MITS Kochi
Muthoot Institute of Technology and Science
(Autonomous)

# B. TECH
# COMPUTER SCIENCE & ENGINEERING (CYBER SECURITY)
# CURRICULUM & SYLLABUS

2025
REGULATION

# B.Tech

# COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)

# 2025 REGULATION

# CURRICULUM & SYLLABUS

CONTENTS

SEMESTER 1

CURRICULUM

| SLOT | COURSE CATEGORY | COURSE CODE | COURSE NAME | L | T | J | P | S | C |
|---|---|---|---|---|---|---|---|---|---|
| A | BST | B250904/MA100A | Mathematics for Information Science-1 | 3 | 1 | 0 | 0 | 2 | 3 |
| B | BSE | B250904/CH910B | Chemistry for Information Science | 3 | 0 | 0 | 2 | 3 | 4 |
| C | EST | B250906/CN100C | Engineering Graphics and Computer Aided Drawing | 1 | 2 | 0 | 0 | 3 | 3 |
| D | EST | B250906/CN100D | Introduction to Electrical and Electronics Engineering | 4 | 0 | 0 | 0 | 4 | 4 |
| E | ESE | B250905/CN110E | Algorithmic Thinking with Python | 2 | 1 | 0 | 2 | 3 | 4 |
| K | HMT | B250908/CN910K | Health and Wellness | 1 | 0 | 0 | 1 | 0 | 1 |
| U | ESL | B250906/CN930U | Basic Electrical and Electronics Engineering Workshop | 0 | 0 | 0 | 2 | 0 | 1 |
| G | SEC | Skill Enhancement Course: NASSCOM or equivalent | | | | | | | 1 |
| *(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work, C- Credit)* | | | | | | | | | |

| COURSE DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Regulation** | **2025** | **L-T-J-P-S** | **3-1-0-0-2** | **Version** | **25/0** | **Credits** | **3** |
| *(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)* | | | | | | | |

| Course Code | Course Name | Course Category |
|---|---|---|
| **B250904/MA100A** | **MATHEMATICS FOR INFORMATION SCIENCE-1** | **BST** |
| **Pre-requisite** | | |
| The basic knowledge of single variable calculus. | | |

| COURSE OBJECTIVES | |
|---|---|
| 1 | To develop an understanding of differential calculus for analysing the slope, tangents, normal, and curvature of single-variable functions, and to interpret their geometric and physical significance. |
| 2 | To introduce the concepts of multivariable calculus and their applications in determining directional derivatives, gradients, and extremum points of multivariable functions. |
| 3 | To equip the students with optimization techniques for solving constrained and unconstrained problems using analytical methods such as Lagrange multipliers, and iterative methods such as the method of steepest descent. |

| COMPETENCY STATEMENT (CC) | |
|---|---|
| CC1 | Demonstrate the ability to apply limits, continuity, and differentiation to single-variable and multivariable functions which includes higher-order, partial and directional derivatives, and use these concepts to find extrema. |
| CC2 | Demonstrate the ability to apply methods of Lagrange multipliers, Steepest descent and graphical method in solving different types of constrained and unconstrained optimization problems. |

**COURSE OUTCOMES (CO)**

**Course Outcomes** (CO): At the end of this course, learners will be able to:

| CO | CO Statement | CC Mapping | Cognitive (C) | Psychomotor (P) | Affective (A) |
|---|---|---|---|---|---|
| CO1 | **Apply** the concepts of calculus to find tangent, normal, and concavity of single variable functions. | CC1 | A | | Rs |
| CO2 | **Apply** the concepts of partial derivatives in finding directional derivatives, local extrema, and absolute extrema of multivariable functions. | CC1 | A | | Rs |
| CO3 | **Solve** optimization problems using the method of Lagrange multipliers, graphical method, and method of steepest descent. | CC2 | A | | Rs |

***Cognitive (Revised blooms Level):*** *- **R**: Remember; **U**: Understand; **A**: Apply; **An**: Analyse; **E**: Evaluate; **C**: Create*
***Psychomotor Domain (Dave's):*** *- **I**-Imitation, **M**-Manipulation, **P**-Precision, **Ar**-Articulation, **N**-Naturalisation*
***Affective (Krathwohl)**: - **Re**-Receiving, **Rs**-Responding, **V**-Valuing, **O**-Organization, **Ch**-Characterization*

| CO | Program Outcomes (PO) & Program Specific Outcomes (PSO) Correlation Matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO | | | | | | | | | | | PSO | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 1 | 2 | 2 | | | | | | | | | 1 | | | |
| 2 | 2 | 2 | | | | | | | | | 1 | | | |
| 3 | 2 | 2 | | | | | | | | | 1 | | | |

*Correlation [3 – High, 2 -Medium, 1 – Low]*

| TEACHING AND ASSESSMENT SCHEME | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Teaching Scheme / Week | | | | | Credit | Hours / Semester | Examination Scheme | | |
| | | | | | | | Theory | | |
| L | T | J | P | S | C | | CIA | ESE | Total |
| 3 | 1 | 0 | 0 | 2 | 3 | 90 | 40 | 60 | 100 |

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

| SYLLABUS (Major Topics) | | | |
|---|---|---|---|
| Module | Title | Major Topics | Hrs |
| 1 | Single Variable Calculus | Limits of function values, continuity at a point, continuous functions, rates of change: derivative at a point, derivative as a function, second and higher order derivatives, instantaneous rates of change, chain rule, implicit differentiation, tangents and normal lines, linearization,<br>extreme values of functions on closed intervals, the Mean Value Theorem (without proof), concavity: the second derivative test for concavity.<br>**(Text 1 - Relevant topics from sections 2.2, 2.5, 3.1, 3.2, 3.3, 3.4, 3.6, 3.7, 3.9, 4.1, 4.2 4.4)** | 10 |
| 2 | Partial derivatives - 1 | Functions of several variables: domains and ranges, level curves of two variables, limits for functions of two variables, continuity for functions of two variables, partial derivatives of a function of more than two variables, partial derivatives and continuity, second order partial derivatives, the mixed derivative theorem, the chain rule: functions of two variables.<br>**(Text 1 - Relevant topics from sections 14.1, 14.2, 14.3, 14.4)** | 10 |
| 3 | Partial derivatives - 2 | The chain rule: functions of three variables, directional derivatives in the plane, interpretation of the directional derivative, gradient, properties of the directional derivative, the linearization of a function of two variables, local extreme values for functions of two variables: relative extrema, first derivative theorem for local extreme values, critical point, saddle point, second derivative test for local extreme values, absolute maxima and minima on closed bounded regions.<br>**(Text 1 - Relevant topics from sections 14.4, 14.5, 14.6, 14.7)** | 12 |
| 4 | Optimization Techniques | Constrained maxima and minima, the method of Lagrange multipliers with one constraint, the method of Lagrange multipliers with two constraints, method of steepest descent (only two variables), LPP-formation, solution of LPP using graphical methods.<br>**(Text 1 - Relevant topics from section 14.8, Text 2 - Relevant topics from sections 22.1, 22.2)** | 10 |

| SELF-LEARNING / TEAM WORK | | |
|---|---|---|
| Sl. No | Self-learning / Team Work Description | Hrs |
| 1 | Relations, functions, types of functions, limits of functions, continuity at a point, continuous functions **(2 hours)**.<br>Practice problems on continuity of functions, derivatives **(2 hours)**, Practice problems on rate of change, tangents & normal **(2 hours)**, Practice problems on maxima & minima of functions, concavity **(2 hours)**.<br>**Team Work -** Formulate and solve real-life problem situations by identifying the appropriate mathematical function, determining its critical points, and applying suitable techniques to find the local or absolute extrema of the function **(1 hour)**. | 9 |
| 2 | Practice problems on Limits & continuity for functions of two variables **(3 hours)**,<br>Practice problems on partial derivatives of first & higher order derivatives **(3 hours)**,<br>Practice problems on chain rule for two variables **(3 hours)**. | 9 |
| 3 | Practice problems on chain rule for three variables **(2 hours)**, Practice problems on directional derivatives & gradient **(3 hours)**, Practice problems on linearization of a function & extreme values of a function **(3 hours)**. | 9 |

| | | |
|---|---|---|
| | **Team Work -** Analyse real-life problem situations by modelling them using multivariable functions, determine the critical points and apply suitable optimization techniques to identify local and global extrema of the functions **(1 hour)**. | |
| 4 | Basics of Linear programming problems, concept of global and local optimum **(2 hours)** Practice problems on Lagrange Multipliers with one constraint & two constraints **(2 hours)**, Practice problems on Method of Steepest Descent **(2 hours)**, Practice problems on formulation of LPP & finding the solution by graphical method **(2 hours)**.<br>**Team Work -** Formulate & apply the graphical method to solve the real-life linear programming problems by representing the constraints as feasible regions and identifying the optimal solution to maximize or minimize the objective function **(1 hour)**. | 9 |

**SUGGESTED LEARNING RESOURCES**

| **Text Book** | | | |
|---|---|---|---|
| Sl. No. | Title of Book | Author | Publication |
| 1 | Thomas' Calculus | Maurice D. Weir, Joel Hass, Christopher Heil, Przemyslaw, Bogacki | Pearson, 15th edition |
| 2 | Advanced Engineering Mathematics | Erwin Kreyszig | John Wiley & Sons, 10th edition |

| **Reference** | | | |
|---|---|---|---|
| Sl. No. | Title of Book | Author | Publication |
| 1 | Calculus | Howard Anton, Irl Bivens, Stephens Davis | Wiley, 10th edition, 2012 |
| 2 | Optimization: Algorithms and Applications | Rajesh Kumar Arora | CRC Press, 1st edition 2015 |
| 3 | Multivariable Calculus | Ron Larson, Bruce Edwards | Brooks/Cole, Cengage Learning, 10th edition, 2014 |
| 4 | Calculus & Its Applications | Goldstein, Schneider, Lay, Asmar | Pearson, 14th edition, 2018 |
| 5 | Bird's Higher Engineering Mathematics | John Bird | Taylor & Francis, 9th edition, 2021 |
| 6 | Higher Engineering Mathematics | B.V Ramana | McGraw-Hill Education, 39th edition, 2023 |

| **Web Resource** | |
|---|---|
| 1 | https://nptel.ac.in/courses/109104124 |
| 2 | https://nptel.ac.in/courses/111103764 |
| 3 | https://nptel.ac.in/courses/111104125 |
| 4 | https://youtu.be/Hi81OgB38OI?feature=shared |

| **DETAILED SYLLABUS** *(Self-learning if any to be marked)* | | | | | | | |
|---|---|---|---|---|---|---|---|
| Module | Topic | Mode of Delivery | CO | Learning Domain | | | Hrs |
| | | | | C | P | A | |
| 1 | Introduction to the subject and syllabus | L | CO1 | U | | | 1 |
| | Relations, functions, types of functions, limits of functions, continuity at a point, continuous functions. | S | CO1 | U | | | |
| | Limits of Function Values, Continuity at a point, Continuous Functions. | L | CO1 | U | | | 1 |
| | Rates of Change: Derivative at a Point Derivative as a Function, Second and Higher-Order Derivatives, Instantaneous Rates of Change | L | CO1 | U | | | 1 |
| | Tutorial | T | CO1 | U | | Rs | 1 |
| | Chain Rule, Implicit Differentiation | L | CO1 | U | | | 2 |
| | Linearization | L | CO1 | U | | | 1 |
| | Tutorial | T | CO1 | U | | Rs | 1 |
| | Extreme Values of Functions on Closed Intervals. | L | CO1 | A | | | 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | The Mean Value Theorem (without proof). | L | CO1 | U | | | 1 |
| | Tangents and Normal Lines, Concavity: The Second Derivative Test for Concavity. | L | CO1 | A | | | 1 |
| | Tutorial | T | CO1 | U | | Rs | 1 |
| 2 | Functions of Several Variables: Domains and Ranges | L | CO2 | U | | | 1 |
| | Level curves of functions two variables | L | CO2 | U | | | 1 |
| | Limits for functions of two variables | L | CO2 | U | | | 1 |
| | Tutorial | T | CO2 | U | | Rs | 1 |
| | Continuity for functions of two variables | L | CO2 | U | | | 1 |
| | Partial derivatives of functions of more than two variables | L | CO2 | U | | | 2 |
| | Tutorial | T | CO2 | U | | Rs | 1 |
| | Partial derivatives and continuity | L | CO2 | U | | | 1 |
| | Second - order partial derivatives | L | CO2 | U | | | 1 |
| | The mixed derivative theorem, The Chain Rule: Functions of two variables | L | CO2 | U | | | 2 |
| | Tutorial | T | CO2 | U | | Rs | 1 |
| 3 | The Chain Rule: Functions of three Variables | L | CO2 | U | | Rs | 1 |
| | Directional Derivatives in the Plane, Interpretation of the Directional Derivative | L | CO2 | A | | | 2 |
| | Gradient | L | CO2 | U | | | 1 |
| | Tutorial | T | CO2 | U | | Rs | 1 |
| | Properties of the Directional Derivative | L | CO2 | U | | | 1 |
| | The Linearization of a Function of Two Variables. | L | CO2 | U | | | 1 |
| | Local Extreme Values for Functions of Two Variables: Relative extrema | L | CO | A | | | 2 |
| | Tutorial | T | CO2 | U | | Rs | 1 |
| | First derivative theorem for local extreme values | L | CO2 | A | | | 1 |
| | Critical point, saddle point | L | CO2 | U | | | 1 |
| | Second Derivative Test for Local Extreme Values, Absolute Maxima and Minima on Closed Bounded Regions | L | CO2 | A | | | 2 |
| | Tutorial | T | CO2 | U | | Rs | 1 |
| 4 | Basics of Linear programming problem, concepts of Global and local optimum | S | CO3 | | | | 1 |
| | Constrained Maxima and Minima | L | CO3 | U | | | 1 |
| | The Method of Lagrange Multipliers with one constraint | L | CO3 | A | | | 2 |
| | Tutorial | T | CO3 | U | | Rs | 1 |
| | The Method of Lagrange Multipliers with two constraints | L | CO3 | A | | | 2 |
| | Method of Steepest Descent (only two variables) | L | CO3 | A | | | 2 |
| | Tutorial | T | CO3 | U | | Rs | 1 |
| | LPP - formation | L | CO3 | U | | | 1 |
| | Solution of LPP using graphical method | L | CO3 | A | | | 2 |
| | Tutorial | T | CO3 | U | | Rs | 1 |

**TABLE OF SPECIFICATIONS (ToS) (ESE Question Paper Design)**

| Module | Module Title | Distribution of Marks (RBL) | | | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| | | R | U | A | An | E | C | |
| 1 | Single Variable Calculus | √ | √ | √ | | | | 15 |
| 2 | Partial Derivatives -1 | √ | √ | | | | | 15 |
| 3 | Partial Derivatives - 2 | √ | √ | √ | | | | 15 |
| 4 | Optimization Techniques | √ | √ | √ | | | | 15 |

*This ToS shall be treated as a general guideline for students and teachers for distribution of marks.*

| ASSESSMENT PATTERN | |
|---|---|
| **Assessment Method** | **Marks** |
| **Continuous Internal Assessment** | **40** |
| 1. Internal Examination | 20 |
| 2. Learning Activity | 15 |
| 3. Regularity | 5 |
| 4. Course Project | |
| **End Semester Examination** | **60** |
| **Total** | **100** |

| | | | |
|---|---|---|---|
| | | | Total Pages: ..... |
| Register No.: | ..... | Name: | ..... |

(AN AUTONOMOUS COLLEGE AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANATHAPURAM)

| **FIRST SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, DECEMBER 2025 (2025 SCHEME)** | | | |
|---|---|---|---|
| **Course Code**: | B250904/MA100A | | |
| **Course Name**: | MATHEMATICS FOR INFORMATION SCIENCE-1 | | |
| **Max. Marks** | **60** | **Duration**: | 2 hours 30 minutes |
| Common to CS, CY, AI, AD. | | | |

| **PART A** | | | |
|---|---|---|---|
| ***(Answer all questions. Each question carries 3 marks)*** | | | |
| ***No.*** | ***Question*** | ***CO*** | ***Marks*** |
| 1 | An object is dropped from the top of a 200 m high tower. Its height above ground after $t$ sec is $(200 - 5t^2)$ m. How fast is it falling 5 sec after it is dropped? | CO1 | (3) |
| 2 | Find the linearisation of $f(x) = 3\sqrt{x}$ at $x = -8$. | CO1 | (3) |
| 3 | Determine $\frac{\partial}{\partial x}(x^2y + e^{xy})$. | CO2 | (3) |
| 4 | A cost function is given by $C(x,y) = \frac{xy}{x^2+y^2}$, test the continuity at the origin. | CO2 | (3) |
| 5 | Find the direction in which the function $f(x,y) = \frac{x^2}{2} + \frac{y^2}{2}$ increases most rapidly at the point (1,1). | CO2 | (3) |
| 6 | Express $\frac{\partial w}{\partial r}$ and $\frac{\partial w}{\partial s}$ in terms of $r$ and $s$, if $w = x + 2y + z^2$, $x = \frac{r}{s}, y = r^2 + \ln s, z = 2r$. | CO2 | (3) |
| 7 | Using the method of Lagrange multipliers, solve for the point(s) that maximize the function $f(x,y) = x^2 + y^2$ given that $g(x,y) = x + y - 1 = 0$ . | CO3 | (3) |
| 8 | A garment manufacturer has a production line making two styles of shirts. Style I needs 200g of cotton thread, 300g of Dacron thread and 300g of linen thread. Corresponding requirements of style II are 200g, 200g and 100g. The net contributions are Rs.19.50 for style I and Rs.15.90 for style II. The available inventory of cotton thread, Dacron thread and linen thread are, respectively, 24 kg, 26 kg and 22 kg. The manufacturer wants to determine the number of each style to be produced with the given inventory. Formulate the LPP model. | CO3 | (3) |

| **PART B** | | | | |
|---|---|---|---|---|
| ***(Answer any one full question from each module, each question carries 9 marks)*** | | | | |
| ***No.*** | | ***Question*** | ***CO*** | ***Marks*** |
| **MODULE I** | | | | |
| 9 | a) | Determine the ranges of values of $x$ for which $y = x^4 - 6x^3 + 12x^2 + 4x + 10$ is concave up or down. Also find the point of inflexion. | CO1 | (5) |
| | b) | Evaluate $\lim_{x\to 2} \frac{x^2-4}{\sqrt{x+2}-\sqrt{3x-2}}$. | CO1 | (4) |
| **OR** | | | | |
| 10 | a) | Find all points $(x,y)$ on the graph of $g(x) = \frac{1}{3}x^3 - \frac{3}{2}x^2 + 1$ with tangent lines parallel to the line $8x - 2y = 1$. | CO1 | (5) |
| | b) | The displacement of a particle moving along a straight line is given by $y = \frac{(x-2)(2x^2+3x-2)}{x^4}$. Find the velocity and acceleration of the particle at the point $x = 2$. | CO1 | (4) |
| **MODULE II** | | | | |

| | | | | |
|---|---|---|---|---|
| 11 | a) | Verify mixed derivative theorem for $w = \tan^{-1}(\frac{y}{x})$. | CO2 | (5) |
| | b) | Determine the rate of change of x with respect to $z$ at the point $(x, y, z) = (1, -1, 3)$, if the relation $xz + y\ln x - x^2 + 4 = 0$ defines x as a function of two independent variables y and $z$ and the partial derivatives exist. | CO2 | (4) |
| | | **OR** | | |
| 12 | a) | The steady-state temperature distribution of a thin rectangular plate is modelled by $u(x, y) = e^x \sin y + e^y \cos x$. Verify whether u(x, y) satisfies Laplace's equation. | CO2 | (5) |
| | b) | The displacement of a particle in space is given by $w = \ln(x^2 + y^2 + z^2)$ where the coordinates vary with time as $x = \cos t, y = \sin t, z = 4\sqrt{t}$. Find the rate of change of $w$ with respect to time when $t = 3$. | CO2 | (4) |
| | | **MODULE III** | | |
| 13 | a) | A storage company plans to construct a rectangular box, open at the top, with a volume of 32 cubic feet. Determine the dimensions of the box that will minimize the total surface area, thereby reducing the amount of wood required. | CO2 | (5) |
| | b) | Is there a direction $\boldsymbol{u}$ in which the rate of change of $f(x, y) = x^2 - 3xy + 4y^2$ at P(1,2) equals 14? Give reasons for your answer. | CO2 | (4) |
| | | **OR** | | |
| 14 | a) | Find three positive numbers whose sum is 36 and such that the sum of their squares is as small as possible. | CO2 | (5) |
| | b) | A flat circular plate has the shape of the region $x^2 + y^2 \leq 1$. The plate including the boundary where $x^2 + y^2 = 1$, is heated so that the temperature at the point $T(x, y)$ is given by $x^2 + 2y^2 - x$. Find the temperature at the hottest and coldest points on the plate. | CO2 | (4) |
| | | **MODULE IV** | | |
| 15 | a) | Solve the following linear programming problem graphically: Maximize $z = 2x + 3y$ subject to the constraints: $x + y \leq 30, y \geq 3, 0 \leq y \leq 12, x - y \geq 0, 0 \leq x \leq 20$. | CO3 | (5) |
| | b) | Find the dimension of the rectangle of the greatest area that can be inscribed in the ellipse $\frac{x^2}{2} + \frac{y^2}{2} = 1$ with sides parallel to the coordinate axes by the method of Lagrange multipliers. | CO3 | (4) |
| | | **OR** | | |
| 16 | a) | The plane $x + y + z = 1$ cuts the cylinder $x^2 + y^2 = 1$ in an ellipse. Find the points on the ellipse that lie closest to and farthest from the origin. | CO3 | (5) |
| | b) | Minimize the quadratic function $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2$ starting from the point (1,1), using the method of steepest descent with a fixed step size $t = 0.01$. | CO3 | (4) |

| COURSE DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Regulation** | **2025** | **L-T-J-P-S** | **3-0-0-2-3** | **Version** | **25/0** | **Credits** | **4** |
| *(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)* | | | | | | | |

| Course Code | Course Name | Course Category |
|---|---|---|
| **B250904/CH910B** | **CHEMISTRY FOR INFORMATION SCIENCE** | **BSE** |
| **Pre-requisite** | | |
| Concepts of chemistry introduced at the plus two levels especially Electrochemistry, Polymers, Structure of Molecules, Environmental Pollution and Volumetric Analysis. | | |

| COURSE OBJECTIVES | |
|---|---|
| 1 | To equip students with a thorough understanding of electrochemical principles and their applications in energy storage and corrosion science, enabling them to address challenges in areas such as battery development, corrosion prevention, and pH measurement. |
| 2 | To explore the synthesis, properties, and applications of nanomaterials, conducting polymers and advanced devices which are relevant in the field of electronics, quantum computing, and energy technology. |
| 3 | To understand the principles and applications of spectroscopic and microscopic techniques for material characterization and analysis at the atomic and molecular levels. |
| 4 | To develop an understanding of water chemistry, pollution control, e-waste management, and the role of chemistry in achieving sustainable development goals. |

| COMPETENCY | |
|---|---|
| CC1 | Demonstrate the ability to apply fundamental principles of electrochemistry, materials science, and spectroscopy to design and develop materials and systems for various technological applications, including energy storage, corrosion protection, and advanced materials characterization. |
| CC2 | Demonstrate the ability to apply the principles of water chemistry and waste management to analyse water quality parameters, and implement sustainable strategies for waste reduction and resource recovery. |

**COURSE OUTCOMES (CO)**

**Course Outcomes** (CO): At the end of this course, learners will be able to:

| CO | CO Statement | CC Mapping | Cognitive (C) | Psychomotor (P) | Affective (A) |
|---|---|---|---|---|---|
| CO1 | **Apply** the basic concept of electrochemistry and corrosion to explore the applications in engineering fields. | CC1 | A | M | V |
| CO2 | **Apply** the principles of nanomaterials, conducting polymers and organic electronic devices to solve engineering problems. | CC1 | A | M | V |
| CO3 | **Utilize** the principles and applications of spectroscopic and microscopic techniques for the analysis and characterization of materials. | CC1 | A | M | V |
| CO4 | **Select** various water treatment and waste management methods to solve different environmental issues in a sustainable way. | CC2 | A | M | V |

***Cognitive (Revised blooms Level):*** *- **R**: Remember; **U**: Understand; **A**: Apply; **An**: Analyse; **E**: Evaluate; **C**: Create*
***Psychomotor Domain (Dave's):*** *- **I**-Imitation, **M**-Manipulation, **P**-Precision, **Ar**-Articulation, **N**-Naturalisation*
***Affective (Krathwohl)**: - **Re**-Receiving, **Rs**-Responding, **V**-Valuing, **O**-Organization, **Ch**-Characterization*

| CO | Program Outcomes & Program Specific Outcomes Correlation Matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO | | | | | | | | | | | PSO | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 1 | 2 | 2 | 1 | 1 | 2 | 3 | 2 | 3 | 1 | | 2 | | | |
| 2 | 2 | 1 | 1 | | | 3 | 1 | 1 | 1 | | 2 | | | |
| 3 | 2 | 2 | 1 | | 1 | | 1 | 2 | 1 | | 2 | | | |
| 4 | 2 | 2 | 1 | | 1 | 3 | 2 | 2 | 1 | | 2 | | | |
| *Correlation [3 – High, 2 -Medium, 1 – Low]* | | | | | | | | | | | | | | |

| TEACHING AND ASSESSMENT SCHEME | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Teaching Scheme / Week | | | | | Credit | Hours / Semester | Examination Scheme | | | | | | |
| | | | | | | | Theory | | | Practical | | | Total |
| L | T | J | P | S | C | | CIA | ESE | Total | CIA | ESE | Total | |
| 3 | 0 | 0 | 2 | 3 | 4 | 120 | 25 | 60 | 85 | 15 | 0 | 15 | 100 |

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

| SYLLABUS (Major Topics) | | | |
|---|---|---|---|
| Module | Title | Major Topics | Hrs |
| 1 | Electrochemistry and Corrosion | Electrochemical Cell-Electrode potential- Nernst equation - Reference electrodes –Electrochemical series - Glass Electrode & pH Measurement- Conductivity and its measurement. Li-ion battery & $H_2$-$O_2$ fuel cell. Corrosion –Electrochemical corrosion - Galvanic series - Corrosion control methods – Electroplating of copper - Electroless plating of copper. | 9 |
| 2 | Materials for Electronic Applications | Nanomaterials - Classification -Synthesis -Carbon Nanotubes, Fullerenes, Graphene & Carbon Quantum Dots – Polymers - Fire Retardant Polymers- Conducting Polymers- Polyaniline & Polypyrrole-Organic electronic materials and devices-Organic Light Emitting Diode (OLED) & Dye-Sensitized Solar Cells (DSSC). Materials used in Quantum computing Technology, Super capacitors, Spintronics. | 9 |
| 3 | Molecular Spectroscopy and Analytical Techniques | Spectroscopy- Types of spectra- Molecular energy levels – Beer Lambert's law – Electronic spectroscopy- Instrumentation – Applications. Vibrational spectroscopy – Number of vibrational modes – Vibrational modes of $CO_2$ and $H_2O$ – Applications. Thermal Analysis: Dielectric Thermal Analysis (DETA) of Polymers-Electron Microscopic Techniques: SEM. | 9 |
| 4 | Environmental Chemistry | Water characteristics - Hardness -Degree of hardness (Numericals)- Water softening methods – Water disinfection methods – Dissolved oxygen (DO), BOD and COD. Waste Management: Sewage water treatment- E Waste-Methods of disposal. Chemistry of climate change- Greenhouse Gases-Ozone Depletion- Sustainable Development- Sustainable Development Goals. | 9 |

| SELF-LEARNING / TEAM WORK | | |
|---|---|---|
| Sl. No | Self-learning / Team Work Description | Hrs |
| 1 | Cells and Batteries– Primary and Secondary cells- Construction, working and applications of Lead acid battery, Nickel cadmium battery and Nickel metal hybrid battery. | 12 |
| 2 | Polymers- Classification-Types of Polymerisation-Copolymers. Sensors- Physical, chemical and bioensors- introduction and applications | 12 |

| | | |
|---|---|---|
| 3 | Structure of Atom, Molecular Orbital Theory and Shape of Molecules.<br>Application of spectroscopy in daily life | 12 |
| 4 | Estimation of Hardness – EDTA Method and Estimation of Dissolved Oxygen-Winkler's method.<br>Health impacts of E- waste | 12 |
| 5 | Pre- lab work. | 16 |

**SUGGESTED LEARNING RESOURCES**

| **Text Book** | | | |
|---|---|---|---|
| Sl. No. | Title of Book | Author | Publication |
| 1 | Engineering Chemistry | B. L. Tembe, Kamaluddin, M. S. Krishnan | NPTEL Web-book |
| 2 | Physical Chemistry | P. W. Atkins | Oxford University Press |
| 3 | Instrumental Methods of Analysis | H. H. Willard, L. L. Merritt | CBS Publishers |
| 4 | Engineering Chemistry | Jain & Jain | Dhanpath Rai Publishing Company |

| **Reference** | | | |
|---|---|---|---|
| Sl. No. | Title of Book | Author | Publication |
| 1 | Fundamentals of Molecular Spectroscopy | C. N. Banwell | McGraw-Hill |
| 2 | Principles of Physical Chemistry | B. R. Puri, L. R. Sharma, M. S. Pathania | Vishal Publishing Co |
| 3 | Introduction to Spectroscopy | Donald L. Pavia | Cengage Learning India Pvt. Ltd |
| 4 | Polymer Chemistry: An Introduction | Raymond B. Seymour, Charles E. Carraher | Marcel Dekker Inc |
| 5 | The Chemistry of Nanomaterials: Synthesis, Properties and Applications | Prof. Dr. C. N. R. Rao, Prof. Dr. h.c. mult. Achim Müller, Prof. Dr.A. K. Cheetham | Wiley-VCH Verlag GmbH & Co. |
| 6 | Organic Electronics Materials and Devices | Shuichiro Ogawa | Springer Tokyo |
| 7 | Principles and Applications of Thermal Analysis | Gabbot, P | Oxford: Blackwell Publishing |

| **Web Resource** | |
|---|---|
| 1 | https://onlinecourses.nptel.ac.in/noc25_mm35/preview |
| 2 | https://onlinecourses.nptel.ac.in/noc25_ch51/preview |

| **DETAILED SYLLABUS** (Self-learning if any to be marked) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Module | Topic | Mode of Delivery | CO | Learning Domain | | | Hrs |
| | | | | C | P | A | |
| 1 | **Electrochemical Cell** Electrochemical Cell and Electrode potential | L | CO1 | U | | Rs | 1 |
| | Nernst equation for single electrode and cell (Numerical problems) | L, P | CO1 | A | M | V | 1 |
| | Nernst Equation-Numerical Problems | L | CO1 | A | | Rs | 1 |
| | Electrochemical series and applications | L, P | CO1 | A | M | V | 1 |
| | Reference electrodes – SHE & Calomel electrode – Construction and Working | L | CO1 | U | | Rs | 1 |
| | Glass Electrode & pH Measurement Conductivity-Measurement using Digital conductivity meter. | L, P | CO1 | A | M | V | 1 |
| | Li-ion battery & $H_2$-$O_2$ fuel cell (acid electrolyte only) construction and working. | L | CO1 | U | | Rs | 1 |
| | **Corrosion** Electrochemical corrosion mechanism (acidic & alkaline medium) | L | CO1 | U | | Rs | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Galvanic series - Corrosion control methods - Cathodic Protection - Sacrificial anodic protection and impressed current cathodic protection. Electroplating of copper – Electroless plating of copper. | L | CO1 | U | | Rs | 1 |
| | Construction, working and applications of Lead acid battery, Nickel cadmium battery and Nickel metal hybrid battery. | S | CO1 | U | | Rs | |
| 2 | **Nanomaterials** Classification based on Dimension & Materials | L | CO2 | U | | Rs | 1 |
| | Synthesis – Sol gel & Chemical Reduction - Applications of nanomaterials | L | CO2 | U | | Rs | 1 |
| | Carbon Nanotubes, Fullerenes- structure, properties & application. | L | CO2 | U | | Rs | 1 |
| | Graphene & Carbon Quantum Dots – structure, properties & application. | L | CO2 | U | | Rs | 1 |
| | **Polymers Fire Retardant Polymers-** Halogenated & Non-halogenated polymers (Examples only) Conducting Polymers- Classification | L | CO2 | U | | Rs | 1 |
| | Polyaniline- synthesis, properties and applications. Polypyrrole-synthesis, properties and applications | L, P | CO2 | A | M | V | 1 |
| | **Organic electronic materials and devices** Construction, working and applications of Organic Light Emitting Diode (OLED) | L | CO2 | U | | Rs | 1 |
| | Construction, working and applications of Dye-Sensitized Solar Cells (DSSC) | L | CO2 | U | | Rs | 1 |
| | Materials used in Quantum computing Technology. Super capacitors, Spintronics | L | CO2 | U | | Rs | 1 |
| | Polymers- Classification-Types of Polymerisation-Copolymers. Sensors- Physical, chemical and bio sensors- introduction and applications | S | CO2 | U | | Rs | |
| 3 | **Spectroscopy** Types of spectra and Molecular Energy Levels | L | CO3 | U | | Rs | 1 |
| | Beer Lambert's law – Numerical problems | L, P | CO3 | A | M | V | 1 |
| | Beer-Lambert's law-Numerical Problems | L | CO3 | A | | Rs | 1 |
| | Electronic Spectroscopy – Principle, Types of electronic transitions | L | CO3 | U | | Rs | 1 |
| | Role of conjugation in absorption maxima. Instrumentation-Applications | L, P | CO3 | A | M | V | 1 |
| | Vibrational spectroscopy – Principle Number of vibrational modes | L | CO3 | U | | Rs | 1 |
| | Vibrational modes of $CO_2$ and $H_2O$ – Applications | L, P | CO3 | A | M | V | 1 |
| | **Thermal Analysis** Dielectric Thermal Analysis (DETA) of Polymers-Working and Application. | L | CO3 | U | | Rs | 1 |
| | **Electron Microscopic Techniques** SEM - Principle, instrumentation and Applications. | L | CO3 | U | | Rs | 1 |
| | Structure of Atom, Molecular Orbital Theory and Shape of Molecules. Application of spectroscopy in daily life | S | CO3 | U | | Rs | |
| 4 | **Water Characteristics** Hardness - Types of hardness- Temporary and Permanent | L | CO4 | U | | Rs | 1 |
| | Disadvantages of hard water. Degree of hardness | L, P | CO4 | A | M | V | 1 |
| | Degree of hardness (Numerical) | L | CO4 | A | | Rs | 1 |
| | Water softening methods-Ion exchange process-Principle, procedure and advantages. Reverse osmosis – principle, process and advantages | L | CO4 | U | | Rs | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Water disinfection methods – chlorination-Break point chlorination, ozone and UV irradiation. | L | CO4 | U | | Rs | 1 |
| | Dissolved oxygen (DO), BOD and COD- Definition & Significance. | L, P | CO4 | A | M | V | 1 |
| | **Waste Management** Sewage water treatment- Primary, Secondary and Tertiary - Flow diagram - Trickling filter and UASB process. | L | CO4 | U | | Rs | 1 |
| | E Waste, Methods of disposal – recycle, recovery and reuse. | L | CO4 | U | | Rs | 1 |
| | Chemistry of climate change- Greenhouse Gases- Ozone Depletion. Sustainable Development- an introduction to Sustainable Development Goals. | L | CO4 | U | | Rs | 1 |
| | Estimation of Hardness – EDTA Method and Estimation of Dissolved Oxygen- Winkler's method Health impacts of E-waste | S | CO4 | U | | Rs | |

**PRACTICAL SYLLABUS**

| Topic | Objective | CO | Learning Domain | | | Hrs |
|---|---|---|---|---|---|---|
| | | | C | P | A | |
| Calibration of pH meter and determination of pH of a solution. | To calibrate a digital pH meter using standard buffer solutions and to accurately determine the pH of the given unknown solutions. | CO1 | A | M | V | 2 |
| Determination of cell constant and conductance of solutions. | To determine the cell constant of a conductivity cell using a standard KCl solution and to measure the conductance of given solutions using a digital conductivity meter. | CO1 | A | M | V | 2 |
| Verification of Nernst equation for electrochemical cell. | To verify the Nernst equation by measuring the electrode potential of a given electrochemical cell at different ion concentrations and comparing the experimental values with theoretical values. | CO1 | A | M | V | 2 |
| Estimation of iron in iron ore. | To estimate the percentage of iron present in a given iron ore sample using a redox titration method with potassium permanganate as the titrant. | CO1 | A | M | V | 2 |
| Synthesis of polymers (a)Urea- formaldehyde resin (b)Phenol-formaldehyde resin. | To synthesise the polymers such as urea-formaldehyde resin and phenol- formaldehyde resin and hence to note their yield. | CO2 | A | M | V | 2 |
| Determination of wavelength of absorption maximum and colorimetric estimation of $Fe^{3+}$ in solution. | To determine the wavelength of maximum absorption of $Fe^{3+}$ using a colorimeter and to estimate the concentration of $Fe^{3+}$ in a given solution based on Beer-Lambert's law. | CO3 | A | M | V | 2 |
| Determination of molar absorptivity of a compound (KMnO4 or any water-soluble food colorant). | To determine the molar absorptivity (ε) of a coloured compound such as potassium permanganate by measuring absorbance at its λmax and applying Beer-Lambert's law. | CO3 | A | M | V | 2 |
| Analysis of IR spectra. | To analyse the IR spectrum of given compounds based on characteristic absorption bands and to characterize the unknown compounds | CO3 | A | M | V | 2 |
| Estimation of dissolved oxygen by Winkler's method. | To estimate the amount of dissolved oxygen (DO) present in a water sample using Winkler's iodometric method, which is essential for assessing water quality and aquatic life sustainability. | CO4 | A | M | V | 2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Estimation of total hardness of water-EDTA method. | To determine the total hardness of a given water sample by complexometric titration using Ethylene diamine tetra acetic acid (EDTA) as the titrant and Eriochrome Black T as the indicator. | CO4 | A | M | V | 2 |

| **TABLE OF SPECIFICATIONS (ToS) (ESE Question Paper Design)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Module | Module Title | Distribution of Marks (RBL) | | | | | | Total Marks |
| | | R | U | A | An | E | C | |
| 1 | Electrochemistry and Corrosion Science | √ | √ | √ | | | | 15 |
| 2 | Materials for Electronic Applications | √ | √ | √ | | | | 15 |
| 3 | Molecular Spectroscopy and Analytical Techniques | √ | √ | √ | | | | 15 |
| 4 | Environmental Chemistry | √ | √ | √ | | | | 15 |
| *This ToS shall be treated as a general guideline for students and teachers for distribution of marks.* | | | | | | | | |

| **ASSESSMENT PATTERN** | |
|---|---|
| **Assessment** | **Marks** |
| **Continuous Internal Assessment** | **40** |
| 1. Internal Examination | 20 |
| 2. Continuous Lab Evaluation | 10 |
| 3. Learning Activity | |
| 4. Regularity | 5 |
| 5. Course Project | |
| 6. Internal Examination (Lab) | 5 |
| **End Semester Examination** | **60** |
| Total | **100** |

| | | | |
|---|---|---|---|
| | | | Total Pages: ……. |
| Register No.: | …… | Name: | …… |

(AN AUTONOMOUS COLLEGE AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANATHAPURAM)

| | | | |
|---|---|---|---|
| **FIRST SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, DECEMBER 2025 (2025 SCHEME)** | | | |
| **Course Code**: | **B250904/CH910B** | | |
| **Course Name**: | **Chemistry for Information Science** | | |
| **Max. Marks** | **60** | **Duration**: | 2 hours 30 minutes |
| Common to AI, AD and CY | | | |

## PART A

***(Answer all questions. Each question carries 3 marks)***

| *No.* | *Question* | *CO* | *Marks* |
|---|---|---|---|
| 1 | Design and sketch the electrochemical cell for the following cell reaction. $2\ Al\ (s) + 3\ Fe^{2+}\ (aq) \rightarrow 2Al^{3+}\ (aq) + 3\ Fe\ (s)$ Formulate the Nernst equation at $25^0$C and write the half-cell reactions. | CO1 | (3) |
| 2 | Write any three differences between electrochemical series and galvanic series. | CO1 | (3) |
| 3 | Aluminium oxide ($Al_2O_3$) nanoparticles can be synthesized by the sol-gel method. Explain the sol-gel process for the preparation of metal oxide nanoparticles. | CO2 | (3) |
| 4 | Graphene is widely used in supercapacitors. Which properties of graphene make it suitable for this application? | CO2 | (3) |
| 5 | IR spectroscopy can be used to differentiate intra molecular and inter molecular hydrogen bonds. Explain with an example. | CO3 | (3) |
| 6 | The absorbance of a 0.02M dye solution in ethanol is 0.48 when measured in a 1 cm cell at 5200Å. If the path length is tripled and the concentration is reduced to one-third, calculate the new absorbance value. | CO3 | (3) |
| 7 | Chemical methods such as chlorination and ozonation make drinking water safe and contribute to Sustainable Development Goal 6. Explain how? | CO4 | (3) |
| 8 | A water sample contains 18.2mg/L $Ca(HCO_3)_2$, 9.3mg/L $Mg(HCO_3)_2$, 10.5mg/L $MgCl_2$ and 15.6mg/L $CaSO_4$. Calculate the temporary and permanent hardness of water and what will happen if 10.5mg/L $NaHCO_3$ is added? | CO4 | (3) |

## PART B

***(Answer any one full question from each module, each question carries 9 marks)***

| *No.* | | *Question* | *CO* | *Marks* |
|---|---|---|---|---|
| **MODULE I** | | | | |
| 9 | a) | With the help of a neat labelled diagram, explain the construction and working principle of a glass electrode pH measurement system. Justify why glass electrodes are preferred over hydrogen electrodes for pH measurement. | CO1 | (5) |
| | b) | Emf of an electrochemical cell is 1.6178V at $20^0$C and 1.6214V at $30^0$C. If the cell reaction involves 2 electrons, find the standard emf of the cell and the reaction quotient. | CO1 | (4) |
| **OR** | | | | |
| 10 | a) | With the help of electrochemical equations, show that rusting of iron is more severe in oxygen rich acidic medium than alkaline medium. | CO1 | (5) |
| | b) | Calculate the conductivity of a given sample of water at 298K which shows a conductance of 620µS in the given cell at 298K. A standard solution of 0.1M KCl shows a conductance of 12.34mS in that cell. (Given that conductivity of 0.1 M KCl at 298K is 0.01288$Scm^{-1}$. | CO1 | (4) |
| **MODULE II** | | | | |

| | | | | |
|---|---|---|---|---|
| 11 | a) | Dye-Sensitized Solar Cells (DSSC) are considered a sustainable energy device. With the help of a neat labelled diagram explain the working of DSSC. | CO2 | (5) |
| | b) | Suggest how fullerenes can be used in targeted drug delivery systems. Also discuss any three properties of fullerene. | CO2 | (4) |
| **OR** | | | | |
| 12 | a) | Describe one chemical synthesis method of Polyaniline and Polypyrrole. How does the structure influence their conductivity? List any two applications of Polyaniline and Polypyrrole. | CO2 | (5) |
| | b) | Classify nanomaterials based on dimension and type of materials. | CO2 | (4) |
| **MODULE III** | | | | |
| 13 | a) | Draw the molecular orbital energy diagram of i)1, 3-butadiene, (ii)1,3,5-hexatriene and iii) benzene to explain their UV-Vis absorption spectrum. | CO3 | (5) |
| | b) | Use vibrational spectroscopy to distinguish between Carbon dioxide and Water molecule. Sketch their vibrational modes and predict which of them are IR active and why? | CO3 | (4) |
| **OR** | | | | |
| 14 | a) | Propose how Scanning Electron Microscopy (SEM) can be used in material characterization for nanotechnology with the help of a suitable diagram. Discuss any two applications of SEM. | CO3 | (5) |
| | b) | State Beer-Lambert's law and deduce the integrated form. Discuss the plot of absorbance versus concentration and what does the slope of the graph represents? | CO3 | (4) |
| **MODULE IV** | | | | |
| 15 | a) | The ion exchange process is widely used in boiler feed water treatment. Explain with the help of a diagram how this method prevents scale formation in boilers and improves the efficiency of power plants. How the exhausted resins are regenerated? | CO4 | (5) |
| | b) | Break point chlorination is widely applied in municipal water treatment plants. Explain how this method ensures safe drinking water, and compare its effectiveness with UV irradiation in terms of residual disinfection. | CO4 | (4) |
| **OR** | | | | |
| 16 | a) | A rapidly growing city faces frequent water pollution issues due to the discharge of untreated sewage into nearby rivers. As an engineer, suggest how you would design a sewage treatment system incorporating primary, secondary, and tertiary stages. | CO4 | (5) |
| | b) | An electronic manufacturing company generates a large amount of obsolete circuit boards and plastic casings. If you are assigned to design an effective disposal strategy, which methods of e-waste disposal would you apply for each type of waste, and why? | CO4 | (4) |

**********

| COURSE DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Regulation** | **2025** | **L-T-J-P-S** | **4-0-0-0-2** | **Version** | **25/0** | **Credits** | **3** |
| *(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)* | | | | | | | |

| Course Code | Course Name | Course Category |
|---|---|---|
| **B250906/CN100C** | **ENGINEERING GRAPHICS AND COMPUTER AIDED DRAWING** | **EST** |
| **Pre-requisite** | | |
| NIL | | |

| COURSE OBJECTIVES | |
|---|---|
| 1 | To equip students with the ability to visualize, represent, and interpret engineering designs using technical drawings. |
| 2 | To learn the features of CAD software |

| COMPETENCY STATEMENT (CC) | |
|---|---|
| CC1 | Demonstrate the ability to interpret, construct, and communicate technical drawings by applying standard conventions and projection techniques, enabling effective visualization and representation of engineering components for design, analysis, and manufacturing applications. |
| CC2 | Develop the ability to use CAD software for 2D drawings. |

**COURSE OUTCOMES (CO)**

**Course Outcomes** (CO): At the end of this course, learners will be able to:

| CO | CO Statement | CC Mapping | Cognitive (C) | Psychomotor (P) | Affective (A) |
|---|---|---|---|---|---|
| CO1 | Draw the orthographic projection of points and lines located in different quadrants | CC1 | A | | |
| CO2 | Generate multi-view orthographic projections of engineering objects by visualizing them in different positions | CC1 | A | | |
| CO3 | Plot sectional views of engineering solids | CC1 | A | | |
| CO4 | Develop surfaces of engineering objects | CC1 | | | |
| CO5 | Prepare pictorial drawings using the principles of isometric projection | CC1 | A | | |
| CO6 | Sketch simple 2Ddrawings using CAD tools | CC2 | U | | Rs |

***Cognitive (Revised blooms Level):*** *- **R**: Remember; **U**: Understand; **A**: Apply; **An**: Analyse; **E**: Evaluate; **C**: Create*
***Psychomotor Domain (Dave's):*** *- **I**-Imitation, **M**-Manipulation, **P**-Precision, **Ar**-Articulation, **N**-Naturalisation*
***Affective (Krathwohl)**: - **Re**-Receiving, **Rs**-Responding, **V**-Valuing, **O**-Organization, **Ch**-Characterization*

| CO | Program Outcomes (PO) & Program Specific Outcomes (PSO) Correlation Matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO | | | | | | | | | | | PSO | | |
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** | **3** |
| 1 | **3** | | | | | | | | | | **1** | | 1 | |
| 2 | **3** | | | | | | | | | | **1** | | 1 | |
| 3 | **3** | | | | | | | | | | **1** | | 1 | |
| 4 | **3** | | | | | | | | | | **1** | | 1 | |
| 5 | **3** | | | | | | | | | | **1** | | 1 | |
| 6 | **3** | | | | **2** | | | | | | **1** | 1 | 1 | |

*Correlation [3 – High, 2 -Medium, 1 – Low]*

| TEACHING AND ASSESSMENT SCHEME | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Teaching Scheme / Week | | | | | Credit | Hours / Semester | Examination Scheme | | |
| | | | | | | | Theory | | |
| L | T | J | P | S | C | | CIA | ESE | Total |
| 4 | 0 | 0 | 0 | 2 | 3 | 90 | 40 | 60 | 100 |

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

| SYLLABUS (Major Topics) | | | |
|---|---|---|---|
| Module | Title | Major Topics | Hrs |
| 1 | Orthographic projection of points and lines | Introduction: Relevance of technical drawing in the engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing. (No questions for the end semester examination)<br>Orthographic Projection of points in different quadrants, Projection of straight lines inclined to one plane, and inclined to both planes. Trace of a line. Inclination of lines with reference planes. True length and true inclinations of line inclined to both the reference planes. | 12 |
| 2 | Orthographic projection of solids | Orthographic Projection of Simple solids such as Triangular, Rectangular, Square, Pentagonal and Hexagonal Prisms and Pyramids, Cube, Cone and Cylinder. Projection of solids in simple position including profile view.<br>Projection of solids with axis inclined to one of the reference planes and with axis inclined to both reference planes. | 12 |
| 3 | Sections of solids and Development of surfaces | Sections of Solids: Sections of Prisms, Pyramids, Cube, Cone and Cylinder with axis in vertical position and cut by different section planes. True shape of the sections. (Exclude true shape given problems).<br>Development of Surfaces: Development of surfaces of the solids and solids cut by different section planes. (Exclude problems with through holes) | 16 |
| 4 | Isometric projection | Isometric Projection: Isometric scale- Isometric View and Projections of Prisms, Pyramids, Cone, Cylinder, Sphere, Hemisphere and their combinations. | 10 |
| 5 | Computer Aided Drawing (CAD) | Computer Aided Drawing (CAD): Introduction, Role of CAD in design and development of new products, Advantages of CAD. Creating two-dimensional drawing with dimensions using suitable software. (CAD, only internal evaluation) | 10 |

| SELF-LEARNING / TEAM WORK | | |
|---|---|---|
| Sl. No | Self-learning / Team Work Description | Hrs |
| 1 | Application problems from projection of lines | 6 |
| 2 | Application problems from development of surfaces | 6 |
| 3 | Understand the basics of AutoCAD: https://www.autodesk.in/campaigns/autocad-tutorials | 6 |
| 4 | https://knowledge.autodesk.com/support/autocad/getting-started?sort=score | 6 |
| 5 | https://all3dp.com/autocad-tutorial-beginners/ | 6 |

**SUGGESTED LEARNING RESOURCES**

| Text Book | | | |
|---|---|---|---|
| Sl. No. | Title of Book | Author | Publication |
| 1 | Engineering Graphics | Varghese, P. I. | V I P Publishers |
| 2 | Engineering Graphics | Benjamin, J. | Pentex Publishers |
| 3 | Engineering Graphics | John, K. C. | Prentice Hall India Publishers |
| 4 | Engineering Drawing | Bhatt, N., D. | Charotar Publishing House Pvt Ltd. |
| 5 | Engineering Graphics | Anilkumar, K. N. | Adhyuth Narayan Publishers |

| Reference | | | |
|---|---|---|---|
| Sl. No. | Title of Book | Author | Publication |
| 1 | Engineering Graphics with AutoCAD, | Kulkarni, D. M., Rastogi, A. P. and Sarkar, A. K., | Prentice Hall India Publishers |
| 2 | Engineering Drawing & Graphics | Venugopal, K. | New Age International Publishers |
| 3 | Engineering Drawing | Parthasarathy, N. S., and Murali, V. | Oxford University Press |

| Web Resource | |
|---|---|
| 1 | NPTEL Course – Engineering Drawing (Web) - https://archive.nptel.ac.in/courses/112/102/112102304/ |
| 2 | A R STUDY DESK – Engineering Graphics - Introduction Videos |
| 3 | Online learning App<br>A R STUDY DESK – Engineering Graphics: Your Animated Notebook (EGYAN) |

**DETAILED SYLLABUS** *(Self-learning if any to be marked)*

| Module | Topic | Mode of Delivery | CO | Learning Domain | | | Hrs |
|---|---|---|---|---|---|---|---|
| | | | | C | P | A | |
| 1 | Introduction: Relevance of technical drawing in the engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing. | CL | CO1 | A | | | 1 |
| | Orthographic projection of points | CL | CO1 | A | | | 1 |
| | Projection of straight lines inclined to one plane | CL | CO1 | A | | | 1 |
| | Projection of straight lines inclined to both planes | CL | CO1 | A | | | 4 |
| | Trace of a line. | CL | CO1 | A | | | 1 |
| | Inclination of lines with reference planes. | CL | CO1 | A | | | 1 |
| | True length and true inclinations of line inclined to both the reference planes. | CL | CO1 | A | | | 3 |
| | Orthographic projection of lines (Additional numerical problems – Self learning) | SL | CO1 | A | | | 6 |
| 2 | Orthographic projection of solids- Introduction | CL | CO2 | A | | | 1 |
| | Orthographic Projection of Simple solids such as Triangular, Rectangular, Square, Pentagonal and Hexagonal Prisms and Pyramids, Cube, Cone and Cylinder | CL | CO2 | A | | | 2 |
| | Projection of solids in simple position including profile view. | CL | CO2 | A | | | 2 |
| | Projection of solids with axis inclined to one of the reference planes | CL | CO2 | A | | | 2 |
| | Projection of solids with axis inclined to both reference planes | CL | CO2 | A | | | 5 |
| 3 | Sections of Solids- Introduction | CL | CO3 | A | | | 1 |
| | Sections of Prisms, Pyramids, Cube, True shape | CL | CO3 | A | | | 3 |
| | Section of Cone and Cylinder with axis in vertical position, True shape | CL | CO3 | A | | | 4 |
| | Development of Surfaces- Introduction | CL | CO4 | A | | | 1 |
| | Development of surfaces of the solids and solids cut by different section planes | CL | CO4 | A | | | 1 |
| | Development of surfaces (additional problems) – self learning | SL | CO4 | A | | | 6 |
| 4 | Isometric projection- Introduction | CL | CO5 | A | | | 1 |
| | Isometric scale- Isometric View and Projections of Prisms, Pyramids, Cone, Cylinder, Sphere, Hemisphere | CL | CO5 | A | | | 4 |
| | Projections of combination of solids | CL | CO5 | A | | | 5 |
| 5 | Computer Aided Drawing (CAD)- Introduction | CL | CO6 | A | | | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Creating two-dimensional drawing with dimensions using suitable software | CL | CO6 | A | | Re | 5 |
| | CAD - self learning- Questions in 2D drawing | SL | CO6 | A | | Re | 18 |

| TABLE OF SPECIFICATIONS (ToS) (ESE Question Paper Design) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Module | Module Title | Distribution of Marks (RBL) | | | | | | Total Marks |
| | | R | U | A | An | E | C | |
| 1 | Orthographic projections of points and lines | | | √ | | | | 15 |
| 2 | Orthographic projections of solids | | | √ | | | | 15 |
| 3 | Sections of solids and development of surfaces | | | √ | | | | 15 |
| 4 | Isometric projection | | | √ | | | | 15 |
| *This ToS shall be treated as a general guideline for students and teachers for distribution of marks* | | | | | | | | |

| ASSESSMENT PATTERN | |
|---|---|
| **Assessment Method** | **Marks** |
| **Continuous Internal Assessment** | **40** |
| 1. Internal Examination | 20 |
| 2. Learning Activity | 15 |
| 3. Regularity | 5 |
| 4. Course Project | - |
| **End Semester Examination** | **60** |
| **Total** | **100** |

| | | | |
|---|---|---|---|
| | | | Total Pages: ..... |
| Register No.: | ..... | Name: | ..... |

(AN AUTONOMOUS COLLEGE AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANATHAPURAM)

| | | | |
|---|---|---|---|
| **FIRST SEMESTER B. TECH DEGREE REGULAR EXAMINATION, DECEMBER 2025 (2025 SCHEME)** | | | |
| **Course Code**: | **B250906/CN100C** | | |
| **Course Name**: | **Engineering Graphics and Computer Aided Drawing** | | |
| **Max. Marks** | **60** | **Duration**: | 2 hours 30 minutes |
| (EEE, ECE, CSE, AI, AD, CY) | | | |
| | | | |

**Instructions: Retain all Construction lines. Show necessary dimensions. Answer any ONE question from each module. Each question carries 15 marks**

| ***No.*** | ***Question*** | ***CO*** | ***Marks*** |
|---|---|---|---|
| **MODULE 1** | | | |
| 1 | A line AB has its end A 20mm above HP and 25mm in front of VP. The other end B is 45mm above HP and 55mm in front of VP. The distance between the end projectors is 60mm. Draw its projections. Also find the true length and true inclinations of the line with HP and VP. | CO1 | (15) |
| 2 | The top view of a line PQ is 60mm long measures 50mm, while the length of its front view is 40mm. Its end P is in the VP and is 10mm below the HP. Draw the projections of the line and find its inclination with HP and VP. | CO1 | (15) |
| **MODULE 2** | | | |
| 3 | Draw the projections of a pentagonal prism of 30mm base side and 60mm height which is resting on its base edge on the ground such that its axis is inclined at $45^0$ to HP and the resting base edge at $30^0$ to VP. | CO2 | (15) |
| 4 | A square pyramid, base 30mm side and axis 60mm long has a triangular face on the ground and the vertical plane containing the axis makes an angle of $45^0$ with the VP. Draw its projections. | CO2 | (15) |
| **MODULE 3** | | | |
| 5 | A square prism of base side 30mm and height 75mm rests on the HP on one of its ends with two of its rectangular faces equally inclined to the VP. It is cut by a plane perpendicular to the VP and inclined at $60^0$ to the HP meeting the axis at 15mm from the top. Draw the elevation, sectional plan and true shape of the section. What are the maximum width W and length L of the section? | CO3 | (15) |
| 6 | A vertical cone of 35mm diameter and axis 50mm is cut by a section plane which makes $45^0$ to HP and bisects the axis of the cone. Draw the development of the lateral surface of the truncated cone. | CO4 | (15) |
| **MODULE 4** | | | |

| | | | |
|---|---|---|---|
| 7 | A square pyramid of side 30mm and axis length 50mm is resting centrally on the top of a cube of side 50mm. Draw the isometric view of the solids. | CO5 | (15) |
| 8 | A cylinder 50mm base diameter and 70mm high is resting on its base on the HP. It is surmounted centrally by a sphere of 30mm diameter. Draw the isometric projection of the solids. | CO5 | (15) |

| COURSE DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Regulation** | **2025** | **L-T-J-P-S** | **4-0-0-0-4** | **Version** | **25/0** | **Credits** | **4** |
| *(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)* | | | | | | | |

| Course Code | Course Name | Course Category |
|---|---|---|
| **B250906/CN100D** | **INTRODUCTION TO ELECTRICAL AND ELECTRONICS ENGINEERING** | **EST** |
| **Pre-requisite** | | |
| The basic knowledge of single variable calculus. | | |

| COURSE OBJECTIVES | |
|---|---|
| 1 | Analyse simple DC electric circuits by applying circuit laws |
| 2 | Describe the basic concepts of magnetic circuits and electromagnetic Induction |
| 3 | Apply electrical concepts to solve single-phase and three-phase circuits |
| 4 | To provide fundamental knowledge of electronic devices and circuits. |
| 5 | To introduce communication systems, instrumentation, and IoT concepts. |
| 6 | To create awareness of applications of electronics in real-life domains. |

| COMPETENCY STATEMENT (CC) | |
|---|---|
| CC1 | Analyse and troubleshoot complex electrical circuits using fundamental principles |
| CC2 | Apply principles of solid-state physics in electronic system design |
| CC3 | Design and analyse communication systems with modulation and demodulation |

**COURSE OUTCOMES (CO)**

**Course Outcomes** (CO): At the end of this course, learners will be able to:

| CO | CO Statement | CC Mapping | Cognitive (C) | Psychomotor (P) | Affective (A) |
|---|---|---|---|---|---|
| CO1 | Apply circuit laws to solve simple DC circuits in steady state | CC1 | A | | V |
| CO2 | Explain the basics of magnetic circuits and concept of electromagnetic induction | CC1 | U | | Rs |
| CO3 | Calculate the parameters of alternating voltage and current waveforms | CC1 | A | | V |
| CO4 | Apply the fundamental laws of electrical engineering to solve single phase and three phase AC circuits in steady state | CC1 | A | | V |
| CO5 | Describe the working principles and V–I characteristics of semiconductor devices and apply them in basic electronic circuits. | CC2 | U | I | Rs |
| CO6 | Discuss the concepts of communication systems, electronic instrumentation, and IoT with applications in various real-life domains. | CC3 | U | I | Rs |

***Cognitive (Revised blooms Level):*** *- **R**: Remember; **U**: Understand; **A**: Apply; **An**: Analyse; **E**: Evaluate; **C**: Create*
***Psychomotor Domain (Dave's):*** *- **I**-Imitation, **M**-Manipulation, **P**-Precision, **Ar**-Articulation, **N**-Naturalisation*
***Affective (Krathwohl)**: - **Re**-Receiving, **Rs**-Responding, **V**-Valuing, **O**-Organization, **Ch**-Characterization*

| CO | Program Outcomes (PO)& Program Specific Outcomes (PSO) Correlation Matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO | | | | | | | | | | | PSO | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 1 | 3 | 3 | | | 2 | | 3 | | | | | | | |
| 2 | 2 | | | | | | | | | | | | | |
| 3 | 3 | 3 | | | 2 | | 3 | | | | | | | |
| 4 | 3 | 3 | | | 2 | | 3 | | | | | | | |
| 5 | 3 | 2 | | | | | | | | | | | | |
| 6 | 2 | 2 | | | | 1 | 1 | | 1 | | | | | |
| *Correlation [3 – High, 2 -Medium, 1 – Low]* | | | | | | | | | | | | | | |

| TEACHING AND ASSESSMENT SCHEME | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Teaching Scheme / Week | | | | | Credit | Hours / Semester | Examination Scheme | | |
| | | | | | | | Theory | | |
| L | T | J | P | S | C | | CIA | ESE | Total |
| 4 | 0 | 0 | 0 | | 4 | 120 | 40 | 60 | 100 |

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

| SYLLABUS (Major Topics) | | | |
|---|---|---|---|
| Module | Title | Major Topics | Hrs |
| 1 | Analysis of Circuits | Equivalent resistance, mesh analysis, Node analysis | 10 |
| 1, 2 | Concepts of Magnetic circuits and Electromagnetic Induction | Basic terminologies in magnetic circuits, Series and Parallel magnetic circuits | 6 |
| 2 | Analysis of AC Circuits | AC Fundamentals, Analysis of single-phase circuits, Analysis of balanced three phase circuits | 14 |
| 3 | Introduction to Electronics devices & circuits | Passive & active components, Diodes, voltage regulator, power supply, BJT, FET | 16 |
| 4 | Introduction to telecommunication & Instrumentation | Wired communication, AM, FM, Wireless communication, Instrumentation | 14 |

| SELF-LEARNING / TEAM WORK | | |
|---|---|---|
| Sl. No | Self-learning / Team Work Description | Hrs |
| 1 | Equivalent resistance of a circuit (star delta conversion): additional problems | 7 |
| 2 | Mesh analysis: additional problems | 7 |
| 3 | Node analysis: additional problems | 7 |
| 4 | Parameters of AC waveforms: additional problems | 8 |
| 5 | Analysis of single phase RLC circuits: additional problems | 8 |
| 6 | Analysis of 3 phase RLC circuits: additional problems | 8 |
| 7 | Collect datasheets or product manuals of at least 3 basic electronic components (diode, transistor, MOSFET) and summarize their key parameters. | 3 |
| 8 | Trace the evolution of communication systems through simple block diagrams and real-world examples. | 2 |
| 9 | Small group case study on IoT applications – smart home OR healthcare OR agriculture. | 10 |

**SUGGESTED LEARNING RESOURCES**

| Text Book | | | |
|---|---|---|---|
| Sl. No. | Title of Book | Author | Publication |
| 1 | Basic Electrical Engineering | D P Kothari and I J Nagrath | McGraw Hill 4/e 2019 |
| 2 | Schaum's Outline of Basic Electrical Engineering | J.J.Cathey and Syed A Nasar | Tata McGraw Hill 3/e 2010 |
| 3 | Basic Electrical and Electronics Engineering | Bhattacharya S K | Pearson |
| 4 | Basic Electrical and Electronics Engineering | D. P. Kothari and I. J. Nagrath | McGraw Hill 2/e 2020 |
| 5 | Electronics Devices & Circuit Theory | R. LBoylstead, L.Nashelsky | Pearson 11/e, 2015 |
| 6 | Electronics Communication Systems | Kennedy & Davis | McGraw Hill, 6/e, 2017 |

| Reference | | | |
|---|---|---|---|
| Sl. No. | Title of Book | Author | Publication |
| 1 | Electrical Engineering Fundamentals | Del Toro V | Pearson Education 2/e 2019 |
| 2 | Engineering Circuit Analysis | Hayt W H, Kemmerly J E, and Durbin S M | Tata McGraw-Hill |

| | | | |
|---|---|---|---|
| 3 | Electrical and Electronic Technology | Hughes | Pearson Education |
| 4 | Basic Electrical Engineering | D C Kulshreshtha | Tata McGraw Hill 2/e 2019 |
| 5 | Electronics Fundamentals: Circuits, Devices & Applications | Thomas Floyd, David Buchla | Pearson, 8/e |
| 6 | Electronics: A system approach | Neil Storey | Pearson 6/e, 2017 |
| 7 | Electronic Communication | Dennis Roddy &John Coolen | Pearson, 4/e, 2008 |
| 8 | Principles of Electronics Communication Systems | FrenzelL.E | McGraw Hill, 4/e, 2016 |

| **Web Resource** | |
|---|---|
| 1 | https://www.coursera.org/learn/linear-circuits-dcanalysis (Module 1) |
| 2 | https://www.coursera.org/lecture/linear-circuits-ac-analysis/1-4-circuit-analysis-with-ac-impedances-gArJ6 (Module 1) |
| 3 | https://www.coursera.org/lecture/linear-circuits-ac-analysis/1-2-phasors-rEHhq(Module 2) |
| 4 | https://nptel.ac.in/courses/117106108 |
| 5 | https://ocw.mit.edu/courses/ec-s06-practical-electronics-fall-2004/ |
| 6 | https://nptel.ac.in/courses/108101091 |
| 7 | https://nptel.ac.in/courses/117105143 |

**DETAILED SYLLABUS** *(Self-learning if any to be marked)*

| Module | Topic | Mode of Delivery | CO | Learning Domain | | | Hrs |
|---|---|---|---|---|---|---|---|
| | | | | C | P | A | |
| 1 | Introduction to Electrical Engineering, Basic Terminology, including voltage, current, power, resistance, emf, | CD | CO1 | A | | | 1 |
| | Resistances in series and parallel, Current and Voltage Division Rules | L | | | | | 1 |
| | Capacitors & Inductors: V-I relations and energy stored. Ohm's law | L | | | | | 1 |
| | star-delta conversion (resistive networks only) - problems. | L | | | | Rs | 1 |
| | Numerical problems | T, S | CO1 | A | | V | 2 |
| | Mesh current method – matrix representation - Solution of network equations. | L, T, S | | | | | 1 |
| | Numerical problems | T | | | | | 1 |
| | Node voltage methods-matrix representation-solution of network equations by matrix methods - numerical problems. | L, T, S | | | | | 1 |
| | Numerical problems | T | | | | | 2 |
| | Basic Terminology: MMF, field strength, flux density, reluctance - comparison between electric and magnetic circuits | L | CO2 | U | | Rs | 1 |
| | Series and parallel magnetic circuits with composite materials | L | | | | | 1 |
| 2 | Faraday's laws, Lenz's law, statically induced and dynamically induced emfs, problems | L | CO2 | U | | Rs | 1 |
| | Self-inductance and mutual inductance, coefficient of coupling | L | | | | | 1 |
| | Generation of alternating voltages-Representation of sinusoidal waveforms: frequency, period | L | CO3 | A | | V | 1 |
| | Average and RMS values and form factor of waveforms - Numerical Problems | L, T, S | | | | | 2 |
| | Phasor representation of sinusoidal quantities. Trigonometric, Rectangular, Polar and complex forms. | L | | | | | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Analysis of simple AC circuits: Purely resistive circuit | L | CO3 | A | | V | 1 |
| | Analysis of simple AC circuits: Purely inductive & capacitive | L, T, S | | | | | 2 |
| | circuits; Inductive and capacitive reactance, concept of impedance. | | | | | | |
| | Average Power, Power factor | | | | | | |
| | Analysis of RL, RC and RLC series Circuits- active, reactive and apparent power. | | | | | | 2 |
| | Numerical Problems | T | | | | | 2 |
| | Generation of three phase voltages, advantages of three phase systems, star and delta connections | L | CO4 | U | | Rs | 1 |
| | Relation between line and phase voltages, line and phase currents - Numerical problems. | L, T, S | | | | | 1 |
| | Numerical Problems | T | | | | | 2 |
| 3 | Passive & Active components | L, T | CO5 | U | I | Rs | 1 |
| | Rectifiers: Full-wave & Bridge - Ripple factor (with & without capacitor filter) | | | | | | 2 |
| | Zener voltage regulator, Line & load regulation | L, T, S | CO5 | U | I | Rs | 2 |
| | Block diagram of regulated DC power supply | | | | | | 1 |
| | BJT Construction & working, V-I characteristics of BJT | L, T | CO5 | U | I | Rs | 2 |
| | CE configuration: Input-output characteristics | | | | | | 1 |
| | Comparison of CE, CB & CC configurations | L | CO5 | U | I | Rs | 1 |
| | Concept of biasing & load line, Transistor as a switch (circuit & working) | L, T | CO5 | U | I | Rs | 2 |
| | Transistor as an amplifier, RC coupled amplifier: Circuit diagram & frequency response | L, T | CO5 | U | I | Rs | 2 |
| | Basics of FETs (MOSFET) - Construction & working of N & P channel MOSFET (Drain & Transfer characteristics) | L, S | CO5 | U | I | Rs | 2 |
| 4 | General block diagram of a communication system | L, T | CO6 | U | I | Rs | 1 |
| | Need for modulation, Concept of AM & angle modulation (no derivation) | | | | | | 2 |
| | Basic concept of wired communication, Wired channels: twisted pair, coaxial cable, fiber optic cable | L | CO6 | U | I | Rs | 2 |
| | Introduction to wireless communication, Block diagram of GSM, Comparison of 3G, 4G, 5G & 6G technologies | L, S | CO6 | U | I | Rs | 2 |
| | Block diagram of electronic instrumentation system, Digital Multimeter, | L | CO6 | U | I | Rs | 2 |
| | Function generator, Introduction to CRO & Lissajous patterns | | | | | | 2 |
| | IoT based smart homes, IoT in healthcare, IoT in agriculture (case study only) | L, S | CO6 | U | I | V | 3 |

**TABLE OF SPECIFICATIONS (ToS) (ESE Question Paper Design)**

| Module | Module Title | Distribution of Marks (RBL) | | | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| | | R | U | A | An | E | C | |
| 1 | Analysis of DC Circuits | √ | √ | √ | | | | 15 |
| 2 | Analysis of AC Circuits | √ | √ | √ | | | | 15 |
| 3 | Introduction to Electronics devices & circuits | | √ | √ | | | | 15 |
| 4 | Introduction to telecommunication & Instrumentation | | √ | √ | | | | 15 |

*This ToS shall be treated as a general guideline for students and teachers for distribution of marks*

| ASSESSMENT PATTERN | |
|---|---|
| **Assessment Method** | **Marks** |
| **Continuous Internal Assessment** | **40** |
| 1. Internal Examination | 20 |
| 2. Learning Activity | 15 |
| 3. Regularity | 5 |
| 4. Course Project | - |
| **End Semester Examination** | **60** |
| **Total** | **100** |

| | | | |
|---|---|---|---|
| | | | Total Pages: ……. |
| Register No.: | …… | Name: | …… |

(AN AUTONOMOUS COLLEGE AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANATHAPURAM)

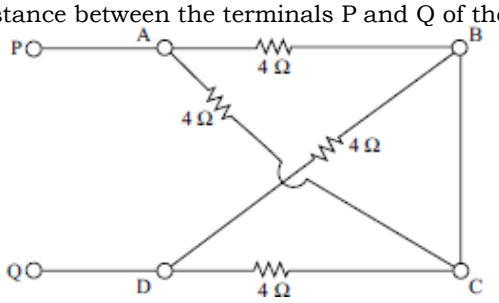
| | | | |
|---|---|---|---|
| **FIRST SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, DECEMBER 2025 (2025 SCHEME)** | | | |
| **Course Code**: | **B250906/CN100D** | | |
| **Course Name**: | **INTRODUCTION TO ELECTRICAL AND ELECTRONICS ENGINEERING** | | |
| **Max. Marks** | **60** | **Duration**: | 2 hours 30 minutes |
| Specify if the question paper is common to different programmes | | | |
| ***Use of Data Book / IS codes, etc to be specified by the question paper setter*** | | | |
| • ***Students should write answers to Questions of Part 1 between the pages 1 and 15 and answers to Questions of Part 2 between pages 16 and 30 of the answer booklet. No additional answer books / sheets will be provided.*** <br> • ***No separate minimum marks are required to pass.*** | | | |

**PART 1- ELECTRICAL ENGINEERING (30 MARKS)**

**PART 1 - A**

**MODULE 1 & 2**

***(Answer all questions. Each question carries 3 marks)***

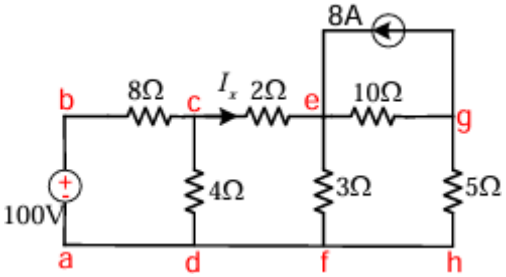
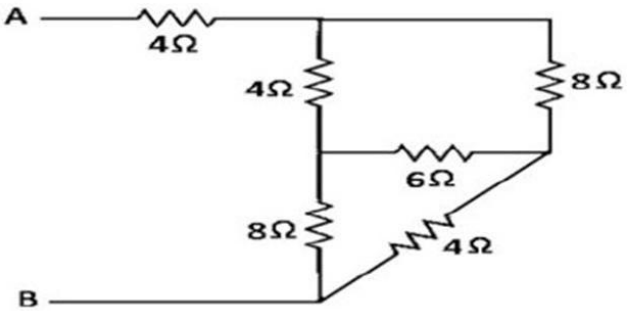
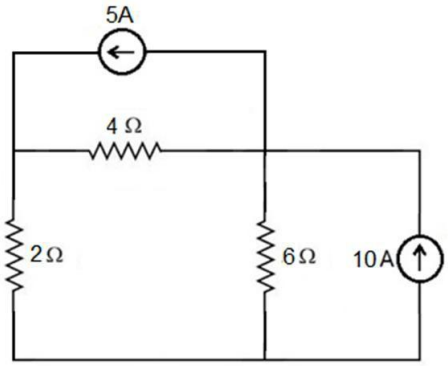
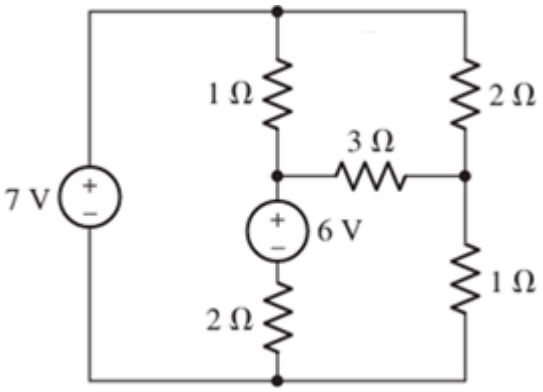
| ***No.*** | ***Question*** | ***CO*** | ***Marks*** |
|---|---|---|---|
| 1 | Calculate the resistance between the terminals P and Q of the network shown.   | CO1 | (3) |
| 2 | Differentiate between electric resistance and magnetic reluctance. | CO2 | (3) |
| 3 | Electromotive force (emf) can be generated in two ways – statically induced and dynamically induced. Compare these two types of induced emf with respect to principle, condition of flux, and applications. | CO2 | (3) |
| 4 | A solenoid coil with an inductance of 0.5 H is used in a smart lighting control system, which operates on a 230 V, 50 Hz AC supply. Derive the expressions for the instantaneous voltage and current through the coil. | CO3 | (3) |

**PART 1 - B**

**MODULE 1 & 2**

***(Answer any one full question from each module, each question carries 9 marks)***

| ***No.*** | | ***Question*** | ***CO*** | ***Marks*** |
|---|---|---|---|---|
| **MODULE I** | | | | |
| 5 | a | In the circuit shown determine the current $I_x$. | CO1 | (5) |

| | | | | |
|---|---|---|---|---|
| | |  | | |
| | b | Apply star-delta transformation to determine the equivalent resistance $R_{AB}$.<br>  | CO1 | (4) |
| | | **OR** | | |
| | | | | |
| 6 | a | Apply Nodal analysis to solve the node voltages in the circuit shown.<br>  | CO1 | (4) |
| | b | Apply mesh analysis to determine the three mesh currents in the circuit shown below.<br>  | CO1 | (5) |

| | | | | |
|---|---|---|---|---|
| **MODULE II** | | | | |
| 7 | a | A technician is testing a device that uses a capacitor to limit current flow. When connected directly to a 230 V AC source, the device draws 1 A current. To protect sensitive components, the current needs to be reduced to 0.5 A by adding a resistor in series.<br>i) Determine the frequency of the applied voltage.<br>ii) Calculate the resistance required to be connected in series with the capacitor to limit the current to 0.5 A, assuming frequency remains unchanged.<br>iii) Compute the phase angle between supply voltage and current after inserting the resistor, and state whether current leads or lags the voltage. | CO4 | (4) |
| | b | An industrial motor is connected to a 3-phase, 400V supply through a delta-connected impedance network. Each phase of the network has an impedance of 8+j6 Ω.<br>i) Calculate the line current drawn by the motor system.<br>ii) Determine the power factor of the system.<br>iii) Compute the total power consumed. | CO4 | (5) |
| **OR** | | | | |
| 8 | a | An R–L–C series circuit is used as part of an AC filtering system. By adjusting the inductance, the current peaks at 0.5 A while operating at 230 V, 50 Hz supply. At this point, a voltage of 350 V is recorded across the capacitor.<br>i) Calculate the resistance of the circuit.<br>ii) Determine the capacitance of the capacitor.<br>iii) Find the inductance of the inductor when the circuit is in resonance. | CO4 | (4) |
| | b | An industrial motor acting as a balanced three phase load consists of three coils each having resistance of 4Ω and inductance 0.02H. It is connected to a 415V, 50Hz, 3-phase ac supply. Determine the phase voltage, phase current, power factor and active power when the load is connected in star. | CO4 | (5) |

| | | | |
|---|---|---|---|
| **PART 2 – ELECTRONICS ENGINEERING (30 MARKS)** | | | |
| **PART 2 - A** | | | |
| **MODULE 3 & 4** | | | |
| ***(Answer all questions. Each question carries 3 marks)*** | | | |
| ***No.*** | ***Question*** | ***CO*** | ***Marks*** |
| 1 | The colour bands Violet, Blue, Brown, and Gold are observed on a resistor. Analyse whether this resistor is suitable for a circuit that specifies the resistance must remain between 730 Ω and 780 Ω. Support your conclusion with appropriate calculations. | CO5 | (3) |
| 2 | Calculate emitter current $I_E$ in a BJT if the value of β is 50 and $I_B$ =20μA | CO5 | (3) |
| 3 | Discuss the role of IoT in transforming traditional agricultural practices. | CO6 | (3) |
| 4 | Discuss how the information signal affects the carrier in AM and FM, and critically compare their advantages and limitations. | CO6 | (3) |

| | | | | |
|---|---|---|---|---|
| **PART 2 - B** | | | | |
| **MODULE 3 & 4** | | | | |
| ***(Answer any one full question from each module, each question carries 9 marks)*** | | | | |
| ***No.*** | | ***Question*** | ***CO*** | ***Marks*** |
| **MODULE III** | | | | |
| 5 | | You are designing a power supply circuit for a portable radio that requires a steady DC voltage. The circuit includes a rectifier to convert the AC mains supply to DC before the voltage is regulated. | | |
| | a | Identify and sketch the type of rectifier used in the circuit. | CO5 | (3) |
| | b | Describe the working principle of the above rectifier in the power supply circuit. | CO5 | (3) |
| | c | Sketch the waveforms of the input AC voltage, the rectified output voltage, and the regulated output voltage supplied to the radio. | CO5 | (3) |

| | | | | |
|---|---|---|---|---|
| | | **OR** | | |
| | | | | |
| 6 | | An electronics trainee is testing a MOSFET using a multimeter. When the voltage measured between the gate and source is 0 V, the device does not conduct between drain and source. However, on applying a positive gate to source voltage, current begins to flow from drain to source. | | |
| | a | Identify the type and illustrate the construction of MOSFET. | CO5 | (3) |
| | b | Justify the trainee's observations regarding the operation of this MOSFET when tested under different gate to source voltages. | CO5 | (4) |
| | c | Interpret the drain characteristics of this MOSFET with the help of a neat sketch, identifying the different regions of operation. | CO5 | (2) |
| | | **MODULE IV** | | |
| 7 | | A broadcast engineer is planning to transmit an audio signal of frequency range 300 Hz – 3.4 kHz directly over a long distance to multiple locations. After setting up the transmission, he notices that at the receiver end, the signal is highly attenuated and gets distorted with noise, making the speech almost unintelligible. | | |
| | a | Identify the reason for the poor reception of the directly transmitted audio signal and suggest a suitable method to overcome this issue. | CO6 | (4) |
| | b | Describe any two techniques that enable effective transmission of signals over long distances, and illustrate your explanation with neat sketches. | CO6 | (5) |
| | | **OR** | | |
| 8 | | You are assigned to troubleshoot an electrical circuit in a lab where a resistor, capacitor, and a battery are connected. The circuit is not functioning as expected, and you suspect faulty components. | | |
| | a | Recommend a suitable instrumentation system that can be used to perform the necessary measurements in this scenario, and draw its block diagram. | CO6 | (4) |
| | b | How does the suggested instrument function in measuring battery current and resistance. | CO6 | (5) |

**********

| COURSE DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Regulation** | **2025** | **L-T-J-P-S** | **2-1-0-2-3** | **Version** | **25/0** | **Credits** | **4** |
| *(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)* | | | | | | | |

| Course Code | Course Name | Course Category |
|---|---|---|
| **B250905/CN110E** | **ALGORITHMIC THINKING WITH PYTHON** | **ESE** |
| **Pre-requisite** | | |
| NIL | | |

| COURSE OBJECTIVES | |
|---|---|
| 1 | To provide students with a thorough understanding of algorithmic thinking and its practical applications in solving real-world problems |
| 2 | To explore various algorithmic paradigms, including brute force, divide-and-conquer, dynamic programming, and heuristics, in addressing and solving complex problems |

| COMPETENCY | |
|---|---|
| CC1 | Apply the basic engineering concepts to solve near to real-life engineering problems |
| CC2 | Demonstrates proficiency in programming languages, frameworks, and development tools |

**COURSE OUTCOMES**

**Course Outcomes** (CO): At the end of this course, learners will be able to:

| CO | CO Statement | CC Mapping | Cognitive (C) | Psychomotor (P) | Affective (A) |
|---|---|---|---|---|---|
| CO1 | Interpret problem-solving strategies by using computing as a model for addressing near real-world problems | 1 | U | M | Rs |
| CO2 | Develop clear and accurate models, such as algorithms, pseudocode, flowcharts, to represent the problem by articulating it before attempting to solve it | 1 | A | M | Rs |
| CO3 | Apply the essential python programming skills, to translate the algorithmic model into executable program | 2 | A | M | Rs |
| CO4 | Identify systematic approaches and problem-solving strategies for computational problems | 1 | A | M | Rs |

***Cognitive (Revised blooms Level):*** *- **R**: Remember; **U**: Understand; **A**: Apply; **An**: Analyse; **E**: Evaluate; **C**: Create*
***Psychomotor Domain (Dave's):*** *- **I**-Imitation, **M**-Manipulation, **P**-Precision, **Ar**-Articulation, **N**-Naturalisation*
***Affective (Krathwohl)**: - **Re**-Receiving, **Rs**-Responding, **V**-Valuing, **O**-Organization, **Ch**-Characterization*

| CO | Program Outcomes & Program Specific Outcomes Correlation Matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO | | | | | | | | | | | PSO | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 1 | 3 | 3 | 3 | | 2 | | 2 | | 2 | 2 | 3 | 2 | | |
| 2 | 3 | 3 | 3 | | 2 | | 2 | | 2 | 2 | 3 | 2 | | |
| 3 | 3 | 3 | 3 | | 2 | | 2 | | 2 | 2 | 3 | 2 | | |
| 4 | 3 | 3 | 3 | | 2 | | 2 | | 2 | 2 | 3 | 2 | | |

*Correlation [3 – High, 2 -Medium, 1 – Low]*

**TEACHING AND ASSESSMENT SCHEME**

| Teaching Scheme / Week | | | | | Credit | Hours / Semester | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Theory | | | Practical | | | Total |
| L | T | J | P | S | C | | CIA | ESE | Total | CIA | ESE | Total | |
| 2 | 1 | 0 | 2 | 2 | 4 | 120 | 25 | 60 | 85 | 15 | 0 | 15 | 100 |

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

| **SYLLABUS (Major Topics)** | | | |
|---|---|---|---|
| Module | Title | Major Topics | Hrs |
| 1 | Foundations of Problem-Solving and Python Basics | Problem-Solving Strategies, The Problem-Solving Process, Essentials of Python Programming | 7 |
| 2 | Algorithm Design with Pseudocode and Flowcharts | Pseudocode, Flowcharts | 9 |
| 3 | Modular Problem-Solving with Python: Control Structures to Recursion | Selection and Iteration, Decomposition and Modularization, Recursion: - | 10 |
| 4 | Fundamental Computational Approaches to Problem-Solving | Divide-and-Conquer Approach, Dynamic Programming Approach, Greedy Algorithm Approach | 10 |

| **SELF-LEARNING / TEAM WORK** | | |
|---|---|---|
| Sl. No | Self-learning / Team Work Description | Hrs |
| 1 | Pre-Lab practical Preparation | 19 |
| 2 | Case study: Pick simple problems (e.g., finding prime numbers) document steps: understanding, model, algorithm, coding, testing. | 12 |
| 3 | Group activity: Each team takes a real-world scenario (e.g., ATM withdrawal process, online shopping checkout) and develops pseudocode with sequencing, selection, and repetition. | 12 |
| 4 | Compare recursive vs iterative solutions for factorial & Fibonacci.<br>Trace recursion using call-stack diagrams. | 10 |
| 5 | Study simple brute-force problems: padlock, password guessing.<br>Write small brute-force code (e.g., linear search). | 11 |

**SUGGESTED LEARNING RESOURCES**

| **Text Book** | | | |
|---|---|---|---|
| Sl. No. | Title of Book | Author | Publication |
| 1 | Problem solving & programming concepts | Maureen Sprankle, Jim Hubbard | Pearson |
| 2 | How to Solve It: A New Aspect of Mathematical Method | George Pólya | Princeton University Press |

| **Reference** | | | |
|---|---|---|---|
| Sl. No. | Title of Book | Author | Publication |
| 1 | Creative Problem Solving: An Introduction | Donald Treffinger., Scott Isaksen, Brian Stead-Doval | Prufrock Press |
| 2 | Psychology (Sec. Problem Solving.) | Spielman, R. M., Dumper, K., Jenkins, W., Lacombe, A., Lovett, M., & Perlmutter, M | H5P Edition |
| 3 | Computational Thinking: A Primer for Programmers and Data Scientists | G Venkatesh Madhavan Mukund | Mylspot Education Services Pvt Ltd |
| 4 | Computer Arithmetic Algorithms | Koren, Israel | AK Peters/CRC Press |

| **Web Resource** | |
|---|---|
| 1 | https://opentextbc.ca/h5ppsychology/chapter/problem-solving/ |
| 2 | https://onlinecourses.nptel.ac.in/noc21_cs32/preview |

| **DETAILED SYLLABUS** *(Self-learning if any to be marked)* | | | | | | | |
|---|---|---|---|---|---|---|---|
| Module | Topic | Mode of Delivery | CO | Learning Domain | | | Hrs |
| | | | | C | P | A | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | **Problem-solving strategies** – definition, importance, trial & error, heuristics, means-ends analysis, backtracking (working backward) | L | CO1 | U | M | Rs | 2 |
| | **The problem-solving process** – computer as a model of computation, understanding the problem, formulating a model, developing an algorithm, writing the program, testing & evaluating the solution | L | CO1 | U | M | Rs | 3 |
| | **Essentials of Python programming** – variables, numeric and string data types, math module, Python Standard Library, I/O (print, input), operators & precedence | L | CO1 | U | M | Rs | 2 |
| | **Case study**: Pick simple problems (e.g., prime numbers) and document steps (understanding, model, algorithm, coding, testing) | S | CO1 | U | M | Rs | 12 |
| 2 | **Pseudocode Representation** – meaning & definition, reasons for using pseudocode, constructs of pseudocode (sequencing, selection – if-else, case structure; repetition – for, while, repeat-until loops) | L | CO2 | A | M | Rs | 3 |
| | **Sample problems using pseudocode** – evaluate expression (d=a+b*c), simple interest, larger of two numbers, smallest of three numbers, grade computation (KTU scale), numbers 1–50 in descending order, sum of n numbers (all loop types), factorial, largest of n numbers (more may be added) | L, T | CO2 | A | M | Rs | 3 |
| | **Flowcharts** – symbols: start/end, arithmetic operation, I/O, decision, module call, loop (hexagon), flow-lines, connectors (on-page & off-page) | L | CO2 | A | M | Rs | 2 |
| | **Flowcharts for sample problems** – construct diagrams for problems listed earlier (expression evaluation, interest, factorial, largest number, etc.); use of tools like RAPTOR suggested | T | CO2 | A | M | Rs | 1 |
| | **Self-learning –** Group activity: Each team takes a real-world scenario (e.g., ATM withdrawal process, online shopping checkout) and develops pseudocode with sequencing, selection, and repetition | S | CO2 | A | M | Rs | 12 |
| **3** | **Selection and iteration using Python** – if-else, elif, for loop, range, while loop | L | CO3 | A | M | Rs | 2 |
| | **Sequence data types in Python** – list, tuple, set, strings, dictionary | L | CO3 | A | M | Rs | 2 |
| | Creating and using arrays in Python (using NumPy library) | L | CO3 | A | M | Rs | 1 |
| | **Decomposition and modularization** – problem decomposition as a strategy for solving complex problems, modularization, motivation for modularization | L | CO3 | A | M | Rs | 2 |
| | **Functions in Python** – defining & using functions, functions with multiple return values. The idea should be demonstrated using Merge Sort and the problem of returning the top three integers from a list of n ≥ 3 integers (examples). (Not limited to these exercises; more can be worked out if time permits). | L | CO3 | A | M | Rs | 1 |
| | **Recursion** – definition, reasons for using recursion, the call stack, recursion and the stack, avoiding circularity in recursion | T | CO3 | A | M | Rs | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Sample recursive problems** – finding nth Fibonacci number, GCD of two integers, factorial of a positive integer, adding two positive integers, sum of digits of a positive number (Not limited to these exercises; more can be worked out if time permits). | L, T | CO3 | A | M | Rs | 1 |
| | **Self-learning:** Compare recursive vs iterative solutions for factorial & Fibonacci; trace recursion using call-stack diagrams | S | CO3 | A | M | Rs | 10 |
| 4 | **Brute-force Approach** – Introductory diagrammatic/algorithmic explanation (analysis not required). Example: Padlock, Password guessing | L | CO4 | A | M | Rs | 2 |
| | **Divide-and-Conquer Approach**–Introductory diagrammatic/algorithmic explanation (analysis not required). Example: The Merge Sort Algorithm. Advantages of Divide and Conquer Approach. Disadvantages of Divide and Conquer Approach | L | CO4 | A | M | Rs | 2 |
| | **Dynamic Programming Approach** – introductory diagrammatic/algorithmic explanation (analysis not required). Example: Fibonacci series. Recursion vs Dynamic Programming | L | CO4 | A | M | Rs | 2 |
| | **Greedy Algorithm Approach** – Introductory diagrammatic/algorithmic explanation (analysis not required). Example: Given an array of positive integers each indicating the completion time for a task, find the maximum number of tasks that can be completed in the limited amount of time you have. Motivations for the Greedy Approach. Characteristics of the Greedy Algorithm. Greedy Algorithms vs Dynamic Programming | L | CO4 | A | M | Rs | 2 |
| | **Randomized Approach** – Introductory diagrammatic/algorithmic explanation (analysis not required). Example: Coupon Collector Problem – A company selling jeans gives a coupon for each pair of jeans. There are n different coupons. Collecting n different coupons gives you a free pair. How many jeans do you expect to buy before getting a free one? | L | CO4 | A | M | Rs | 2 |
| | **Self-learning** – Study simple brute-force problems: padlock, password guessing. Write small brute-force code (e.g., linear search). | S | CO4 | A | M | Rs | 11 |

**PRACTICAL SYLLABUS**

| Module | Objective | CO | Learning Domain | | | Hrs |
|---|---|---|---|---|---|---|
| | | | C | P | A | |
| 1 | To practice basic syntax, operators and user input handling | 3 | A | M | Rs | 1 |
| 1 | To familiarize string operations and indexing | 3 | A | M | Rs | 1 |
| 1 | To understand built-in libraries and formatting | 3 | U | M | Rs | 1 |
| 1 | To apply data structures and library usage | 3 | A | M | Rs | 1 |
| 3 | To apply selection control structure | 3 | A | M | Rs | 1 |
| 1 | To apply formulas and I/O | 3 | A | M | Rs | 1 |
| 3 | To practice nested iteration and control flow | 3 | A | P | Rs | 1 |
| 3 | To apply iteration and conditions with efficiency | 3 | A | P | Rs | 1 |
| 3 | To apply recursion for mathematical problems | 3 | A | P | Rs | 1 |
| 3 | To practice recursion basics | 3 | A | P | Rs | 1 |
| 3 | To strengthen recursive algorithm design | 3 | A | P | Rs | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3 | To apply recursion for number theory problems | 3 | A | P | Rs | 1 |
| 3 | To apply modularization and conditionals | 3 | C | P | V | 1 |
| 3 | To understand modular programming and reuse | 3 | C | P | V | 1 |
| 3 | To apply string validation logic | 3 | A | P | Rs | 1 |
| 4 | To apply sorting, merging and algorithm design | 3 | A | P | V | 1 |
| 4 | To apply loops, decision making and simulate game strategy | 3 | A | P | V | 2 |
| 4 | To apply probability simulation, decision analysis and algorithmic reasoning | 4 | A | P | V | 2 |

**TABLE OF SPECIFICATIONS (ToS) (ESE Question Paper Design)**

| Module | Module Title | Distribution of Marks (RBL) | | | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| | | R | U | A | An | E | C | |
| 1 | Foundations of Problem-Solving and Python Basics | - | √ | - | - | - | - | 15 |
| 2 | Algorithm Design with Pseudocode and Flowcharts | - | √ | √ | - | - | - | 15 |
| 3 | Modular Problem-Solving with Python: Control Structures to Recursion | - | √ | √ | - | - | - | 15 |
| 4 | Fundamental Computational Approaches to Problem-Solving | - | √ | √ | - | - | - | 15 |

*This ToS shall be treated as a general guideline for students and teachers for distribution of marks.*

**ASSESSMENT PATTERN**

| **Assessment** | **Mark** |
|---|---|
| **Continuous Internal Assessment** | **40** |
| 1. Internal Examination | 20 |
| 2. Continuous Lab Evaluation | 5 |
| 3. Learning Activity | - |
| 4. Regularity | 5 |
| 5. Course Project | - |
| 6. Lab Examination | 10 |
| **End Semester Examination** | **60** |
| **Total** | **100** |

| | | | |
|---|---|---|---|
| | | | Total Pages: ..... |
| Register No.: | ..... | Name: | ..... |

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| | | | |
|---|---|---|---|
| **FIRST SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, DECEMBER 2025 (2025 SCHEME)** | | | |
| **Course Code**: | B250905/CN110E | | |
| **Course Name**: | ALGORITHMIC THINKING WITH PYTHON | | |
| **Max. Marks** | **60** | **Duration**: | 2 hours 30 minutes |
| Specify if the question paper is common to different programmes | | | |
| ***Use of Data Book / IS codes, etc to be specified by the question paper setter*** | | | |

**PART A**

***(Answer all questions. Each question carries 3 marks)***

| ***No.*** | ***Question*** | ***CO*** | ***Marks*** |
|---|---|---|---|
| 1 | Distinguish between **trial-and-error strategy** and **divide-and-conquer strategy** with suitable real-life examples. | CO 1 | (3) |
| 2 | When driving in a city with frequent traffic congestion, how can a heuristic approach be applied to find the fastest route to your destination? | CO 1 | (3) |
| 3 | Draw a flowchart to compute the sum of the first n odd numbers. | CO 2 | (3) |
| 4 | Write pseudocode to check whether a given number is prime or not. | CO 2 | (3) |
| 5 | Trace the output of the following Python code:<br><br>a = [1, 2, 3]<br>b = a<br>b.append(4)<br>print(a)<br>print(b is a) | CO 3 | (3) |
| 6 | Predict the output of the following expressions:<br>i) 7 % 3 * 2<br>ii) "10" * 3<br>iii) bool([]) | CO 3 | (3) |
| 7 | Differentiate between top-down and bottom-up approaches in Dynamic Programming. | CO 4 | (3) |
| 8 | Suppose you are designing a security system. A password must contain at least one uppercase, one lowercase, one digit, and one special character. Suggest an algorithmic approach to validate the password. | CO 4 | (3) |

| PART B | | | | |
|---|---|---|---|---|
| *(Answer any one full question from each module, each question carries 9 marks)* | | | | |
| ***No.*** | | ***Question*** | ***CO*** | ***Marks*** |
| **MODULE I** | | | | |
| 9 | a) | Explain how the **backtracking strategy** can be applied to solve a real-life problem, for example, planning steps to reach a financial savings goal. | CO 1 | (5) |
| | b) | Write a Python program to convert a temperature given in Celsius to Fahrenheit and Fahrenheit to Celsius (Hint: °F = (°C × 9/5) + 32). | CO 1 | (4) |
| **OR** | | | | |
| 10 | a) | A student is preparing for multiple competitive exams with limited time. Describe how the **Means–Ends Analysis** approach can be applied to plan an effective study schedule. | CO 1 | (5) |
| | b) | Write a Python program to calculate the bill amount for an item given its quantity sold, value, discount, and tax. | CO 1 | (4) |
| **MODULE II** | | | | |
| 11 | a) | Write pseudocode to simulate a simple ATM withdrawal system. The system should check balance, deduct the amount, and display the remaining balance. | CO 2 | (5) |
| | b) | Draw a flowchart to compute the sum of digits of an integer. | CO 2 | (4) |
| **OR** | | | | |
| 12 | a) | Write pseudocode to compute the average marks of N students and classify them into "Pass" and "Fail" categories (Criteria to consider as pass is greater than or equal to 50 marks out of 100.). | CO 2 | (5) |
| | b) | Develop an algorithm to check whether a given year is a leap year. | CO 2 | (4) |
| **MODULE III** | | | | |
| 13 | a) | Differentiate recursion and iteration. Write a recursive program to find factorial of a number. | CO 3 | (5) |
| | b) | Write a Python function to accept a list of integers and return a new list containing only the perfect numbers (Hint: A perfect number is a positive integer equal to the sum of its proper divisors, e.g., 6, 28, 496). | CO 3 | (4) |
| **OR** | | | | |
| 14 | a) | Write a Python program using function to print 'n' lines of the following pattern.<br>1<br>1 2<br>1 2 3<br>1 2 3 4 | CO 3 | ( 5) |
| | b) | You have tuples representing election results: (Candidate Name, Votes Received). Write a program to find the candidate with the maximum votes. Also calculate the percentage of votes each candidate received.<br>Sample Input: [("Alice", 3400), ("Bob", 2800), ("Charlie", 1500)]<br>Output:<br>Winner: Alice<br>Vote Percentages: [47.22%, 38.89%, 13.89%] | CO 3 | (4) |
| **MODULE IV** | | | | |
| 15 | a) | Illustrate the process of sorting the array [15, 8, 3, 12, 6, 10, 4, 1] using the merge sort algorithm. Draw a diagram showing how the array is split and merged at each stage. | CO 4 | (5) |
| | b) | Compare Greedy Algorithms and Dynamic Programming in terms of their approach, solution guarantee, and applicable scenarios. Provide examples where each approach is preferred. | CO 4 | (4) |

| | | | | |
|---|---|---|---|---|
| | | **OR** | | |
| 16 | a) | A company wants to allocate jobs to machines to minimize total cost. Formulate this as an optimization Problem and describe how dynamic programming can be applied. | CO 4 | (5) |
| | b) | A student has exams for 5 subjects, each requiring different preparation times (Subject A – 2 hrs, Subject B – 4hrs, Subject C – 1 hr, Subject D – 3hrs, Subject E – 5hrs). Given a total of 10 study hours, design a Greedy Strategy to maximize the number of subjects covered. Show the sequence of subjects chosen and the total number of subjects. | CO 4 | (4) |

| COURSE DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Regulation** | **2025** | **L-T-J-P-S** | **1-0-0-1-0** | **Version** | **25/0** | **Credits** | **1** |
| *(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)* | | | | | | | |

| Course Code | Course Name | Course Category |
|---|---|---|
| **B250908/CN910K** | **HEALTH AND WELLNESS** | **HMT** |
| **Pre-requisite** | | |
| NIL | | |

| COURSE OBJECTIVES | |
|---|---|
| 1 | To provide essential knowledge on physical activity, health and wellness. |
| 2 | To ensure students understand body systems, exercise principles, nutrition, mental health, and disease management. |
| 3 | To educate students on the benefits of yoga, the risks of substance abuse and basic first aid skills. |
| 4 | To equip students with the ability to lead healthy lifestyles. |
| 5 | To enable students to design effective and personalized exercise programs. |

| COMPETENCY STATEMENT (CC) | |
|---|---|
| **CC** | Demonstrate a commitment to a healthy lifestyle through regular physical activity and avoidance of addictive substances to promote holistic wellness. |

**COURSE OUTCOME (CO)**

**Course Outcomes** (CO): At the end of this course, learners will be able to:

| CO | CO Statement | CC Mapping | Cognitive (C) | Psychomotor (P) | Affective (A) |
|---|---|---|---|---|---|
| CO1 | Explain the importance of physical activity in maintaining human metabolic system. | CC1 | U | | Re |
| CO2 | Practice life style management strategies.to improve mental health and wellness. | CC1 | U | M | Rs |
| CO3 | Practice healthy life style through regular physical activities and abstaining from addictive substances. | CC1 | U | M | Ch |

***Cognitive (Revised blooms Level):*** *- **R**: Remember; **U**: Understand; **A**: Apply; **An**: Analyse; **E**: Evaluate; **C**: Create*
***Psychomotor Domain (Dave's):*** *- **I**-Imitation, **M**-Manipulation, **P**-Precision, **Ar**-Articulation, **N**-Naturalisation*
***Affective (Krathwohl)**: - **Re**-Receiving, **Rs**-Responding, **V**-Valuing, **O**-Organization, **Ch**-Characterization*

| CO | Program Outcomes & Program Specific Outcomes Correlation Matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO | | | | | | | | | | | PSO | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 1 | 2 | | | | | 1 | 1 | | 1 | | 1 | | | |
| 2 | 2 | | | | | 1 | 1 | | 1 | | 1 | | | |
| 3 | 2 | | | | | 1 | 1 | | 1 | | 1 | | | |

*Correlation [3 – High, 2 -Medium, 1 – Low]*

**TEACHING AND ASSESSMENT SCHEME**

| Teaching Scheme / Week | | | | | Credit | Hours / Semester | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Theory | | | Practical | | | Total |
| L | T | J | P | S | C | | CIA | ESE | Total | CIA | ESE | Total | |
| 1 | 0 | 0 | 1 | 0 | 1 | 30 | 30 | 0 | 30 | 20 | 0 | 20 | 50 |

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

| SYLLABUS (Major Topics) | | | |
|---|---|---|---|
| Module | Title | Major Topics | Hrs |
| 1 | Physical Well-Being and Fitness | Human Body Systems. Quantifying Physical Activity Energy Expenditure. FITT principle | 4 |
| 2 | Mental Health Awareness & Balanced diet | Understanding Mental Health, Addiction and Related Issues, Resources for Mental Wellness. | 2 |
| 3 | Health and Wellness Through Lifestyle Management | Manage common hypokinetic diseases and disorders. Meaning, Aims and objectives of yoga. Understanding on substance abuse and addiction | 4 |
| 4 | First Aid Essentials | First aid and principles of First Aid. | 2 |

| SELF-LEARNING / TEAM WORK | | |
|---|---|---|
| Sl. No | Self-learning / Team Work Description | Hrs |
| 1 | Team activities: Group presentations (Sample topics: Addiction /mental health awareness and suicide prevention, Nutrition concepts, Popular dietary trends, Nutritional needs at different life stages) | 4 |

**SUGGESTED LEARNING RESOURCES**

| Text Book | | | |
|---|---|---|---|
| Sl. No. | Title of Book | Author | Publication |
| 1 | Foundations of Nutrition | Bhavana Sabarwal | Commonwealth Publishers 1999 |
| 2 | Anatomy and physiology in health and illness. | Ross and Wilson | Waugh, A., & Grant, A. 2022 |
| 3 | The Mental Health Handbook A Cognitive Behavioural Approach | Trevor Powell | Routledge 2009 |

| Reference | | | |
|---|---|---|---|
| Sl. No. | Title of Book | Author | Publication |
| 1 | Fit to be Well Essential Concept | Thygerson, A. L., Thygerson, S. M., & Thygerson, J. S. | Jones & Bartlett Learning 2018 |
| 2 | Introduction to physical education, fitness, and sport | Siedentop, D., & Van der Mars, H. | Human kinetics. 2022 |
| 3 | Substance Use Disorders. Manual for Physicians. | Lal, R., & Ambekar, A. (2005). | National Drug Dependence Treatment Centre, New Delhi 2005 |
| 4 | The exercise health connection- how to reduce your risk of disease and other illnesses by making exercise your medicine. | Nieman, D. C., & White, J. A | Public Health 1998 |
| 5 | ACSM's resource manual for guidelines for exercise testing and prescription. | Lippincott Williams & Wilkins. | American College of Sports Medicine. 2012 |
| 6 | Exercise Physiology: energy, nutrition and human performance | Katch, F. I., Katch, V. L., & McArdle, W. D. | Lippincott Williams & Wilkins 2010 |
| 7 | Positive Psychology for Improving Mental Health & Well-Being | Dr.Geetika Patnaik | Notion Press 2019 |

| Web Resource | |
|---|---|
| 1 | https://www.nutrition.gov/#:~:text=Nutrition.gov%20is%20powered%20by,you%20make%20healthful%20eating%20choices |
| 2 | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2879108/ |
| 3 | https://yoga.ayush.gov.in/ |
| 4 | https://www.mindful.org/ |

| DETAILED SYLLABUS *(Self-learning if any to be marked)* | | | | | | | |
|---|---|---|---|---|---|---|---|
| Module | Major Topic & Sub Topic | Mode of Delivery | CO | Learning Domain | | | Hrs |
| | | | | C | P | A | |
| 1 | Human Body Systems related to Physical activity and its functions: Respiratory System - Cardiovascular System. Musculoskeletal System and the Major Muscle groups of the Human Body | L | CO1 | U | | Re | 1 |
| | Quantifying Physical Activity Energy Expenditure and Metabolic equivalent of task (MET) Exercise Continuum: Light- intensity physical activity, Moderate - intensity physical activity, Vigorous - intensity physical activity. | L | CO1 | U | | Re | 1 |
| | Defining Physical Activity, Aerobic Physical Activity, Anaerobic Physical Activity, Exercise and Health-Related Physical Fitness. FITT principle to design an Exercise program | L | CO1 | U | | V | 1 |
| | Components of Health-related Physical Fitness: - Cardiorespiratory Fitness-Muscular strength - Muscular Endurance-Flexibility- Body composition. | L | CO1 | U | | Re | 1 |
| 2 | Concept of Health and Wellness: Health and wellness differentiation, Factors affecting health and wellness. Mental health and Factors affecting mental health Sports and Socialization: Sports and character building -Leadership through Physical Activity and Sports | L | CO2 | U | | V | 2 |
| | Diet and nutrition: Exploring Micro and Macronutrients: Concept of Balanced diet Carbohydrate & the Glycemic Index Animal & Plant -based Proteins and their Effects on Human Health Dietary Fats & their Effects on Human Health Essential Vitamins and Minerals | L | CO2 | U | | Rs | 2 |
| 3 | Life style management strategies to prevent / manage common hypokinetic diseases and disorders –Obesity Cardiovascular diseases - Diabetes -Osteoporosis - Musculoskeletal disorders (e.g., osteoarthritis, Low back pain, Kyphosis, lordosis, flat-foot, Knock knee) | L | CO2 | U | | Re | 1 |
| | Meaning, Aims and objectives of yoga - Classification and importance of Yogic Asanas (Sitting, Standing, lying) Pranayama and Its Types - Active Lifestyle and Stress Management Through Yoga | L | CO2 | U | | O | 1 |
| | Understanding on substance abuse and addiction Psychoactive substances & its ill effects- Alcohol- Opioids- Cannabis -Sedative -Cocaine -Other stimulants, including caffeine -Hallucinogens - Tobacco -Volatile solvents. | L | CO3 | U | | V | 2 |
| 4 | First aid and principles of First Aid: Primary survey: ABC (Airway, Breathing, Circulation). Qualities of a Good First Aider First aid measures for: - Cuts and scrapes - Bruises- Sprains - Strains- Fractures - Burns - Nosebleeds. | L | CO3 | U | | Rs | 1 |
| | First Aid Procedures: Cardiopulmonary Resuscitation (CPR) - Heimlich Maneuver - Applying a sling Sports injuries: Classification (Soft Tissue Injuries -Abrasion, Contusion, Laceration, Incision, Sprain & Strain) | L | CO3 | U | | Rs | 1 |

| PRACTICAL SYLLABUS | | | | | | |
|---|---|---|---|---|---|---|
| Topic | Objective | CO | Learning Domain | | | Hrs |
| | | | C | P | A | |
| Stretching exercises (V Sit Reach Test) | Improving Flexibility through Stretching Exercises | CO3 | | M | | 12 |
| Strength exercises (Partial Curl Up, Push Up) | To assess and improve muscular strength. | CO3 | | M | | |
| Endurance Exercises (Run & Walk) | To assess and improve cardiovascular endurance, | CO3 | | M | | |

| ASSESSMENT PATTERN | |
|---|---|
| **Assessment** | **Marks** |
| **Continuous Internal Assessment** | **100** |
| 1. Internal Examination | |
| 2. Activity Evaluation | 40 |
| 3. Learning Activity | 40 |
| 4. Regularity | 20 |
| 5. Course Project | |
| **End Semester Examination** | **0** |
| **Total** | **100** |

| COURSE DESCRIPTION | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Regulation** | **2025** | **L-T-J-P-S** | **0-0-0-2-0** | **Version** | **25/0** | **Credits** | **1** |
| *(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)* | | | | | | | |

| Course Code | Course Name | Course Category |
|---|---|---|
| **B250906/CN930U** | **Basic Electrical and Electronics Engineering Workshop** | **ESL** |
| **Pre-requisite** | | |
| NIL | | |

| COURSE OBJECTIVES | |
|---|---|
| 1 | To enable students to gain hands-on exposure to fundamental tools, instruments, and practices in electrical engineering |
| 2 | To develop a practical understanding on how electrical engineering concepts are applied to Domestic wiring |
| 3 | To familiarize students with basic electronic components, instruments, and circuit symbols, and to enable them to interpret datasheets and specifications. |
| 4 | To develop the ability to test, assemble, and simulate simple electronic circuits using standard tools, PCB techniques, and EDA software. |
| 5 | To develop basic electronic skills with emphasis on safety, practical use, and real-life applications |

| COMPETENCY | |
|---|---|
| CC1 | Apply skills in wring, circuit assembly, trouble shooting and testing to solve real life problems |
| CC2 | Apply basic sciences to address industrial needs effectively. |
| CC3 | Apply the principle of solid-state physics in electronic system design. |
| CC4 | Apply Total Quality Management (TQM) principles for ensuring the quality of products and services. |
| CC5 | Demonstrate effective individual and teamwork, communication, problem-solving, conflict resolution, and leadership skills. |

**COURSE OUTCOMES**

**Course Outcomes** (CO): At the end of this course, learners will be able to:

| CO | CO Statement | CC Mapping | Cognitive (C) | Psychomotor (P) | Affective (A) |
|---|---|---|---|---|---|
| CO1 | **Demonstrate** safety measures against electric shocks. | CC1 | U | | Rs |
| CO2 | **Identify** the tools used for electrical wiring, electrical accessories, wires, cables, batteries and standard symbols | CC1<br>CC2 | U | I | Rs |
| CO3 | **Illustrate** the connection diagram using suitable accessories for wiring simple electrical circuits | CC1 | A | M | V |
| CO4 | Demonstrate the use of components and instruments to construct and test simple circuits | CC1<br>CC3 | A | M | Rs |
| CO5 | Perform PCB fabrication, soldering, and interconnections to build and test simple circuits. | CC54<br>CC5 | A | P | V |
| CO6 | Construct basic electronic circuits such as rectifiers and amplifiers, and verify their operation through simulation using EDA tools | CC1<br>CC3<br>CC5 | An | Ar | V |

***Cognitive (Revised blooms Level):*** *- **R**: Remember; **U**: Understand; **A**: Apply; **An**: Analyse; **E**: Evaluate; **C**: Create*
***Psychomotor Domain (Dave's):*** *- **I**-Imitation, **M**-Manipulation, **P**-Precision, **Ar**-Articulation, **N**-Naturalisation*
***Affective (Krathwohl)**: - **Re**-Receiving, **Rs**-Responding, **V**-Valuing, **O**-Organization, **Ch**-Characterization*

| CO | Program Outcomes & Program Specific Outcomes Correlation Matrix | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO | | | | | | | | | | | PSO | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 1 | 1 | | | | | 3 | | | | | 2 | | | |
| 2 | 2 | 1 | | | | 2 | | 1 | 1 | | 2 | | | |
| 3 | 2 | 1 | 1 | | | 2 | 1 | 2 | 2 | | 2 | | | |
| 4 | 3 | 2 | 1 | | | | | | | | | | | |
| 5 | 3 | 2 | 1 | | 2 | | | | 1 | 1 | | | | |
| 6 | 3 | 2 | 2 | 1 | 3 | | | | 1 | 1 | | | | |
| *Correlation [3 – High, 2 -Medium, 1 – Low]* | | | | | | | | | | | | | | |

| TEACHING AND ASSESSMENT SCHEME | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Teaching Scheme / Week | | | | | Credit | Hours / Semester | Examination Scheme | | |
| | | | | | | | Practical | | |
| L | T | J | P | S | C | | CIA | ESE | Total |
| 0 | 0 | 0 | 2 | 0 | 1 | 30 | 50 | 50 | 100 |
| ***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination* | | | | | | | | | |

| SYLLABUS (Major Topics) | | | |
|---|---|---|---|
| Module | Title | Major Topics | Hrs |
| 1 | Basic wiring and safety measures | Demonstration of precautionary measures against electric shock | 8 |
| 2 | Identification and use of electric accessories | Demonstrate the use of components and instruments to construct and test simple circuits | 8 |
| 3 | Basic Circuit Wiring and Component Testing | Fundamentals of Circuit Wiring and Component Testing (covers familiarization of components, datasheets, instruments/tools, multimeter testing, and safety practices) | 8 |
| 4 | PCB Fabrication, Soldering, and Circuit Assembly | PCB Fabrication, Soldering, and Circuit Assembly (covers PCB study, fabrication, soldering/interconnection, circuit assembly & testing, and EDA tool introduction) | 8 |

| SELF-LEARNING / TEAM WORK | | |
|---|---|---|
| Sl. No | Self-learning / Team Work Description | Hrs |
| 1 | Study of electrical components and safety measures | 2 |
| 2 | Study of different types of wiring | 2 |
| 3 | Study of distribution board with protective devices. | 2 |
| 4 | Watch tutorial videos on safe handling of multimeter, CRO, and function generator; summarize key safety points. | 1 |
| 5 | Practice drawing simple electronic circuit diagrams (power supply, 555 timer) using IEEE symbols. | 1 |
| 6 | Mini-project Assemble and test a fixed voltage power supply. | 1 |

**SUGGESTED LEARNING RESOURCES**

| Text Book | | | |
|---|---|---|---|
| Sl. No. | Title of Book | Author | Publication |
| 1 | Electrical Design Estimating and Costing | K B Raina, SK Bhattacharya | New Age International Publishers |
| 2 | Basic Electrical Engineering | D P Kothari, I J Nagrath | Tata McGraw Hill |
| 3 | Electronic Devices and Circuit Theory | R. L. Boylestad& L. Nashelsky | Pearson Ed |
| 4 | Electronic Devices: Conventional Current Version | Thomas L. Floyd | Pearson Ed |

| Reference | | | |
|---|---|---|---|
| Sl. No. | Title of Book | Author | Publication |
| 1 | Electrical Wiring Residential | Ray C. Mullin & Phil Simmons | Cengage Learning |
| 2 | Electrical Wiring, Estimating and Costing | S.L. Uppal & G.C. Garg | Khanna Publishers |
| 3 | Basic Electrical Engineering | V.K. Mehta & Rohit Mehta | S. Chand Publishing |
| 4 | Electronic Devices and Circuits | David A Bell | Oxford University Press |
| 5 | Electronic Circuit Analysis and Design | Donald A. Neamen | McGraw Hill |

| Web Resource | |
|---|---|
| 1 | www.allaboutcircuits.com |
| 2 | https://ocw.mit.edu/courses/ec-s06-practical-electronics-fall-2004/ |
| 3 | https://nptel.ac.in/courses/122106025 |
| 4 | https://be-iitkgp.vlabs.ac.in |

**PRACTICAL SYLLABUS**

| Topic | Objective | CO | Learning Domain | | | Hrs |
|---|---|---|---|---|---|---|
| | | | C | P | A | |
| a) Demonstrate the precautionary steps adopted in case of Electrical shocks.<br>b) Identify different types of cables, wires, switches, fuses, fuse carriers, MCB, ELCB and MCCB, familiarize the ratings. | Demonstrate essential safety procedures and first-aid steps to be followed in case of electric shock.<br>Identify and understand the types, ratings, and applications of various electrical cables, protection devices, and switches. | CO1<br>CO2 | U<br>U | I<br>I | Rs<br>Rs | 2 |
| Wiring of a simple light circuit for light/ fan point (PVC conduit wiring) and a 6A plug socket with individual control. | PVC conduit wiring for light/fan point and 6A plug socket – Perform PVC conduit wiring for a light/fan point and a 6 A plug socket with individual control. | CO3 | A | M | V | 2 |
| Wiring of light/fan circuit using two-way switches. (Staircase wiring) | Wire a light/fan circuit controlled from two different locations using two-way switches. | CO3 | A | M | V | 2 |
| Wiring of fluorescent lamp and a power plug (16 A) socket with a control switch. | Connect and control a fluorescent lamp and a 16 A power plug socket using a control switch. | CO3 | A | M | V | 2 |
| Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and Energy meter. | Assemble and wire a single-phase power distribution system with protective and metering devices. | CO3 | A | M | V | 2 |
| Familiarisation of step up and step-down transformers, (use low voltage transformers) Measurement and representation of voltage and waveform to scale in graph sheet with the help of CRO | Identify and understand the operation of step-up and step-down transformers using low-voltage models. Measure and plot voltage waveforms to scale on a graph sheet using a Cathode Ray Oscilloscope. | CO2 | U | | Rs | 2 |
| Familiarisation of rheostats, measurement of potential across resistance elements and introducing the concept of relative potential using a DC circuit. | Use a rheostat to measure potential across resistance elements and illustrate relative potential in a DC circuit. | CO2 | U | | Rs | |

| | | | | | | |
|---|---|---|---|---|---|---|
| a) Identify battery specifications using different types of batteries. (Lead acid, Li Ion, NiCd etc.) b) Familiarize different types of earthing (Pipe, Plate Earthing, Mat Schemes) and ground enhancing materials (GEM). | Identify the specifications and characteristics of different types of batteries such as Lead-acid, Li-ion, and NiCd. | CO2 | U | | Rs | 2 |
| Familiarization of Electronic Components | To identify active, passive, and electromechanical components along with connectors, fuses, switches, relays, heat sinks, and displays, and to learn their specifications, circuit symbols, and approximate cost. | CO4 | A | M | Rs | 2 |
| Drawing of Circuit Diagrams & Data Sheets | To draw electronic circuit diagrams using BIS/IEEE standard symbols and to interpret data sheets of commonly used discrete components and ICs. | CO4 | A | P | V | 2 |
| Familiarization of Instruments & Tools | To operate basic electronic testing instruments such as Multimeter, Function Generator, DC Power Supply, CRO, and DSO, and to familiarize with commonly used tools including soldering iron, desoldering pump, and crimping tools. | CO5 | A | M | Rs | 2 |
| Testing of Components using Multimeter | To test the electrical characteristics and functionality of basic electronic components such as resistors, capacitors, diodes, BJTs, and JFETs using appropriate testing methods. | CO5 | A | P | V | 2 |
| PCB Study and Fabrication | To study different types of printed circuit boards (single-sided, double-sided, and plated through hole) and to design and fabricate a simple single-sided PCB. | CO6 | A | Ar | V | 2 |
| Soldering & Interconnection Practice | To study various interconnection methods such as breadboard, crimping, and soldering, and to practice soldering of connectors and assembling simple circuits on a PCB. | CO6 | An | Ar | V | 2 |
| Assembly & Testing of Simple Circuit | To assemble and test an electronic circuit, for a fixed voltage power supply using transformer, rectifier diode, capacitor filter, and Zener/IC regulator and verify it's working. | CO6 | An | Ar | V | 2 |
| Introduction to EDA tool | Simulation of basic electronic circuit using Multisim | CO6 | An | P | V | 2 |

| ASSESSMENT PATTERN | |
|---|---|
| **Assessment Method** | **Marks** |
| **Continuous Internal Assessment** | **50** |
| 1. Continuous Lab Evaluation | 45 |
| 2. Internal Examination | - |
| 3. Regularity | 5 |
| 4. Course Project | - |
| **End Semester Examination** | **50** |
| **Total** | **100** |