vide conferencing and face to face sessions. Externa Communication Enterprise Social Media & Networking. Printed and environment Media | 5<br>5 | CO1 |

| | | | | |
|---|---|---|---|---|
| | | Industry collaboration readiness. | | |
| II | Active Listening | Active Listening: Discussions, and note-taking techniques. Audio-book listening, Understanding colleagues' and clients during meetings. Types of Listening Comprehensive Listening , Critical Listening and Reflective /Empathetic<br>**Self Learning Topics:** Listening kryptonite : Distractions and Preoccupations Semantic Jargons information overload, speaker pace, Pseudo listening & Interruptions Neglecting Nonverbal Cues, Knowledge Hiding & Siloed Departments | 2<br>2 | CO2 |
| III | Conversational Proficiencies | Technical Communication Skills<br>Technical Discussion, delivering technical oral presentations inside and outside organizations Q&A, Explaining Engineering Concepts in Simple Terms (Tips & Guidelines) Grooming and Self Development:<br>**Self Learning Topics**: Customer pitches and stakeholder meetings. Vendor evaluations or regulatory compliance., vendors as strategic partners, Vendor Negotiations or Demos, Risk & Contingency Planning, Consensus for brainstorm. | 2<br>2 | CO3 |
| IV | Text Interpretation Expertise | Intensive Reading, Extensive ReadingSkimming,Scanning,SQ5R Method *(Survey, Question, Reading, Recording, Recall, Review and Revise)* Industry Related Articles and Report, .Summarizing text to Graphic | | CO4 |

| | | | | |
|---|---|---|---|---|
| | | Organizers (GO) Infographics , Process Flowcharts & Swimlane Diagrams SWOT analysis KWL Charts, Different Types of Organograms etc. Summarising text in point form. Leveraging Online Resources like IEC standards Market Research Report , Business Case study , Tech Business News, Product Management & Development,Financial & Strategy Reading.<br><br>**Self Learning Topics** :Technical Vocabulary, Financial Reports of Electronics Companies' Annual Reports, Supply Chain & Manufacturing: | 2<br><br>2 | |
| V | Technical & Corporate Writing Skills | Seven Cs of Business Writing Completeness, Conciseness, Consideration, Concreteness, Clarity, Courtesy, Correctness. Format & Types of Formal Letters : Cover Letter,Inquiry Letter Offer Acceptance / Rejection Letter Quotation Letters Grievance Service Change Notification, Recommendation Letter. Technical Writing for Professionals: Short And Long Reports Formatting Guidelines Tips For Text Chat users manuals Standard Operating Procedures (SOP) Product Specification writing. Legal and compliance writing: Compliance Reports and License Agreement. Studio Activities | 3 | CO5 |

| | | | | |
|---|---|---|---|---|
| | | **Self Learning Topics:**Studio Activities: Content Creation for Social Media and e-Commerce Platforms Blogs, Vlog Keynote speeches Podcast titles Landing pages Social media posts, Shor videos, YouTube video description | 3 | |
| VI | Community Communication and Ethics | 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 challenges. Sustainable smart urban infrastructure,Smart Waste ManagementEnergy Efficiency & Management Communication Transparency and Honesty Accountability Avoiding Misuse of Information Uphold ethical standards in all written, verbal, and digital communication.<br>**Self Learning Topics** : Ethical use of technology,Sustainable Study Habits: Time Management and Responsibility Active participation in professional communities, forums, and collaborative platforms. | 1<br><br>1 | CO6 |

**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/ |

**Assessment**
**IAT -I 20 marks**
**IAT-20 Marks**
**IAT -I - Independent speaking activity,** where a student will deliver a Three mins. prepared speech on a Technical topic related to his program and a two mins. Impromptu speech on general topics

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**IAT -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.**

*R-2025- F.E - (Sem-II)Electronics And Computer Science*

| 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 | |
| 98422213 | Enterprise Communication and Corporate Culture LAB | - | - | 2 | - | - | 30 | - | 30 | 1 |

| Course Code | Course Name | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical/ Exam | Total |
| | | Internal assessment | | | End Sem. Exam | | | |
| | | IA T1 | IAT2 | Total | | | | |
| 98422213 | Enterprise Communication and Corporate | -- | -- | -- | -- | 25 | - | 25 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Culture LAB** | | | | | | | |

**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 communication principles for excellence in academic and professional settings.

2. Test listening capabilities for advanced listening strategies in physical and digital mode.

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

4. Demonstrate reading proficiencies through practicing extensive technical and non-technical texts.

5. Design digital technical and business write ups for professional transactions

6. Implement interpersonal skills and professional ethics to provide fair and collaborative solutions.

**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. Enterprise Communication: Industry Reports, and Articles News Letter, Brand messaging, Multi stakeholders collaborations. Private - Academic Partnerships | 4 | LO1 |
| II | Active Listening | Comprehensive Listening and Applications: Technical or Business podcasts, You tube lecture on academic stuff/ processes/ procedures/ Development Plans. | | |

| | | | | |
|---|---|---|---|---|
| | | Critical Listening: Listen to an audio recording presentation, podcast Interviews and summarise in your words in an oral manner Reflective /Empathetic Listening: Paraphrase What You Hear, Reflect Emotions, Summarize Key Points, Review recorded calls. | 4 | LO2 |
| 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.<br><br>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 Prepare Diagram Organizers on: Summarising text to Graphic Organisers (GO) Process Flowcharts & Swimlane SWOT | | |

| | | | | |
|---|---|---|---|---|
| IV | Text Interpretation Expertise | analysis KWL Charts, Different Types of Organograms etc.as per the situations in the organizational setting. Summarising text in point form after reading Market Research Report , Business Case study ,Tech Business News | 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 Quotation Letters Grievance Service Change Notification Letters Grievance Letter Letter Standard users manuals Operating Procedures (SOP) Data Privacy Policy , Compliance Reports and License Agreement Content Creation for Social Media CMS - Wordpress to create, manage and publish content. e-Commerce Platforms Blogs, Vlog Podcast titles,Landing pagesSocial media posts | 6 | LO5 |
| VI | Community Communication and Ethics | Local Area Visit, Field Visits. BSNL , MTNL training Centre Surveys & gaining knowledge on switching mechanism telecom network Feedback Analysis and Report Writing ,Providing solutions for Technical issues. | 4 | LO6 |

**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

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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 Enterprise Communication strategies/Issues/ Achievements in Select Indian Companies, Tata Consultancy Services (TCS),Infosys,Reliance Jio Infocomm Industries, Bharti Airtel Ltd., Vodafone Idea. BSNL, Tata Communication etc | 02 |
| 2 | Listening Skill Activity Sheet containing minimum three types of listening activities from Lab Syllabus.( Technical Podcasts, Video/Audios of meeting collaboration. Processes and descriptions on You tube channels. | 02 |
| 3 | A.Continuous Evaluation of at least three types of the activities from Lab Syllabus for proficiency in oral communication/presentation | 02 |
| 4. | a. Two Verbal Ability Test based on GRE, TOEFL,IELTS<br>b. Summary report and Graphic Organizers for the relevant scenario or situation<br>c. Powerpoint / Slide Preparation on business 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/ ,Metro Projects/ Local visit to MTNL and BSNL/ Traffic Management and ensure the implementation of your subject completely or partially for the smooth functioning of the system<br><br>Conduct a Survey( Face to face, Kiosk /Mobile , QR Code/ SMS survey and get feedback from outside agencies regarding the future inputs for synergistic solutions. | 02 |

**Term Work - 25**

**Experiments/Practicals**

10 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**