



B. TECH

ELECTRICAL & ELECTRONICS ENGINEERING

CURRICULUM & SYLLABUS

SEMESTER 1&2

2025 REGULATION

B. Tech

ELECTRICAL & ELECTRONICS

ENGINEERING

CURRICULUM & SYLLABUS

SEMESTER 1 & 2

2025 REGULATION

B. Tech in Electrical and Electronics Engineering

CURRICULUM STRUCTURE

SEM	SLOT	COURSE CATEGORY	COURSE CODE	COURSE NAME	L	T	J	P	S	C	CREDIT / SEM
I	A	BST	B250802/MA100A	Mathematics for Electrical Science-1	3	1	0	0	2	3	20
	B	BSE	B250802/CH910B	Chemistry for Electrical Science	3	0	0	2	3	4	
	C	EST	B250906/CN100C	Engineering Graphics and Computer Aided Drawing	2	0	0	2	2	3	
	D	EST	B250906/CN100D	Introduction to Electrical and Electronics Engineering	4	0	0	0	4	4	
	E	ESE	B250903/CN110E	Programming in Python	2	0	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							
II	A	BST	B250802/MA200A	Mathematics for Electrical Science-2	3	1	0	0	2	3	24
	B	BSE	B250802/PH910B	Physics for Electrical Science	3	0	0	2	3	4	
	C	EST	B250901/CE200C	Introduction to Engineering Mechanics	3	1	0	0	2	3	
	D	EST	B250003/CN210D	Foundations of C Programming	2	0	0	2	4	4	
	E	PCT	B250003/EE200E	Circuits and Networks	3	1	0	0	4	4	
	F	ESB	B250908/CN220F	Entrepreneurship and IPR	2	0	1	0	3	3	
	K	HMT	B250908/CN900K	Life Skills and Professional Communication	1	1	0	0	0	1	
	U	ESL	B250902/CN230U	Essentials of Embedded and Computing Lab	0	0	0	2	0	1	
G	SEC		Skill Enhancement Course						1		
III	A	BST	B250802/MA300A	Mathematics for Electrical Science - 3	3	1	0	0	2	3	25
	B	PCE	B250003/EE310B	Measurements and Instrumentation	3	1	0	3	5	6	
	C	PCE	B250003/EE310C	Analog Electronics	3	1	0	3	5	6	
	D	PCB	B250003/EE320D	Digital Electronics	2	1	1	0	4	4	
	E	EST	B250003/EE300E	Introduction to Artificial Intelligence and Data Science	3	0	0	0	5	4	
	F	HMT	B250908/HU900F	Engineering Economics	3	0	0	0	1	2	
			B250908/CN900F	Management for Engineers	3	0	0	0	1	2	
M	M		Minor	3	1	0	0	4	4		
IV	A	BST	B250802/MA400A	Mathematics for Electrical Science - 4	3	1	0	0	2	3	24
	B	PCE	B250003/EE410B	DC Machines and Transformers	3	1	0	3	5	6	
	C	PCE	B250003/EE410C	Microcontroller and Embedded Systems	3	1	0	3	5	6	
	D	PCB	B250003/EE420D	Electromagnetic Theory	2	1	1	0	4	4	
	E	PET	B250003/EE41*E	Program Elective - Theory	2	1	0	0	3	3	
	F	HMT	B250908/HU900F	Engineering Economics	3	0	0	0	1	2	
			B250908/CN900F	Management for Engineers	3	0	0	0	1	2	
M/H	M/H		Minor / Hons	3	1	0	0	4	4		
V	A	PCT	B250003/EE500A	Signals and Systems	3	1	0	0	4	4	23
	B	PCE	B250003/EE510B	Synchronous and Induction Machines	3	1	0	3	5	6	

	C	PCE	B250003/EE510C	Power Electronics and Drives	3	1	0	3	5	5	
	D	PCB	B250003/EE520D	Power Generation, Transmission and Protection	2	1	1	0	4	4	
	E	PET	B250003/EE51*E	Program Elective - Theory	2	1	0	0	3	3	
	K	HMT	B250908/CN500K	Constitution of India	2	0	0	0	0	1	
	M/H	M/H		Minor / Hons	4	0	0	0	4	4	
VI	A	PCT	B250003/EE600A	Control Systems	3	1	0	0	4	4	23
	B	PCE	B250003/EE610B	Power System Analysis	3	1	0	3	3	5	
	C	PET	B250003/EE61*C	Program/ Industry Linked Elective - Theory	3	1	0	0	2	3	
	D	PCB	B250003/EE620D	Electrical System Design and Estimation	2	1	1	0	4	4	
	E	EST	B250908/CN600E	Design Thinking and Product Development	2	1	1	0	0	2	
	J	OET	B250908/CN6**J	Open Elective - Theory	2	0	0	0	4	3	
	F	PCL	B250003/EE630U	Control Systems Lab	0	0	0	3	1	2	
	M/H	M/H		Minor / Hons					6	3	
VII	A	PET	B250003/EE71*A	Program/ Industry Linked Elective - Theory	3	1	0	0	2	3	17
	B	PET	B250003/EE72*B	Program/ Industry Linked Elective - Theory	3	1	0	0	2	3	
	J	HMT	B250908/CN700C	Engineering Ethics and Sustainable Development	3	0	0	0	1	2	
	K	OET	B250908/CN7**J	Open Elective - Theory	3	0	0	0	3	3	
	L	PSL	B250908/CN700T	Research Seminar	2	0	0	0	2	2	
	P	PSL	B250908/CN740U	Project	0	0	6	0	2	4	
	H	H		Hons					8	4	
VIII	A	PET	B250003/EE81*A	Program Elective - Theory	3	1	0	0	2	3	11
	J	OET	B250908/CN8**J	Open Elective - Theory	3	0	0	0	3	3	
	K	HMT	B250908/CN800K	Organizational Behavior and Business Communication	2	0	0	0	0	1	
	P	PSL	B250908/CN840U	Project	0	0	6	0	2	4	
Total Earned Credits											167
Mandatory Student Activities											3
TOTAL CREDITS											170
MINOR											15
HONOURS											15
MANDATORY TOTAL CREDITS FOR AWARD OF DEGREE										157+3 = 160	

B. Tech in Electrical and Electronics Engineering

PROGRAM ELECTIVE BASKET

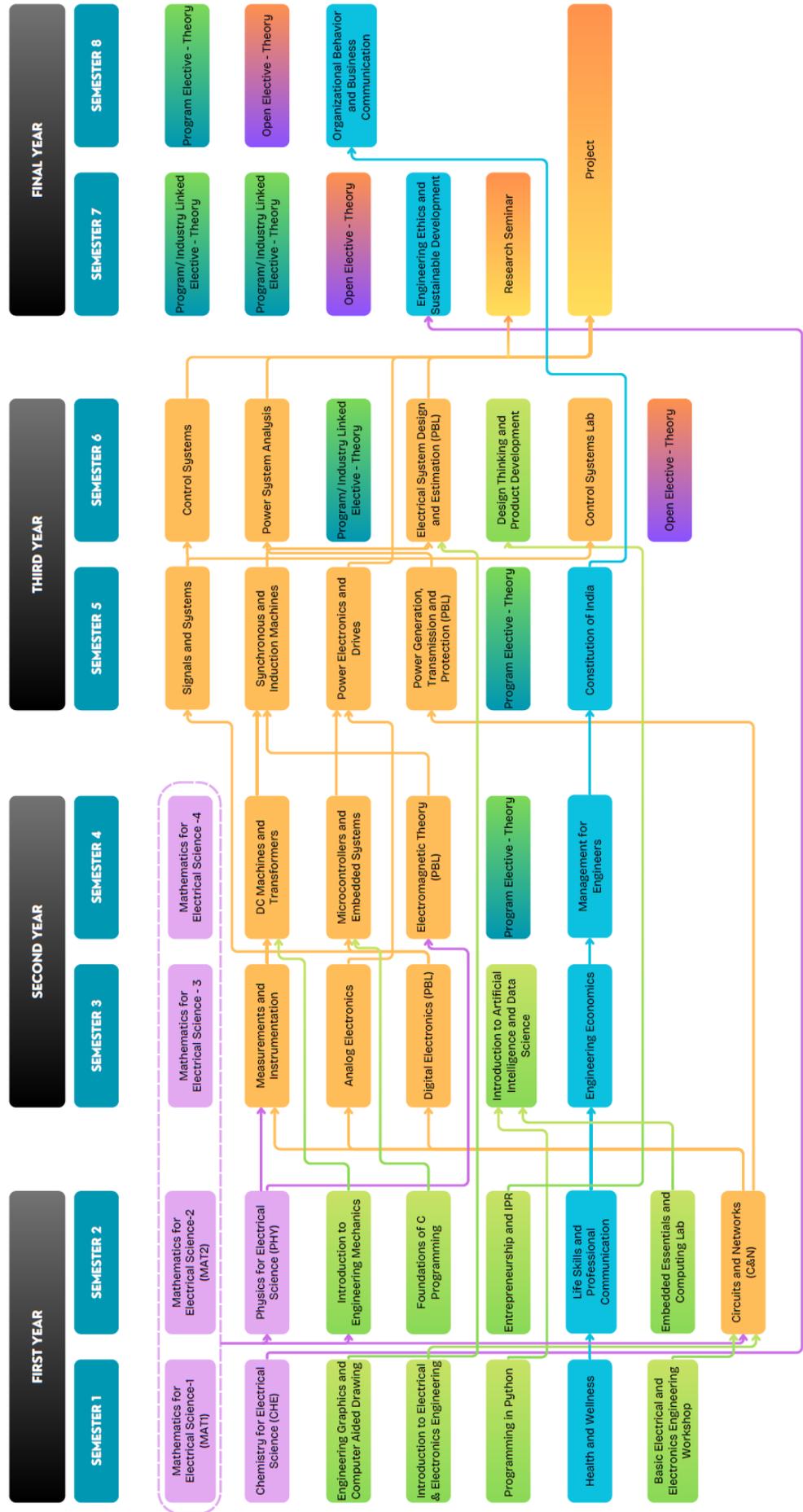
Sem	Basket 1 (Energy Systems)	
	Course Code	Course Name
4	B250003/EE411E	Renewable Energy Sources
5	B250003/EE511E	Energy Storage Systems
6	B250003/EE611C	High Voltage Engineering
7	B250003/EE711A	Power Quality Issues and Solutions
7	B250003/EE721B	Energy Management and Auditing
8	B250003/EE811A	Smart Grid Technologies

Sem	Basket 2 (E-Mobility)	
	Course Code	Course Name
4	B250003/EE412E	Hybrid and Electric Vehicles
5	B250003/EE512E	Battery Technologies
6	B250003/EE612C	Special Electrical machines
7	B250003/EE712A	Switched Mode Power Converters
7	B250003/EE722B	EV Power Train: Drives and Control
8	B250003/EE812A	EV Infrastructure

Sem	Basket 3 (Digital Control and Automation)	
	Course Code	Course Name
4	B250003/EE413E	Electronic Instrumentation
5	B250003/EE513E	Basic VLSI Design
6	B250003/EE613C	Industrial Automation
7	B250003/EE713A	FPGA Architecture and Programming
7	B250003/EE723B	Mechatronics
8	B250003/EE813A	Electronic Communication and Protocols

Sem	Basket 4 (Computational Technologies)	
	Course Code	Course Name
4	B250003/EE414E	Mathematics for Machine Learning
5	B250003/EE514E	Introduction to Object Oriented Programming
6	B250003/EE614C	Neural Networks and Fuzzy Logic
7	B250003/EE714A	Optimization Techniques
7	B250003/EE724B	Cloud Computing
8	B250003/EE814A	Introduction to Cyber Security

COURSE FLOW



SEMESTER I

APPROVAL

This is to certify that the syllabus titled “Syllabus for B. Tech in Electrical and Electronics Engineering” implemented from the academic year **2025–2026**, is prepared in accordance with the regulations, academic framework, and Outcome Based Education guidelines prescribed by the Institution and the affiliating University.

The syllabus has been **discussed, reviewed, and approved** by the following statutory bodies.

BOARD OF STUDIES (BOS)

Approved in the Board of Studies Meeting of the Electrical and Electronics Engineering held on ____ / ____ / 20 .

Chairperson, BoS

Name: Dr. Anjali Varghese C

Designation: Professor & HoD

Signature: _____

Date: _____

ACADEMIC COUNCIL

Approved by the Academic Council in its meeting held on ____ / ____ / 20

PRINCIPAL

Recommended for implementation from the Academic year 2025-2026.

Name: Dr. Neelakantan P C

Signature: _____

Date: _____

SEMESTER 1

CURRICULUM

SLOT	COURSE CATEGORY	COURSE CODE	COURSE NAME	L	T	J	P	S	C
A	BST	B250802/MA100A	Mathematics for Electrical Science-1	3	1	0	0	2	3
B	BSE	B250802/CH910B	Chemistry for Electrical Science	3	0	0	2	3	4
C	EST	B250906/CN100C	Engineering Graphics and Computer Aided Drawing	2	1	0	0	3	3
D	EST	B250906/CN100D	Introduction to Electrical and Electronics Engineering	4	0	0	0	4	4
E	ESE	B250903/CN110E	Programming in 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
I	Skill Enhancement Course: Digital 101 (30Hours, NASSCOM) or equivalent								1
<i>(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work, C- Credit)</i>									

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

Course Code	Course Name	Course Category
B250802/MA100A	MATHEMATICS FOR ELECTRICAL SCIENCE-1	BS
Pre-requisite		
The basic knowledge in matrices and calculus.		

COURSE OBJECTIVES	
1	To equip students with the knowledge and skills to analyze and solve linear systems of equations using matrix methods, understand the concepts of linear independence and matrix rank, and apply eigenvalue and eigenvector techniques for matrix diagonalization in mathematical and engineering applications.
2	To equip students with analytical techniques for solving ordinary differential equations (ODEs), including both homogeneous and non-homogeneous equations using methods like undetermined coefficients and variation of parameters.
3	To explain the concept of Laplace Transform and its use in solving differential equations arise in engineering problems.
4	To develop the ability to represent functions as series using Taylor and Fourier methods, and to apply these expansions for analyzing and solving problems in science and engineering.

COMPETENCY STATEMENT (CC)	
CC 1	Demonstrate the ability to apply the concepts of linear algebra, differential equations, Laplace Transforms and series expansions to construct mathematical models and obtain effective solutions to practical 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	Solve linear systems of equations by applying the properties of matrices and vectors.	CC1	A		Rs
CO2	Solve linear differential equations with constant coefficients by using various methods.	CC1	U		Rs
CO3	Apply Laplace transform to find the solution of Initial value problem.	CC1	A		Rs
CO4	Determine series expansion of the given functions using Taylor and Fourier series.	CC1	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	2	2									1				
2	2	2									1				
3	2	2									1				
4	2	2									1				
<i>Correlation [3 – High, 2 -Medium, 1 – Low]</i>															

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme		
L	T	J	P	S			C	Theory	
						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	Linear Algebra	Linear systems of equations, Row echelon form and rank of a matrix, Solution by Gauss elimination, Eigenvalues and Eigenvectors of matrices, Diagonalization of matrices. (Text 1- Relevant topics from sections 7.3, 7.4, 7.5, 8.1, 8.4)	10
2	Ordinary Differential Equation	Homogeneous linear ODEs of second order, non-homogeneous linear ODEs of second order (with constant coefficients) – General solution by the method of undetermined coefficients, Solution of Non - homogeneous second order linear ODE (with constant coefficients)- by the method of variation of parameters. Solution of Homogeneous linear ODEs of higher order with constant coefficients, Solution of Non-Homogeneous linear ODEs of higher order with constant coefficients by the method of undetermined coefficients (particular solutions for the functions $ke^x, kx^n, k \cos \omega x, k \sin \omega x$ and their linear combinations). (Text 1: Relevant topics from sections 2.1, 2.2, 2.7, 2.10, 3.1, 3.2, 3.3)	10
3	Laplace Transform	Laplace transform, Inverse Laplace transform, Linearity property, First shifting theorem, Transform of derivatives, solution of initial value problems by Laplace transform (Second order linear ODE with constant coefficients with initial conditions at $t=0$ only), Unit step function, Second shifting theorem, Dirac delta function and its transform (Initial value problems involving unit step function and Dirac delta function are excluded) , Convolution theorem (without proof) and its application to finding Laplace transform of products of functions. (Text 1: Relevant topics from sections 6.1, 6.2, 6.3, 6.4, 6.5)	10
4	Fourier Series	Taylor series representation (without proof, assuming the possibility of power series expansion in appropriate domains), Maclaurin series representation, Fourier series, Euler formulas, Convergence of Fourier series (Dirichlet's conditions), Fourier series of periodic functions, Fourier series of 2l periodic functions, Half range sine series expansion, Half range cosine series expansion. (Text 1: Relevant topics from sections 11.1, 11.2 Text 2: Relevant topics from section 10.8)	10

SELF-LEARNING / TEAM WORK		
Sl. No	Self-learning / Team Work Description	Hrs
1	Symmetric matrix, Skew-symmetric matrix, Orthogonal Matrix, Properties of eigenvalues of Symmetric matrix, Skew-symmetric matrix, Orthogonal Matrix (1 hour) Practice problems on solving systems of linear equations using Gauss elimination (2 hours) , finding eigenvalues and eigenvectors (2 hours) , diagonalization (2 hour) Team Work - Apply Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL) in a simple electrical circuit to form a system of linear equations in matrix form. Then solve the system of equations using Gauss Elimination method and using python. (2 hours) .	9
2	Solving non-homogeneous ODE using direct integration method (1 hour) , Solving non-homogeneous ODE using variable separable method (1 hour) . Practice problems on solving non-homogeneous ODE with constant coefficients by the method of undetermined coefficients (3 hours) , variation of parameters (2 hours) .	9

	Team Work - Develop a mathematical model for a mass-spring-damper system subjected to an external time-dependent force, and perform its dynamic analysis using Python-based simulation (2 hours) .	
3	Practice problems on Solving initial value problem using Laplace transform (3 hours) , unit step function, second shifting theorem (2 hours) Finding inverse Laplace transform using convolution theorem (2 hours) Team work -Identify and explain a real-world engineering problem that can be modeled using a linear differential equation with constant coefficient, and solve it using Laplace Transform methods and using python (2 hours) .	9
4	Practice problems on Fourier series expansion of functions (2 hours) , Half range sine series expansion of functions (2 hours) and Half range cosine series expansion of functions (2 hours) . Team work - Develop Fourier series expansions of real-world signals like square wave and triangular wave also plot the Fourier approximation using python (2 hours) .	8

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Advanced Engineering Mathematics	Erwin Kreyszig	John Wiley & Sons 10th edition, 2016
2	Calculus	H Anton, I Biven, S Davis	12th edition, Wiley, 2024

Reference			
Sl. No.	Title of Book	Author	Publication
1	Thomas Calculus	Maurice D. Weir, Joel Hass, Christopher Heil, Przemyslaw Bogacki	15 th edition, Pearson, 2023
2	Essential Calculus	J. Stewart	2nd edition, Cengage, 2017
3	Elementary Linear Algebra	Howard Anton, Chris Rorres	11th edition, Wiley, 2019
4	Bird's Higher Engineering Mathematics	John Bird	9th edition, Taylor & Francis, 2021
5	Higher Engineering Mathematics	B. V. Ramana	39th edition, McGraw-Hill Education, 2023.
6	Signals and systems	Simon Haykin, Barry Van Veen	2nd edition, Wiley, 2002

Web Resource	
1	https://nptel.ac.in/courses/111101115
2	Ordinary and Partial Differential Equations and Applications - Course
3	Mod-01 Lec-01 General Introduction
4	https://youtube.com/playlist?list=PLyqSpQzTE6M8gnapvdLN92hs_4F75OSuH&si=hWcuSXdZilZs5ZCs

DETAILED SYLLABUS (Self-learning if any to be marked)							
Module	Topic	Mode of Delivery	CO	Learning Domain			Hrs
				C	P	A	
1	Linear systems of equations	L	CO1	U			1
	Row echelon form and rank of a matrix	L	CO1	U			2
	Tutorial Problems	T	CO1	U			1
	Solution by Gauss elimination	L	CO1	A			2
	Tutorial Problems	T	CO1	A		Rs	1
	Eigenvalues and Eigenvectors of matrices	L	CO1	A			3
	Tutorial Problems	T	CO1	A		Rs	1
	Symmetric matrix, Skew-symmetric matrix, Orthogonal Matrix	S	CO1	U			1
	Properties of eigenvalues of Symmetric matrix, Skew-symmetric matrix, Orthogonal Matrix	S	CO1	U			11
	Diagonalization of matrices	L	CO1	A			2
Tutorial Problems	T	CO1	A		Rs	1	

2	Solving non-homogeneous ODE using direct integration method	S	CO2	U			1
	Solving non-homogeneous ODE using variable separable method	S	CO2	U			1
	Solution of Homogeneous linear ODEs of second order with constant coefficients	L	CO2	U			2
	Tutorial Problems	T	CO2	U		Rs	1
	Existence and uniqueness of solutions (without proof), Linear dependence and independence of solutions using Wronskian	L	CO2	U			1
	Non-homogeneous linear ODEs of second order (with constant coefficients) – General solution by the method of undetermined coefficients	L	CO2	U			2
	Tutorial Problems	T	CO2	U		Rs	1
	Solution of non - homogeneous second order linear ODE (with constant coefficients)- by the method of variation of parameters.	L	CO2	U			2
	Tutorial Problems	T	CO2	U		Rs	1
	Solution of Homogeneous linear ODEs of higher order with constant coefficients.	L	CO2	U			1
	Solution of non- homogeneous linear ODEs of higher order with constant coefficients by the method of undetermined coefficients	L	CO2	U			2
	Tutorial Problems	T	CO2	U		Rs	1
3	Laplace Transform and its inverse	L	CO3	U			2
	Linearity. First shifting theorem(s-shifting)	L	CO3	U			1
	Tutorial Problems	T	CO3	U		Rs	1
	Transform of Derivatives	L	CO3	U			1
	Solution of differential equation using Laplace transform	L	CO3	A			2
	Tutorial Problems	T	CO3	A		Rs	1
	Unit step function, Second shifting theorem	L	CO3	U			2
	Dira delta function and its transform	L	CO3	U			1
	Tutorial Problems	T	CO3	U		Rs	1
	Convolution theorem in finding inverse Laplace transform of products of functions	L	CO3	U			1
	Tutorial Problems	T	CO3	U		Rs	1
	4	Taylor series representation	L	CO4	U		
Maclaurin series representation		L	CO4	U			1
Tutorial Problems		T	CO4	U		Rs	1
Fourier series, Euler formulas, Convergence of Fourier series (Dirichlet's conditions)		L	CO4	U			1
Fourier series of 2π periodic functions		L	CO4	U			2
Tutorial Problems		T	CO4	U		Rs	1
Fourier series of $2l$ periodic functions		L	CO4	U			2
Tutorial Problems		T	CO4	U		Rs	1
Half range sine series expansion		L	CO4	U			1
Half range cosine series expansion		L	CO4	U			2
Tutorial Problems	T	CO4	U		Rs	1	

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

Module	Module Title	Revised Blooms Level Mapping						Total Marks
		R	U	A	An	E	C	
1	Linear Algebra	√	√	√				15
2	Ordinary Differential Equation	√	√					15
3	Laplace Transforms	√	√	√				15
4	Fourier Series	√	√					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

Register No.:	Name:
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FIRST SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR (2025 SCHEME)			
Course Code:	B250802/ MA100A		
Course Name:	MATHEMATICS FOR ELECTRICAL SCIENCE-1		
Max. Marks	60	Duration:	2 hours 30 minutes
Common to EC & EE			

PART A
(Answer all questions. Each question carries 3 marks)

No.	Question	CO	Marks
1	Determine the row echelon form of the matrix $[1 \ 2 \ 3 \ 2 \ 4 \ 6 \ 1 \ 1 \ 1]$ and hence evaluate its rank.	CO 1	(3)
2	If 2 is an eigen value of the matrix $[3 \ -1 \ 1 \ -1 \ 5 \ -1 \ 1 \ -1 \ 3]$, without using its characteristic equation find the other eigen values and also find the eigen values of A^3, A^T, A^{-1} and $6A$.	CO 1	(3)
3	Obtain the general solution of the ordinary differential equation $y'' - 5y' + 6y = 0$.	CO 2	(3)
4	Form an ordinary differential equation from the given basis: $x, x \ln x$.	CO 2	(3)
5	Determine the inverse Laplace transform of the function $\frac{s+1}{s^2+2s+5}$.	CO 3	(3)
6	Find the Laplace transform of the function $f(t) = t^2 e^{3t}$.	CO 3	(3)
7	Construct the half-range cosine series for $f(x) = e^x$ in $(0, 1)$.	CO 4	(3)
8	Obtain the Fourier series representation of $f(x) = x^2 - 2$ for $-2 < x < 2$.	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) Find the values of λ and μ so that the given system of equations $x + y + z = 6, x + 2y + 3z = 10, x + 2y + \lambda z = \mu$ has (i) No solution. (ii) Infinite solutions. (iii) Unique solution.	CO 1	(5)
	b) Determine the eigenvalues and corresponding eigenvectors of the matrix $A = [-2 \ 2 \ -3 \ 2 \ 1 \ -6 \ -1 \ -2 \ 0]$.	CO 1	(4)
OR			
10	a) Diagonalize the matrix $A = [-1 \ 2 \ -2 \ 2 \ 4 \ 1 \ 2 \ 1 \ 4]$.	CO 1	(5)
	b) Test for consistency and solve the following system of equations using Gauss elimination method $2x + 3y - z = 3, x - y + 2z = 2, 3x + 2y + z = 5$.	CO 1	(4)
MODULE II			
11	a) The current $i(t)$ in an electrical circuit satisfies $i'' - 3i' + 2i = e^{2t}$. Find the complete solution for $i(t)$ using the method of undetermined coefficients.	CO 2	(5)
	b) Find the general solution of $y'' + 4y = 8x^2$.	CO 2	(4)
OR			
12	a) Obtain the general solution of the ordinary differential equation $(3D^2 + 27I)y = 3\cos x + \cos 3x$.	CO 2	(5)
	b) Use variation of parameters to obtain the solution of the linear ordinary differential equation $y'' - 2y' + y = e^x \ln x$.	CO 2	(4)
MODULE III			

13	a)	Using Laplace transform, solve the differential equation $y'' + 5y' + 6y = e^{-t}, y(0) = 0, y'(0) = 1.$	CO 3	(5)
	b)	Find the inverse Laplace transform of the function $\frac{s^2+2}{s(s^2+9)}$.	CO 3	(4)
OR				
14	a)	Using the convolution theorem, determine the inverse Laplace transform of the function $\frac{\omega}{s^2(s^2-\omega^2)}$.	CO 3	(5)
	b)	Express in terms of unit step function and hence find the Laplace transform of $f(t) = \{t - 1; 1 < t < 2 \quad 3 - t; 2 < t < 3 \}$.	CO 3	(4)
MODULE IV				
15	a)	Find the Fourier series expansion of the periodic function $f(x) = \{x; 0 < x < 1 \quad 1 - x; 1 < x < 2 \}$.	CO 4	(5)
	b)	The periodic function $f(x) = x $, defined on $(-\pi, \pi)$ is used to model a triangular waveform. Determine the Fourier coefficients a_n and b_n .	CO 4	(4)
OR				
16	a)	The periodic square wave signal is defined by $f(x) = \{-\pi; -\pi < x < 0 \quad x; 0 < x < \pi \}$ with period 2π . Find the Fourier series expansion of $f(x)$.	CO 4	(5)
	b)	Construct the half-range sine series for $f(x) = \sin \sin \left(\frac{\pi x}{l}\right)$ in $(0, l)$.	CO 4	(4)

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

Course Code	Course Name	Course Category
B250802/CH910B	CHEMISTRY FOR ELECTRICAL SCIENCE	BS
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	
C C 1	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.
C C 2	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					

C O	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 C	Hours / Semester	Examination Scheme						Total
L	T	J	P	S			Theory			Practical			
					CI A	ES E	Tota l	CI A	ES E	Tota l			
3	0	0	2	3	4	120	25	60	85	15	0	15	100
<i>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</i>													

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 ₂ O – 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 biosensors- introduction and applications	12

3	Structure of Atom, Molecular Orbital Theory and Shape of Molecules. Application of spectroscopy in daily life	12
4	Estimation of Hardness – EDTA Method and Estimation of Dissolved Oxygen-Winkler's method. 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
3	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	
	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 ₂ O – Applications	L, P	CO3	A	M	V	1
	Thermal Analysis Dielectric Thermal Analysis (DETA) of Polymers-Working and Application.	L	CO3	U		Rs	1
4	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	
	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 (KMnO ₄ 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 λ_{max} 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	Revised Blooms Level Mapping						Total Marks
		R	U	A	A n	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

Register No.:	Name:
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FIRST SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR (2025 SCHEME)			
Course Code:	B250802/CH910B		
Course Name:	Chemistry for Electrical Science		
Max. Marks	60	Duration:	2 hours 30 minutes
Common to EC and EE			

PART A			
<i>(Answer all questions. Each question carries 3 marks)</i>			
No.	Question	CO	Marks
1	Design and sketch the electrochemical cell for the following cell reaction. $2 \text{Al (s)} + 3 \text{Fe}^{2+} \text{(aq)} \rightarrow 2\text{Al}^{3+} \text{(aq)} + 3 \text{Fe (s)}$ Formulate the Nernst equation at 25°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 0.02 M 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 $\text{Ca}(\text{HCO}_3)_2$, 9.3mg/L $\text{Mg}(\text{HCO}_3)_2$, 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			
<i>(Answer any one full question from each module, each question carries 9 marks)</i>			
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°C and 1.6214V at 30°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 0.1M KCl at 298K is 0.01288Scm ⁻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	2-1-0-0-3	Version	25/0	Credits	3
<i>(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)</i>							

Course Code	Course Name	Course Category
B250906/CN100C	ENGINEERING GRAPHICS AND COMPUTER AIDED DRAWING	ES
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 2D drawings 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		
L	T	J	P	S			C	Theory	
						CIA	ESE	Total	
2	1	0	0	3	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) 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. 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). 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 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
	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	Revised Blooms Level Mapping						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
<i>This ToS shall be treated as a general guideline for students and teachers for distribution of marks</i>								

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: ...1....	
Register No.:	Name:

FIRST SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR (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° to HP and the resting base edge at 30° 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° 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° 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° 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	ES
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 Scheme / Week						Hours / Semester	Examination Scheme		
L	T	J	P	S	C		Theory		
							CIA	ESE	Total
4	0	0	0	4	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	Frenzel L.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		Rs	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					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	CO2	U		Rs	2
	Basic Terminology: MMF, field strength, flux density, reluctance - comparison between electric and magnetic circuits	L					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
	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	Revised Blooms Level Mapping						Total Mark
		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

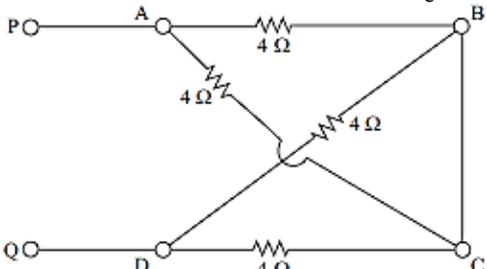
This ToS shall be treated as a general guideline for students and teachers for distribution of marks

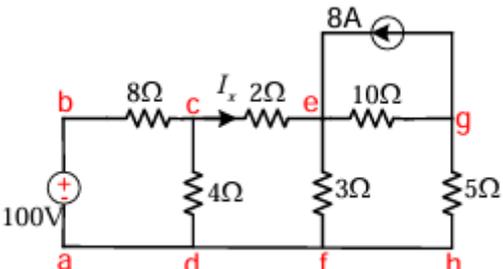
ASSESSMENT PATTERN

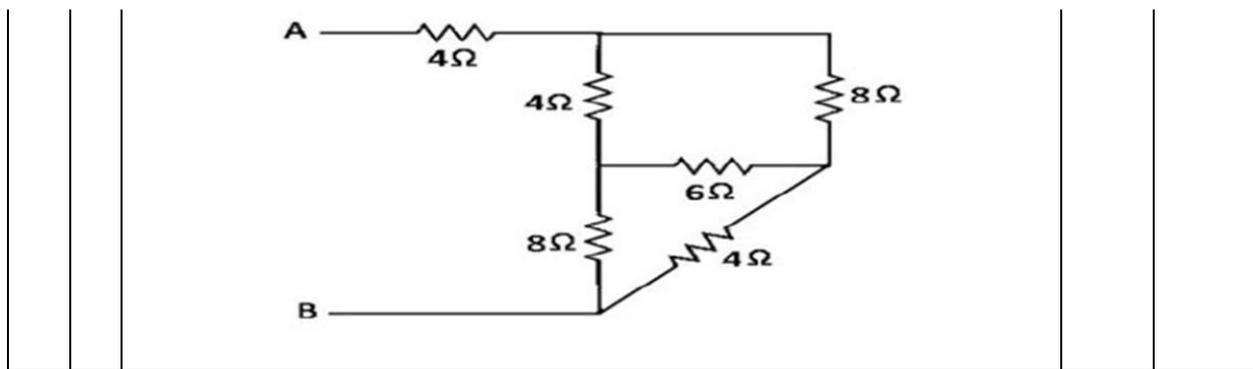
Assessment Method	Marks
Continuous Internal Assessment	40
1. Internal Examination	20
2. Learning Activity	15
3. Regularity	5
4. Course Project	-
End Semester Examination	60
Total	100

Register No.:	Name:
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FIRST SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR (2025 SCHEME)			
Course Code:	B250906/CN100D		
Course Name:	INTRODUCTION TO ELECTRICAL & 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			
<ul style="list-style-type: none"> 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. No separate minimum marks are required to pass. 			

PART 1- ELECTRICAL ENGINEERING (30 MARKS)			
PART 1 - A			
MODULE 1 & 2			
<i>(Answer all questions. Each question carries 3 marks)</i>			
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			
<i>(Answer any one full question from each module, each question carries 9 marks)</i>			
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} .	CO1	(4)



OR

Apply Nodal analysis to solve the node voltages in the circuit shown.

a		CO1	(4)
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Apply mesh analysis to determine the three mesh currents in the circuit shown below.

6		CO1	(5)
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MODULE II

7	a	<p>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.</p> <p>i) Determine the frequency of the applied voltage. 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. iii) Compute the phase angle between supply voltage and current after inserting the resistor, and state whether current leads or lags the voltage.</p>	CO4	(4)
	b	<p>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 $8+j6 \Omega$.</p> <p>i) Calculate the line current drawn by the motor system. ii) Determine the power factor of the system. iii) Compute the total power consumed.</p>	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. i) Calculate the resistance of the circuit. ii) Determine the capacitance of the capacitor. 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				
<i>(Answer all questions. Each question carries 3 marks)</i>				
No.	Question		CO	Mark s
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 $I_B = 20\mu\text{A}$		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				
<i>(Answer any one full question from each module, each question carries 9 marks)</i>				
No.	Question		CO	Mark s
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				
		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.		
8	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	1	Credits	4
<i>(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)</i>							
Course Code	Course Name					Course Category	
B250903/CN110E	PROGRAMMING IN PYTHON					ES	
Pre-requisite if any							
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 STATEMENT (CC)	
CC1	Apply the basic engineering concepts to solve near to real-life engineering problems
CC2	Demonstrates proficiency in the Python programming language

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	3	3	3		2		2		2	2	3			
3	3	3	3		2		2		2	2	3			
4	3	3	3		2		2		2	2	3			

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

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	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, and 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:** Analyze; **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

TEACHING AND ASSESSMENT SCHEME													
Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme						
L	T	J	P	S			Theory			Practical			Total
					C	CIA	ESE	Total	CIA	ESE	Total		
2	1	0	2	2	4	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 Learning	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. Trace recursion using call-stack diagrams.	10
5	Study simple brute-force problems: padlock, password guessing. Write small brute-force code (e.g., linear search).	10

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/h5pppsychology/chapter/problem-solving/
2	https://onlinecourses.nptel.ac.in/noc21_cs32/preview

DETAILED SYLLABUS (Self-learning if any to be marked)								
Module	Title	Major Topic & Sub Topic	Mode of Delivery	CO	Learning Domain			Hrs
					C	P	A	
1	Foundations of Problem-Solving and Python Basics	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,	L	CO1	U	M	Rs	3

		developing an algorithm, writing the program, testing & evaluating the solution						
		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	Algorithm Design with Pseudocode and Flowcharts	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		Modular Problem-Solving with Python: Control Structures to Recursion	Selection and iteration using Python – if-else, elif, for loop, range, while loop	L	CO3	A	M	Rs
	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

		<p>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 $n \geq 3$ integers (examples). (Not limited to these exercises; more can be worked out if time permits).</p>	L	CO3	A	M	Rs	1
		<p>Recursion – definition, reasons for using recursion, the call stack, recursion and the stack, avoiding circularity in recursion</p>	T	CO3	A	M	Rs	1
		<p>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).</p>	L, T	CO3	A	M	Rs	1
		<p>Self-learning: Compare recursive vs iterative solutions for factorial & Fibonacci; trace recursion using call-stack diagrams</p>	S	CO3	A	M	Rs	10
4	Fundamental Computational Approaches to Problem-Solving	<p>Brute-force Approach – Introductory diagrammatic/algorithmic explanation (analysis not required). Example: Padlock, Password guessing</p>	L	CO4	A	M	Rs	2
		<p>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</p>	L	CO4	A	M	Rs	2
		<p>Dynamic Programming Approach – introductory diagrammatic/algorithmic explanation (analysis not required). Example: Fibonacci series. Recursion vs Dynamic Programming</p>	L	CO4	A	M	Rs	2
		<p>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</p>	L	CO4	A	M	Rs	2

	<p>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?</p>	L	CO4	A	M	Rs	2
	<p>Self-learning – Study simple brute-force problems: padlock, password guessing. Write small brute-force code (e.g., linear search).</p>	S	CO4	A	M	Rs	11

PRACTICAL SYLLABUS						
Module	Objective	CO	Learning Domain			Hrs
			C	P	A	
1	To practice basic syntax, input/output, and simple execution in Python	3	A	M	Rs	1
1	To understand and apply different primitive data types in Python	3	A	M	Rs	1
1	To practice arithmetic operators and precedence in Python	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	A	Ar	V	1
3	To understand modular programming and reuse	3	A	Ar	V	1
3	To apply modularization by selective import of functions	3	A	Ar	V	2
3	To apply string validation logic	4	A	P	Rs	2

TABLE OF SPECIFICATIONS (ToS) (ESE Question Paper Design)								
Module	Module Title	Revised Blooms Level Mapping						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

Register No.:	Name:
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FIRST SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR (2025 SCHEME)			
Course Code:	B250903/CN110E		
Course Name:	PROGRAMMING IN PYTHON		
Max. Marks	60	Duration:	2 hours 30 minutes
CE, ME, EEE			

PART A			
<i>(Answer all questions. Each question carries 3 marks)</i>			
No.	Question	CO	Mark s
1	With the help of a suitable example, explain the membership operator in Python.	CO 1	(3)
2	List the operator precedence rules supported in Python.	CO 1	(3)
3	Draw a flowchart to find and display the factorial of a given number.	CO 2	(3)
4	Develop the algorithm, flowchart, and pseudocode to find the sum of 'n' numbers entered by the user.	CO 2	(3)
5	Compare and contrast pre-test and post-test looping constructs in Python with examples.	CO 3	(3)
6	Write a Python program to read two matrices and display its sum.	CO 3	(3)
7	Compare and contrast the greedy approach and dynamic programming approach.	CO 4	(3)
8	Write an algorithm to calculate the nth Fibonacci number using the dynamic programming approach.	CO 4	(3)

PART B			
<i>(Answer any one full question from each module, each question carries 9 marks)</i>			
No.	Question	CO	Mark s
MODULE I			
9	a) Develop a program that finds all prime numbers up to a given integer n. Elaborate the steps involved in computer-based problem solving process to solve this problem.	CO 1	(6)
	b) Let A =127, B = 63 Predict the output of the expressions: A & B, A B and A >> 3.	CO 1	(3)
OR			
10	a) A delivery driver in a new city does not know all the streets but chooses routes based on experience, such as avoiding busy roads and taking familiar turns. Which problem-solving strategy is the driver using? Discuss how this strategy helps in making quick decisions and where it might lead to errors.	CO 1	(6)
	b) You are given the area of a circle. Write a Python program using the math module to calculate the radius of the circle.	CO 1	(3)
MODULE II			
11	a) Develop the algorithm, flowchart, and pseudocode to find the reverse of a number and to check if it is palindrome or not.	CO 2	(6)
	b) Illustrate how a switch-case statement can be represented in pseudocode.	CO 2	(3)
OR			
12	a) You visit a shop to buy a new mobile. During the festive season, the shop offers a 10% discount on all mobiles. Additionally, customers can exchange their old mobiles for a flat price of ₹1000. Draw a flowchart to input the original price of the mobile and print its selling price. Note that all customers may not have an old mobile for exchange. Also prepare algorithm and pseudocode for the given problem.	CO 2	(6)
	b) Illustrate how a loop or repetition can be represented in a flowchart.	CO 2	(3)
MODULE III			
13	a) Create a telephone directory using a dictionary, where the name of the individual is the key and the telephone number is the value. Write a Python program that allows the user to perform the following operations: 1. Add a contact – add a new name and phone number. 2. Update a contact – modify the phone number of an existing contact. 3. Delete a contact – remove an existing contact.	CO 3	(6)

		<p>4. Search for a contact – retrieve the phone number by name. 5. Display all contacts. 6. Exit the program. Use a menu-driven approach.</p>		
	b)	Write a program that accepts the lengths of three sides of a triangle as inputs. The program should output whether or not the triangle is a right-angled triangle (recall the Pythagorean theorem). Implement the solution using functions.	CO 3	(3)
OR				
14	a)	A person deposits a fixed amount every year into a retirement account that earns compound interest. Given the initial deposit, annual contribution, interest rate, and number of years, write a recursive program to calculate the total savings at retirement. Do not use loops or built-in financial functions.	CO 3	(5)
	b)	<p>Sarah is a data analyst working for a marketing agency. She is given a list of customer ages from a recent survey conducted by her company. The list contains a mix of integers representing ages and some strings due to data entry errors. Sarah needs to clean the data by removing erroneous entries (non-integer values) and then analyze the data to find:</p> <ol style="list-style-type: none"> 1. The youngest and oldest customers. 2. The average age of the customers. 3. The most common age in the list. 	CO 3	(4)
MODULE IV				
15	a)	With the help of a neat diagram, demonstrate the merge sort algorithm to sort the following set of numbers: [20, 30, 10, 7, 23, 17, 100, 2].	CO 4	(5)
	b)	You are organizing a security system for your office where each employee has a 4-digit PIN code for access. Due to a system malfunction, you forgot the correct PIN but know that it is a 4-digit number (0000–9999). Write an algorithm to determine the correct PIN using a brute-force approach. Explain the logic behind trying all possible combinations.	CO 4	(4)
OR				
16	a)	A company selling coffee gives a sticker with every cup purchased. There are ‘n’ different stickers in total. Collecting all ‘n’ different stickers earns you a free cup of coffee. Using a randomized approach, design an algorithm to estimate how many cups of coffee you need to buy on average to collect all ‘n’ stickers.	CO 4	(5)
	b)	You want to watch as many movies as possible at a film festival. Each movie has a start and end time, and you can only watch one at a time. Given an array of movies with their start and end times, write an algorithm to find the maximum number of movies you can watch in full.	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	HM
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 1	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							
L	T	J	P	S			Theory			Practical			Total	
					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
<i>(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)</i>							

Course Code	Course Name	Course Category
B250906/CN930U	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP	ES
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 wiring, 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 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 CC3	A	M	Rs
CO5	Perform PCB fabrication, soldering, and interconnections to build and test simple circuits.	CC4 CC5	A	P	V
CO6	Construct basic electronic circuits such as rectifiers and amplifiers, and verify their operation through simulation using EDA tools	CC1 CC3 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		
L	T	J	P	S			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.	Demonstrate essential safety procedures and first-aid steps to be followed in case of electric shock.	CO1	U	I	Rs	2
b) Identify different types of cables, wires, switches, fuses, fuse carriers, MCB, ELCB and MCCB, familiarize the ratings.	Identify and understand the types, ratings, and applications of various electrical cables, protection devices, and switches.	CO2	U	I	Rs	
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	CO4	A	M	Rs	2

	specifications, circuit symbols, and approximate cost.					
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

SEMESTER II

APPROVAL

This is to certify that the syllabus titled “Syllabus for B. Tech in Electrical and Electronics Engineering” implemented from the academic year **2025–2026**, is prepared in accordance with the regulations, academic framework, and Outcome Based Education guidelines prescribed by the Institution and the affiliating University.

The syllabus has been **discussed, reviewed, and approved** by the following statutory bodies.

BOARD OF STUDIES (BOS)

Approved in the Board of Studies Meeting of the Electrical and Electronics Engineering held on ____ / ____ / 20 .

Chairperson, BoS

Name: Dr. Anjali Varghese C

Designation: Professor & HoD

Signature: _____

Date: _____

ACADEMIC COUNCIL

Approved by the Academic Council in its meeting held on ____ / ____ / 20

PRINCIPAL

Recommended for implementation from the Academic year 2025-2026.

Name: Dr. Neelakantan P C

Signature: _____

Date: _____

SEMESTER 2

CURRICULUM

SLOT	COURSE CATEGORY	COURSE CODE	COURSE NAME	L	T	J	P	S	C
A	BST	B250802/MA200A	Mathematics for Electrical Science-2	3	1	0	0	2	3
B	BSE	B250802/PH910B	Physics for Electrical Science	3	0	0	2	3	4
C	EST	B250901/CE200C	Introduction to Engineering Mechanics	3	1	0	0	2	3
D	EST	B250003/CN210D	Foundations of C Programming	2	0	0	2	4	4
E	PCT	B250003/EE200E	Circuits and Networks	3	1	0	0	4	4
F	ESB	B250908/CN220F	Entrepreneurship and IPR	2	0	1	0	3	3
K	HMT	B250908/CN900K	Life Skills and Professional Communication	1	1	0	0	0	1
U	ESL	B250902/CN230U	Essentials of Embedded and Computing Lab	0	0	0	2	0	1
I	Skill Enhancement Course								1
<i>(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work, C- Credit)</i>									

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
B250802/MA200 A	MATHEMATICS FOR ELECTRICAL SCIENCE - 2	BS
Pre-requisite if any		
Sound knowledge in calculus of one real variable.		

COURSE OBJECTIVES	
1	To enable the students to apply multivariable differentiation techniques—including chain rule, implicit differentiation, and optimization methods for solving engineering-related problems.
2	To equip students with the skills to evaluate double and triple integrals and to apply coordinate transformations for computing areas, volumes, and related quantities in engineering applications.
3	To develop a deep understanding of vector fields through the analysis of gradient, divergence, curl, and line integrals, and to apply these in evaluating conservative fields and constructing potential functions in physical systems.
4	To enable the students to apply vector integral theorems in the evaluation of line, surface, and flux integrals and to solve engineering problems involving circulation, flux, and work.

COMPETENCY STATEMENT (CC)	
CC 1	Demonstrate the ability to analyze mathematical models of physical systems and find its solution using appropriate calculus-based methods.

COURSE OUTCOMES (CO)					
Course Outcomes (CO): At the end of this course, learners will be able to:					
CO	CO Statement	Competency Statement Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO 1	Apply the concept of partial derivatives to find maxima and minima of multivariable functions.	CC 1	A	–	Rs
CO 2	Use the concept of multiple integrals to find area and volume of geometrical shapes.	CC 1	A	–	Rs
CO 3	Apply the calculus of vector valued functions to solve physical problems.	CC 1	A	–	Rs
CO 4	Apply vector integral theorems in the evaluation of line integrals, surface integrals, and volume integrals.	CC 1	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			
4	2	2									1			
	2	2									1			
Correlation [3 – High, 2 -Medium, 1 – Low]														

TEACHING AND ASSESSMENT SCHEME													
Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme						
L	T	J	P	S			Theory			Practical			Total
					CIA	ESE	Total	CIA	ESE	Total			
3	1	0	0	2	3	90	40	60	100	-	-	-	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)			
Mod ule	Title	Major Topics	Hrs
1	Multivariable Calculus-Differentiation	Limits and Continuity, Partial derivatives, Local linear approximation, The Chain Rule, Maxima, and Minima of functions of Two variables. (Relevant topics from sections 13.2,13.3, 13.4,13.5, 13.8 of Text 1)	11
2	Multivariable Calculus-Integration	Double Integrals, Reversing the order of integration, Converting Double integrals from Cartesian Coordinates to Polar Coordinates, Triple Integrals, Converting Triple integrals in Cartesian coordinates to cylindrical coordinates. (Relevant topics from sections 14.1,14.2,14.3, 14.5,14.6 of Text 1)	11
3	Calculus of Vector Functions	Vector valued function of a single variable, Concept of scalar and vector field, Gradient and its properties, Directional Derivatives, Divergence and Curl of vector fields, Line integral of vector fields, Conservative vector fields, Potential function. (Relevant topics from sections 12.1,12.2,13.6, 15.1,15.2,15.3 of Text 1)	12
4	Vector Integral Theorems	Green's theorem for simply connected region (without proof), Applications of Green's theorem, Surface integrals, Flux integrals, Divergence theorem (without proof), Stokes' theorem (without proof), finding work done using Stokes' theorem. (Relevant topics from sections 15.4,15.5,15.6, 15.7,15.8 of Text 1)	11

SELF-LEARNING / TEAM WORK		
Sl. No.	Self-learning Topics / Team Work Description	Hrs (30)
1	Differentiability (1 Hour)	7
2	Practice problems on Partial Derivatives, Local linear approximation, Chain Rule and Maxima and Minima of functions of Two variables (5 Hours)	
3	Team Work - Contour plot, Graphing functions of two variables using GeoGebra/ Python (1 Hour)	
4	Center of gravity using Multiple integrals- Mass and Center of gravity of inhomogeneous laminas, Center of gravity and Centroid of a solid (2 Hours)	8
5	Practice problems on double integrals and triple integrals (5 Hours)	
6	Team Work - Visualizing solids and their intersections using GeoGebra/ Python (1 Hour)	
7	Motion along a curve-velocity, acceleration, speed, displacement and distance travelled (1 Hour)	7
8	Practice problems on Gradient and Directional Derivative of scalar fields, Curl and Divergence of vector fields, Line Integrals and Conservative vector fields. (5 Hours)	
9	Team work - Visualizing gradient and its properties using GeoGebra/ Python, visualizing vector fields using GeoGebra/ Python and presenting their applications. (1 Hour)	
10	Curl viewed as circulation (2 Hour)	8
11	Practice problems on Line integrals using Green's theorem, Surface integrals, Flux integrals, Flux integrals using Divergence theorem, Work done using Stokes' theorem. (5 Hours)	
12	Team Work - Visualizing Curl and Divergence using GeoGebra/ Python (1 Hour)	

SUGGESTED LEARNING RESOURCES

Sl. No.	Title of Book	Author	Publication
Text Book			
1	Calculus	H. Anton, I. Biven, S. Davis	Wiley, 12th edition, 2024
Reference			
1	Advanced Engineering Mathematics	Dennis G Zill, Warren S. Wright	Jone's and Bartlett Learning, 4th edition, 2011
2	Thomas' Calculus	Maurice D. Weir, Joel Hass, Christopher Heil, Przemyslaw Bogacki	Pearson 15th edition, 2023
3	Engineering Mathematics (Vol. 2)	S S Sastry	PHI, 2011
4	Advanced Engineering Mathematics	Erwin Kreyszig	John Wiley & Sons 10th edition, 2016
5	Higher Engineering Mathematics	B V Ramana	Mc Graw Hill, 2021
6	Engineering Mathematics (Vol. I)	A.C. Srivastava, P. K. Srivastava	PHI, 2010
Web Resource			
1	https://nptel.ac.in/courses/111107108	NPTEL	

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

Module	Title	Major Topic & Sub Topic	Mode of Delivery	Relevant COs	Learning Domain Level			Teaching Hours
					C	P	A	
1	Multivariable Calculus-Differentiation	Limits and Continuity	L	1	A			1
		Partial derivatives of functions of two variables, Partial derivatives viewed as rate of change and slopes	L	1	A			2
		Tutorial	T	1	A		Rs	1
		Partial derivatives of functions with more than two variables, Higher order partial derivatives	L	1	A			2
		Tutorial	T	1	A		Rs	1
		Local linear approximation	L	1	A			2
		Tutorial	T		A		Rs	1
		The Chain Rule, Implicit partial differentiation	L	1	A			2
		Maxima and Minima of functions of Two Variables-Finding relative extrema.	L	1	A			2
Tutorial	T		A		Rs	1		
2	Multivariable Calculus-Integration	Double Integrals, Evaluating double integrals over rectangular regions	L	2	U			1
		Evaluating double integrals over nonrectangular regions	L	2	A			2
		Reversing the order of integration	L	2	A			1
		Tutorial	T		A		Rs	1
		Converting Double integrals from Cartesian Coordinates to Polar Coordinates	L	2	A			1
		Area calculated as a double integral, finding volumes using double integration	L	2	U			2

		Triple Integrals-Evaluating triple integrals over rectangular boxes	L	2	U			1
		Evaluating triple integrals over more general regions	L	2	A			1
		Tutorial	T	2	A		Rs	1
		Volume calculated as a triple integral	L	2	A			1
		Converting Triple integrals in Cartesian coordinates to cylindrical coordinates	L	2	A			1
		Tutorial	T	2	A		Rs	1
3	Calculus of Vector Functions	Vector valued function of a single variable	L	3	U			1
		Limit, continuity and derivatives of vector valued function of a single variable	L	3	U			1
		Tutorial	T	3	A		Rs	1
		Concept of scalar and vector field	L	3	U			1
		Gradient and Directional Derivatives of a scalar field and its properties.	L	3	A			2
		Tutorial	T	3	A		Rs	1
		Divergence and curl of a vector field	L	3	U			2
		Line integral of vector fields	L	3	A			2
		Work as line integral	L	3	A			1
		Tutorial	T	3	A		Rs	1
		Conservative vector fields, Independence of path and Potential function (results without proof)	L	3	A			2
Tutorial	T	3	A		Rs	1		
4	Vector Integral Theorems	Green's theorem for simply connected region	L	4	U			2
		Applications of Green's theorem	L	4	A			1
		Tutorial	T	4	A		Rs	1
		Surface integrals over surfaces of the form $z = g(x, y)$.	L	4	A			1
		Flux integrals over surfaces of the form $z = g(x, y)$.	L	4	A			2
		Tutorial	T	4	A		Rs	1
		Divergence theorem (without proof)	L	4	U			1
		Finding flux using Divergence theorem, Sources, and sinks	L	4	A			2
		Tutorial	T	4	A		Rs	1
		Stokes' theorem (without proof)	L	4	U			1
		Finding work done using Stokes' theorem	L	4	A			1
Tutorial	T	4	A		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	Multivariable Calculus-Differentiation	√	√	√				15
2	Multivariable Calculus-Integration	√	√	√				15
3	Calculus of Vector Functions	√	√	√				15
4	Vector Integral Theorems	√	√	√				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
Internal Examination	20
Learning Activity	15
Regularity	5
End Semester Examination	60
Total	100

MODEL QUESTION PAPER

Total Pages: 2	
Register No.:	Name:

SECOND SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR (2025 SCHEME)			
Course Code:	B250802/MA200A		
Course Name:	MATHEMATICS FOR ELECTRICAL SCIENCE - 2		
Max. Marks	60	Duration:	2 hours 30 minutes
Common to EEE and ECE			

PART A			
(Answer all questions. Each question carries 3 marks)			
No.	Question	CO	Marks
1	Find the slope of the surface $z = 3ye^x + e^{4y-x}$ in the x -direction at the point $(3,0)$.	CO1	(3)
2	Show that the function $z = e^x \cos y + e^y \sin x$ satisfies Laplace's equation $\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial y^2} = 0$.	CO1	(3)
3	Use a double integral to find the volume of the solid that is bounded above by the plane $z = 2 - x^2 - y^2$ and below by the rectangle $R = [-1, -1] \times [1, 1]$.	CO2	(3)
4	Use polar co-ordinates to evaluate $\iint_R e^{-(x^2+y^2)} dA$, where R is the region enclosed by the circle $x^2 + y^2 = 1$.	CO2	(3)
5	Find a unit vector in the direction in which $f(x,y) = 3x - \log y$ increases most rapidly at the point $(2, 4)$. Also, find the rate of change of $f(x,y)$ at $(2, 4)$ in that direction.	CO3	(3)
6	Determine the value of a so that the vector field, $\vec{F}(x,y,z) = (x + 3y)\hat{i} + (y - 2z)\hat{j} + (x + az)\hat{k}$ is solenoidal.	CO3	(3)
7	Determine whether the vector field, $\vec{F}(x,y,z) = x^3\hat{i} + y^3\hat{j} + z^3\hat{k}$ is free of sources and sinks. If it is not, locate them.	CO4	(3)
8	Use Green's theorem to find the area enclosed by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.	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) Let f be differentiable function of three variables, and suppose that $w = f\left(\frac{x}{y}, \frac{y}{z}, \frac{z}{x}\right)$. Show that $x \frac{\partial w}{\partial x} + y \frac{\partial w}{\partial y} + z \frac{\partial w}{\partial z} = 0$.	CO1	(4)
	b) Find all points on the portion of the plane $3x + 2y + z = 6$ in the first octant at which $w = x^2y^3z$ attains its maximum value.	CO1	(5)
OR			
10	a) Find the local linear approximation $L(x,y,z)$ to $f(x,y,z) = xy + yz + zx$ at the point $(1, 2, 3)$. Also find the error in the approximation of f at the point $(0.99, 2.03, 2.98)$.	CO1	(4)
	b) Let $u = \ln(x^2 + y^2)$, $v = 2 \tan^{-1}\left(\frac{y}{x}\right)$ and $x = r \cos \theta$, $y = r \sin \theta$. Show that u and v satisfy the polar form of the Cauchy Riemann equation: $\frac{\partial u}{\partial r} = \frac{1}{r} \frac{\partial v}{\partial \theta}$ and $\frac{\partial v}{\partial r} = -\frac{1}{r} \frac{\partial u}{\partial \theta}$.	CO1	(5)
MODULE II			
11	a) Use a double integral to find the area of the region between the parabola $y = 2x^2$ and the straight-line $y = 3x$.	CO2	(4)
	b) Sketch the region of integration and evaluate the integral $\int_0^\pi \int_y^\pi \frac{\sin x}{x} dx dy$ by changing the order of integration.	CO2	(5)
OR			
12	a) Evaluate $\iint_R y \cos x dA$, where R is the triangular region bounded by the lines $y = x, x = 0$ and $y = \pi$.	CO2	(4)

	b)	Find the volume of the solid within the cylinder $x^2 + y^2 = 9$ and between the planes $z = 1$ and $x + z = 5$.	CO2	(5)
MODULE III				
13	a)	Evaluate the line integral $\int_C (x^2 + y^2) dx + 2x dy$, where C is the curve $x^2 + y^2 = 1$, traversed counterclockwise from $(1,0)$ to $(0,1)$.	CO3	(4)
	b)	Find the work done by the force field $\vec{F}(x,y) = xy \hat{i} + x^3 \hat{j}$ on a particle moving along the curve C , given by $x = y^2$, from $(0, 0)$ to $(1, 1)$.	CO3	(5)
OR				
14	a)	Find the divergence and curl of the vector field: $\vec{F}(x,y,z) = x^2y \hat{i} + 2y^3z \hat{j} + 3z \hat{k}$.	CO3	(4)
	b)	Show that the line integral $I = \int_{(1,4)}^{(3,1)} 2xy^3 dx + (1 + 3x^2y^2) dy$ is independent of the path. Hence, use the potential function to evaluate the line integral I .	CO3	(5)
MODULE IV				
15	a)	Find the mass of the lamina that is portion of the cone $z = \sqrt{x^2 + y^2}$, lying between the planes $z = 1$ and $z = 2$, if the density function is $\delta(x,y,z) = 5y^2z$.	CO4	(4)
	b)	Using Green's theorem, evaluate work done by the force field $\vec{F}(x,y) = (e^{2x} - y^3) \hat{i} + (\sin y + x^3) \hat{j}$ on a particle that travels once around the circle $x^2 + y^2 = 4$ in the counterclockwise direction.	CO4	(5)
OR				
16	a)	Use Stokes' theorem to find the circulation of the vector field $\vec{F}(x,y,z) = (x - z) \hat{i} + (y - x) \hat{j} + (z - xy) \hat{k}$ around the triangle with vertices, $A(1,0,0)$, $B(0,1,0)$ and $C(0,0,1)$ oriented counterclockwise, when viewed from the origin towards the first octant.	CO4	(4)
	b)	Use the Divergence theorem to find the outward flux of the vector field, $\vec{F}(x,y,z) = (x^2 + y) \hat{i} + z^2 \hat{j} + (e^y - z) \hat{k}$ across the surface of the rectangular solid bounded by the coordinate planes and the planes $x = 1, y = 2$ and $z = 3$.	CO4	(5)

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
B250802/PH910B	PHYSICS FOR ELECTRICAL SCIENCE	BS
Pre-requisite if any		
Basics of semiconductor materials and devices, basics of dielectrics, basics of fiber optics		

COURSE OBJECTIVES	
1	To develop a strong foundation in fundamentals of physics employed in electrical disciplines
2	To equip students with practical skills required in setting and characterizing semiconductor and optical devices.

COMPETENCY STATEMENT (CC)	
CC1	Demonstrate ability to apply the principles of semiconductors to solve basic problems in semiconductor circuits and devices.
CC2	Demonstrate ability to apply the principles of lasers, fiber optics, and dielectrics to solve basic problems in photonics, electrical circuits, and communication systems.

COURSE OUTCOMES (CO)					
Course Outcomes (CO): At the end of this course, learners will be able to:					
CO	CO Statement	Competency Statement Mapping	Cognitive (C)	Psycho motor (P)	Affective (A)
CO 1	Apply the theory of semiconductors in a p-n junction under forward and reverse biased conditions	CC1	A	M	Rs
CO 2	Apply the theory of semiconductors to characterize semiconductor devices and circuits.	CC1	A	M	Rs
CO 3	Apply the theory of dielectrics and superconductors to characterize electrical circuits with these components.	CC2	A		
CO 4	Apply the principles of lasers and optical fibers in an optical communication system.	CC2	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	2	2			1		2	2	2		2			
2	2	2			1		2	2	2		2			
3	2	2			1		2	2	2		2			
4	2	2			1		2	2	2		2			

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

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

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Semiconductor Physics	Intrinsic carrier concentration, Extrinsic semiconductor, Diode equation.	9
2	Semiconductor Devices	Full wave and Half wave Rectifiers, Zener diode, Tunnel diode, Photodiodes, Solar cells, Light Emitting Diode.	9
3	Superconductivity & Dielectrics	Superconductivity, Type I and Type II superconductors, Dielectric constant, Relation between polarization and dielectric constant, Types of Polarization, Clausius-Mossotti Relation.	9
4	Laser & Fiber Optics	Optical processes, Basic components of laser, Ruby laser, Semiconductor Laser, Principle of propagation of light, Types of fibres, Numerical aperture, Fiber optic communication system.	9

SELF-LEARNING / TEAM WORK		
Sl. No	Self-learning / Team Work Description	Hrs
1	Intrinsic semiconductors (Self-Learning 1) - Extrinsic semiconductors (Self-Learning 2) - LED (Self-Learning 3) - Zener diode as voltage regulator (Self-Learning 4) - Tunnel diode (Self-Learning 5)	10
2	Semiconductor laser (Self-Learning 6)- Photo diode (Self-Learning 7) - Solar cell (Self-Learning 8) - Half wave rectifier (Self-Learning 9) - Full wave rectifier (Self-Learning 10)	10
3	Basics of isotopic effect and critical field (Self-Learning 11), Basics of dielectrics (Self-Learning 12), Internal Field (Self-Learning 13).	6
4	Fundamentals of emission and absorption in atomic system (Self-Learning 14), laser applications (Self-Learning 15), Fiber optics communication (Self-Learning 16)	6
5	Prelab assignment 1 - 10	20
6	Practice problems 1-6	12

SUGGESTED LEARNING RESOURCES

Sl. No.	Title of Book	Author	Publication
Text Book			
1	A Textbook of Engineering Physics	M N Avadhanulu, P G Kshirsagar, TVS Arun Murthy	S. Chand 11th Edition, 2018
2	A Text Book of Engineering Physics	Dominic and. A. Nahari	Owl Books Publishers Revised Edition, 2016
References			
1	Concepts of Modern Physics	Arthur Beiser	Tata McGraw-Hill Publications 6th Edition, 2003
2	Introduction to Solid State Physics	Charles Kittel	Wiley India Edition 2019

3	Semiconductor Devices Fundamentals	Robert F Pierret	Pearson Education 1995
4	Electronic Instrumentation	H S Kalsi	Tata McGraw-Hill, Second edition
Web Resource			
1	https://nptel.ac.in/courses/108106181		
2	https://nptel.ac.in/courses/108108112		
3	https://nptel.ac.in/courses/115103108		
4	https://nptel.ac.in/courses/115102124		
5	https://archive.nptel.ac.in/courses/108/108/108108122/#		

DETAILED SYLLABUS (Self-learning if any to be marked)								
Module	Title	Major Topic & Sub Topic	Mode of Delivery	Relevant COs	Learning Domain Level			Teaching Hours
					C	P	A	
1	Semiconductor Physics	Prelab assignment 1	S	CO1	A			
		Self-Learning 1	S	CO1	A			
		Intrinsic semiconductor	L	CO1	A	M	Rs	1
		derivation of density of electrons in conduction band	L	CO1	A	M	Rs	1
		Density of holes in valence band	L	CO1	A	M	Rs	1
		Prelab assignment 2	S	CO1	A			
		Self-Learning 2	S	CO1	A			
		Intrinsic carrier concentration, variation of intrinsic carrier concentration with temperature, Extrinsic semiconductor	L	CO1	A	M	Rs	1
		Formation of p-n junction, Fermi level in semiconductors, intrinsic and extrinsic	L	CO1	A	M	Rs	1
		Energy band diagram of p-n junction, charge flow across p-n junction	L	CO1	A	M	Rs	1
		Practice Problem 1	T	CO1	A			1
		Prelab assignment 3	S	CO1	A			
		Self-Learning 3	S	CO1	A			
		Forward and reverse biased p-n junction	L	CO1	A	M	Rs	1
		I-V characteristics of p-n junction	L	CO1	A	M	Rs	1
Diode equation	L	CO1	A	M	Rs	1		
2	Semiconductor Devices	Prelab assignment 4	S	CO2	A			
		Self-Learning 4, Self-Learning 5	S	CO2	A			
		Half wave rectifiers	L	CO2	A	M	Rs	1
		Full wave rectifier	L	CO2	A	M	Rs	1
		Zener diode- VI characteristics, Tunnel diode, VI characteristics	L	CO2	A	M	Rs	1
		Practice Problem 2	T	CO2	A			1
		Prelab assignment 5	S	CO2	A			
		Self-Learning 6, Self-Learning 7	S	CO2	A			
		Semiconductor laser, applications	L	CO2	A	M	Rs	1
		Photo detectors - Junction photo diode	L	CO2	A	M	Rs	1
		PIN photodiodes	L	CO2	A	M	Rs	1
		Prelab assignment 6	S	CO2	A			
		Self-Learning 8, Self-Learning 9	S	CO2	A			

		Solar cell – construction and working	L	CO2	A	M	Rs	1
		VI characteristics - Efficiency, Stringing of solar cells to solar panel	L	CO2	A	M	Rs	1
		Light Emitting Diode, Applications	L	CO2	A	M	Rs	1
		Practice Problem3	T	CO2	A			1
		Prelab assignment 7	S	CO2	A			
		Self-Learning 10	S	CO2	A			
3	Superconductivity & Dielectrics	Super conductivity, Transition temperature, Critical field	L	CO3	A	M	Rs	1
		Meissner effect, Type I and Type II Super conductors	L	CO3	A	M	Rs	1
		Applications of superconductors	L	CO3	A	M	Rs	1
		Practice Problem4	T	CO3	A			1
		Prelab assignment 8	S	CO3	A			
		Self-Learning 11	S	CO3	A			
		Dielectric constant, Polarization	L	CO3	A	M	Rs	1
		Permittivity- relative permittivity, Relation between polarization and dielectric constant	L	CO3	A	M	Rs	1
		Types of Polarization	L	CO3	A	M	Rs	1
		Prelab assignment 9	S	CO3	A			
		Self-Learning 12	S	CO3	A			
		Internal fields in liquids and solids	L	CO3	A	M	Rs	1
		Clausius Mossotti Relation	L	CO3	A	M	Rs	1
		Dielectric loss(qualitative), Dielectric breakdown (qualitative)	L	CO3	A	M	Rs	1
		Prelab assignment 10	S	CO3	A			
4	Laser & Fibre optics	Optical processes – Absorption-Spontaneous emission and stimulated emission,	L	CO4	A	M	Rs	1
		Principle of laser - conditions for sustained lasing – Population inversion- Pumping- Metastable states,	L	CO4	A	M	Rs	1
		Basic components of laser - Active medium - Optical resonant cavity	L	CO4	A	M	Rs	1
		Practice Problem5	T	CO4	A			1
		Self-Learning 13	S	CO4	A			
		Construction and working of Ruby laser	L	CO4	A	M	Rs	1
		Semiconductor laser (qualitative), Properties of laser, Applications of laser.	L	CO4	A	M	Rs	1
		Optic fibre-Principle of propagation of light, Types of fibres	L	CO4	A	M	Rs	1
		Self-Learning 14	S	CO4	A			
		Step index and Graded index fibres Acceptance angle	L	CO4	A	M	Rs	1
		Numerical aperture –Derivation	L	CO4	A	M	Rs	1
		Applications of optical fibres - Fibre optic communication system (block diagram)	L	CO4	A	M	Rs	1
				Practice Problem6	T	CO4	A	
		Self-Learning 15, Self-Learning 16	S	CO4	A			

PRACTICAL SYLLABUS							
Module	Topic	Objective	Relevant COs	Learning Domain Level			Teaching Hours
				C	P	A	
1	Diffraction grating	To determine the wavelength of laser using grating	CO4	A	M	Rs	2
2	Diode characteristics	To determine the characteristics of a diode	CO1	A	M	Rs	2
3	Cathode Ray Oscilloscope	To determine voltage and frequency of an electronic signal from function generator	CO1	A	M	Rs	2
4	LED characteristics	To determine the characteristics of an LED	CO2	A	M	Rs	2
4	Solar cell	To determine the characteristics of a solar cell	CO2	A	M	Rs	2
4	Numerical aperture	To determine numerical aperture of an optical fiber	CO4	A	M	Rs	2
4	Zener diode characteristics	To determine the characteristics of a zener diode	CO2	A	M	Rs	2
4	Half wave rectifier	To determine input and output waveforms through a half wave rectifier	CO2	A	M	Rs	2
4	Full wave rectifier	To determine input and output waveforms through a half wave rectifier	CO2	A	M	Rs	2
4	Photo diode characteristics	To determine the characteristics of a photo diode	CO2	A	M	Rs	2

TABLE OF SPECIFICATIONS (ToS) FOR QUESTION PAPER DESIGN								
Module	Module Title	Distribution of Marks (Revised Bloom's Level)						Total Marks
		R	U	A	An	E	C	
1	Semiconductor Physics	✓	✓	✓				15
2	Semiconductor Devices	✓	✓	✓				15
3	Superconductivity & Dielectrics	✓	✓	✓				15
4	Laser & Fiber Optics	✓	✓	✓				15

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

ASSESSMENT PATTERN	
Assessment	Marks
Continuous Internal Assessment	40
Internal Examination (IE1-10, IE2-10)	20
Regularity	5
Continuous Lab Evaluation	15
End Semester Examination	60
Total	100

MODEL QUESTION PAPER

Total Pages: 2

Register No.:	Name:
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SECOND SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR (2025 SCHEME)			
Course Code:	B250802/PH910B		
Course Name:	PHYSICS FOR ELECTRICAL SCIENCE		
Max. Marks	60	Duration:	2 hours 30 minutes
<i>Use of Calculator permitted</i>			

PART A			
<i>(Answer all questions. Each question carries 3 marks)</i>			
No.	Question	CO	Marks
1	Intrinsic semiconductors are not suitable for device fabrication. Give reason.	CO1	(3)
2	Width of the depletion region varies with biasing in a pn junction. Explain it with the help of a diagram.	CO1	(3)
3	Distinguish between Zener breakdown and avalanche breakdown.	CO2	(3)
4	Photo diode is a light sensitive device. Explain its working.	CO2	(3)
5	Prove that superconducting state is a perfect diamagnetic state.	CO3	(3)
6	When a dielectric material is placed in an external electric field, some molecules align while others show no alignment. Explain this behaviour by distinguishing between polar and non-polar dielectrics, giving one example of each.	CO3	(3)
7	Ruby laser is a three-level system. Explain the pumping scheme and population inversion mechanism in a ruby laser.	CO4	(3)
8	Distinguish between step-index and graded index fiber.	CO4	(3)

PART B			
<i>(Answer any one full question from each module, each question carries 9 marks)</i>			
No.	Question	CO	Marks
MODULE I			
9	a) Derive an expression for electron density in conduction band and hole density in valence band, thereby give an expression for intrinsic carrier concentration.	CO1	(6)
	b) If the effective mass of an electron is equal to twice the effective mass of hole, determine the position of the Fermi level in an intrinsic semiconductor from the centre of forbidden gap at room temperature.	CO1	(3)
OR			
10	a) Derive diode equation for a pn junction and draw its VI characteristics graph.	CO1	(6)
	b) Current flowing in a p-n junction is 0.2 μ A at room temperature when a large reverse bias voltage is applied. Calculate the current when a forward bias of 0.1 V is applied.	CO1	(3)
MODULE II			
11	a) Describe the working of a full wave rectifier with necessary circuit diagrams, input, and output waveforms. Derive efficiency and ripple factor of full wave rectifier.	CO2	(6)
	b) A full-wave bridge rectifier is connected to a 12 V (rms) AC supply. Each diode has a forward voltage drop of 0.7 V.	CO2	(3)
(ii) Calculate the average DC output voltage.			
(iii) Explain briefly why the ripple frequency in the output is twice the supply frequency.			
OR			

12	a)	Give an expression for wavelength of light emitted by an LED. Explain the working of an LED with the help of a circuit diagram. What is your inference about white light produced from an LED?	CO2	(6)
	b)	Calculate the wavelength of light emitted from an LED with a band gap of 2 eV.	CO2	(3)
MODULE III				
13	a)	Type II superconductors are commonly used for practical applications. Give an account of type I and type II superconductor with examples. Give four applications of superconductors.	CO3	(6)
	b)	Lead in the superconducting state has critical temperature of 7.26 K and a critical field of 8×10^5 A/m at 0 K. Determine the critical field at 5 K.	CO3	(3)
OR				
14	a)	Starting from the relation between polarization and electric field intensity, derive the Clausius-Mossotti equation.	CO3	(6)
	b)	A dielectric material has an electric susceptibility 3.5. It is placed in an electric field of strength $E=2.0 \times 10^5$ V/m. Find the relative permittivity and the polarization in the dielectric.	CO3	(3)
MODULE IV				
15	a)	In a laser, certain electrons remain “trapped” in an excited energy level for a longer time before emitting photons. Identify this energy level and explain briefly why it is crucial for achieving population inversion. Explain how the metastable state in a Ruby laser enables stimulated emission. Include a labeled energy-level diagram showing the ground state, metastable state, and laser transition.	CO4	(6)
	b)	A Ruby laser emits light of wave length $\lambda=694$ nm. (i) Calculate the energy of a single photon emitted. (ii) If the laser emits 2.0×10^{18} photons per second, find the total power output of the laser.	CO4	(3)
OR				
16	a)	Define numerical aperture of an optical fiber. Derive an expression for numerical aperture of step index fiber.	CO4	(6)
	b)	What is the numerical aperture of an optical fiber with core refractive index of 1.546 and cladding refractive index 1.478?	CO4	(3)

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

Course Code	Course Name	Course Category
B250901/CE200C	INTRODUCTION TO ENGINEERING MECHANICS	ES
Pre-requisite		
NIL		

COURSE OBJECTIVES	
1	To develop a comprehensive understanding of static and dynamic principles governing mechanical systems.
2	To cultivate advanced problem-solving skills through the application of mathematical modelling, vector analysis, and computational techniques.

COMPETENCY STATEMENT (CC)	
CC1	Apply the fundamental principles of mechanics to analyse Engineering Systems.

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	Analyse static systems involving concurrent and non-concurrent forces in 2D and 3D.	CC1	A		
CO2	Apply the laws of friction to analyse structural systems.	CC1	A		
CO3	Determine the Centre of Gravity and Moment of Inertia of plane and solid system components.	CC1	A		
CO4	Apply kinematic and kinetic principles to rectilinear motion of particles, rigid bodies and connected systems.	CC1	A		
CO5	Apply principles of curvilinear motion rotation and Simple Harmonic motion to problems involving combined static and dynamic systems.	CC1	A		
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	3		2						2	1			
2	3	2			2		2				1	1			
3	3	2	2								1	1			
4	3	3	2		2	2					1	1			
5	3	3	2		3			2			2	1			
<i>Correlation [3 – High, 2 -Medium, 1 – Low]</i>															

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme		
L	T	J	P	S			C	Theory	
						CIA	ESE	Total	
3	1	0	0	2	3	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	Introduction to Mechanics	Introduction to statics: Branches of mechanics, Concept of rigid body scalars and vectors, vector operations. Force systems: Coplanar, concurrent, Collinear and parallel forces, rectangular components in 2D and 3D, moment and couple, resultants. Equilibrium: System isolation and the free-body diagram, equilibrium conditions 2D and 3D.	18
2	Friction Centroid & Moment of inertia	Friction: -laws of friction – analysis of blocks. Centroid of composite areas- – moment of inertia- parallel axis and perpendicular axis theorems. Mass moment of inertia – Rod, Disk, Ring, wheel and spoke. Polar moment of inertia, radius of gyration (Concept only)	16
3	Kinetics and Kinematics	Rectilinear translation - equations of motion in kinematics and kinetics – D'Alembert's principle. –motion on horizontal and inclined surfaces, motion of connected bodies	13
4	Curvilinear Translation, Rotation and Simple Harmonic Motion	Curvilinear translation - equations of kinematics - projectile motion (Concept only) Rotation – kinematics of rotation- equation of motion for a rigid body rotating about a fixed axis Combined motion of rotation and translation Simple harmonic motion – equilibrium position – displacement, amplitude, period, frequency, velocity, acceleration – related simple problems. Spring Mass model.	13

SELF-LEARNING / TEAM WORK		
Sl. No.	Self-learning / Team Work Description	Hrs
1	Visualize the animation/video on idealization and prepare a reflection.	3
2	Solve 10 problems on resolution & resultant of forces. Draw Free Body Diagrams (FBDs) for at least 8 real-life objects (ladder, trolley, bridge pier, chair, crane, table, wall beam, cycle)	7
3	Solve 8 equilibrium problems (concurrent & non-concurrent force systems).	5
4	Identify and document (photos/sketches) 6 real-life supports (roller, hinge, fixed, suspension, continuous, cantilever).	3
5	Apply parallel & perpendicular axis theorems in at least 3 examples.	2
6	Calculate centroid of 5 cardboard shapes; verify experimentally by balancing.	5
7	Solve problems on mass moment of inertia.	2
8	Presentation on radius of gyration & engineering applications	2
9	Build a simple lever/see-saw model and demonstrate conditions of equilibrium.	8
10	Demonstrate laws of friction using block, pulley & weights; present observations.	8

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Engineering Mechanics - Statics and Dynamics	Shames, I. H.	Prentice Hall of India.
2	Engineering Mechanics, Vol. I statics, Vol II Dynamics	R. C. Hibbeler and Ashok Gupta	Pearson Education.

Reference			
Sl. No.	Title of Book	Author	Publication
1	Engineering Mechanics	Timoshenko S P & Young	M c Graw Hill
2	Engineering Mechanics	Rajasekharan S&Sankara Subramanian G	Vikas Publishing House
3	Engineering Mechanics - Statics & Dynamics	Tayal A. K.	Umesh Publications.
4	Engineering Mechanics	Bhavikatti S. S.	Pearson Prentice Hall.

5	Engineering Mechanics	Bansal R. K.	Laxmi Publications Pvt. Ltd.
6	Engineering Mechanics	Benjamin J.	Pentex Book Publishers and Distributors.

Web Resource

1	https://nptel.ac.in/courses/122104015
2	https://unacademy.com/lesson/overview-of-the-course/Y363O9AC

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

Module	Topic	Mode of Delivery	COs	Learning Domain			Hrs
				C	P	A	
1	Introduction to Statics – Branches of mechanics, concept of rigid body, scalars & vectors, vector operations	L, S	CO1	U			3
	Force Systems – Coplanar, concurrent, collinear, parallel forces	L, T	CO1	A			3
	Rectangular components in 2D & 3D	L, T	CO1	A			3
	Moment & Couple, Resultants	L, T	CO1	A			4
	Equilibrium – System isolation, Free-body diagram, Equilibrium conditions (2D & 3D)	L, T, S	CO1	A			5
2	Friction – Laws of friction, analysis of blocks on horizontal/inclined planes	L, T, S	CO2	A			3
	Centroid – Composite areas	L, S	CO3	A			3
	Moment of Inertia – Parallel Axis Theorem	L, T, S	CO3	A			3
	Moment of Inertia – Perpendicular Axis Theorem	L, T, S	CO3	A			3
	Mass moment of inertia for Rod, Disk, Ring, wheel and spoke	L	CO3	A			3
	Polar MoI, radius of gyration (Self-learning)	L	CO3	U			1
3	Equations of motion in kinematics & kinetics	L	CO4	A			4
	D'Alembert's principle	L, T	CO4	A			3
	Motion on horizontal & inclined surfaces	T	CO4	A			3
	Motion of connected bodies	T	CO4	A			3
4	Curvilinear Translation – Equations of kinematics	L	CO5	U			4
	Projectile motion (Concept only)	L, T, S	CO5	A			3
	Rotation – Kinematics of rotation, equations of motion of rigid body about fixed axis	L, T	CO5	A			3
	Simple harmonic Motion- – equilibrium position – displacement, amplitude, period, frequency, velocity, acceleration – related simple problems. Spring Mass model – Effective stiffness for springs connected in series and parallel.	L, T	CO5	A			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	Introduction to Mechanics		□	□				15
2	Friction Centroid & Moment of inertia		□	□				15
3	Kinetics and Kinematics		□	□				15
4	Curvilinear Translation, Rotation and Simple Harmonic Motion		□	□				15

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

ASSESSMENT PATTERN		
Assessment		Weightage
Continuous Internal Assessment		40
1	Internal Examination	20
2	Learning Activity	15
3	Regularity	5
End Semester Examination		60
Total		100

MODEL QUESTION PAPER

Total Pages: 3

Register No.:	Name:
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SECOND SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR (2025 SCHEME)			
Course Code:	B250901/CE200C		
Course Name:	INTRODUCTION TO ENGINEERING MECHANICS		
Max. Marks	60	Duration:	2 hours 30 minutes
<i>(For Electrical and Electronics Engineering)</i>			

PART A

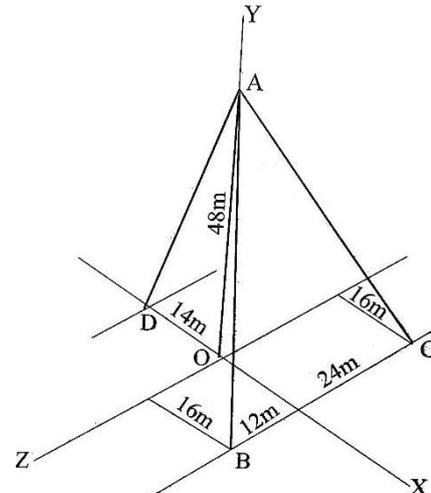
(Answer all questions. Each question carries 3 marks)

No.	Question	CO	Marks	
1	A seesaw plank of negligible mass is 3.0 m long with a central fulcrum. A parent of 700 N sits at the left end. At what distance from the right end should a child of 350 N sit so that the seesaw just balances?	CO1	(3)	
2	Define resultant and equilibrant. Conceptually describe how the equilibrant is related to the resultant in a general coplanar force system.	CO1	(3)	
3	Match the following:	CO2	(3)	
	A			B
	Static friction			Opposes sliding
	Kinetic friction			Measured in metres
	Rolling friction			Prevents start of motion
	Limiting friction			Opposes rolling
	Angle of repose			Same magnitude for static & kinetic friction
	Coefficient of friction			$\mu = \text{limiting friction} / \text{normal reaction}$
				Equals mass \times acceleration
	Inclination where sliding begins			
	Causes energy creation			
	Maximum static value			
4	Differentiate between mass moment of inertia and area moment of inertia.	CO3	(3)	
5	Explain how D'Alembert's principle turns a starting/stopping elevator problem into a statics-like one. Indicate the direction of the inertial force when the car accelerates up and when it accelerates down, and what that means for writing equilibrium.	CO4	(3)	
6	A person of mass 70 kg stands on a weighing scale inside a lift that accelerates upward at 1.5 m/s^2 for a few seconds. What reading (in N) will the scale show during this phase? Take $g=9.81 \text{ m/s}^2$	CO4	(3)	
7	Explain the analogy between $F=ma$ in rectilinear motion and $\tau=I\alpha$ in rotational motion about a fixed axis. Discuss how this analogy helps in building intuition for problems involving flywheels or scooter wheels without doing calculations.	CO5	(3)	
8	A car takes a circular exit ramp of radius 50 m at 54 km/h. Assuming speed is nearly constant, compute the normal (centripetal) acceleration of the car.	CO5	(3)	

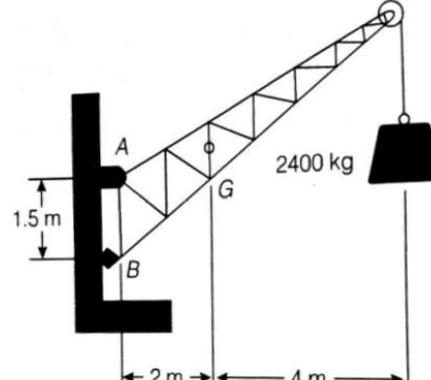
PART B

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

No.	Question	CO	Marks
MODULE I			
9	a) A post is held in vertical position by three cables AB, AC and AD as shown in the figure. If the tension in the cable AB is 40N, calculate the required	CO1	(6)

		<p>tension in AC and AD so that the resultant of the three forces applied at A is vertical.</p>		
				

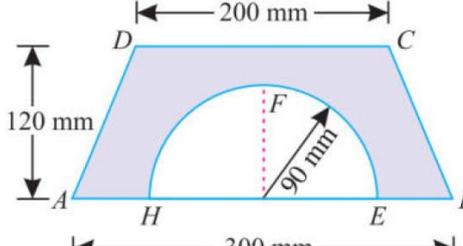
OR

10	a)	<p>A Fixed crane shown in Fig. has a mass of 1000kg and it is used to lift a 2400 kg weight. It is held in a place by a pin at A and a rocker at B. The centre of gravity of the crane is located at G. Determine the components of the reactions at A and B.</p>	CO1	(9)
				

MODULE II

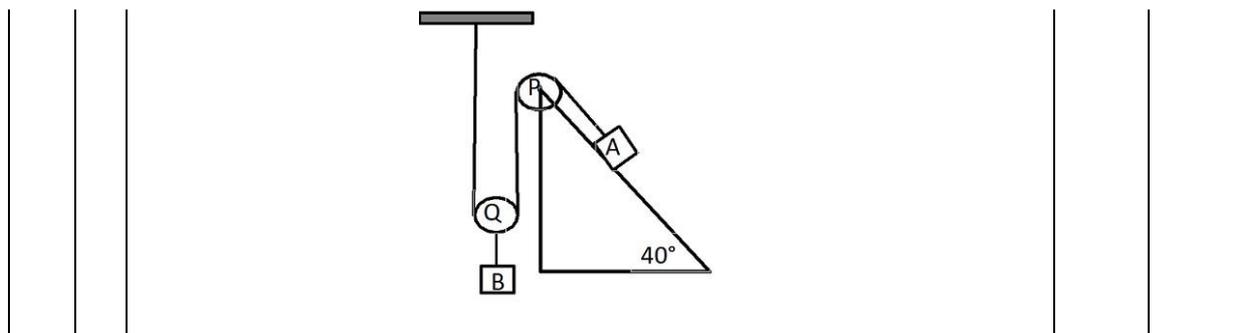
11	a)	<p>A box weighs 300 N on a 12° ramp; the effective coefficient of friction is $\mu = 0.28$. A helper pushes the box up the plane with a force parallel to the ramp. Find the minimum push to just start the box uphill.</p>	CO2	(5)
	b)	<p>If the helper can only push 65 N, will the box stay put or slide down? Justify with limiting-equilibrium checks.</p>	CO2	(4)

OR

12	a)	<p>Determine the moments of inertia of the section about the horizontal and vertical axes passing through the centroid.</p>	CO3	(9)
				

MODULE III

13	a)	<p>Determine the tension in the inextensible string and the acceleration of the masses as shown in Figure 8. Consider the pulley as massless and the coefficient of friction as 0.20. Block A=200 kg and block B=100kg.</p>	CO4	(9)
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OR

14	a)	<p>Two blocks of 100N (A) and 50N (B) are connected by a flexible but inextensible string as shown in the Figure 9. Assuming coefficient of friction between block 100N and horizontal surface is 0.25, find the acceleration of masses and tension in the string.</p>	CO4	(7)	
		b)	<p>A car moving with a velocity of 20 m/s is uniformly retarded at 2 m/s². Find the distance it travels before coming to rest and the time taken for it.</p>	CO4	(2)

MODULE IV

15	a)	<p>A flywheel rotates with a constant retardation due to breaking. In the first 10 seconds, it made 300 revolutions. At $t = 7.5$ sec, its angular velocity was 40π rad/s. Determine</p> <p>The value of constant retardation The total time taken to come to rest. The total revolutions made till it comes to rest</p>	CO5	(9)
----	----	--	-----	-----

OR

16	a)	<p>A car negotiates a circular exit ramp of radius 60 m. For passenger comfort, the lateral (centripetal) acceleration should not exceed 0.30 g. Compute the maximum safe speed (in m/s and km/h) assuming nearly constant speed on the curve.</p>	CO5	(5)	
		b)	<p>If signage mistakenly permits 70 km/h, quantify the percentage by which the recommended comfort limit is exceeded.</p>	CO5	(4)

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

Course Code	Course Name	Course Category
B250003/CN210D	FOUNDATIONS OF C PROGRAMMING	EST
Pre-requisite		
NIL		

COURSE OBJECTIVES	
1	To prepare learner to write versatile C programs for solving computational problems that they come across in their professional life.
2	To equip the learner to write efficient C programs using suitable language constructs to solve real world computational 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	Infer a computational problem and develop C programs from them using basic constructs of C language including the control statements.	1	U	M	Rs
CO2	Develop C programs using arrays, matrices, and strings.	2	A	M	Rs
CO3	Utilize functions to find solution to the computational problems by dividing it into a number of modules and abstract data types.	2	A	M	Rs
CO4	Develop C programs using pointers for efficient dynamic data handling and implement file operations for permanent data storage.	2	A	M	Rs
CO5	Apply C programming concepts to interpret basic embedded and electrical system applications such as data acquisition and control.	2	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	3		1	1				1				
2	3	3	3	3		1	1				1				
3	3	3	3	3		1	1				1				
4	3	3	3	3		1	1				1				
5	3	3	3	3		1	1				1				

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

TEACHING AND ASSESSMENT SCHEME													
Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme						
L	T	J	P	S			Theory			Practical			Total
					C	CIA	ESE	Total	CIA	ESE	Total		
2	0	0	2	4	4	120	25	40	65	15	20	35	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	C Fundamentals	Character Set, Constants, Identifiers, Keywords, Basic Data types, Variables, Operators and its precedence, Control Statements.	10
2	Arrays and Strings in C	Single dimensional arrays, Enumerated data type, Type Definition, Two- dimensional arrays, Programs for sequential search, Bubble sort, Declaring a string variable, Reading and displaying strings	10
3	Advanced Concepts: Functions, Structures, Pointers and Files in C	Function definition, Function call, Function prototype, Parameter passing; Recursion; Passing array to function, Macros, Command Line Arguments, Defining a Structure variable, Accessing members, Storage Classes associated with variables, Operations on pointers, Basic file operations	10
4	Introduction to C in Embedded and Electrical Systems	Overview of Embedded C, Use of C in Electrical System Control, C for Sensor Data Handling, Memory and File Handling Concept in Electrical Applications, Real-World Applications	10

SELF-LEARNING / TEAM WORK		
Sl. No	Self-learning / Team Work Description	Hrs
1	Pre-Lab Practical Preparation	20
2	Self-Study: Binary search algorithm, Type casting, Advanced I/O functions, Sorting algorithms, different matrices, Tower of Hanoi, function overloading.	20
3	Group Activity: Each team selects a real-life electrical system (e.g., home energy monitoring, inverter battery status monitor, solar panel tracker, or motor speed controller). Students must: <ul style="list-style-type: none"> Identify sensors/inputs, decision/control logic, and output action Write structured pseudocode in C using if-else / loops / functions Explain how this could be extended to an embedded C program in future (No actual coding — only algorithmic logic and control flow mapping) 	10
4	Awareness activity: Study how C is used in electrical/embedded systems (smart meter, relay ON/OFF, sensor reading). Present a simple simulation logic (no coding required)	10

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Programming with C	Byron S Gottfried	Mc Graw Hill Education, 4th Edition July 2018
2	The C Programming Language	Brian W. Kernighan and Dennis Ritchie	Pearson, 2nd Edition, January 2015
3	C The Complete Reference	Herbert Schildt	Mc Graw Hill Education, 4th Edition July 2017
4	Embedded C	Michael J. Pont	Pearson Education, 2nd Edition, 2008.

Reference			
Sl. No.	Title of Book	Author	Publication
1	Programming In Ansi C	E Balagurusamy	Mc Graw Hill, 8th Edition March 2019
2	Programming in C	Kamthane	Pearson, 3rd Edition January 2015

3	Let us C	Yashavant Kanetkar	Bpb publishers, 19th Edition December 2022
4	Computer Programming in C	V Rajaraman	PHI Learning Private Limited, 2nd July 2019
5	Programming in C for Embedded Systems	K.V.K.K. Prasad	Dreamtech Press, 1st Edition, 2013.

Web Resource	
1	https://onlinecourses.nptel.ac.in/noc20_cs91/preview
2	https://onlinecourses.swayam2.ac.in/imb25_mg71/preview
3	https://onlinecourses.nptel.ac.in/noc20_ee98/preview

DETAILED SYLLABUS (Self-learning if any to be marked)							
Module	Topic	Mode of Delivery	CO	Learning Domain			Hrs
				C	P	A	
1	Introduction to C - History, features, applications, C Fundamentals - Character Set, Constants (integer, float, character, string), Identifiers, Keywords, Rules for naming identifiers, Basic Data types - int, float, double, char, void, Variables - Declaration, initialization, scope	L	CO1	U	M	Rs	2
	Operators - Arithmetic, Relational, Logical operators, Assignment, Increment/Decrement, Conditional, Comma operators, bit-wise operators, Operator precedence and associativity	L	CO1	U	M	Rs	2
	Self-Study: Type casting and type conversion - implicit and explicit	S	CO1	U	M	Rs	3
	Expressions - Arithmetic, Relational, Logical expressions, Input and Output statements	L	CO1	U	M	Rs	2
	Self-Study: Advanced I/O functions - getchar(), putchar(), gets(), puts()	S	CO1	U	M	Rs	2
	Structure of a C program - Preprocessor, main function, statements, Selection statements - if statement with examples, if else, nested if, else-if ladder, switch case	L	CO1	U	M	Rs	2
	Self-Study: goto statement and its implications, labeled statements	S	CO1	U	M	Rs	3
	Iteration statements- while, do-while, for loop, break and continue statements	L	CO1	U	M	Rs	2
2	Introduction to Arrays - Need and advantages, Single dimensional arrays - Declaration, initialization, Accessing array elements, array bounds, Searching in arrays - Linear/Sequential search algorithm	L	CO2	U	M	Rs	2
	Self-Study: Binary search algorithm - concept and implementation	S	CO2	U	M	Rs	3
	Sorting in arrays - Bubble sort algorithm, Two-dimensional arrays - Declaration, initialization, Accessing 2D array elements - row-major order	L	CO2	U	M	Rs	2
	Self-Study: Selection sort and Insertion sort algorithms with programs, Symmetric matrix, Diagonal matrix, Sparse matrix operations	S	CO2	U	M	Rs	3
	Enumerated data type - enum keyword, usage, examples, Type Definition - typedef keyword, creating type aliases	L	CO2	A	M	Rs	2
	Strings - Introduction, string as character array, null terminator, String declaration, initialization methods, Reading strings - gets(), scanf(), fgets(), Displaying strings - puts(), printf()	L	CO2	U	M	Rs	2

	String library functions - strlen(), strcpy(), strcmp(), String library functions - strcat(), strrev(), strlwr(),strupr()	L	CO2	A	M	Rs	2
	Self-Study: String tokenization using strtok(), advanced string operations	S	CO2	U	M	Rs	4
3	Introduction to Functions - Need, advantages of modular programming, Function components - return type, function name, parameters, body, Function definition, Function declaration (prototype), Function call, return statement and return values	L	CO3	U	M	Rs	2
	Parameter passing - Call by value concept, Parameter passing - Call by reference using pointers, Recursion - Concept, base case, recursive case	L	CO3	U	M	Rs	2
	Self-Study: Inline functions, function overloading concepts in C, Tower of Hanoi, Binary search using recursion	S	CO3	U	M	Rs	2
	Passing arrays to functions - 1D arrays, 2 D arrays, Macros - #define directive, defining and calling macros, Macros vs Functions, parameterized macros	L	CO3	U	M	Rs	2
	Self-Study: Preprocessor directives - #include, #ifdef, #ifndef, #undef	S	CO3	U	M	Rs	3
	Command line arguments - argc, argv, usage, Structures - Introduction, need, definition, declaration, Structure variables, accessing members using dot operator, Array of structures with programs, Passing structure to functions - by value and by reference	L	CO3	U	M	Rs	2
	Self-Study: Nested structures, structure within structure	S	CO3	U	M	Rs	3
	Union, Storage classes, basics of pointers, basics of files	L	CO4	U	M	Rs	2
	Self-Study: File copying programs, basic pointer programs	S	CO4	A	M	Rs	2
4	Introduction to Embedded C — need and relevance in electrical systems	L	CO5	U	M	Rs	2
	Difference between Standard C and Embedded C	L	CO5	U	M	Rs	2
	Self- Study: Study the need and relevance of Embedded C in electrical and automation systems. Identify key differences between Standard C and Embedded C in terms of memory, hardware interaction, and compiler features.	S	CO5	U	M	Rs	2
	Role of C language in microcontroller-based control systems	L	CO5	U	M	Rs	1
	Self- Study: Explore the role of C language in microcontroller-based control systems, focusing on input/output ports, timers, and interrupts.	S	CO5	U	M	Rs	2
	Concept of real-time data acquisition — reading voltage/current values (simulation-based explanation)	L	CO5	U	M	Rs	1
	Introduction to data logging — storing electrical readings using C (file handling concept awareness)	L	CO5	U	M	Rs	2
	Self- Study: Study the concept of real-time data acquisition – how C can be used to read analog values (voltage/current) through sensors in simulation environments.	S	CO5	U	M	Rs	2
	Relation of C programming with SCADA / smart meter / automation systems (theory only)	L	CO5	U	M	Rs	2
	Learn about data logging and file handling concepts in C for storing measured values (CSV or text format).	S	CO5	U	M	Rs	2
	Case study: Smart energy meter / automatic street light / basic motor control (scenario discussion)	S	CO5	U	M	Rs	2

PRACTICAL SYLLABUS						
Topic	Objective	CO	Learning Domain			Hrs
			C	P	A	
Basic syntax and operators	Practice basic syntax, operators and user input handling	1	A	M	Rs	1
String operations and indexing	Familiarize string operations and indexing	2	A	M	Rs	1
Built-in libraries and formatting	Understand built-in libraries and formatting	2	U	M	Rs	2
Formulas and I/O operations	Apply formulas and I/O operations	1	A	M	Rs	1
Single and two-dimensional arrays	Apply single and two-dimensional array operations	2	A	P	Rs	2
Sorting and searching algorithms	Apply sorting and searching algorithms	2	A	P	Rs	2
String handling using built-in functions	Apply string handling using built-in functions	2	A	P	Rs	1
User-defined functions	Apply modular programming using user-defined functions	3	A	P	Rs	1
Recursion	Apply recursion in numerical problem solving	3	A	P	Rs	1
Structures	Apply structures for real-world data representation	3	A	P	Rs	1
Pointers	Implement pointer operations for dynamic data handling	4	A	P	Rs	1
Text file operations	Implement text file operations for data storage	4	A	P	Rs	1
Sensor reading simulation	Simulate basic sensor reading using Embedded C concept (theoretical simulation)	5	U	P	V	2
Device control simulation	Apply C logic for simple device control (LED / relay / motor – simulated)	5	A	P	V	2
File-based data logging	Demonstrate file-based data logging for electrical monitoring (simulated example)	5	A	P	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	C Fundamentals	-	√	-	-	-	-	10
2	Arrays and Strings in C	-	√	√	-	-	-	10
3	Advanced Concepts: Functions, Structures, Pointers and Files in C	-	√	√	-	-	-	10
4	Introduction to C in Embedded and Electrical Systems	-	√	√	-	-	-	10

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	15
2	Continuous Lab Evaluation	15
3	Learning Activity	5
4	Regularity	5
End Semester Examination - Lab		20
End Semester Examination - Theory		40
Total		100

MODEL QUESTION PAPER

Total Pages: 14

Register No.:	Name:
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SECOND SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR (2025 SCHEME)			
Course Code:	B250003/CN210D		
Course Name:	FOUNDATIONS OF C PROGRAMMING		
Max. Marks:	60	Duration:	2 hours 30 minutes
(For Electrical and Electronics Engineering)			

PART A			
(Answer any one full question from each module, each question carries 15 marks)			

No.	Question	CO	Marks												
MODULE I															
1	<p>A factory monitors furnace temperature continuously. The system reads temperature every hour and triggers alerts based on defined thresholds.</p> <p>a) Match the Following:</p> <table border="1" style="width: 100%;"> <thead> <tr> <th>Column A (Code Purpose)</th> <th>Column B (C Construct)</th> </tr> </thead> <tbody> <tr> <td>1. Check if temp is between 500-800°C</td> <td>A. while(temp > 1000)</td> </tr> <tr> <td>2. Repeat reading until temp < 1000°C</td> <td>B. temp >= 500 && temp <= 800</td> </tr> <tr> <td>3. Choose alert type based on temp range</td> <td>C. for(i=0; i<24; i++)</td> </tr> <tr> <td>4. Read 24 hourly temperatures</td> <td>D. switch(range)</td> </tr> <tr> <td></td> <td>E. if(temp>1200) printf("Overheat");</td> </tr> </tbody> </table>	Column A (Code Purpose)	Column B (C Construct)	1. Check if temp is between 500-800°C	A. while(temp > 1000)	2. Repeat reading until temp < 1000°C	B. temp >= 500 && temp <= 800	3. Choose alert type based on temp range	C. for(i=0; i<24; i++)	4. Read 24 hourly temperatures	D. switch(range)		E. if(temp>1200) printf("Overheat");	CO1	(2)
	Column A (Code Purpose)	Column B (C Construct)													
	1. Check if temp is between 500-800°C	A. while(temp > 1000)													
2. Repeat reading until temp < 1000°C	B. temp >= 500 && temp <= 800														
3. Choose alert type based on temp range	C. for(i=0; i<24; i++)														
4. Read 24 hourly temperatures	D. switch(range)														
	E. if(temp>1200) printf("Overheat");														
<p>b) Multiple Choice Questions (Choose the correct answer):</p> <p>i) What is the output? <pre>int temp = 750; printf("%d", temp > 800 ? 1 : temp < 500 ? -1 : 0);</pre> A. 1 B. -1 C. 0 D. Error</p> <p>ii) Which loop executes at least once even if condition is false initially? A. for loop B. while loop C. do-while loop D. nested loop</p> <p>iii) What will be the value of x? <pre>int temp = 5; temp = temp++ + ++temp;</pre> A. 11 B. 12 C. 13 D. Undefined behavior</p> <p>iv) Which is the correct way to read a float variable temp? A. scanf("%f", temp); B. scanf("%f", &temp); C. scanf("%d", &temp); D. read(temp);</p>	(4)														
<p>c) Fill in the Blanks & Find Output: <pre>int temp = 750, count = 0;</pre></p>	(3)														

	<pre>int a = 10, b = 20, c = 30; int result = a + b * c / 5 % 7 - a; printf("Result = %d\n", result);</pre>		
	<p>c) Fill in the Blanks:</p> <pre>// Calculate bill for 7 days and apply discount if total > 1000 int units, totalBill = 0; for(int day = 1; day ____ 7; day++) // Fill: <=, <, >= { scanf("%d", &units); if(units <= 50) totalBill += units * 3; ____ if(units <= 100) // Fill: else, else if, if totalBill += 50*3 + (units-50)*5; else totalBill += 50*3 + 50*5 + (units-100)*7; } if(totalBill ____ 1000) // Fill: >, <, == totalBill = totalBill * 0.9; // 10% discount printf("Final Bill: %d", ____); // Fill: variable name</pre>		(3)
	<p>d) Write a complete C program that:</p> <ul style="list-style-type: none"> • Reads meter readings for 5 customers • Calculates bill for each using rates: 0-100 units: ₹5/unit, above 100: ₹7/unit • Displays customer number and bill for each • Finds and displays the customer with the highest bill • Uses proper variable declarations and loop structures 		(4)
	<p>e) Multiple Choice Questions:</p> <p>i) Which statement is correct about switch-case?</p> <p>A. Can use float values in case B. break is mandatory in every case C. default case must be at the end D. case values need not be constants</p> <p>ii) What is the output?</p> <pre>int unit = 5; printf("%d %d %d", unit, ++unit, unit++);</pre> <p>A. 5 6 6 B. 7 6 5 C. Compiler dependent D. 5 6 7</p>		(2)
MODULE II			
3	<p>A solar farm tracks daily power output (kWh) of 5 panels over 7 days.</p> <p>Fill in the Blanks:</p> <p>a) <pre>int power[5] = {120, 135, 128, 142, 130}; // To access 3rd element: power[____] // Size of array in bytes: sizeof(power) = ____ (if int = 4 bytes) // Last element value: power[____] = ____ // Number of elements: sizeof(power)/sizeof(power[____]) = ____</pre></p>	CO2	(2)
	<p>b) Predict Output:</p> <pre>int power[3][3] = {{100, 110, 105}, {120, 125, 118}, {95, 100, 98}};</pre> <p>// Part 1</p>		(4)

	<pre>for(int i=0; i<3; i++) printf("%d ", power[i][i]); printf("\n"); // Part 2 int sum = 0; for(int i=0; i<3; i++) for(int j=0; j<3; j++) if(i == j) sum += power[i][j]; printf("Sum = %d\n", sum); // Part 3 printf("%d %d %d", power[0][2], power[2][0], power[1][1]);</pre>		
	<p>c) True or False (Correct if False)</p> <p>i) Array indexing in C starts from 1.</p> <p>ii) The code <code>int power[5] = {1, 2};</code> initializes first two elements to 1 and 2, rest to 0.</p> <p>iii) Arrays can be returned from a function in C directly.</p>		(3)
	<p>d) Complete the Code & Debug:</p> <pre>// Find panel with minimum average output int output[5][7]; // 5 panels, 7 days float avg[5]; // Input data (assume already done) // Calculate average for each panel for(int i=0; i<5; i++) { int sum = __; for(int j=0; j<7; j++) sum = sum + _____; // Fill avg[i] = _____ / 7.0; // Fill } // Find minimum average panel int minPanel = 0; for(int i=1; i<5; i++) if(avg[i] ___ avg[minPanel]) // Fill: <, >, == minPanel = __; // Fill printf("Panel %d has minimum average: %.2f", minPanel+1, avg[minPanel]);</pre>		(4)
	<p>e) Multiple Choice Question:</p> <p>i) What does <code>power[i]</code> represent if 'power' is a 2D array <code>int power[3][4]</code>?</p> <p>A. An integer value</p> <p>B. Address of first element of ith row</p> <p>C. An entire row</p> <p>D. Compilation error</p> <p>ii) For <code>int power[] = {10,20,30,40}</code>, what is <code>*(power+2)</code>?</p> <p>A. 10</p> <p>B. 20</p> <p>C. 30</p> <p>D. Address of <code>power[2]</code></p>		(2)
OR			
4	<p>The RTO office manages vehicle registration numbers and owner names.</p> <p>a) Match the Following:</p>	CO2	(2)

Column A (String Function)	Column B (Return Value)
1. strlen("HELLO")	A. 0
2. strcmp("ABC", "ABC")	B. 5
3. strcpy(s1, "TEST") returns	C. Address of s1
4. strcat("HI", "BYE") gives length	D. 5

b) Find Output (Show step-by-step)

```
char reg1[20] = "KL07AB1234";
char reg2[20] = "KL07";
char reg3[20];
printf("%d\n", strlen(reg1)); // Output 1
strcat(reg2, "XY");
printf("%s\n", reg2); // Output 2
strcpy(reg3, reg1);
printf("%d\n", strcmp(reg3, reg1)); // Output 3
printf("%c %c\n", reg1[0], reg1[9]); // Output 4
```

(4)

c) Fill in the Blanks:

```
char name[30] = "Rajesh Kumar";
char copy[30];
// Copy name to copy
_____(copy, name); // Fill function
// Convert to uppercase (assume function available)
_____(name); // Fill function:strupr
// Find length
int len = _____(name); // Fill function
// Compare with "RAJESH KUMAR"
if(strcmp(name, _____) == 0) // Fill string
printf("Match");
// Extract first 6 characters "RAJESH" into new array
char first[7];
for(int i=0; i<6; i++)
first[i] = name[____]; // Fill
first[6] = ____; // Fill: null terminator
```

(3)

c) Debug the Code

```
// Search registration and sort owners alphabetically
#include <stdio.h>
#include<string.h>
int main()
```

(4)

```

{
char regs[3][15] = {"KL07AB1234", "KL09CD5678",
"KL12EF9012"};

char owners[3][30] = {"Rajesh", "Priya", "Amit"};

char search = "KL09CD5678"; // Error 1

// Search
for(int i=0; i<3; i++)
{
if(strcmp(regs[i], search) = 0) // Error 2
{
printf("Owner: %s", owners[i]);
}
}

// Bubble Sort owners
for(int i=0; i<2; i++)
{
for(int j=0; j<2-i; j++)
{
if(strcmp(owners[j], owners[j+1]) > 0) // Error 3
{
char temp[30];
strcpy(temp, owners[j]);
strcpy(owners[j], owners[j+1]);
strcpy(owners[j+1], temp);
}
}
}

printf("Sorted: %s %s %s", owners[0] owners[1] owners[2]);
// Error 4
}

```

e) True or False:

- i) String is a built-in data type in C.
- ii) strcmp() returns 0 when two strings are equal.

(2)

MODULE III

An electricity board maintains customer records and generates monthly bills.

a) Match the Following

Column A (Code)	Column B (Concept)
1. void func(int *p)	A. Function returning pointer

CO3
CO4

(2)

2. int* func(int a)	B. Pass by reference	
3. int func(int a, int b)	C. Recursion	(4)
4. int fact(int n) {return n*fact(n-1); }	D. Pass by value	
<p>b) Multiple Choice & Output:</p> <p>i) void swap(int a, int b)</p> <pre> { int t = a; a = b; b = t; } int main() { int x=5, y=10; swap(x, y); printf("%d %d", x, y); } </pre> <p>A. 10 5 B. 5 10 C. 5 5 D. 10 10</p> <p>ii) Which is correct to declare a structure pointer?</p> <p>A. struct Student *ptr; B. struct *Student ptr; C. *struct Student ptr; D. Student *ptr;</p> <p>iii) Find the output</p> <pre> int add(int a, int b) { return a + b; } int main() { int result; result = add(10, 20) + add(5, 15); printf("%d", result); return 0; } </pre>		
<p>c) Fill in the Blanks:</p> <pre> struct Customer { int id; ____ name[30]; // Fill: data type int units; float bill; } </pre>		(3)

```

};

float calculateBill(____ c) // Fill: pass by value or reference
{
    if(c.units <= 100)
        return c.units * 3.0;
    else
        return 100*3.0 + (c.units - 100) * ____; // Fill: rate 5.0
}

int main()
{
    struct Customer c1 = {101, "Ram", 150, 0};
    c1.bill = calculateBill(____); // Fill: c1 or &c1

    printf("Bill: %.2f", c1.____); // Fill: member name
    return 0;
}

```

d) Debug and Complete:

```

// Calculate factorial using recursion and store results in file
#include <stdio.h>
int factorial(int n)
{
    if(n = 0) // Error 1
        return 1;
    else
        return n * factorial(n-1) // Error 2
}
struct Result
{
    int number;
    int fact;
} // Error 3
int main()
{
    FILE *fp;
    struct Result r;
    fp = fopen("results.txt", "w");
    for(int i=1; i<=5; i++)
    {
        r.number = i;
        r.fact = factorial(i);
        fprintf(fp, "%d! = %d\n", r.number, r->fact); // Error 4
    }
    fclose(fp);
}

```

(4)

	<pre>return 0; }</pre>														
	<p>e) True or False:</p> <p>i) A function can return multiple values directly using a return statement.</p> <p>ii) sizeof(struct) gives the exact sum of sizes of all its members.</p>		(2)												
OR															
6	<p>Smart meters log hourly power consumption to a file for analysis.</p> <p>a) Fill in the Blanks:</p> <pre>FILE *fp; fp = fopen("meter.txt", ____); // Fill: mode for reading if(fp ____ NULL) // Fill: ==, != { printf("Error opening file\n"); return 1; } int units; while(fscanf(fp, "%d", &units) ____ EOF) // Fill: !=, == { printf("%d ", units); } ____(fp); // Fill: function to close file</pre>		(2)												
	<p>b) Multiple Choice question:</p> <p>i) What does ptr++ do for int *ptr?</p> <p>A) Increments value by 1 B) Moves pointer to next integer (4 bytes ahead) C) Increments address by 1 byte D) Syntax error</p> <p>ii) Which mode opens a file for appending?</p> <p>A) "r" B) "w" C) "a" D) "r+"</p> <p>iii) Find the output</p> <pre>int arr[4] = {10, 20, 30, 40}; int *ptr = arr; printf("%d ", *ptr); ptr = ptr + 2; printf("%d ", *ptr); printf("%d ", *(arr+3)); printf("%d", ptr - arr);</pre>	CO3 CO4	(4)												
	<p>c) Match the following:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Column A (Code)</th> <th style="width: 50%;">Column B (Purpose)</th> </tr> </thead> <tbody> <tr> <td>1. fprintf(fp, "%d", x)</td> <td>A. Read from file</td> </tr> <tr> <td>2. fscanf(fp, "%d", &x)</td> <td>B. Close file</td> </tr> <tr> <td>3. fclose(fp)</td> <td>C. Write to file</td> </tr> <tr> <td>4. feof(fp)</td> <td>D. Check end of file</td> </tr> <tr> <td>5. rewind(fp)</td> <td>E. Reset file pointer to beginning</td> </tr> </tbody> </table>	Column A (Code)	Column B (Purpose)	1. fprintf(fp, "%d", x)	A. Read from file	2. fscanf(fp, "%d", &x)	B. Close file	3. fclose(fp)	C. Write to file	4. feof(fp)	D. Check end of file	5. rewind(fp)	E. Reset file pointer to beginning		(3)
	Column A (Code)	Column B (Purpose)													
	1. fprintf(fp, "%d", x)	A. Read from file													
2. fscanf(fp, "%d", &x)	B. Close file														
3. fclose(fp)	C. Write to file														
4. feof(fp)	D. Check end of file														
5. rewind(fp)	E. Reset file pointer to beginning														
<p>d) Debug the code</p> <pre>// Read meter data from file and find maximum consumption #include <stdio.h> struct Meter { int id; float consumption; };</pre>		(4)													

	<pre>int main() { FILE *fp; struct Meter m, maxMeter; float max = 0; fp = fopen("meters.txt", "r"); while(fscanf(fp, "%d %f", &m.id, &m.consumption) = EOF) // Error 1 { if(m.consumption > max) { max = m.consumption; maxMeter = m; // Error 2 } } printf("Max consumption: %d %.2f", maxMeter.id, maxMeter->consumption); // Error 3 return 0; // Error 4 }</pre>		
	<p>e) True or False (Justify):</p> <p>i) A pointer variable contains the address of another variable.</p> <p>ii) Files opened in "w" mode preserve existing data.</p>		(2)
MODULE IV			
7	<p>A microcontroller-based system controls 4 street lights based on LDR (light sensor) readings.</p> <p>a) Multiple choice:</p> <p>i) What is the main difference between Standard C and Embedded C?</p> <p>A) Syntax is different B) Embedded C has direct hardware access C) Embedded C doesn't support functions D) No difference</p> <p>ii) Which keyword prevents the compiler from optimizing a variable (used for hardware registers)?</p> <p>A) const B) static C) volatile D) register</p>		(2)
	<p>b) Find the output</p> <pre>#define LIGHT_ON 1 #define LIGHT_OFF 0 #define THRESHOLD 400 int main() { int ldr[4] = {350, 420, 380, 450}; int lights[4]; int totalON = 0; for(int i=0; i<4; i++) { if(ldr[i] < THRESHOLD) { lights[i] = LIGHT_ON; totalON++; } else lights[i] = LIGHT_OFF; } }</pre>	CO5	(4)

```
printf("Lights ON: %d\n", totalON);
printf("Light status: ");
for(int i=0; i<4; i++)
    printf("%d ", lights[i]);

// Power calculation: Each light = 40W
float power = totalON * 40;
printf("\nPower: %.2f W", power);
return 0;
}
```

c) Fill in the blanks:

```
// Control lights based on time AND LDR
#define THRESHOLD 500
int hour = 20; // 8 PM
int ldrValue = 450;
int lightStatus;

// Turn ON if: (hour >= 18 OR hour <= 6) AND ldrValue < THRESHOLD
if((hour ____ 18 ____ hour ____ 6) ____ ldrValue ____ THRESHOLD)
// Fill: >=, | |, <=, &&,

{
    lightStatus = ____; // Fill: 1 or 0
    printf("Lights: ON\n");
}
else
{
    lightStatus = ____; // Fill: 0 or 1
    printf("Lights: OFF\n");
}
```

(3)

d) Debug and Write Code:

```
// Log light status every hour to file
#include <stdio.h>
struct LightLog
{
    int hour;
    int ldrValue;
    int status;
} // Error 1

void logData(struct LightLog log)
{
    FILE *fp;
    fp = fopen("lightlog.txt", "a");

    if(fp = NULL) // Error 2
        return;

    fprintf(fp, "Hour:%d LDR:%d Status:%d\n",
        log.hour, log.ldrValue, log->status); // Error 3

    fclose(fp);
}

int main()
{
    struct LightLog log = {20, 350, 1};
    logData(log);

    // Write code to read back and display all logs
    _____ // Complete this
```

(4)

	<pre> return 0; } </pre>												
	e) Match the Following:												
	<table border="1"> <thead> <tr> <th>Column A (Concept)</th> <th>Column B (Description)</th> </tr> </thead> <tbody> <tr> <td>1. ADC</td> <td>A. Set/Clear specific bits</td> </tr> <tr> <td>2. Bitwise operations</td> <td>B. Convert analog to digital</td> </tr> <tr> <td>3. ISR</td> <td>C. Saving power</td> </tr> <tr> <td>4. Sleep mode</td> <td>D. Interrupt Service Routine</td> </tr> </tbody> </table>	Column A (Concept)	Column B (Description)	1. ADC	A. Set/Clear specific bits	2. Bitwise operations	B. Convert analog to digital	3. ISR	C. Saving power	4. Sleep mode	D. Interrupt Service Routine	(2)	
Column A (Concept)	Column B (Description)												
1. ADC	A. Set/Clear specific bits												
2. Bitwise operations	B. Convert analog to digital												
3. ISR	C. Saving power												
4. Sleep mode	D. Interrupt Service Routine												
OR													
	A Battery Management System for Electric Vehicle monitors battery voltage, current, and temperature to ensure safe operation.												
	a) True or False (Justify if False):												
	<ul style="list-style-type: none"> i) In embedded systems, memory optimization is not important because modern controllers have unlimited memory. ii) Interrupt-driven approach is better than polling for real-time systems. 	(2)											
	b) i) Find the output												
	<pre> #define MIN_VOLTAGE 48.0 #define MAX_VOLTAGE 54.0 float voltage = 52.5; int status; if(voltage >= MIN_VOLTAGE && voltage <= MAX_VOLTAGE) status = 1; // Safe else if(voltage < MIN_VOLTAGE) status = -1; // Low else status = 2; // High printf("Status: %d\n", status); // Calculate SOC percentage float soc = ((voltage - MIN_VOLTAGE) / (MAX_VOLTAGE - MIN_VOLTAGE)) * 100; printf("SOC: %.1f%%", soc); </pre>	(4)											
8	<ul style="list-style-type: none"> ii) What does 0x0F & 0xF0 equal to? <ul style="list-style-type: none"> A) 0xFF B) 0x00 C) 0x0F D) 0xF0 iii) To check if bit 5 is set in variable x, which is correct? <ul style="list-style-type: none"> A) x & 5 B) x & (1 << 5) C) x 5 D) x << 5 		CO5										
	c) Fill in the blanks:												
	<pre> // Calculate remaining range float voltage = 50.0; float minVoltage = 48.0, maxVoltage = 54.0; // SOC = ((current - min) / (max - min)) * 100 float soc = ((_____ - _____) / (_____ - _____)) * 100; // If battery capacity = 50 kWh, efficiency = 5 km/kWh float capacity = 50.0; float efficiency = 5.0; </pre>	(3)											

```
// Remaining capacity = (SOC/100) * total capacity
float remainingCap = (soc / _____) * capacity;

// Range = remaining capacity * efficiency
float range = _____ * _____;
printf("Range: %.1f km", range);
```

d) Debug the code:

```
// Monitor battery and trigger alerts
#include <stdio.h>
struct Battery
{
    float voltage;
    float current;
    int temp;
};

void checkStatus(struct Battery b) // Error 1 (should be pointer)
{
    if(b.voltage < 48.0) // Error 2 (should use ->)
        printf("Low voltage alert!\n");

    if(b->current > 80.0)
        printf("Overcurrent alert!\n");

    if(b->temp > 60)
        printf("Overheat alert!\n") // Error 3
}

int main()
{
    struct Battery batt = {47.5, 85.0, 65};

    checkStatus(batt); // Error 4 (should pass address)

    // Write code to save battery data to file
    _____
    _____

    return 0;
}
```

(4)

e) Match the following:

Column A (Application)	Column B (Programming Requirement)
1. Read sensor every 1ms	A. File handling
2. Store daily logs	B. Interrupt handling
3. Turn LED ON/OFF	C. Bit manipulation
4. Control motor speed	D. PWM (ADC/DAC)

(2)

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

Course Code	Course Name	Course Category
B250003/EE200E	CIRCUITS AND NETWORKS	PC
Pre-requisite if any		
Course Code	Course Name	
B250906/CN100D	Introduction to Electrical and Electronics Engineering	
B250802/MA100A	Mathematics for Electrical Science -1	

COURSE OBJECTIVES	
1	To analyse electrical circuits in steady-state and dynamic conditions with DC and sinusoidal excitations by applying Kirchhoff's laws and Network theorems
2	To describe the two-port networks in terms of various parameters

COMPETENCY STATEMENT (CC)	
CC1	Apply the knowledge of linear algebra, Complex numbers, Transforms, Calculus, probability, statistics, and numerical techniques to solve electrical engineering problems
CC2	Design, analyse, and troubleshoot complex electrical circuits using fundamental principles like Ohm's Law, Kirchhoff's Laws, and network theorems.
CC3	Capability to analyze both AC and DC circuits, including steady-state and transient behaviour.

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)
CO 1	Apply circuit theorems to solve complex DC and AC electric networks	CC2	A		
CO 2	Solve series /parallel resonant circuits	CC2	A		
CO 3	Analyse the steady-state behaviour of coupled circuits with sinusoidal excitation	CC2	A		
CO 4	Analyse dynamic DC and AC circuits and develop the complete response to excitations by transforming from time domain to S-domain.	CC1, CC3	A		
CO 5	Develop the representation of two-port networks using network parameters and analyse	CC2	A		
CO 6	Analyse three-phase networks in Y and Δ configurations	CC2	A		

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			1	1					1	3		2
2	3	3									1	3		2
3	3	3			1	1					1	3		2
4	3	3			1	1					1	3		2
5	3	3									1	3		2
6	3	3									1	3		2

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

TEACHING AND ASSESSMENT SCHEME										
Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme			
L	T	J	P	S			Theory		Total	
					C	CIA	ESE			
3	1	0	0	4	4	110	40	60	100	
<p><i>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</i></p>										

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Circuit analysis using Mesh and Nodal analysis	Dependent Sources-Classification. Mesh analysis and nodal analysis (AC&DC), Super mesh, and Super node (DC Analysis only)	4
	Circuit analysis using Network Theorems	Superposition Theorem, Thevenin's and Norton's Theorem [DC excitation with independent and dependent sources], Maximum power transfer theorem [DC and AC excitation with independent and dependent sources (DC)], Reciprocity Theorem [Application to the analysis of DC Circuits].	10
2	Resonance in Series and Parallel RLC circuits	Series RLC circuit: Series resonance, Resonant frequency, Variations of impedance with frequency, Bandwidth, Quality factor. RLC Parallel circuit: Parallel resonance, Resonant frequency, Variations of impedance with frequency	4
	Coupled circuit	Dot convention, fixing of dots, Coefficient of coupling, conductively coupled equivalent circuit, Sinusoidal steady state analysis of coupled circuits.	5
3	Transient analysis of first order circuits with DC excitation	Transient response of series and parallel RL and RC circuits with excitation and initial conditions, Natural response and forced response, Time constant	4
	Transient analysis of Second order circuits with DC excitation	Second order systems, Transient response of series RLC circuit with DC excitation and initial conditions. Overdamped, underdamped, critically damped and undamped.	3
	Transient analysis of circuits with sinusoidal excitation	Transient response of simple series and parallel RL and RC circuits with sinusoidal excitation and zero initial conditions (Derivation not required)	2
	Transient analysis with transformed circuits	Transformed circuits in s-domain, Analysis using mesh analysis and nodal analysis	4
4	Two port parameters	Relationship of Two Port variables, The open circuit impedance parameter(Z), Short Circuit admittance parameter(Y), Transmission Parameter (ABCD), Hybrid Parameter(h). Conditions for symmetry and reciprocity, Relationship between parameter sets, Interconnection of two port networks (Series, Parallel and Cascade). Z-T transformation, Y-pi Transformation.	8
	Analysis of three Phase Circuits	Three phase systems, Steady state analysis of 3-wire unbalanced delta connected circuit. Steady state analysis of 3-phase 4-wire and 3-wire-unbalanced star connected circuit. Neutral shift, Power in 3-phase circuits. Complex power - active, reactive and apparent power in unbalanced load	6

SELF-LEARNING / TEAM WORK		
Sl. No	Self-learning / Team Work Description	Hrs
1	Study the practical applications of dependent sources	2
2	Solve problems on Mesh and Nodal Analysis	8
3	Apply network theorems to solve electric circuits	8
4	Study the resonance in practical LC parallel circuits	5

5	Solve problems in coupled circuits	5
6	Demonstrate transients in RL series circuit in Laboratory/ Simulation	10
7	Apply Laplace transform method to solve 10 problems in transient analysis	10
8	Identify the applications of two port networks in engineering applications	4
9	Solve problems in Three phase system analysis	8

SUGGESTED LEARNING RESOURCES

Sl. No	Title of Book	Author	Publication
Text Book			
1	Engineering Circuit Analysis	Hayt W H, Kemmerly J E, and Durbin S M	Tata McGraw-Hill
2	Circuits and Networks, Analysis and Synthesis	A Sudhakar, Shyammohan S Palli	McGraw Hill Education
3	Network Analysis and Synthesis	Ravish R Singh	Tata McGraw-Hill Education
Reference			
1	Network Analysis	Van Valkenburg	Pearson
2	Electric Circuits & Networks	K S Suresh Kumar	Pearson
3	Electric Circuits	Mahmood Nahvi, Joseph A Edminister	McGraw Hill Education
Web Resource			
1	https://www.youtube.com/watch?v=7Nh7ISeqn6E&list=PLbRMhDVUMngfNnABo5mre45ZbHqJE2sUn&index=1 , Network Analysis, NPTEL IIT Kharagpur		
2	https://www.youtube.com/watch?v=UJXeWzTKgNw Parallel RLC Circuit - Phase Angles - Impedance - Resonance, Lectures by Walter Lewin		

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

Module	Title	Major Topic & Sub Topic	Mode of Delivery	CO	Learning Domain Level			Teaching Hours	
					C	P	A		
1	Circuit analysis using Mesh and Nodal analysis	Introduction to Dependent Sources, Classification of dependent Sources. Mesh analysis with dependent sources, Nodal analysis with dependent sources	L, S	CO1	A			2	
		Mesh and Nodal Analysis (AC)	L, T		A			1	
		Super mesh	L, T		A			1	
		Super node	L, T		A			1	
	Circuit analysis using Network Theorems	Superposition Theorem [DC excitation with independent sources]	L, T		CO1	A			1
		Superposition Theorem, [DC excitation with dependent sources]	L, T			A			1
		Source Transformation, Thevenin's and Norton's Theorem [DC excitation with independent sources]	L, T			A			1
		Thevenin's and Norton's Theorem [DC excitation with dependent sources]	L, T			A			1
		Numerical problems	T			A			1
		Maximum Power transfer theorem, Statement proof for AC and DC circuits	L, T			A			1
Maximum power transfer theorem [DC excitation with independent sources]	L, T	A			1				

		Maximum power transfer theorem [DC excitation with independent sources]	L, T		A			1
		Maximum power transfer theorem [AC excitation with independent sources]	L, T		A			1
		Reciprocity Theorem [Application to the analysis of DC Circuits].	L, T		A			1
2	Resonance in Series and Parallel RLC Circuits	Series RLC circuit: Series resonance, Resonant frequency,	L	CO2	U			1
		Variations of impedance with frequency, Bandwidth, Quality factor (Derivation)	L		U			1
		Numerical problems on Series Resonance	T		A			1
		RLC Parallel circuit: Parallel resonance, Resonant frequency, Variations of impedance with frequency	L, T		U			2
	Coupled Circuits	Inductive coupling, fixing of dots in coupled circuits, Dot convention, Coefficient of coupling.	L	CO3	A			2
		Conductively coupled equivalent circuit	L, T		A			1
		Sinusoidal steady state analysis of coupled circuits.	L, T		A			2
3	Transient analysis of first order circuits with DC excitation	Introduction to Transient analysis, Natural response and forced response. Transient response of series RL Circuit (Derivation), Time constant	L	CO4	A			2
		Transient response of series RC Circuit (Derivation), Time constant.	L, T		A			1
		Numerical problems on series RL and RC circuits with DC excitation and initial conditions	T		A			1
		Numerical problems on parallel RL and RC circuits with DC excitation and initial conditions	T		A			1
	Transient analysis of Second order circuits with DC excitation	Second order systems, Transient response of series RLC circuit with DC excitation Overdamped, underdamped, critically damped and undamped. (Derive conditions for different cases of damping)	L	CO4	A			2
		Numerical problems on RLC series circuits with DC excitation and initial conditions.	T		A			1
	Transient analysis of circuits with sinusoidal excitation	Transient response of simple series RL and RC circuits with sinusoidal excitation and zero initial conditions (Derivation not required)	L, T	CO4	A			1
		Transient response of simple parallel RL and RC circuits with sinusoidal excitation and zero initial conditions (Derivation not required)	L, T		A			1
	Transient analysis with	Transformed circuits in s-domain (L and C) with and without initial conditions	L		U			1

	transformed circuits	Analysis of transformed circuits using mesh analysis and nodal analysis (with initial conditions)	L, T		A			3
4	Two port parameters	Relationship of Two Port variables, The open circuit impedance parameter (Z)	L, T	CO5	A			1
		Short Circuit admittance parameter (Y)	L, T		A			1
		Transmission Parameter (ABCD), Hybrid Parameter (h)	L, T		A			1
		Conditions for symmetry and reciprocity	L, T		A			1
		Relationship between parameter sets, Interconnection of two port networks (Series, Parallel and Cascade)	L		U			1
		Z to T Network transformation, Y to pi network Transformation.	L, T		A			1
	Analysis of three Phase Circuits	Introduction to three phase systems. Phase sequence, Relation between line and phase parameters in star and delta. Power in a three-phase system with balanced load. (Review only)	L	CO6	U			1
		Steady state analysis of 3-wire unbalanced delta connected circuit.	L, T		A			1
		Steady state analysis of 3-phase 4-wire unbalanced star connected circuit.	L, T		A			1
		Steady state analysis of 3-phase 4-wire and 3-wire-unbalanced star connected circuit. Neutral shift, Power in 3-phase circuits. Complex power - active, reactive and apparent power in unbalanced load	L, T		A			1

TABLE OF SPECIFICATIONS (ToS) FOR QUESTION PAPER DESIGN

Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	U	A	An	E	C	
1	Network Theorems	15		✓	✓				15
2	Resonance and coupled circuits	10		✓	✓				15
3	Transient Analysis	14		✓	✓				15
4	Two port networks and Three phase systems	11		✓	✓				15

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

ASSESSMENT PATTERN

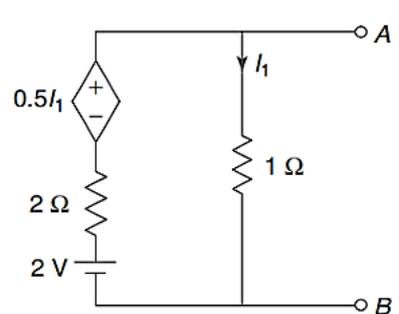
ASSESSMENT	ACTIVITY	MARKS DISTRIBUTION
CIA	LEARNING ACTIVITIES	10
	INTERNAL EXAMINATIONS	25
	REGULARITY	5
ESE	Theory	60
Total		100

MODEL QUESTION PAPER

Total Pages: 6	
Register No.:	Name:

SECOND SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR (2025 SCHEME)			
Course Code:	B250003/EE200E		
Course Name:	CIRCUITS AND NETWORKS		
Max. Marks	60	Duration:	2 hours 30 minutes

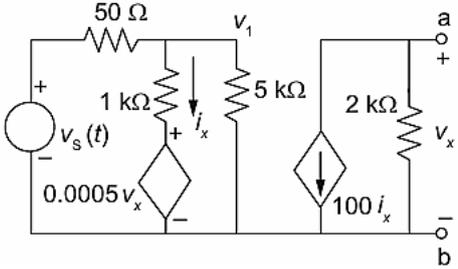
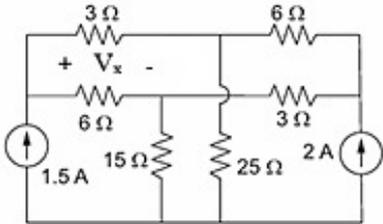
PART - A
(Answer all questions. Each question carries 3 marks)

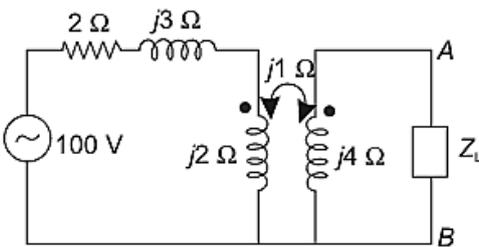
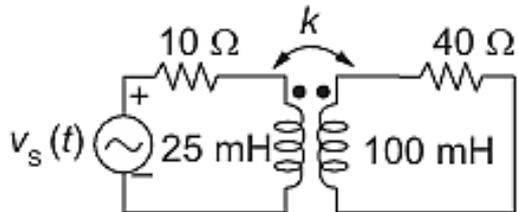
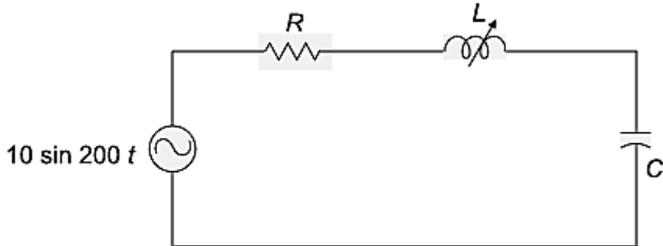
No.	Question	CO	Marks
1	When analyzing the stability of a regional power grid, we often need to know how sensitive one part of the network is to disturbances in another. If a test voltage source V_{test} is injected at Substation A, causing a current I_{sense} to flow into a fault monitoring sensor at Substation B, what can an engineer immediately deduce about the current I_A that would flow into a sensor at Substation A if the same test voltage V_{test} was instead injected at Substation B? Substantiate your answer with a suitable theorem.	CO1	(3)
2	Convert the network given below to an equivalent network with a current source in parallel with a resistance. 	CO1	(3)
3	A high-performance drone motor system has to be designed. The motor itself is the load resistance R_L . The drone's battery pack and its internal resistance are modelled as a voltage source in series with a resistance. The open circuit voltage measured across the load is 60V and the equivalent resistance of the system is 15Ω (excluding the load resistance R_L) a) Calculate the value of motor resistance that must be selected for maximum power transfer from battery source to the load? b) Determine the maximum power that the motor will consume? c) Calculate the current drawn from the battery when maximum power is transferred from the source.	CO2	(3)
4	Explain, with the aid of a simple diagram, how the dot rule is used to determine the sign of the induced voltage in the secondary coil when the current in the primary coil is known.	CO3	(3)
5	Derive the s-domain equivalent circuit for an inductor (L) carrying a non-zero initial current $i(0^-) = I_0$. Sketch the series voltage source model.	CO4	(3)
6	A massive 100mH inductor is used to limit fault currents in a power grid. The reactor carries a 5A steady-state current $i(0^-)$ just before a fault occurs (at $t=0$). An Electrical Engineer must study the transient behaviour of the entire system during the fault. i) Derive the s-domain equivalent circuit for an inductor (L) with a non-zero initial current $i(0^-)$. ii) Sketch and explain the series voltage source model.	CO4	(3)
7	A maintenance technician is called to a large commercial kitchen that is supplied by a three-phase, four-wire Star-connected system. The system is designed to power heavy loads like industrial ovens (Phase R), refrigeration units (Phase Y), and deep fryers (Phase B). Suddenly, one of the massive deep fryer elements (Phase B load) fails completely, effectively disconnecting that load. This creates a	CO6	(3)

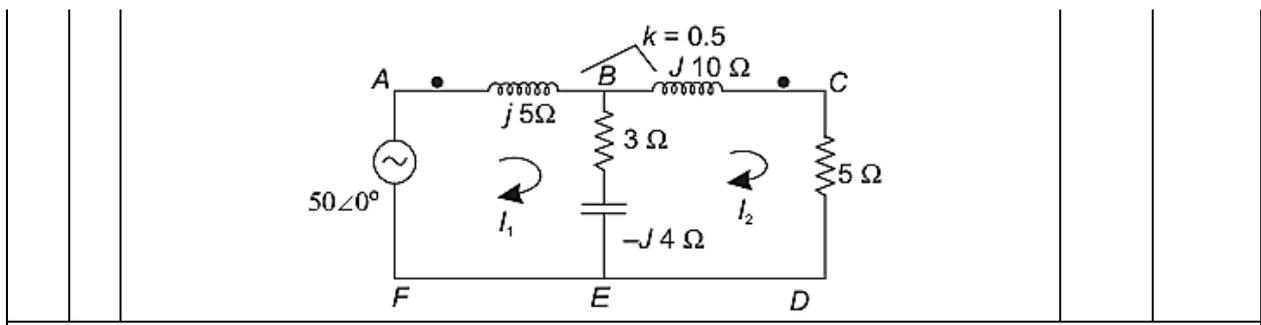
	severe unbalanced load condition. The technician finds that the lights connected to Phase R are flickering and running dangerously bright (overvoltage), while the ovens on Phase Y are running cold (undervoltage). i) Identify the cause for the above phenomenon ii) Explain how the sudden loss of one load in the kitchen causes this dangerous voltage imbalance across the remaining working phases?		
8	A factory automation technician is troubleshooting a control system where a main Programmable Logic Controller (PLC) needs to interface with a peripheral device. This interfacing circuit is passive and is modeled as a two-port network defined by its Hybrid parameters. The technician is interested to understand if the interface can be installed in reverse. For this two-port network, derive the specific mathematical condition involving the h-parameters that must be satisfied for the network to be (a) Reciprocal (b) Symmetrical.	CO5	(3)

PART - B

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

No.	Question	CO	Marks
MODULE I			
5	<p>A low-frequency signal model for a RC-coupled Common Emitter Amplifier is shown below.</p> <p>i) Find the Thevenin's equivalent of the circuit with respect to the terminals 'a' and 'b'</p> <p>ii) Find the ratio of $V_x(t)$ to $V_s(t)$ when a resistor of $2\text{ k}\Omega$ is connected across the output</p> 	CO1	(4)
5	<p>A biomedical technician is calibrating a sensor interface circuit that uses two independent power sources: a 1.5A and a 2A constant current source as shown in Figure below. The technician needs to determine the total voltage V_x across the 3Ω resistor. However, because the circuit has two independent sources, the technician must analyze the contribution of each source separately. Use a suitable theorem to find the total voltage V_x across the 3Ω resistor. (Hint: Apply Star delta transformation)</p> 	CO1	(5)
OR			
6	A coupled circuit with output terminal A-B is shown in Figure below. Obtain its equivalent circuit and find the value of Z_L for maximum power transfer.	CO1	(9)

				
MODULE II				
7	a	<p>A radio frequency engineer is calibrating the intermediate frequency stage of a specialized satellite communication receiver. This stage uses a series RLC circuit to filter and amplify a specific signal frequency with a bandwidth of 500 rad/s. From system testing, the engineer obtained the following data:</p> <p>The circuit is excited by a high-frequency voltage $v(t) = 50 \sin \omega t$. At the resonant frequency, the maximum voltage across the capacitor is measured to be 400V. The circuit's impedance at resonance is 100Ω. From the given data, compute i) the resonant frequency ii) the upper and lower limits of the bandwidth iii) values of L and C of the circuit</p>	CO2	(5)
	b	<p>The applied voltage $v_s(t) = 100\sqrt{2} \cos 1000t$ in the circuit shown in Figure below. Find the primary (the side with source connection) and the secondary (the side with no source connection) currents and the average power delivered to the resistors for (i) $k=0$, (ii) $k=0.5$.</p> <div style="text-align: center;">  </div>	CO3	(4)
OR				
8	a	<p>A radio frequency systems engineer working on a software-defined radio receiver designed to automatically tune to different frequencies by electronically adjusting its inductance. The receiver uses a series RLC circuit for filtering.</p> <p>The engineer performs two tests at a fixed frequency of ω:</p> <p>Test 1: With the inductor set to $L_1 = 0.5$ H the circuit is at resonance, and the current I is at its maximum value I_{max}</p> <p>Test 2: With the inductor adjusted to $L_2 = 0.2$ H, the current drops to 0.707 times its maximum value</p> <p>Using the results from these two tests, find the following characteristics of the series RLC circuit:</p> <ol style="list-style-type: none"> i) The Quality Factor of the circuit at $\omega=200$rad/s. ii) The values of the Circuit Constants (R and C) 	CO2	(5)
	b	<div style="text-align: center;">  </div> <p>For the magnetically coupled circuit shown in Figure below, find the voltage across 5Ω resistor</p>	CO3	(4)



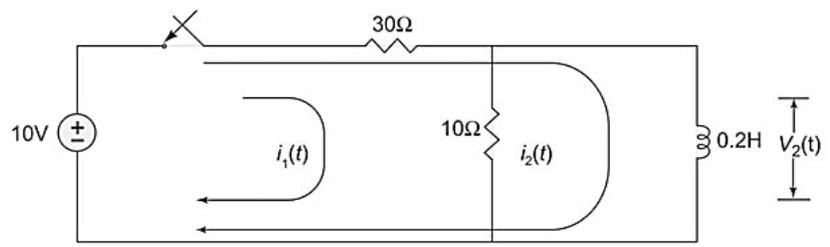
MODULE III

a A power systems researcher is analyzing a crucial protection circuit designed to suppress electrical noise and voltage surges (transients) on a sensitive data line. This circuit uses a RLC network. The system is characterized by $R=10\ \Omega$, $L=10\text{mH}$ and $C=1000\mu\text{F}$. Initially, a residual voltage of 10V exists across the capacitor ($V_c(0^-)$) from a previous event. At time $t=0$, the circuit is subjected to a sudden 10V step input $10u(t)$ representing a large, abrupt surge. In order to understand how the protection circuit responds to the voltage surge, deduce the complete mathematical expression for the voltage across the capacitor, $V_c(t)$, for all time $t \geq 0$.

CO4 (5)

g The switch in the circuit shown in figure below is closed at $t=0$. Find $V_2(t)$ for all $t \geq 0$ by time domain method. Assume zero initial current in the inductance.

b



CO4 (4)

OR

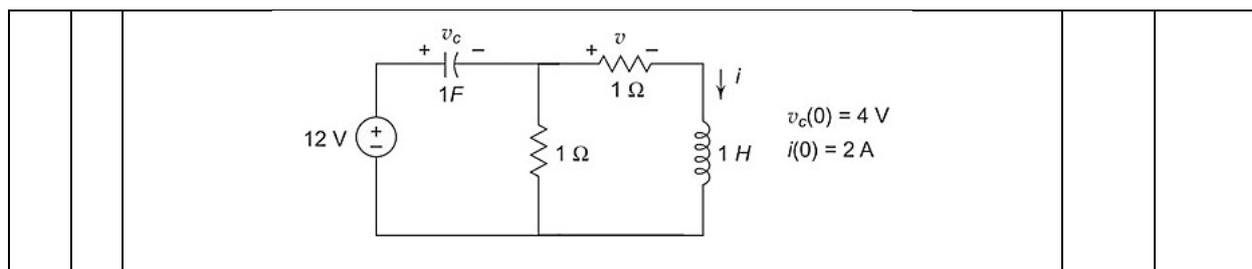
10 a An avionics engineer is designing a crucial power rail for a flight control computer. The rail is stabilized by a decoupling circuit consisting of a $2\ \Omega$ resistor and a $1\ \text{mH}$ inductor as represented in Figure below. Under normal operation, the circuit is powered by a 100 V source (main battery) and has reached steady-state conditions with switch K in position 1. When a fault is detected, transfer switch K is instantly moved to Position 2, connecting the circuit to a 0.1F supercapacitor to initiate a controlled shutdown sequence. The engineer needs to predict the current decay within the decoupling circuit to ensure the component tolerances are not exceeded during the transition. For the circuit shown in the Figure below, use the time domain method to determine the current through the inductor for all time $t \geq 0^+$, following the switch to Position 2.

CO4 (5)

b

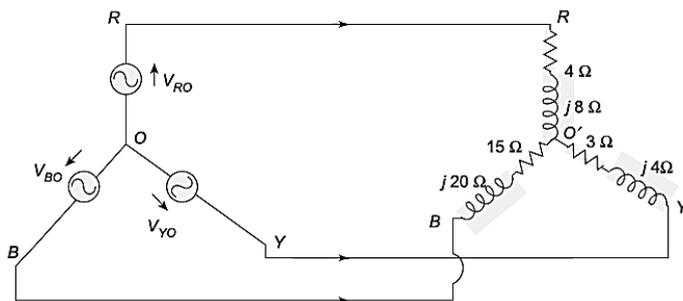
Determine the voltage v for the circuit shown below

CO4 (4)

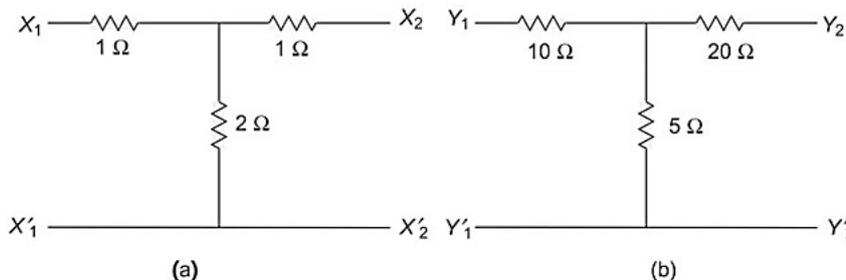


MODULE IV

11	a	<p>A plant maintenance engineer is performing a system audit on a factory floor. The factory uses a 400V, 3-phase, 50 Hz to supply three main load components connected in a star configuration:</p> <p>Motor Load (Z_{BO}) = $(15 + j20) \Omega$, Heating Load (Z_{RO}) = $(4 + j8) \Omega$ and Lighting Load (Z_{YO}) = $(3 + j4) \Omega$. The following parameters are required to understand the electrical strain on the wiring and the energy consumption of each part of the system for optimization and safety checks. Calculate</p> <ol style="list-style-type: none"> i) The Line Currents (I_A, I_B, I_C) ii) The Power Consumed by each phase (P_{AB}, P_{BC}, P_{CA}) 	CO6	(5)
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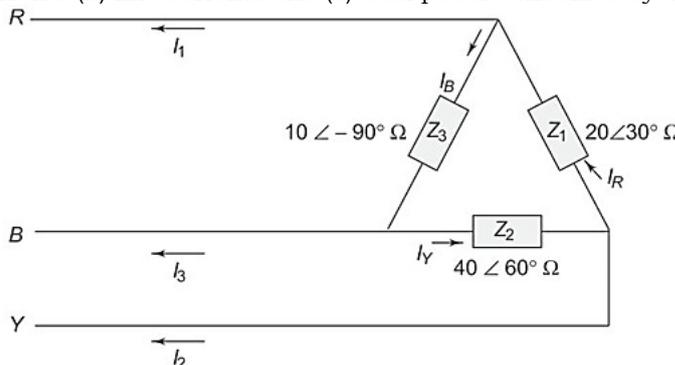


b	<p>Two networks shown in Figure (a) and (b) are connected in series. Obtain the Z-parameters of the combination.</p>	CO5	(4)
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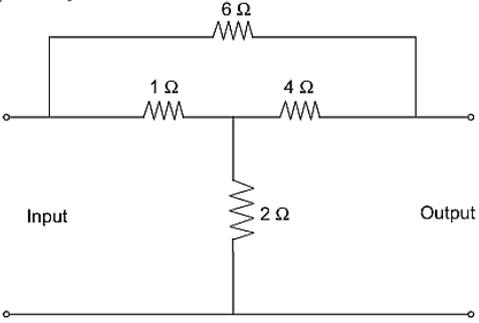


OR

12	a	<p>Three impedances $Z_1 = 20 \angle 30^\circ \Omega$, $Z_2 = 40 \angle 60^\circ \Omega$ and $Z_3 = 10 \angle -90^\circ \Omega$ are delta-connected to a 400 V, 3 phase system as shown in Figure. Determine the (a) phase currents (b) line currents and (c) total power consumed by the load.</p>	CO6	(5)
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b	<p>An electrical distribution engineer is designing a simplified model of a section of the power grid, specifically an interface between a substation and a feeder line. This section is a two-port network composed of known impedances. For</p>	CO5	(4)
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		<p>analysis, the engineer needs a T-Equivalent Circuit and a π Equivalent Circuit. The circuit to be modelled is shown below</p> <p>Determine the component values for the T-Equivalent Circuit and π Equivalent Circuit by calculating the Impedance (z) parameters and the Admittance (y) parameters respectively.</p> <div style="text-align: center;">  </div>		
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COURSE DESCRIPTION							
Regulation	2025	L-T-J-P-S	2-0-1-0-3	Version	25/0	Credits	3
Course Code	Course Name						Course Category
B250908/CN220F	ENTREPRENEURSHIP AND IPR						ESB
Pre-requisite							
Course Code	Course Name						
Nil	Nil						
<i>(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Teamwork)</i>							

COURSE OBJECTIVES
The course introduces the fundamentals of entrepreneurship and innovation, focusing on how ideas develop into ventures. It helps students identify and validate business opportunities, understand the role of Intellectual Property Rights (IPR) in protecting innovations and learn basic procedures for managing and commercializing intellectual property.

COMPETENCY STATEMENT (CC)	
CC1	Develop entrepreneurial thinking and the ability to conceptualize, plan, and implement new ventures.
CC2	Apply knowledge of Intellectual Property Rights (IPR) to protect and commercialize innovative ideas.

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

CO	CO Statement	Competency Statement Mapping	Cognitive	Psychomotor	Affective
CO 1	Explain the fundamentals of entrepreneurship and innovation.	CC1	U	-	Re
CO 2	Analyse business models and plans for technology-based startups.	CC1	An	-	V
CO 3	Explain various forms of intellectual property.	CC2	U	-	Re
CO 4	Apply IPR concepts to protect, manage, and commercialize innovations.	CC2	A	-	Rs
CO 5	Present a project that evaluates business potential by applying suitable IP protection measures.	CC1, CC2	E	Ar	O

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

COURSE ARTICULATION MATRIX																							
C O	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									PO										PSO			
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	*		*					*	*	3					1		1	1		2			
2	*		*					*	*	3			2	1	2	1	2	2	2	3			
3	*		*					*	*	2			1	2	2	2	1	1	2	3			
4	*		*					*	*	3			2	2	2	2	2	1	2	3			
5	*		*					*	*	3			2	3	3	2	2	3	3	3			

Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - “-”

TEACHING AND ASSESSMENT SCHEME										
Teaching Scheme / Week				Self-Learning (S) / Semester	Total Hours / Semester	Credits (C)	Examination Scheme			
L	T	J	P				Theory			Total
2	0	1	0	30	90	3	CIA	ESE	Total	100
							60	40	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	Contact Hours
1	Entrepreneurship Fundamentals	Introduction to Innovation and Entrepreneurship – Entrepreneurial mindset – Types of entrepreneurs – Idea generation – Design thinking – Startup ecosystem – Government initiatives.	8
2	Business Planning and Startup Management	Market research and validation – Business model canvas – Revenue and pricing strategies – Business plan preparation – Prototype and MVP development – Risk management.	8
3	Fundamentals of IPR	Introduction to IPR – Patents, Trademarks, Copyrights, Industrial Designs – Patentability, filing procedures – Patent databases and search – Infringement-Rights and obligations – Case studies.	8
4	IPR Management and Commercialization	IP strategy for startups – Licensing, technology transfer – IPR in digital era – Emerging trends in AI and software patents – Ethical issues and Indian IP policy framework.	8

SELF-LEARNING / TEAM WORK		
Sl. No	Self-learning / Team Work Description	Hrs/ Semester
1	Analysis of government initiatives for startups (Startup India, Kerala Startup Mission, MSME schemes) and their impact on young entrepreneurs.	3
2	Case study on successful Indian startups and analysis of their innovation and growth journey.	3
3	Survey on entrepreneurial mindset among students and analysis of key motivating factors.	3
4	Preparation of a Business Model Canvas (BMC) for a technology or engineering-based idea.	3
5	Role-play exercise on negotiation between inventor and investor for licensing a technology	3
6	Comparative study of patents, trademarks, and copyrights through real-world Indian examples.	3
7	Patent search activity using the Indian Patent Advanced Search System (InPASS) or Google Patents.	3
8	Study on IPR infringement cases in India (e.g., Ilayaraaja vs <i>Manjummel Boys</i> , Novartis vs Union of India) and lessons learned.	3
9	Case study on the commercialization of academic research through technology transfer.	3
10	Seminar or debate on AI-generated content and copyright ethics in the digital era.	3

SUGGESTED LEARNING RESOURCES

Sl. No.	Title of Book	Author	Publication
Text Book			
1	The Engineering Handbook	Richard C.Dorf	CRC Press

2	Business Model Generation	Alexander Osterwalder & Yves Pigneur	Wiley
3	Innovation and Entrepreneurship for Engineers	Bharat Bhushan and Seema Bhushan	CRS Press
4	Indian Patent Law	P. Narayanan	Eastern Book Company
5	The Law of Copyright and Designs	B.L. Wadehra	Universal Law
6	Intellectual Property Rights (Including IPR in the Digital Age)	Prabuddha Ganguli	Tata McGraw-Hill Education
Web Resource			
1	https://onlinecourses.nptel.ac.in/noc25_mg81		
2	https://nptel.ac.in/courses/110107094		
3	https://onlinecourses.nptel.ac.in/noc22_hs59		

Module	Major Topic & Sub Topic	Mode of Delivery	Relevant COs	Learning Domain Level			Teaching Hours
				C	P	A	
1	Introduction to Innovation and Entrepreneurship – Meaning, need, and importance	L	CO1	U		Re	1
	Entrepreneurial mindset – Characteristics and motivation of entrepreneurs	L	CO1	U		Re	1
	Types of entrepreneurs – Intrapreneurs, social, tech-based, women entrepreneurs	L	CO1	U		Re	1
	Idea generation techniques – Creativity, brainstorming, problem identification	L	CO1	U		Re	1
	Design thinking – Empathy, define, ideate, prototype, and testing	L	CO1	U		Re	1
	Startup ecosystem – Incubators, accelerators, funding agencies	L	CO1	U		Re	1
	Government initiatives for startups – Startup India, Make in India, MSME schemes	L	CO1	U		Re	1
	Self-Learning 1	S	CO1	U		Re	
	Self-Learning 2	S	CO1	U		Re	
	Case study / activity – Successful Indian startups and their founders	L	CO1	U		Re	1
2	Market research and validation – Identifying customer needs	L	CO2	An		V	1
	Business model canvas – Key partners, activities, value proposition	L	CO2	An		V	1
	Revenue and pricing strategies – Cost-based and value-based pricing	L	CO2	An		V	1
	Business plan preparation – Structure and key components	L	CO2	An		V	1
	Self-Learning 3	S	CO2	An		V	
	Prototype and MVP development – Concept and significance	L	CO2	An		V	1
	Self-Learning 4	S	CO2	An		V	
	Risk management – Types of risks and mitigation plans	L	CO2	An		V	1
	Startup funding sources – Angel investors, venture capital, crowdfunding	L	CO2	An		V	1
	Self-Learning 5	S	CO2	An		V	
Case study / activity – Analyze a startup's business model canvas	L	CO2	An		V	1	

3	Introduction to IPR – Need, importance, and categories	L	CO3	U		Re	1
	Patents – Concepts, requirements, and types	L	CO3	U		Re	1
	Trademarks and Copyrights – Differences, examples, and protection	L	CO3	U		Re	1
	Industrial Designs and Geographical Indications – Overview	L	CO3	U		Re	1
	Self-Learning 6	S	CO3	U		Re	
	Patentability and filing procedures – Steps involved in India	L	CO3	U		Re	1
	Patent databases and search – Hands-on demonstration (Google Patents)- Infringement	L	CO3	U		Re	1
	Self-Learning 7	S	CO3	U		Re	
	Self-Learning 8	S	CO3	U		Re	
	Rights and obligations of patent holders	L	CO3	U		Re	1
	Case study – Patent disputes and lessons learned	L	CO3	U		Re	1
4	IP strategy for startups – Importance and methods	L	CO4	E	Ar	O	1
	Licensing and technology transfer – Process and agreements	L	CO4	E	Ar	O	1
	IPR in the digital era – Copyrights in AI, software, and digital content	L	CO4	E	Ar	O	1
	Emerging trends – AI-generated inventions, data protection, open-source issues	L	CO4	E	Ar	O	1
	Self-Learning 9	S	CO4	E	Ar	O	
	Self-Learning 10	S	CO4	E	Ar	O	
	Software patents – Challenges and case examples	L	CO4	E	Ar	O	1
	Ethical issues in IPR – Plagiarism, fair use, and data ethics	L	CO4	E	Ar	O	1
	Indian IP policy framework – Overview and updates	L	CO4	E	Ar	O	1
	Case study / seminar – IP commercialization success stories	L	CO4	E	Ar	O	1

TABLE OF SPECIFICATIONS (ToS) FOR QUESTION PAPER DESIGN

Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)					Total Marks
			R	U	A	A n	E	
1	Entrepreneurship Fundamentals	8		√	√			10
2	Business Planning and Startup Management	8			√	√		10
3	Fundamentals of IPR	8		√	√			10
4	IPR Management and Commercialization	8			√	√		10

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

ASSESSMENT PATTERN

Assessment	Weightage
Continuous Internal Assessment	60
Learning Activity	5
Regularity	5

Internal Examination	20
Course Project	30
End Semester Examination	40
Total	100

MODEL QUESTION PAPER

Total Pages: 4	
Register No.:	Name:

SECOND SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR (2025 SCHEME)			
Course Code:	B250908/CN220F		
Course Name:	ENTREPRENEURSHIP AND IPR		
Max. Marks	40	Duration:	2 hours 30 minutes

PART - A													
(Answer all questions. Each question carries 2 marks)													
No.	Question	CO	Marks										
1	The five stages of Design Thinking are _____, Define, Ideate, _____ and Test.	CO1	(2)										
2	Compare entrepreneurs and intrapreneurs in terms of their approach to innovation	CO1	(2)										
3	Analyse the role of market validation in reducing startup failure risk.	CO2	(2)										
4	Evaluate the importance of Minimum Viable Product (MVP) development.	CO2	(2)										
5	The criteria for patentability include novelty, _____ step and _____ applicability.	CO3	(2)										
6	Analyse how Geographical Indications (GIs) help in protecting regional products such as Palakkadan Matta Rice from Kerala.	CO3	(2)										
7	Match the terms in Column A with the appropriate descriptions in Column B . <table border="1" style="margin: 10px auto; width: 80%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; text-align: center;">Column A</th> <th style="width: 50%; text-align: center;">Column B</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">(a) Licensing vs. Assignment</td> <td style="text-align: center;">(i) Assessing economic worth of IP assets</td> </tr> <tr> <td style="text-align: center;">(b) Patent Pooling</td> <td style="text-align: center;">(ii) Fair use, plagiarism, and data ownership</td> </tr> <tr> <td style="text-align: center;">(c) IP Ethics</td> <td style="text-align: center;">(iii) Permission vs. complete ownership transfer</td> </tr> <tr> <td style="text-align: center;">(d) IP Valuation</td> <td style="text-align: center;">(iv) Sharing IP among multiple holders</td> </tr> </tbody> </table>	Column A	Column B	(a) Licensing vs. Assignment	(i) Assessing economic worth of IP assets	(b) Patent Pooling	(ii) Fair use, plagiarism, and data ownership	(c) IP Ethics	(iii) Permission vs. complete ownership transfer	(d) IP Valuation	(iv) Sharing IP among multiple holders	CO4	(2)
Column A	Column B												
(a) Licensing vs. Assignment	(i) Assessing economic worth of IP assets												
(b) Patent Pooling	(ii) Fair use, plagiarism, and data ownership												
(c) IP Ethics	(iii) Permission vs. complete ownership transfer												
(d) IP Valuation	(iv) Sharing IP among multiple holders												
8	Suggest two ways companies like Adobe and Netflix can prevent plagiarism and digital piracy.	CO4	(2)										

PART - B			
(Answer any one full question from each module, each question carries 6 marks)			
No	Question	CO	Marks
MODULE I			
9	Kerala has witnessed a steady rise in youth-led entrepreneurship through initiatives like Kerala Startup Mission (KSUM) , which provides incubation, mentorship, and seed funding support. Programs such as Young Innovators Programme (YIP) encourage school and college students to identify real-world problems and propose innovative solutions. Many student startups—ranging from agritech to renewable energy—have evolved from these programs and are now scaling globally		
a)	Analyse how Kerala’s startup ecosystem supports the development of an entrepreneurial mindset among students.	CO1	(2)
b)	Explain how design thinking principles can be applied to initiatives like YIP to improve innovation outcomes		(2)

	c)	Evaluate the challenges faced by youth entrepreneurs in Kerala in accessing funding and markets.		(1)
	d)	Suggest one policy-level improvement that could further strengthen Kerala's entrepreneurial ecosystem.		(1)
OR				
10		In Kerala, there has been a growing presence of social and women entrepreneurs who are redefining business with a focus on sustainability and inclusivity. Initiatives like Kudumbashree and WE Mission (Women Entrepreneurship Mission) have empowered thousands of women to start micro and small-scale ventures across sectors like food processing, handicrafts, and local tourism. Meanwhile, social entrepreneurs such as <i>G. Venu (Natanakairali)</i> and <i>Jose Kutty Panackal (Farmvent)</i> have used innovation to address social and environmental issues. These ventures not only create employment but also promote sustainable development aligned with the UN SDGs.		
	a)	Differentiate between social entrepreneurs and commercial entrepreneurs with suitable examples from Kerala	CO1	(2)
	b)	Analyse how programs like Kudumbashree and WE Mission contribute to women entrepreneurship development.		(2)
	c)	Evaluate the role of social entrepreneurship in achieving sustainable and inclusive growth in Kerala.		(1)
	d)	Suggest one initiative the state government can introduce to strengthen the social entrepreneurship ecosystem.		(1)
MODULE II				
11		A group of engineering graduates from Kochi developed an IoT-based smart irrigation system that optimizes water usage for farmers in Palakkad. With the support of KSUM's incubation center and an angel investor from Thrissur, the team built a Minimum Viable Product (MVP). However, scaling the product across India required a clear business model, pricing strategy, and risk assessment plan.		
	a)	Construct the key components of a Business Model Canvas for this smart irrigation startup.	CO2	(3)
	b)	Suggest an appropriate pricing strategy and justify your choice.		(2)
	c)	Analyse two major risks this startup may face during national expansion and suggest mitigation strategies		(1)
OR				
12		<p>Founded in 2015, Zomato evolved from a simple restaurant discovery website to a multi-service platform offering food delivery, dining experiences, and grocery delivery. The startup adopted a commission-based revenue model, where it earned a percentage from restaurant orders, and later diversified into subscription models like Zomato Gold.</p> <p>Despite rapid expansion, Zomato faced major financial and operational challenges, including high delivery costs, customer retention issues, and intense competition from Swiggy. To remain sustainable, the company had to rethink its pricing strategy, manage investor expectations, and explore new sources of income such as advertising and cloud kitchens.</p> <p>This journey demonstrates how startup success depends not only on innovation but also on effective business planning, risk management, and strategic funding decisions.</p>		
	a)	Analyse Zomato's business model and identify how it balances value creation for customers and revenue generation for the company	CO2	(3)
	b)	Evaluate the effectiveness of Zomato's diversification strategy (e.g., Zomato Gold, grocery delivery) in maintaining market competitiveness.		(2)
	c)	Suggest any two alternative revenue model Zomato could adopt to achieve long-term profitability.		(1)
MODULE III				
13		In 2023, India's Patent Office rejected Johnson & Johnson's patent extension request for its popular tuberculosis (TB) drug Bedaquiline . The company had sought to extend its patent beyond the original expiry date, claiming a new version of the same compound. However, the Patent Office ruled that the new version did not meet the criteria of novelty and inventive step under the Indian Patent Act, Section 3(d) . As a result, Indian manufacturers were		

	<p>allowed to produce generic versions of Bedaquiline, reducing the cost of TB treatment from thousands of rupees per month to less than a few hundred.</p> <p>This decision was celebrated by public health organizations and patient-rights groups, as it made life-saving TB medicines affordable to thousands of patients in India and other developing nations.</p>		
a)	Explain why the Indian Patent Office rejected Johnson & Johnson's patent extension for Bedaquiline.	CO3	(3)
b)	Analyse how Section 3(d) of the Patent Act helps prevent "evergreening" of pharmaceutical patents.		(2)
c)	Evaluate the social and economic impact of this decision on TB treatment and Indian healthcare.		(1)
OR			
14	<p>In early 2024, a major copyright controversy emerged in the Indian film industry when legendary composer Ilaiyaraaja issued a legal notice to the producers of the Malayalam film Manjummel Boys, which featured his iconic Tamil song "Kanmani Anbodu Kaadhalan" from the 1991 film <i>Guna</i>. The song, deeply emotional and nostalgic, was used in a key scene of <i>Manjummel Boys</i>, which later became a massive box-office success across India.</p> <p>According to Ilaiyaraaja, the filmmakers had not obtained his personal permission to use the song, even though they had secured a license from the audio label that owned the recording rights. He claimed that under the Indian Copyright Act, 1957, a composer retains moral and authorial rights over their work — including the right to be acknowledged and to object to unauthorized or distorted use. He argued that simply acquiring a "sound recording licence" from a music company does not override the composer's ownership of musical and lyrical rights.</p> <p>This case reignited a larger debate in India's creative industry about ownership, moral rights, and licensing practices. Many musicians and lyricists supported Ilaiyaraaja, asserting that composers often lose control of their creations to record labels. Others argued that such disputes could discourage filmmakers from reviving classic songs.</p> <p>Eventually, media reports suggested that the matter was settled out of court, with the <i>Manjummel Boys</i> team reportedly compensating Ilaiyaraaja around ₹60 lakhs for the use of the song. The controversy highlighted the urgent need for clearer copyright awareness and ethical licensing practices in Indian cinema.</p>		
a)	Explain the types of rights Ilaiyaraaja holds under the Copyright Act, 1957, including economic and moral rights	CO3	(2)
b)	Analyse why obtaining permission from a record label may not be sufficient to legally use a musical composition in a film.		(2)
c)	Evaluate how this case impacts future relationships between composers, producers, and music companies in the Indian film industry.		(1)
d)	Suggest one measure — legal, educational, or institutional — that could help prevent such copyright disputes in India's creative sector.		(1)
MODULE IV			
15	<p>With rapid advances in artificial intelligence (AI), India faces new challenges in defining ownership, authorship, and accountability for creative works generated by machines. AI tools such as ChatGPT, Midjourney, and Bard are now widely used by students, designers, and businesses. While these tools accelerate creativity and productivity, they also raise legal and ethical questions about originality, plagiarism, and copyright.</p> <p>In 2024, the Indian Ministry of Electronics and Information Technology initiated discussions on a framework for AI-generated content ownership and data protection, emphasising transparency and responsible innovation.</p> <p>Globally, courts and IP offices are divided: some countries allow limited copyright protection for AI-assisted works, while others — including India — still require human authorship as the basis for copyright registration.</p> <p>The debate highlights a social tension: how can society protect creators' rights while encouraging the open, democratic use of emerging technologies? Without clear IP policies, both human creators and innovators risk exploitation, plagiarism, and loss of credit for their work.</p>		
a)	Explain the challenges India faces in defining copyright ownership for AI-generated works.	CO4	(2)

	b)	Analyse the ethical implications of using AI tools for creative and academic content generation		(2)
	c)	Evaluate whether India should extend partial IP protection to AI-assisted works. Support your view with reasons.		(1)
	d)	Suggest one policy or guideline that could balance innovation and ethical IP use in the AI era.		(1)
OR				
16	<p>Over the past decade, India has witnessed explosive growth in digital entertainment and online media platforms such as Netflix, Hotstar, Zee5 and SonyLIV. However, this growth has been accompanied by a surge in digital piracy, which severely affects the creative economy. According to a 2024 report by the Motion Picture Association (MPA), India ranks among the top five countries in illegal film downloads and streaming site traffic. The Cinematograph (Amendment) Act 2023 introduced strict penalties — including imprisonment — for individuals or groups involved in unauthorised recording or exhibition of films. Despite these legal measures, piracy persists through mirror sites, Telegram channels, and illegal OTT apps. This issue raises broader ethical and social questions: while piracy deprives creators and investors of revenue, it also exposes the affordability gap in India’s digital ecosystem. Many argue that reducing piracy requires not only enforcement but also accessible pricing models and awareness among youth about IP ethics.</p>			
	a)	Explain how licensing and distribution rights contribute to fair commercialisation of digital content in India.	CO4	(2)
	b)	Analyse the effectiveness of India’s new anti-piracy laws in addressing the social and economic impacts of film piracy.		(2)
	c)	Evaluate the ethical dilemma between access and ownership in the context of digital piracy.		(1)
	d)	Suggest one initiative that could reduce piracy while ensuring affordable access to digital content.		(1)

COURSE DESCRIPTION							
Regulation	2025	L-T-J-P-S	1-1-0-0-0	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/CN900K	LIFE SKILLS AND PROFESSIONAL COMMUNICATION	HM
Pre-requisite		
NIL		

COURSE OBJECTIVES	
1	To foster self-awareness and personal growth, promote effective participation in groups and teams, develop critical thinking, problem solving and decision-making skills and cultivate the ability to exercise emotional intelligence
2	To enhance students' overall communication skills, enabling them to comprehend, interpret and express ideas clearly in diverse academic and professional settings
3	To equip students to build their profile in line with the professional requirements and standards.

COMPETENCY STATEMENT (CC)	
CC 1	Learners demonstrate essential life skills and professional communication skills, enabling them to adapt confidently to personal, academic, and professional challenges and contribute meaningfully to society.

COURSE OUTCOMES (CO)					
Course Outcomes (CO): At the end of this course, learners will be able to:					
CO	CO Statement	CC Mapping	Cognitive (C)	Psycho motor (P)	Affective (A)
CO 1	Evaluate self-awareness to set effective goals and plans	CC 1	A		V
CO 2	Evaluate the ability to focus on strengthening the fundamentals of emotional quotient.	CC 1	A		V
CO 3	Apply techniques to enhance Critical Thinking, Problem-solving and Decision-making skills	CC 1	A		V
CO 4	Apply strategies to improve comprehension and communication skills	CC 1	A		Rs
CO 5	Present ideas using modern technological platforms	CC 1	A		V
CO 6	Establish a professional network using networking platforms	CC 1	An		O
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	2	2	3	1	1			
2							2	1	2		1			
3	1	2	1	2		2	1	3	2	2	1			
4						1		2	3	1	2			
5					1			2	3		2			
6						2		3	3		2			
Correlation [3 – High, 2 -Medium, 1 – Low]														

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme		
L	T	J	P	S			Theory		
					C		CIA	ESE	Total
1	1	0	0	0	1	30	100	-	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	Personal Growth & Self-management	1.Group formation and self-introduction 2. Preparation of Gantt chart 3. Online personality development test 4.Role-storming exercise	5
2	Workplace & Interpersonal Skills	1.Presentation on instances of empathy 2.Networking with professionals to develop workplace skills 3. Role- Play 4. Report writing	7
3	Problem-Solving & Creative thinking	1. Identifying real-life problem that requires a technical solution 2. Six thinking hat exercises 3. Group Discussion 4.Video presentation on diversity aspects	9
4	English Language communication & Professional Development	1.Online Interview skills development session. 2. Listening test 3.Activities to improve English vocabulary of students 4. Video content for podcasts on technological interventions/research work tried out in Kerala context	9

SELF-LEARNING / TEAM WORK		
Sl. No	Self-learning / Team Work Description	Hrs
1	Take an online personality development test, self-reflect and report	1
2	Prepare a mind map based on the role-storming exercise	1
3	Students indulge in self-reflection and identify their own goal and prepare for their undergraduate journey	1

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Life Skills & Personality Development	Maithry Shinde et.al.	Cambridge University Press
2	Emotional Intelligence: Why it can matter more than IQ	Daniel Goleman	Bloomsbury Publishing PLC
3	Think Faster, Talk Smarter: How to speak successfully when you are put on the spot	Matt Abrahams	Macmillan Business
4	Deep Work: Rules for focused success in a distracted world	Cal Newport	PIATKUS
5	Effective Technical Communication	Ashraf Rizvi	McGraw Hill Education

Reference			
Sl. No.	Title of Book	Author	Publication
1	Life Skills for Engineers	Remesh S., Vishnu R. G	Ridhima Publication
2	Soft Skills & Employability Skills	Sabina Pillai and Agna Fernandez	Cambridge University Press

3	Guide to writing as an Engineer	David F. Beer and David McMurrey	John Wiley. New York
4	LinkedIn Profile Optimization	Donna Serdula	

Web Resource	
1	www.mindtools.com
2	TED Talks on Life Skills
3	www.linkedin.com/learning

DETAILED SYLLABUS (Self-learning if any to be marked)									
Sl. No.	Activity	Mode of Delivery	Group/ Individual(G/I)	Mark	COs	Learning Domain			Hrs
						C	P	A	
1.1	Group formation and self introduction among the group members	L	G			R		Re	2
1.2	Familiarizing the activities and preparation of the time plan for the activities	L	G			R		Re	
1.3	Preparation of Gantt chart based on the time plan	L, T	G	5	CO1	A		Re	
2.1	Take an online personality development test	L, T	I	2	CO1	U		V	3
2.2	Role-storming exercise 1: Students assume 2 different roles given below and write about their; ●Strengths ●Areas for improvement ●Concerns ●Areas in which he/she hesitates to take advice ●Goals/Expectations from the point of view of the following assumed roles: i) parent/guardian/mentor ii) friend/sibling/cousin	L, T	I	2	CO1	U		Rs	
2.3	Role-storming exercise 2: Students assume the role of their teacher and write about ●Skills required as a B. Tech graduate ●Attitudes, habits, approaches required and activities to be practiced during their B. Tech years, in order to achieve the set goals	L, T	I	2	CO1	U		Rs	
2.4	Discuss the skills identified through role storming exercise by each one within their own group and improvise the list of skills	L, T	G	2	CO1	R		Re	
2.5	Exhibit/present the mind map prepared based on the role storming exercise in the class	L, T	G	2	CO1	U		Re	
3	Prepare a presentation on instances of empathy the students have observed in their own life or in other's life	L, T	I	5	CO2	U		V	3
4.1	Each student connects and	L, T	I	2	CO2	U		Rs	4

	networks with a minimum of 3 professionals from industry/public sector organizations/other agencies/NGOs /academia (at least 1 through LinkedIn)								
4.2	Interact with them to understand their workplace details including <ul style="list-style-type: none"> •workplace skills required •their work experience •activities they have done to enhance their employability during their B.Tech years •suggestions on the different activities to be done during B.Tech years Prepare a documentation of this	L, T	I	4	CO2	U		Rs	
4.3	Discuss the different workplace details & work readiness activities assimilated by each through the interactions within their group and compile the inputs collected by the individuals Prepare the Minutes of the discussions	L, T	G	2	CO2	U		Rs	
4.4	Report preparation based on the discussions	L, T	G	3	CO4	R			
4.5	Perform a role-play based on the workplace dynamics assimilated through interactions and group discussions	L, T	G	4	CO3	U		Rs	
4.6	Students prepare an action plan for their undergraduate journey	L, T	I	2	CO1	R		Rs	
5.1	Select a real-life problem that requires a technical solution and list the study materials needed	L, T	G	2	CO3	A		Rs	
5.2	Listen to TED talks & video lectures from renowned Universities related to the problem and prepare a one-page summary (Each group member should select a different resource)	L, T	I	2	CO4	U			3
5.3	Use any online tech forum to gather ideas for solving the problem chosen	L, T	G	2	CO5	A		Rs	
5.4	Arrive at a possible solution using six thinking hat exercise	L, T	G	5	CO3	An		V	
5.5	Prepare a report based on the problem-solving experience	L, T	G	2	CO4	A			
6.1	LinkedIn profile creation	L, T	I	2	CO6	U			2

6.2	Resume preparation	L, T	I	5	CO6	A			
6.3	Self-introduction video	L, T	I	3	CO6	A		V	
7	Prepare a presentation on instances of demonstration of emotional intelligence	L, T	I	2	CO2	A		V	3
8	Prepare a short video presentation on diversity aspects observed in our society (3 to 5 minutes)	L, T	G	5	CO2 CO5	A		V	3
9	Take online Interview skills development sessions like robotic interviews; self-reflect and report	L, T	I	2	CO6	U		V	1
10	Take an online listening test, self-reflect and report	L, T	I	2	CO6	U		Rs	1
11.1	Activities to improve English vocabulary of students	L, T	I/G	4	CO4	U		Re	4
11.2	Activities to help students identify errors in English language usage	L, T	I/G	2	CO4	U		Re	
11.3	Activity to help students identify commonly misspelled words, commonly mispronounced words, and confusing words	L, T	I/G	2	CO4	U		Re	
11.4	Write a self-reflection report on the improvement in English language communication through this course	L, T	I	2	CO4	A		V	
11.5	Presentation by groups on the experience of using online collaboration tools in various group activities and time management experience as per the Gantt chart prepared	L, T	G	5	CO4 CO5	A		V	
12.1	Each group prepares video content for podcasts on innovative technological interventions/research work tried out in Kerala context by academicians/professionals/Govt. agencies/research institutions/private agencies/NGOs/other agencies	L, T	G	10	CO2 CO4 CO5	A		V	1
12.2	Upload the video content to podcasting platforms or YouTube	T	G	2	CO5	U			
12.3	Add the link of the podcast in their LinkedIn profile	T	G	2	CO5	U			

ASSESSMENT PATTERN		
Assessment		Marks
Continuous Internal Assessment		100
1	Internal Examination	
2	Learning Activity	100
3	Regularity	
4	Course Project	
End Semester Examination		
Total		100

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

Course Code	Course Name	Course Category
B250902/CN230U	ESSENTIALS OF EMBEDDED AND COMPUTING LAB	ESL
Pre-requisite		
B250906/CN100D Introduction to Electrical and Electronics Engineering B250906/CN130U Basic Electrical and Electronics Engineering Workshop		

COURSE OBJECTIVES	
1	To build essential practical skills in electronics and computing through experiential learning.
2	To provide hands-on exposure to hardware assembly, embedded systems, signal simulation, and circuit design.
3	To enable students to apply multidisciplinary engineering concepts in analysing and integrating basic electronic systems.

COMPETENCY STATEMENT (CC)	
CC1	Identify, configure, and troubleshoot fundamental computer systems and network environments, demonstrating proficiency in operating system installation, LAN configuration, and using tools for basic network testing and packet analysis.
CC2	Interface simple sensors using microcontroller platforms like Arduino for digital I/O, and utilize technical software (MATLAB/Simulink) for signal generation, plotting, and simulating the transient response of basic electrical systems.
CC3	Design, simulate, and physically implement a simple electronic circuit project by utilizing simulation tools (LTspice) for circuit analysis and PCB design software (KiCad) for creating a functional layout, integrating multiple concepts.

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)
1	Assemble computing hardware components and configure basic networking systems	CS01 CS04	A	M	V
2	Implement simple embedded applications using Arduino and sensor interfaces.	CS22 CS23	A	P	V
3	Model and visualise basic signals and system responses using MATLAB and Simulink.	CS02 CS21	A	P	V
4	Simulate and design basic electrical and electronic circuits using appropriate software tools.	CS05 CS06	A	P	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 (Kratwohl): - 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
CO1	3	1			3		1	2	3		2	1	1	1
CO2	3	3	2	2	3	2	1	3	3	2	2	1	1	1
CO3	3	3	2	2	3	1	1	3	3	2	2	1	1	1
CO4	3	2	2	2	3		1	3	3	2	2	1	1	1
Correlation [3 – High, 2 -Medium, 1 – Low]														

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme		
L	T	J	P	S			CIA	ESE	Total
0	0	0	2	0	1	24	60	40	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	Computing Hardware, Peripherals and Networking	Identification of major computer hardware components and perform operating system installation; LAN Configuration, Network Testing and Packet Analysis.	4
2	Embedded Hardware (Arduino) and Sensor Interfacing	Digital I/O using Arduino; Sensor Interfacing with Arduino.	4
3	Introductory MATLAB and Simulink	Signal Generation and Plotting in MATLAB; First-Order System Response using Simulink.	6
4	Circuit and PCB design	Circuit Simulation using LTspice; Schematic and PCB Layout of a Simple Circuit using KiCad.	4
5	Course Project	Implementation of a simple project by making use of the concepts learned above.	6

SELF-LEARNING / TEAM WORK		
Sl. No	Self-learning / Team Work Description	Hrs
1	Explore various linear algebra operations available in MATLAB and investigate real-world applications of Singular Value Decomposition (SVD). Develop a MATLAB script demonstrating any one selected application of SVD.	6
2	Develop a MATLAB script or Simulink model that generates and visualizes any real-world waveform (e.g., ECG-like, AM, PWM). Demonstrate parameter variation and compare signals using subplots.	6
3	Design, simulate, and prepare a single-sided PCB layout for a simple power supply or sensor circuit using KiCad; export Gerber files and document design steps.	6

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	<i>Data Communications and Networking with TCP/IP protocol suite</i>	Behrouz A. Forouzan	McGraw Hill, 6/e
2	<i>Upgrading and Repairing PCs</i>	Scott Mueller	Que Publication, 22/e
3	<i>Make: Getting Started with Arduino</i>	Massimo Banzi, Michael Shiloh	O'Reilly Media, 3/e
4	<i>MATLAB for Engineers</i>	Holly Moore	Pearson Education, 5/e
5	<i>SPICE for circuits and electronics</i>	MH.Rashid	Cenage, 4/e
6	<i>KiCad Like a Pro,</i>	Peter Dalmaris,	Tech Explorations, 3/e

Reference			
Sl. No.	Title of Book	Author	Publication
1	Computer Networking: A top-down approach	J.F. Kurose, K.W. Ross	Pearson, 8/e
2	Programming Arduino: Getting started with sketches	Simon Monk	Tab books, 3/e
3	Matlab: An introduction with applications	Amos Gilat	Wiley, 4/e
4	Electronics and Circuit analysis using MATLAB	J.O. Attia	CRC Press, 2/e

Web Resource	
1	https://www.netacad.com/networking
2	https://www.wireshark.org
3	https://docs.arduino.cc/learn/
4	https://learn.sparkfun.com
5	https://learn.adafruit.com
6	https://matlabacademy.mathworks.com/?page=1&sort=featured
7	https://www.analog.com/en/resources/design-tools-and-calculators/ltspice-simulator.html
8	https://docs.kicad.org
9	https://www.hackster.io/projects

PRACTICAL SYLLABUS						
Topic	Objective	CO	Learning Domain			Hrs
			C	A	P	
Computing Hardware, Peripherals and Networking (PC Hardware Identification and OS Installation)	<ul style="list-style-type: none"> Identify and tabulate specs of CPU, RAM, motherboard, storage (HDD/SSD), SMPS, graphics, I/O ports. Physically inspect/assemble a desktop system. Create a bootable USB and install Windows/Linux OS (demonstration or hands-on). Verify installation: device manager, disk management, basic performance checks. 	1	A	M	V	2
Computing Hardware, Peripherals and Networking (Configuring a simple wired/wireless LAN and test connectivity between devices)	<ul style="list-style-type: none"> Identify networking devices: switch, router, Wi-Fi access point, Ethernet cables, RJ-45 connectors. Configure IP addresses (static/DHCP) for 2–3 systems in a LAN. Test connectivity using ping, ipconfig/ifconfig, and enable basic file/printer sharing. Observe and record latency or packet loss, and capture screenshots of configuration and results. Perform packet-level analysis using any opensource packet analyser. 	1	A	P	V	2
Embedded Hardware (Arduino) and Sensor Interfacing (Arduino programming and digital input/output operations)	<ul style="list-style-type: none"> Study Arduino board pinout (digital, analog, power, communication). Write a sketch to blink an LED with a given delay. Extend code to read a push button and toggle LED state based on button press. Add simple “debouncing” delay and observe behaviour. 	2	A	P	V	2
Embedded Hardware (Arduino) and Sensor Interfacing (Interfacing of sensor with Arduino and display results)	<ul style="list-style-type: none"> Interface an LDR + resistor or temperature sensor. Read sensor values using <i>analog Read()</i> and convert them to voltage/temperature/“light level”. Display values on Serial Monitor or LCD. Implement a simple threshold-based action, e.g., turn ON an LED when it’s dark/hot. 	2	A	P	V	2
Introductory MATLAB and Simulink (Generation and visualization of basic continuous-time-like signals and its spectrum using MATLAB)	<ul style="list-style-type: none"> Write MATLAB scripts to generate: Sine wave, square wave, ramp, and exponential signals over a defined time vector. Plot individual signals and combinations (e.g., sum of two sinusoids, AM-like signal) and view its spectrum. Use subplot to show multiple signals in one figure. Annotate axes, titles, legends, and save plots. 	3	A	P	V	4
Introductory MATLAB and Simulink	<ul style="list-style-type: none"> Derive the differential equation of a simple RC or RL circuit (or generic first-order system). 	3	A	P	V	2

(Modelling and simulation of time response of a first-order system using Simulink)	<ul style="list-style-type: none"> ● Build the equivalent Simulink block diagram using integrator, gain, sum blocks, and step input. ● Run simulation for different R/C values and observe step response (rise time, steady-state value). ● Compare Simulink result with analytical solution (optional MATLAB overlay). 					
Circuit and PCB design (DC and transient response analysis using LTspice)	<ul style="list-style-type: none"> ● Draw a DC network (e.g., voltage divider / simple bias circuit) or RC circuit in LTspice. ● Perform DC operating point analysis and record node voltages and branch currents. ● Perform transient analysis for step input; plot voltages and currents vs time. ● Modify component values and study the effect on circuit behaviour. 	3	A	P	V	2
Circuit and PCB design (PCB design using KiCad)	<ul style="list-style-type: none"> ● Draw the schematic of a simple rectifier with filter or regulated DC supply in KiCad. ● Assign footprints to components (resistors, diodes, capacitor, connector, regulator IC). ● Generate PCB layout: place components, route tracks (single-sided if possible), define board outline. ● Run DRC (Design Rule Check) and generate Gerber files. 	3	A	P	V	2
Course Project	Implement a simple project using the concepts learned above. It could be either hardware based or software based.	1,2,3,4	A	P	V	6

ASSESSMENT PATTERN		
Assessment Method		Marks
Continuous Internal Assessment		60
1	Continuous Lab Evaluation	60
End Semester Examination		40
Total		100