

B. TECH
ELECTRONICS & COMMUNICATION ENGINEERING
CURRICULUM & SYLLABUS
SEMESTER 1&2
2025 REGULATION



B. Tech

ELECTRONICS AND

COMMUNICATION

ENGINEERING

CURRICULUM & SYLLABUS

SEMESTER 1 & 2

2025 REGULATION

CONTENTS

Sl. No.	Title	PAGE NO.
1	Curriculum Structure	5
2	Course Flow (Core Courses)	7
3	Course Flow (Elective Courses)	8
4	Semester-1 Syllabus	9
3	Semester-2 Syllabus	62

B Tech in Electronics and Communication Engineering

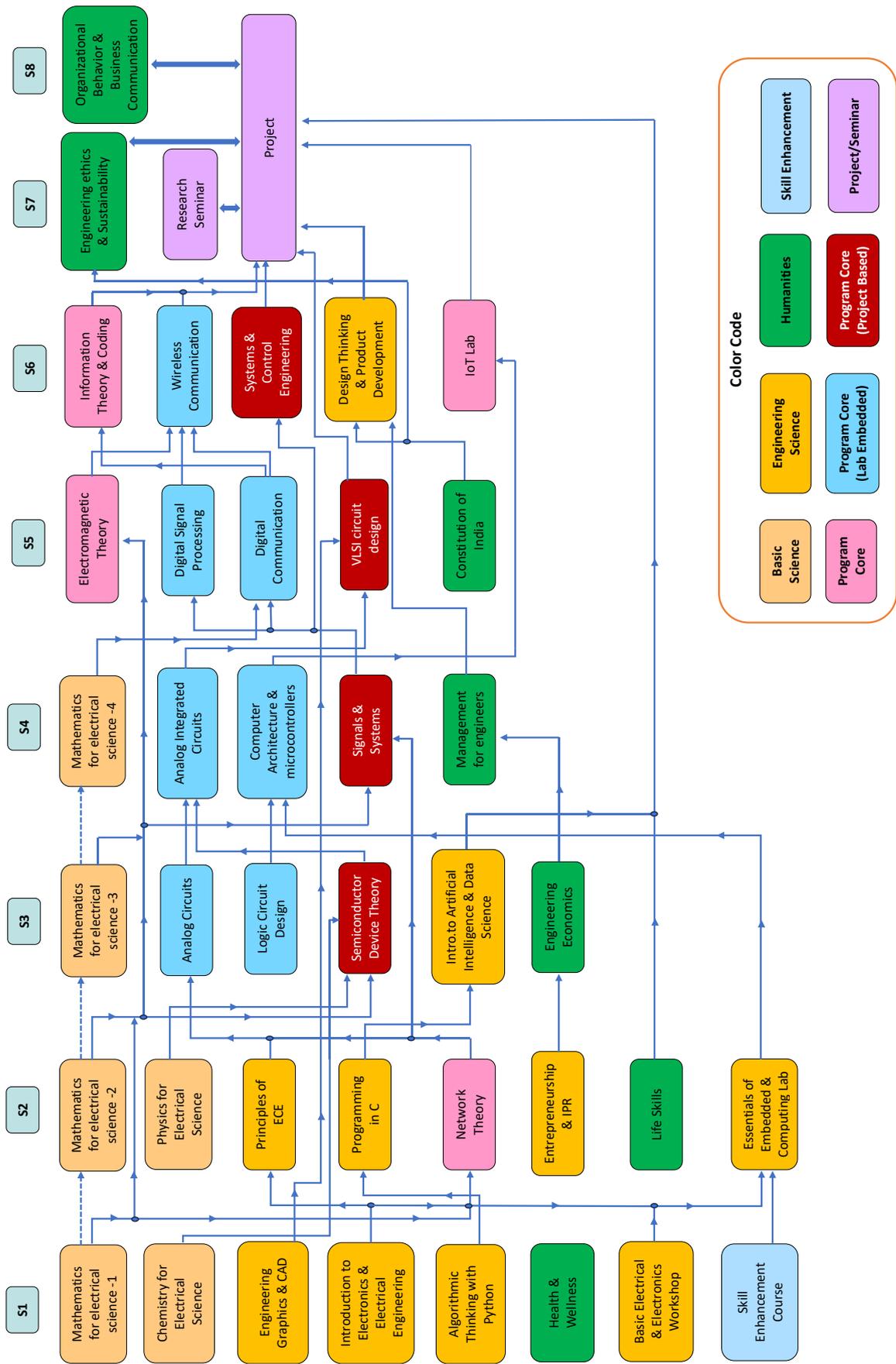
CURRICULUM STRUCTURE

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	B250905/CN110E	Algorithmic Thinking with Python	2	0	0	2	4	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	B250004/EC200C	Principles of Electronics and Communication Engineering	3	1	0	0	2	3	
	D	EST	B250903/CN210D	Programming in C	2	0	0	2	4	4	
	E	PCT	B250004/EC200E	Network Theory	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	B250004/EC310B	Analog Circuits	3	1	0	3	5	6	
	C	PCE	B250004/EC310C	Logic Circuit Design	3	1	0	3	5	6	
	D	PCB	B250004/EC320D	Semiconductor Device Theory	2	1	1	0	4	4	
	E	EST	B250004/EC300E	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							
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	B250004/EC410B	Analog Integrated Circuits	3	1	0	3	5	6	
	C	PCE	B250004/EC410C	Architecture and Programming of Microcontrollers	3	1	0	3	5	6	
	D	PCB	B250004/EC420D	Signals and Systems	2	1	1	0	4	4	
	E	PET	B250004/EC41*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							
M/H			Minor / Honours	3	1	0	0	4	4		
V	A	PCT	B250004/EC500A	Electromagnetic Theory	3	1	0	0	4	4	

	B	PCE	B250004/EC510B	Digital Signal Processing	3	1	0	3	5	6	23
	C	PCE	B250004/EC510C	Digital Communication	3	1	0	3	5	5	
	D	PCB	B250004/EC520D	VLSI circuit design	2	1	1	0	4	4	
	E	PET	B250004/EC51*E	Program/ Industry Linked 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	B250004/EC600A	Information Theory & Coding	3	1	0	0	4	4	23
	B	PCE	B250004/EC610B	Wireless Communication	3	1	0	3	3	5	
	C	PET	B250004/EC61*C	Program/ Industry Linked Elective - Theory	3	1	0	0	2	3	
	D	PCB	B250004/EC620D	Systems and Control Engineering	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	B250004/EC630U	IoT Lab	0	0	0	3	1	2	
	M/H	M/H		Minor / Honours					6	3	
VII	A	PET	B250004/EC71*A	Program/ Industry Linked Elective - Theory	3	1	0	0	2	3	17
	B	PET	B250004/EC72*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		Honours					8	4	
VIII	A	PET	B250004/EC81*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	

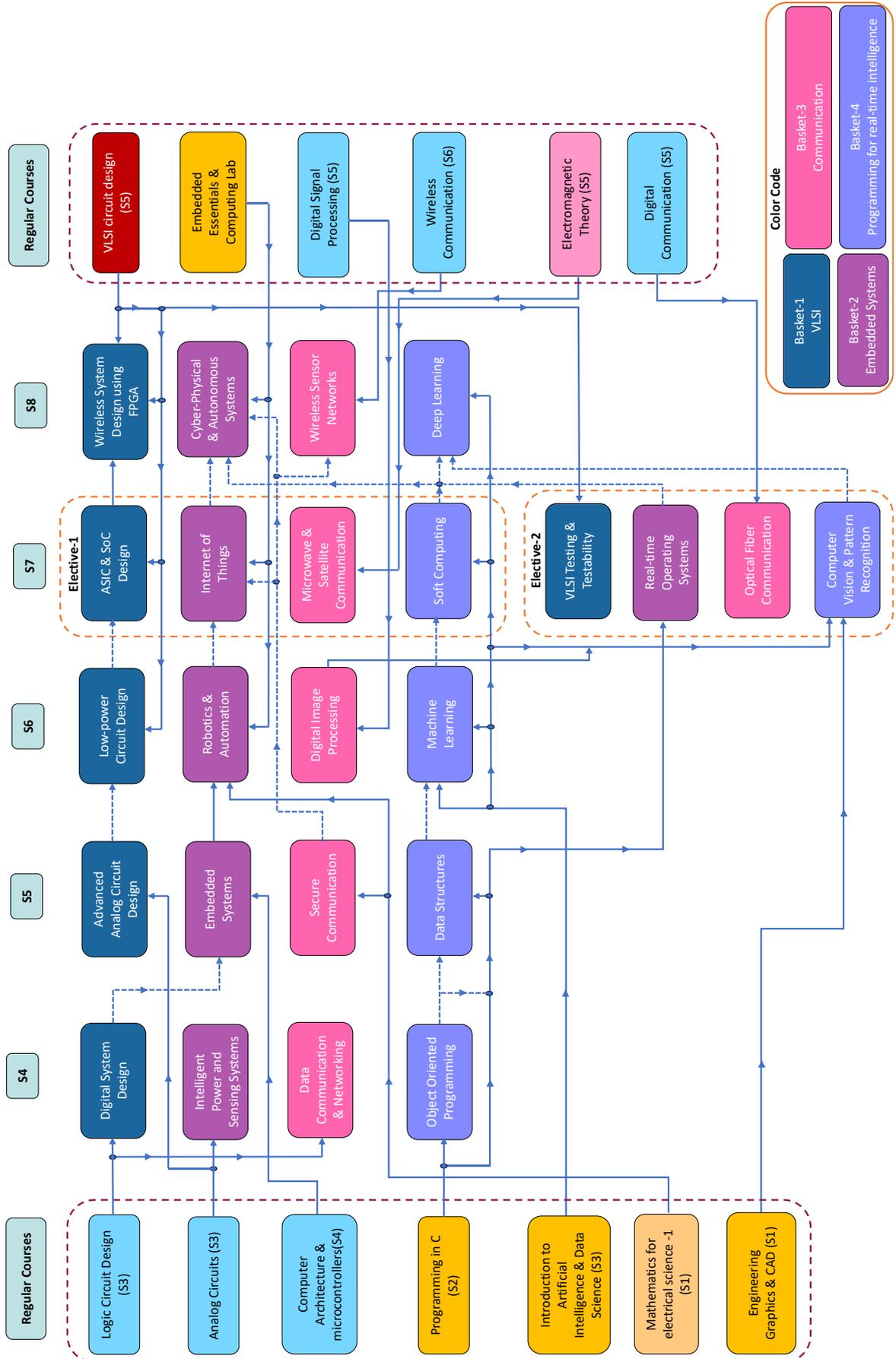
Department of Electronics & Communication Engineering

Course Flow – Regular Courses



Department of Electronics & Communication Engineering

Course Flow – Elective Courses



SEMESTER-1

CONTENTS

COURSE CODE	COURSE NAME	PAGE NO.
	Approval	13
	Curriculum	15
B250802/MA100A	Mathematics for Electrical Science-1	17
B250802/CH910B	Chemistry for Electrical Science	24
B250906/CN100C	Engineering Graphics and Computer Aided Drawing	32
B250906/CN100D	Introduction to Electrical and Electronics Engineering	37
B250905/CN110E	Algorithmic Thinking with Python	46
B250908/CN910K	Health and Wellness	53
B250906/CN930U	Basic Electrical and Electronics Engineering Workshop	57

APPROVAL

This is to certify that the syllabus titled “syllabus for B. Tech in Electronics and Communication 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 Electronics and Communication Engineering held on ____ / ____ / 20

Chairperson, BoS

Name: Dr Abhilash Antony

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. Neelankantan 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	0	0	2	2	3
D	EST	B250906/CN100D	Introduction to Electrical and Electronics Engineering	4	0	0	0	4	4
E	ESE	B250905/CN110E	Algorithmic Thinking with Python	2	0	0	2	4	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	SEC	Skill Enhancement Course: 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	BST
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)	
CC1	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.	CC 1	A		Rs
CO2	Solve linear differential equations with constant coefficients by using various methods.	CC 1	U		Rs
CO3	Apply Laplace transform to find the solution of Initial value problem.	CC 1	A		Rs
CO4	Determine series expansion of the given functions using Taylor and Fourier series.	CC 1	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				

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	
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	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). 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).	9
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			1
	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
	Dirac 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			1
	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	Distribution of Marks (RBL)						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
<i>This ToS shall be treated as a general guideline for students and teachers for distribution of marks</i>								

ASSESSMENT PATTERN	
Assessment	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

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

FIRST SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, DECEMBER 2025 (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			
<i>(Answer all questions. Each question carries 3 marks)</i>			
No.	Question	CO	Marks
1	Determine the row echelon form of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 1 & 1 & 1 \end{bmatrix}$ and hence evaluate its rank.	CO 1	(3)
2	If 2 is an eigen value of the matrix $\begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$, 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			
<i>(Answer any one full question from each module, each question carries 9 marks)</i>			
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 $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$.	CO 1	(4)
OR			
10	a) Diagonalize the matrix $A = \begin{bmatrix} -1 & 2 & -2 \\ 2 & 4 & 1 \\ 2 & 1 & 4 \end{bmatrix}$.	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 $f(t) = \begin{cases} t-1; & 1 < t < 2 \\ 3-t; & 2 < t < 3 \end{cases}$.	CO 3	(4)
MODULE IV				
15	a)	Find the Fourier series expansion of the periodic function $f(x) = \begin{cases} x; & 0 < x < 1 \\ 1-x; & 1 < x < 2 \end{cases}$.	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 $f(x) = \begin{cases} -\pi; & -\pi < x < 0 \\ x; & 0 < x < \pi \end{cases}$ with period 2π . Find the Fourier series expansion of $f(x)$.	CO 4	(5)
	b)	Construct the half-range sine series for $f(x) = \sin(\frac{\pi x}{l})$ 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	BSE
Pre-requisite		
Concepts of chemistry introduced at the plus two levels especially Electrochemistry, Polymers, Structure of Molecules, Environmental Pollution and Volumetric Analysis.		

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

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

COURSE OUTCOMES (CO)					
Course Outcomes (CO): At the end of this course, learners will be able to:					
CO	CO Statement	CC Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	Apply the basic concept of electrochemistry and corrosion to explore the applications in engineering fields.	CC1	A	M	V
CO2	Apply the principles of nanomaterials, conducting polymers and organic electronic devices to solve engineering problems.	CC1	A	M	V
CO3	Utilize the principles and applications of spectroscopic and microscopic techniques for the analysis and characterization of materials.	CC1	A	M	V
CO4	Select various water treatment and waste management methods to solve different environmental issues in a sustainable way.	CC2	A	M	V
Cognitive (Revised blooms Level): - R: Remember; U: Understand; A: Apply; An: Analyse; E: Evaluate; C: Create Psychomotor Domain (Dave's): - I -Imitation, M -Manipulation, P -Precision, Ar -Articulation, N -Naturalisation Affective (Krathwohl): - Re -Receiving, Rs -Responding, V -Valuing, O -Organization, Ch -Characterization					

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

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

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

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

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Electrochemistry and Corrosion	Electrochemical Cell-Electrode potential- Nernst equation - Reference electrodes –Electrochemical series - Glass Electrode & pH Measurement- Conductivity and its measurement. Li-ion battery & H ₂ -O ₂ fuel cell. Corrosion –Electrochemical corrosion - Galvanic series - Corrosion control methods – Electroplating of copper - Electroless plating of copper.	9
2	Materials for Electronic Applications	Nanomaterials - Classification -Synthesis -Carbon Nanotubes, Fullerenes, Graphene & Carbon Quantum Dots – Polymers - Fire Retardant Polymers- Conducting Polymers- Polyaniline & Polypyrrole-Organic electronic materials and devices-Organic Light Emitting Diode (OLED) & Dye-Sensitized Solar Cells (DSSC). Materials used in Quantum computing Technology, Super capacitors, Spintronics.	9
3	Molecular Spectroscopy and Analytical Techniques	Spectroscopy- Types of spectra- Molecular energy levels – Beer Lambert's law – Electronic spectroscopy- Instrumentation – Applications. Vibrational spectroscopy – Number of vibrational modes – Vibrational modes of CO ₂ and H 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.	12

	Health impacts of E- waste	
5	Pre- lab work.	16

SUGGESTED LEARNING RESOURCES

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

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

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

DETAILED SYLLABUS (Self-learning if any to be marked)							
Module	Topic	Mode of Delivery	CO	Learning Domain			Hrs
				C	P	A	
1	Electrochemical Cell Electrochemical Cell and Electrode potential	L	CO1	U		Rs	1
	Nernst equation for single electrode and cell (Numerical problems)	L, P	CO1	A	M	V	1
	Nernst Equation-Numerical Problems	L	CO1	A		Rs	1
	Electrochemical series and applications	L, P	CO1	A	M	V	1
	Reference electrodes – SHE & Calomel electrode –Construction and Working	L	CO1	U		Rs	1
	Glass Electrode & pH Measurement Conductivity-Measurement using Digital conductivity meter.	L, P	CO1	A	M	V	1
	Li-ion battery & H ₂ -O ₂ fuel cell (acid electrolyte only) construction and working.	L	CO1	U		Rs	1
	Corrosion Electrochemical corrosion mechanism (acidic & alkaline medium)	L	CO1	U		Rs	1

	Galvanic series - Corrosion control methods - Cathodic Protection - Sacrificial anodic protection and impressed current cathodic protection. Electroplating of copper – Electroless plating of copper.	L	CO1	U		Rs	1
	Construction, working and applications of Lead acid battery, Nickel cadmium battery and Nickel metal hybrid battery.	S	CO1	U		Rs	
2	Nanomaterials Classification based on Dimension & Materials	L	CO2	U		Rs	1
	Synthesis – Sol gel & Chemical Reduction - Applications of nanomaterials	L	CO2	U		Rs	1
	Carbon Nanotubes, Fullerenes- structure, properties & application.	L	CO2	U		Rs	1
	Graphene & Carbon Quantum Dots – structure, properties & application.	L	CO2	U		Rs	1
	Polymers Fire Retardant Polymers- Halogenated & Non-halogenated polymers (Examples only) Conducting Polymers- Classification	L	CO2	U		Rs	1
	Polyaniline- synthesis, properties and applications. Polypyrrole-synthesis, properties and applications	L, P	CO2	A	M	V	1
	Organic electronic materials and devices Construction, working and applications of Organic Light Emitting Diode (OLED)	L	CO2	U		Rs	1
	Construction, working and applications of Dye-Sensitized Solar Cells (DSSC)	L	CO2	U		Rs	1
	Materials used in Quantum computing Technology. Super capacitors, Spintronics	L	CO2	U		Rs	1
3	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	Distribution of Marks (RBL)						Total Marks
		R	U	A	An	E	C	
1	Electrochemistry and Corrosion Science	√	√	√				15
2	Materials for Electronic Applications	√	√	√				15
3	Molecular Spectroscopy and Analytical Techniques	√	√	√				15
4	Environmental Chemistry	√	√	√				15

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

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

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

FIRST SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, DECEMBER 2025 (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	2-0-0-2-2	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
B250906/CN100C	ENGINEERING GRAPHICS AND COMPUTER AIDED DRAWING	EST
Pre-requisite		
NIL		

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

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

COURSE OUTCOMES (CO)					
Course Outcomes (CO): At the end of this course, learners will be able to:					
CO	CO Statement	CC Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	Draw the orthographic projection of points and lines located in different quadrants	CC1	A		
CO2	Generate multi-view orthographic projections of engineering objects by visualizing them in different positions	CC1	A		
CO3	Plot sectional views of engineering solids	CC1	A		
CO4	Develop surfaces of engineering objects	CC1			
CO5	Prepare pictorial drawings using the principles of isometric projection	CC1	A		
CO6	Sketch simple 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	
<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			Theory			
					C	CIA	ESE	Total		
4	0	0	0	2	3	90	40	60	100	

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

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Orthographic projection of points and lines	Introduction: Relevance of technical drawing in the engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing. (No questions for the end semester examination) 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

5	Computer Aided Drawing (CAD)- Introduction	CL	CO6	A			1
	Creating two-dimensional drawing with dimensions using suitable software	CL	CO6	A		Re	5
	CAD - self learning- Questions in 2D drawing	SL	CO6	A		Re	18

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

Module	Module Title	Distribution of Marks (RBL)						Total Marks
		R	U	A	An	E	C	
1	Orthographic projections of points and lines			√				15
2	Orthographic projections of solids			√				15
3	Sections of solids and development of surfaces			√				15
4	Isometric projection			√				15

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

ASSESSMENT PATTERN

Assessment	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

FIRST SEMESTER B. TECH DEGREE REGULAR EXAMINATION, DECEMBER 2025 (2025 SCHEME)			
Course Code:	B250906/CN100C		
Course Name:	Engineering Graphics and Computer Aided Drawing		
Max. Marks	60	Duration:	2 hours 30 minutes
Common to 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
<i>(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)</i>						

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

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

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

COURSE OUTCOMES (CO)					
Course Outcomes (CO): At the end of this course, learners will be able to:					
CO	CO Statement	CC Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	Apply circuit laws to solve simple DC circuits in steady state	CC1	A		V
CO2	Explain the basics of magnetic circuits and concept of electromagnetic induction	CC1	U		Rs
CO3	Calculate the parameters of alternating voltage and current waveforms	CC1	A		V
CO4	Apply the fundamental laws of electrical engineering to solve single phase and three phase AC circuits in steady state	CC1	A		V
CO5	Describe the working principles and V-I characteristics of semiconductor devices and apply them in basic electronic circuits.	CC2	U	I	Rs
CO6	Discuss the concepts of communication systems, electronic instrumentation, and IoT with applications in various real-life domains.	CC3	U	I	Rs
Cognitive (Revised blooms Level): - R: Remember; U: Understand; A: Apply; An: Analyse; E: Evaluate; C: Create Psychomotor Domain (Dave's): - I-Imitation, M-Manipulation, P-Precision, Ar-Articulation, N-Naturalisation Affective (Krathwohl): - Re-Receiving, Rs-Responding, V-Valuing, O-Organization, Ch-Characterization					

CO	Program Outcomes (PO)& Program Specific Outcomes (PSO) Correlation Matrix														
	PO											PSO			
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	
1	3	3			2		3								
2	2														
3	3	3			2		3								
4	3	3			2		3								
5	3	2													
6	2	2				1	1		1						
<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			Theory		
L	T	J	P	S	C	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

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

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

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme		
L	T	J	P	S			Theory		
L	T	J	P	S	C	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	to & 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			1
	Resistances in series and parallel, Current and Voltage Division Rules	L					1
	Capacitors & Inductors: V-I relations and energy stored. Ohm's law	L					1
	star-delta conversion (resistive networks only) - problems.	L					Rs
	Numerical problems	T, S	CO1	A		V	2
	Mesh current method – matrix representation - Solution of network equations.	L, T, S					1
	Numerical problems	T					1

	Node voltage methods-matrix representation- solution of network equations by matrix methods - numerical problems.	L, T, S					1	
	Numerical problems	T					2	
	Basic Terminology: MMF, field strength, flux density, reluctance - comparison between electric and magnetic circuits	L	CO2	U		Rs	1	
	Series and parallel magnetic circuits with composite materials	L					1	
2	Faraday's laws, Lenz's law, statically induced and dynamically induced emfs, problems	L	CO2	U		Rs	1	
	Self-inductance and mutual inductance, coefficient of coupling	L					1	
	Generation of alternating voltages- Representation of sinusoidal waveforms: frequency, period	L					1	
	Average and RMS values and form factor of waveforms - Numerical Problems	L, T, S	CO3	A		V	2	
	Phasor representation of sinusoidal quantities. Trigonometric, Rectangular, Polar and complex forms.	L					1	
	Analysis of simple AC circuits: Purely resistive circuit	L					1	
	Analysis of simple AC circuits: Purely inductive & capacitive	L, T, S	CO3	A		V	2	
	circuits; Inductive and capacitive reactance, concept of impedance.							
	Average Power, Power factor							
	Analysis of RL, RC and RLC series Circuits- active, reactive and apparent power.						2	
	Numerical Problems	T					2	
	Generation of three phase voltages, advantages of three phase systems, star and delta connections	L	CO4	U			Rs	1
	Relation between line and phase voltages, line and phase currents - Numerical problems.	L, T, S						1
	Numerical Problems	T						2
3	Passive & Active components	L, T	CO5	U	I	Rs	1	
	Rectifiers: Full-wave & Bridge - Ripple factor (with & without capacitor filter)						2	
	Zener voltage regulator, Line & load regulation	L, T, S	CO5	U	I	Rs	2	
	Block diagram of regulated DC power supply						1	
	BJT Construction & working, V-I characteristics of BJT	L, T	CO5	U	I	Rs	2	
	CE configuration: Input-output characteristics						1	
	Comparison of CE, CB & CC configurations	L	CO5	U	I	Rs	1	
	Concept of biasing & load line, Transistor as a switch (circuit & working)	L, T	CO5	U	I	Rs	2	
	Transistor as an amplifier, RC coupled amplifier: Circuit diagram & frequency response	L, T	CO5	U	I	Rs	2	
	Basics of FETs (MOSFET) - Construction & working of N & P channel MOSFET (Drain & Transfer characteristics)	L, S	CO5	U	I	Rs	2	
4	General block diagram of a communication system	L, T	CO6	U	I	Rs	1	
	Need for modulation, Concept of AM & angle modulation (no derivation)						2	
	Basic concept of wired communication, Wired channels: twisted pair, coaxial cable, fiber optic cable	L	CO6	U	I	Rs	2	
	Introduction to wireless communication, Block diagram of GSM, Comparison of 3G, 4G, 5G & 6G technologies	L, S	CO6	U	I	Rs	2	

Block diagram of electronic instrumentation system, Digital Multimeter,	L	CO6	U	I	Rs	2
Function generator, Introduction to CRO & Lissajous patterns						2
IoT based smart homes, IoT in healthcare, IoT in agriculture (case study only)	L, S	CO6	U	I	V	3

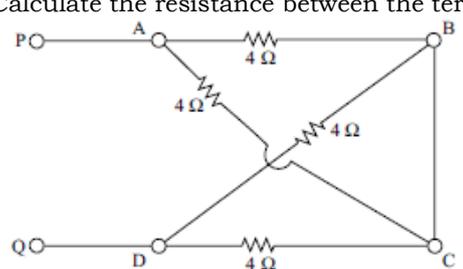
TABLE OF SPECIFICATIONS (ToS) (ESE Question Paper Design)								
Module	Module Title	Distribution of Marks (RBL)						Total Marks
		R	U	A	An	E	C	
1	Analysis of DC Circuits	√	√	√				15
2	Analysis of AC Circuits	√	√	√				15
3	Introduction to Electronics devices & circuits		√	√				15
4	Introduction to telecommunication & Instrumentation		√	√				15

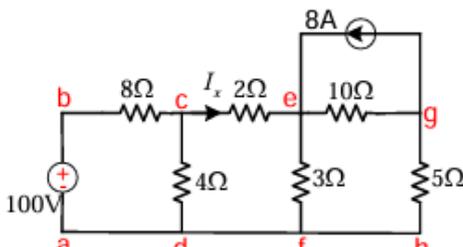
This ToS shall be treated as a general guideline for students and teachers for distribution of marks

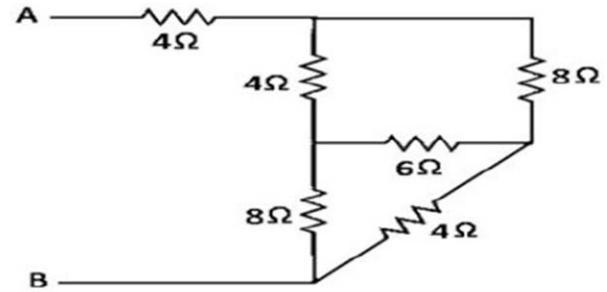
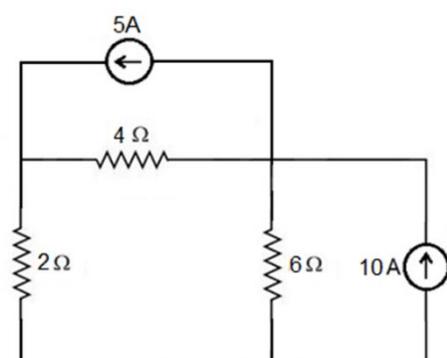
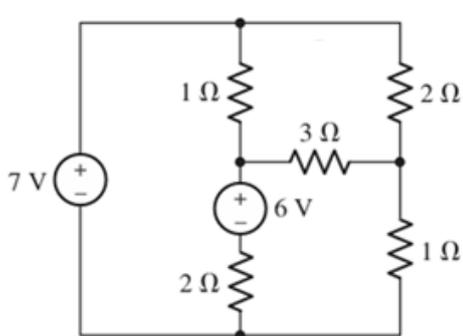
ASSESSMENT PATTERN	
Assessment	Marks
Continuous Internal Assessment	40
1. Internal Examination	20
2. Learning Activity	15
3. Regularity	5
4. Course Project	-
End Semester Examination	60
Total	100

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

FIRST SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, DECEMBER 2025 (2025 SCHEME)			
Course Code:	B250906/CN100D		
Course Name:	INTRODUCTION TO ELECTRICAL & 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			
(Answer all questions. Each question carries 3 marks)			
No.	Question	CO	Marks
1	Calculate the resistance between the terminals P and Q of the network shown. 	CO1	(3)
2	Differentiate between electric resistance and magnetic reluctance.	CO2	(3)
3	Electromotive force (emf) can be generated in two ways – statically induced and dynamically induced. Compare these two types of induced emf with respect to principle, condition of flux, and applications.	CO2	(3)
4	A solenoid coil with an inductance of 0.5 H is used in a smart lighting control system, which operates on a 230 V, 50 Hz AC supply. Derive the expressions for the instantaneous voltage and current through the coil.	CO3	(3)

PART 1 - B			
MODULE 1 & 2			
(Answer any one full question from each module, each question carries 9 marks)			
No.	Question	CO	Marks
MODULE I			
5	a In the circuit shown determine the current I_x . 	CO1	(5)

		<p>Apply star-delta transformation to determine the equivalent resistance R_{AB}.</p> 	CO1	(4)
OR				
		<p>Apply Nodal analysis to solve the node voltages in the circuit shown.</p> 	CO1	(4)
6		<p>Apply mesh analysis to determine the three mesh currents in the circuit shown below.</p> 	CO1	(5)
MODULE II				
7		<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.</p> <p>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.</p> <p>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	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 $8+j6 \Omega$. i) Calculate the line current drawn by the motor system. ii) Determine the power factor of the system. iii) Compute the total power consumed.	CO4	(5)
OR				
8	a	An R-L-C series circuit is used as part of an AC filtering system. By adjusting the inductance, the current peaks at 0.5 A while operating at 230 V, 50 Hz supply. At this point, a voltage of 350 V is recorded across the capacitor. 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)

(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 2 - ELECTRONICS ENGINEERING (30 MARKS)			
PART 2 - A			
MODULE 3 & 4			
(Answer all questions. Each question carries 3 marks)			
No.	Question	CO	Marks
1	The colour bands Violet, Blue, Brown, and Gold are observed on a resistor. Analyse whether this resistor is suitable for a circuit that specifies the resistance must remain between 730Ω and 780Ω . 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 $I_B = 20\mu A$	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	Marks
MODULE III			
5	You are designing a power supply circuit for a portable radio that requires a steady DC voltage. The circuit includes a rectifier to convert the AC mains supply to DC before the voltage is regulated.		
	a)	Identify and sketch the type of rectifier used in the circuit.	CO5 (3)
	b)	Describe the working principle of the above rectifier in the power supply circuit.	CO5 (3)
	c)	Sketch the waveforms of the input AC voltage, the rectified output voltage, and the regulated output voltage supplied to the radio.	CO5 (3)
OR			
6	An electronics trainee is testing a MOSFET using a multimeter. When the voltage measured between the gate and source is 0 V, the device does not conduct between drain and source. However, on applying a positive gate to source voltage, current begins to flow from drain to source.		
	a)	Identify the type and illustrate the construction of MOSFET.	CO5 (3)
	b)	Justify the trainee's observations regarding the operation of this MOSFET when tested under different gate to source voltages.	CO5 (4)
	c)	Interpret the drain characteristics of this MOSFET with the help of a neat sketch, identifying the different regions of operation.	CO5 (2)
MODULE IV			
7	A broadcast engineer is planning to transmit an audio signal of frequency range 300 Hz – 3.4 kHz directly over a long distance to multiple locations. After setting up the transmission, he notices that at the receiver end, the signal is highly attenuated and gets distorted with noise, making the speech almost unintelligible.		
	a)	Identify the reason for the poor reception of the directly transmitted audio signal and suggest a suitable method to overcome this issue.	CO6 (4)
	b)	Describe any two techniques that enable effective transmission of signals over long distances, and illustrate your explanation with neat sketches.	CO6 (5)
OR			
8	You are assigned to troubleshoot an electrical circuit in a lab where a resistor, capacitor, and a battery are connected. The circuit is not functioning as expected, and you suspect faulty components.		
	a)	Recommend a suitable instrumentation system that can be used to perform the necessary measurements in this scenario, and draw its block diagram.	CO6 (4)
	b)	How does the suggested instrument function in measuring battery current and resistance.	CO6 (5)

COURSE DESCRIPTION							
Regulation	2025	L-T-J-P-S	2-0-0-2-4	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
B250905/CN110E	ALGORITHMIC THINKING WITH PYTHON	ESE
Pre-requisite		
NIL		

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

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

COURSE OUTCOMES					
Course Outcomes (CO): At the end of this course, learners will be able to:					
CO	CO Statement	CC Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	Interpret problem-solving strategies by using computing as a model for addressing near real-world problems	1	U	M	Rs
CO2	Develop clear and accurate models, such as algorithms, pseudocode, flowcharts, to represent the problem by articulating it before attempting to solve it	1	A	M	Rs
CO3	Apply the essential python programming skills, to translate the algorithmic model into executable program	2	A	M	Rs
CO4	Identify systematic approaches and problem-solving strategies for computational problems	1	A	M	Rs
Cognitive (Revised blooms Level): - R: Remember; U: Understand; A: Apply; An: Analyse; E: Evaluate; C: Create Psychomotor Domain (Dave's): - I-Imitation, M-Manipulation, P-Precision, Ar-Articulation, N-Naturalisation Affective (Krathwohl): - Re-Receiving, Rs-Responding, V-Valuing, O-Organization, Ch-Characterization					

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

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

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

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

SELF-LEARNING / TEAM WORK		
Sl. No	Self-learning / Team Work Description	Hrs
1	Pre-Lab practical Preparation	19
2	Case study: Pick simple problems (e.g., finding prime numbers) document steps: understanding, model, algorithm, coding, testing.	12
3	Group activity: Each team takes a real-world scenario (e.g., ATM withdrawal process, online shopping checkout) and develops pseudocode with sequencing, selection, and repetition.	12
4	Compare recursive vs iterative solutions for factorial & Fibonacci. 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).	11

SUGGESTED LEARNING RESOURCES

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

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

Web Resource	
1	https://opentextbc.ca/h5pppsychology/chapter/problem-solving/
2	https://onlinecourses.nptel.ac.in/noc21_cs32/preview

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

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

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

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

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

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

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

ASSESSMENT PATTERN

Assessment	Marks
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

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

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

PART B			
<i>(Answer any one full question from each module, each question carries 9 marks)</i>			
No.	Question	CO	Marks
MODULE I			
9	a) Explain how the backtracking strategy can be applied to solve a real-life problem, for example, planning steps to reach a financial savings goal.	CO 1	(5)
	b) Write a Python program to convert a temperature given in Celsius to Fahrenheit and Fahrenheit to Celsius (Hint: $^{\circ}\text{F} = (^{\circ}\text{C} \times 9/5) + 32$).	CO 1	(4)
OR			
10	a) A student is preparing for multiple competitive exams with limited time. Describe how the Means-Ends Analysis approach can be applied to plan an effective study schedule.	CO 1	(5)
	b) Write a Python program to calculate the bill amount for an item given its quantity sold, value, discount, and tax.	CO 1	(4)

MODULE II				
11	a)	Write pseudocode to simulate a simple ATM withdrawal system. The system should check balance, deduct the amount, and display the remaining balance.	CO 2	(5)
	b)	Draw a flowchart to compute the sum of digits of an integer.	CO 2	(4)
OR				
12	a)	Write pseudocode to compute the average marks of N students and classify them into "Pass" and "Fail" categories (Criteria to consider as pass is greater than or equal to 50 marks out of 100.).	CO 2	(5)
	b)	Develop an algorithm to check whether a given year is a leap year.	CO 2	(4)
MODULE III				
13	a)	Differentiate recursion and iteration. Write a recursive program to find factorial of a number.	CO 3	(5)
	b)	Write a Python function to accept a list of integers and return a new list containing only the perfect numbers (Hint: A perfect number is a positive integer equal to the sum of its proper divisors, e.g., 6, 28, 496).	CO 3	(4)
OR				
14	a)	Write a Python program using function to print 'n' lines of the following pattern. 1 1 2 1 2 3 1 2 3 4	CO 3	(5)
	b)	You have tuples representing election results: (Candidate Name, Votes Received). Write a program to find the candidate with the maximum votes. Also calculate the percentage of votes each candidate received. Sample Input: [("Alice", 3400), ("Bob", 2800), ("Charlie", 1500)] Output: Winner: Alice Vote Percentages: [47.22%, 38.89%, 13.89%]	CO 3	(4)
MODULE IV				
15	a)	Illustrate the process of sorting the array [15, 8, 3, 12, 6, 10, 4, 1] using the merge sort algorithm. Draw a diagram showing how the array is split and merged at each stage.	CO 4	(5)
	b)	Compare Greedy Algorithms and Dynamic Programming in terms of their approach, solution guarantee, and applicable scenarios. Provide examples where each approach is preferred.	CO 4	(4)
OR				
16	a)	A company wants to allocate jobs to machines to minimize total cost. Formulate this as an optimization Problem and describe how dynamic programming can be applied.	CO 4	(5)
	b)	A student has exams for 5 subjects, each requiring different preparation times (Subject A – 2 hrs, Subject B – 4hrs, Subject C – 1 hr, Subject D – 3hrs, Subject E – 5hrs). Given a total of 10 study hours, design a Greedy Strategy to maximize the number of subjects covered. Show the sequence of subjects chosen and the total number of subjects.	CO 4	(4)

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

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

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

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

COURSE OUTCOME (CO)					
Course Outcomes (CO): At the end of this course, learners will be able to:					
CO	CO Statement	CC Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	Explain the importance of physical activity in maintaining human metabolic system.	CC1	U		Re
CO2	Practice life style management strategies to improve mental health and wellness.	CC1	U	M	Rs
CO3	Practice healthy life style through regular physical activities and abstaining from addictive substances.	CC1	U	M	Ch
Cognitive (Revised blooms Level): - R: Remember; U: Understand; A: Apply; An: Analyse; E: Evaluate; C: Create Psychomotor Domain (Dave's): - I-Imitation, M-Manipulation, P-Precision, Ar-Articulation, N-Naturalisation Affective (Krathwohl): - Re-Receiving, Rs-Responding, V-Valuing, O-Organization, Ch-Characterization					

CO	Program Outcomes & Program Specific Outcomes Correlation Matrix														
	PO											PSO			
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	
1	2					1	1		1		1				
2	2					1	1		1		1				
3	2					1	1		1		1				
<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			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	Thygeron, A. L., Thygeron, S. M., & Thygeron, 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	ESL
Pre-requisite		
NIL		

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

COMPETENCY	
CC1	Apply skills in 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 specifications, circuit symbols, and approximate cost.	CO4	A	M	Rs	2
Drawing of Circuit Diagrams & Data Sheets	To draw electronic circuit diagrams using BIS/IEEE standard symbols and to interpret data sheets of commonly used discrete components and ICs.	CO4	A	P	V	2
Familiarization of Instruments & Tools	To operate basic electronic testing instruments such as Multimeter, Function Generator, DC Power Supply, CRO, and DSO, and to familiarize with commonly used tools including soldering iron, desoldering pump, and crimping tools.	CO5	A	M	Rs	2
Testing of Components using Multimeter	To test the electrical characteristics and functionality of basic electronic components such as resistors, capacitors, diodes, BJTs, and JFETs using appropriate testing methods.	CO5	A	P	V	2
PCB Study and Fabrication	To study different types of printed circuit boards (single-sided, double-sided, and plated through hole) and to design and fabricate a simple single-sided PCB.	CO6	A	Ar	V	2
Soldering & Interconnection Practice	To study various interconnection methods such as breadboard, crimping, and soldering, and to practice soldering of connectors and assembling simple circuits on a PCB.	CO6	An	Ar	V	2
Assembly & Testing of Simple Circuit	To assemble and test an electronic circuit, for a fixed voltage power supply using transformer, rectifier diode, capacitor filter, and Zener/IC regulator and verify it's working.	CO6	An	Ar	V	2
Introduction to EDA tool	Simulation of basic electronic circuit using Multisim	CO6	An	P	V	2

ASSESSMENT PATTERN	
Assessment	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-2

CONTENTS

COURSE CODE	COURSE NAME	PAGE NO.
	Approval	66
	Curriculum	68
B250802/MA200A	Mathematics for Electrical Science - 2	70
B250802/PH910B	Physics for Electrical Science	78
B250004/EC200C	Principles of Electronics and Communication Engineering	87
B250903/CN210D	Programming in C	96
B250004/EC200E	Network Theory	109
B250908/CN220F	Entrepreneurship and IPR	121
B250908/CN900K	Life Skills and Professional Communication	132
B250902/CN230U	Essentials of Embedded and Computing Lab	138

APPROVAL

This is to certify that the syllabus titled “syllabus for B. Tech in Electronics and Communication 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 Electronics and Communication Engineering held on ____ / ____ / 20

Chairperson, BoS

Name: Dr Abhilash Antony

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. Neelankantan 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	B250004/EC200C	Principles of Electronics and Communication Engineering	3	1	0	0	2	3
D	EST	B250903/CN210D	Programming in C	2	0	0	2	4	4
E	PCT	B250004/EC200E	Network Theory	3	1	0	0	4	4
F	ESB	B250908/CN220F	Entrepreneurship and IPR	2	0	1	0	0	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: 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
Course Code	Course Name						Course Category
B250802/MA200A	MATHEMATICS FOR ELECTRICAL SCIENCE-2						BST
Pre-requisite							
Sound knowledge in calculus of one real variable.							
<i>(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)</i>							

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 & OUTCOMES					
Competency Statements	CC 1	Demonstrate the ability to analyze mathematical models of physical systems and find its solution using appropriate calculus-based methods.			
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					

Program Outcomes & Program Specific Outcomes Correlation Matrix														
CO	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 levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - “-”

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)			
Module	Title	Major Topics	Contact Hours
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/Semester (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	3			1
		Partial derivatives of functions of two variables, Partial derivatives viewed as rate of change and slopes	L	1	3			2
		Tutorial	T	1	3		2	1
		Partial derivatives of functions with more than two variables, Higher order partial derivatives	L	1	3			2
		Tutorial	T	1	3		2	1
		Local linear approximation	L	1	3			2
		Tutorial	T		3		2	1
		The Chain Rule, Implicit partial differentiation	L	1	3			2
		Maxima and Minima of functions of Two Variables-Finding relative extrema.	L	1	3			2
		Tutorial	T		3		2	1
2	Multivariable Calculus-Integration	Double Integrals, Evaluating double integrals over rectangular regions	L	2	2			1
		Evaluating double integrals over nonrectangular regions	L	2	3			2
		Reversing the order of integration	L	2	3			1
		Tutorial	T		3		2	1
		Converting Double integrals from Cartesian Coordinates to Polar Coordinates	L	2	3			1
		Area calculated as a double integral, finding volumes using double integration	L	2	2			2

		Triple Integrals- Evaluating triple integrals over rectangular boxes	L	2	2			1
		Evaluating triple integrals over more general regions	L	2	3			1
		Tutorial	T	2	3		2	1
		Volume calculated as a triple integral	L	2	3			1
		Converting Triple integrals in Cartesian coordinates to Cylindrical coordinates	L	2	3			1
		Tutorial	T	2	3		2	1
3	Calculus of Vector Functions	Vector valued function of a single variable	L	3	2			1
		Limit, continuity and derivatives of vector valued function of a single variable	L	3	2			1
		Tutorial	T	3	3		2	1
		Concept of scalar and vector field	L	3	2			1
		Gradient and Directional Derivatives of a scalar field and its properties.	L	3	3			2
		Tutorial	T	3	3		2	1
		Divergence and curl of a vector field	L	3	2			2
		Line integral of vector fields	L	3	3			2
		Work as line integral	L	3	3			1
		Tutorial	T	3	3		2	1
		Conservative vector fields, Independence of path and Potential function(results without proof)	L	3	3			2
		Tutorial	T	3	3		2	1
4	Vector Integral Theorems	Green's theorem for simply connected region	L	4	2			2
		Applications of Green's theorem	L	4	3			1
		Tutorial	T	4	3		2	1
		Surface integrals over surfaces of the form $z = g(x, y)$.	L	4	3			1

	Flux integrals over surfaces of the form $z = g(x, y)$.	L	4	3			2
	Tutorial	T	4	3		2	1
	Divergence theorem (without proof)	L	4	2			1
	Finding flux using Divergence theorem, Sources and sinks	L	4	3			2
	Tutorial	T	4	3		2	1
	Stokes' theorem (without proof)	L	4	2			1
	Finding work done using Stokes' theorem	L	4	3			1
	Tutorial	T	4	3		2	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
1. Internal Examination	20
2. Learning Activity	15
3. Regularity	5
4. Course Project	0
End Semester Examination	60
Total	100

MODEL QUESTION PAPER

SECOND SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, DECEMBER 2025 (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 $w = x^2 y^3 z$ 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	Credits	4
Course Code	Course Name			Course Category	
B250802/PH910B	Physics for Electrical Science			BS	
Pre-requisite					
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 & OUTCOMES		
Competency Statements	CC-1	Demonstrate ability to apply the principles of semiconductors to solve basic problems in semiconductor circuits and devices.
	CC-2	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): 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 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			

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

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	Hours
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/Semester
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	Pre-lab 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 Problem1	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 Problem2	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	L	CO2	A	M	Rs	1

		solar cells to solar panel						
		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			1
	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
Course Project	--
End Semester Examination	60
Total	100

FIRST SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, DECEMBER 2025 (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 behavior 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. (i) Determine the peak output voltage across the load. (ii) Calculate the average DC output voltage. (iii) Explain briefly why the ripple frequency in the output is twice the supply frequency.	CO2	(3)
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. (a) Calculate the energy of a single photon emitted. (b) 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	2-1-0-0-3	Version	25/0	Credits	3
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

Course Code	Course Name	Course Category
B250004/EC200C	Principles of Electronics and Communication Engineering	EST
Pre-requisite		
B250906/CN100D Introduction to Electrical and Electronics Engineering		

COURSE OBJECTIVES	
1	To introduce RC wave-shaping and diode circuits for developing intuition on time-domain behaviour and signal conditioning.
2	To build conceptual insight into BJT behaviour, small-signal models, and their relation to amplifier and switch operation.
3	To develop conceptual fluency in analysing and characterizing analog modulation schemes, their bandwidth requirements, and spectral features.
4	To examine practical circuits and principles for the generation and detection of AM and angle-modulated signals used in analog communication systems.

COMPETENCY STATEMENT (CC)	
CS05	Design, analyse, and troubleshoot complex electrical circuits by fundamental principles such as Kirchhoff's laws, AC circuit behaviour, power calculations etc.
CS06	Design and develop stable systems for engineering applications while analysing both linear and non-linear electronic systems.
CS09	Design and analyse analog circuits and RF circuits, including amplifiers, filters, power supplies, and signal conditioning circuits.
CS14	Design and analyse communication systems, incorporating modulation and demodulation techniques.
CS15	Apply signal processing techniques like Fourier Transform to analyse and manipulate signals in analog and digital communication 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)
CO 1	Analyse and design RC, diode, and transistor biasing circuits, and evaluate their performance characteristics.	CS05, CS09	A	P	V
CO 2	Apply the principles and modelling to analyse single stage and multistage BJT amplifier circuits.	CS06, CS09	A	P	V
CO 3	Evaluate analog modulation schemes using time and frequency domain analysis of spectra and bandwidth.	CS15	A	M	V
CO 4	Describe the generation and demodulation of AM and angle modulation using practical circuits.	CS14	A	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	2	1	1	2	1	1	1	1		1	1	1	
2	3	2	1	1	2	1	1	1	1		1	1	1	
3	3	2	1	1	2	1	1		1		1	1	1	
4	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			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	Wave-Shaping circuits and BJT biasing	Differentiator and Integrator; High pass and Low pass RC circuits; Clipper; Clamper; Biasing of BJT (CE).	13
2	BJT amplifiers and voltage regulators	RC-Coupled CE Amplifier Design and Small-Signal Analysis; High-Frequency Analysis of CE Amplifier; Multistage and Cascode BJT Amplifiers; Voltage Regulator	11
3	Analog Modulation and Spectral Analysis	Time/Frequency Domain Representation, Signal Spectrum and frequency shifting, Amplitude and Frequency Modulation (Signal Processing Level)	11
4	Generation and Detection of Amplitude and Angle Modulated Signals	AM Generation and Detection Circuits, Superheterodyne Receiver and Frequency Translation, FM Generation Circuits and FM-PM Relationship, FM Demodulation and Phase-Locked Loop (PLL) Techniques	10

SELF-LEARNING / TEAM WORK		
Sl. No	Self-learning / Team Work Description	Hrs
1	Self-learning: Explore RC wave-shaping and diode rectification/regulation through guided notes and simulation demos. Prepare a one-page concept sheet summarizing observed waveform behaviours (rise time, ripple, clipping levels).	7 Hrs
2	Team work: Analyse diode/BJT datasheets to identify ratings and relate them to circuit operation limits. Present a short table comparing device parameters and design constraints.	5 Hrs
3	Team Work: Study real AM and FM radio stations using a receiver or online SDR. Record short samples, observe and compare audio quality, coverage, and interference. Estimate bandwidth and sidebands using MATLAB FFT / spectrum-analyser tools, and relate findings to theoretical AM and FM spectra.	6 Hrs

4	Self-Learning: Explore the principle of frequency conversion in a superheterodyne receiver using an online simulator (e.g., Falstad Circuit Simulator). Observe how tuning and local-oscillator frequency determine the intermediate frequency (IF) and how image interference appears. Prepare a short note with block diagram, observed IF spectrum, and one key insight on frequency selection.	6 Hrs
---	---	-------

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Electronic Devices and Circuit Theory	RL. Boylestad, L.Nashelsky	Pearson, 10/e
2	Electronic Devices and Circuits	J. Millman, C. Halkias	Mc Graw-Hill, 2/e
3	An Introduction to Analog and Digital Communication	S. Haykin, M. Moher	Wiley, 2/e
4	Electronic Communication systems	G. Keneddy, B. Davis	Mc Graw-Hill, 6/e

Reference			
Sl. No.	Title of Book	Author	Publication
1	Electronic Devices	Thomas L. Floyd	Pearson, 10/e
2	Electronic Devices and Circuits	David A. Bell	Oxford, 5/e
3	Principles of Communication Systems	Taub, Schilling	McGraw-Hill Education, 4/e
4	Modern Digital and Analog Communication Systems	B.P. Lathi	Pearson, 4/e
5	Electronic Communications	D. Roddy, J.Coolen	Pearson, 4/e
6	Principles of Electronic Communication Systems	L.Frenzel	Mc Graw-Hill, 5/e

Web Resource	
1	https://www.youtube.com/playlist?list=PLFW6lRTa1g81LohrWnYo_hsVB-RlZJDRm
2	https://www.youtube.com/@analogcommunication2882/videos

DETAILED SYLLABUS (Self-learning if any to be marked)							
Module	Topic	Mode of Delivery	CO	Learning Domain			Hrs
				C	P	A	
1	First-Order RC High-Pass filter and Low-pass filter (HPF/LPF): Response to sine, step, pulse and square wave inputs, tilt/rise-time, Frequency response, bandwidth.	L	1	A	P	Rs	1
	RC Differentiating and Integrating circuits: Concept of differentiation and integration in time domain, Waveform responses-sine, square and triangular wave inputs.	L	1	A	P	Rs	1

	Tutorial-1: LPF, HPF, RC differentiator and Integrator	T	1	A	P	Rs	1
	Diode models: Piecewise-linear and small signal models.	L	1	A	P	Rs	1
	Diode Clipping Circuits: Unbiased and biased positive/negative clippers, combinational clippers, Transfer characteristics and waveform sketches, effect of diode forward drop.	L+S	1	An	P	Rs	2
	Diode Clamping Circuits: Positive, negative and biased clampers.	L+S	1	An	P	Rs	1
	Tutorial 2 – Diode Wave-Shaping Circuits	T	1	An	P	Rs	2
	Transistor Biasing – Fundamentals: Need for biasing, thermal stability and thermal runaway, DC load line and operating point (Q-point) determination.	L	1	A	P	Rs	1
	Fixed Bias and Self Bias (CE): Circuit operation, stability factor (<i>only definition</i>), Design and analysis; Limitations of fixed bias and improvement using emitter resistor	L	1	A	P	Rs	1
	Voltage Divider Bias (CE): Design and analysis, derivation of stability factors, Comparison of fixed, self, and voltage divider bias schemes	L+S	1	A	P	Rs	1
	Tutorial 3 – Transistor Biasing	T	1	An	P	Rs	1
2	RC-Coupled CE Amplifier (Design Fundamentals): Concept of AC load line and operating region, Design.	L+S	2	A	P	Rs	1
	Voltage Gain and Frequency Response of CE Amplifier: Mid-band voltage gain, frequency response, gain roll-off at low and high frequency, Bandwidth and gain-bandwidth product	L+S	2	A	P	Rs	1
	Small-Signal Analysis using Hybrid-π Model (Mid- and Low-Frequency): Small-signal equivalent model of BJT, Small-signal analysis of CE amplifier (<i>with bypass capacitor</i>) - derivation of voltage gain, input impedance and output impedance.	T	2	An	P	Rs	2
	Tutorial 4 – Small-Signal CE Amplifier Analysis	L+S	2	An	P	Rs	2
	High-Frequency Equivalent Circuit of BJT: High-frequency hybrid- π model, Miller Effect.	T	2	An	P	Rs	1
	Multistage BJT Amplifiers: Need and types of multistage amplifiers (RC-coupled, direct-coupled, transformer-coupled), Effect of cascading on overall voltage gain and bandwidth.	L+S	2	A	P	Rs	2

	Cascode Amplifier (CE–CB Combination): Circuit operation	L	2	A	P	Rs	1
	Tutorial 5 – Multistage and Cascode Amplifiers	T	2	A	P	Rs	1
3	Spectrum and Signal Representations : time/frequency-domain concepts; definition of spectrum; examples (sine → single line, speech/music → range); importance of bandwidth and frequency translation	L	3	A	M	Rs	3
	Amplitude Modulation Family: AM, DSB-SC and SSB equations, modulation index and spectra; transmitter/receiver block diagrams; total power relations and bandwidth comparison	L	3	A	M	Rs	3
	Tutorial-6: AM/DSB-SC/SSB	T	3	A	M	Rs	2
	Angle Modulation (FM and PM): Basic equations, Carson’s rule, narrowband vs wideband FM spectra; FM/PM transmitter and receiver block diagrams and applications	L	3	A	M	Rs	2
	Tutorial-7 FM/PM	T	3	A	M	Rs	1
4	AM Generation: Square-law modulator; balanced modulator for DSB-SC; circuit operation.	L	4	A	I	Rs	2
	Envelope Detector and Superheterodyne Receiver: Working of envelope detector, Superheterodyne block diagram; IF selection, image frequency, tracking, IMRR.	L+S	4	A	I	Rs	2
	Direct FM Generation: varactor diode, reactance-modulator circuits; VCO concept and applications; FM-PM relation and conversion methods	L	4	A	I	Rs	2
	FM Demodulation: Frequency discriminators-Foster-Seeley, ratio detector	L+S	4	A	I	Rs	2
	Tutorial-8: AM/ FM generation and detection	T	4	A	P	Rs	2

TABLE OF SPECIFICATIONS (ToS) (ESE Question Paper Design)								
Module	Module Title	Distribution of Marks (RBL)						Total Marks
		R	U	A	An	E	C	
1	Wave-Shaping circuits and BJT biasing		03	8	04			15

2	BJT amplifiers and voltage regulators		03	8	04			15
3	Analog Modulation and Spectral Analysis		03	09	03			15
4	Generation and Detection of Analog Modulated Signals		06	09				15

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

Model Question Paper

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

SECOND SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, DECEMBER 2025 (2025 SCHEME)			
Course Code:	B250004/EC200C		
Course Name:	Principles of Electronics and Communication Engineering		
Max. Marks	60	Duration:	2 hours 30 minutes
Specify if the question paper is common to different programs			
<i>Use of Data Book / IS codes, etc to be specified by the question paper setter</i>			

PART A			
<i>(Answer all questions. Each question carries 3 marks)</i>			
No.	Question	CO	Marks
1	A square wave signal is passed through an RC circuit. At the output, sharp voltage spikes are observed at each transition of the square wave. Identify the RC circuit used and design the same for a square wave of 10V _{pp} amplitude and 1kHz frequency.	CO1	(3)
2	In a low-pass RC filter, the output voltage gradually rises when a step input is applied. Explain what is meant by rise time of the output waveform and how it is related to the time constant of the RC circuit.	CO1	(3)
3	In a transistor amplifier, the DC load line helps to show all possible values of collector current and collector-emitter voltage for a given circuit. The point chosen on this line for proper amplifier operation is called the _____, and it must be placed in the _____ region of the transistor to avoid distortion.	CO2	(3)
4	In a two-stage audio amplifier, the first stage provides a voltage gain of 50 and the second stage provides a gain of 40. Explain how cascading these amplifier stages affects the overall voltage gain and the bandwidth of the system.	CO2	(3)
5	A sound engineer records a pure tuning-fork tone and a piece of music. Explain how their time-domain and frequency-domain representations differ and what these reveal about their signal content.	CO3	(3)
6	When designing a mobile communication system, why must engineers consider the bandwidth and spectrum of the transmitted signal to ensure efficient use of available frequencies?	CO3	(3)
7	An automotive company is developing an in-car FM receiver that uses a Phase-Locked Loop (PLL) for demodulation due to its noise immunity. Describe how the VCO and phase detector work together to track the instantaneous frequency of the input FM signal.	CO4	(3)
8	A satellite communication link uses phase modulation (PM) for data transmission. Suggest one method to convert PM to FM for easier demodulation and explain its principle.	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)	A small audio preamplifier is connected to a loudspeaker system. Sometimes, sudden loud sounds (like a mic drop) create voltage spikes that exceed +3 V and -3 V, which cause distortion and can damage the amplifier stage. Draw a circuit using diodes to limit the signal to ± 3 V.	CO1	(2)
	b)	Show the input and output waveforms for the same circuit for a sine wave of peak amplitude 5 V.		(3)
	c)	Briefly explain how the circuit will respond to the positive and negative cycles of the input waveform.		(4)
OR				
10	a)	A certain low-cost audio transmitter outputs a music signal that swings between -1.5 V and +1.5 V. The audio amplifier it is connected to, can only accept signals between 0 V and +3 V. Design a suitable circuit to shift the signal so it stays within the amplifier's acceptable range without changing its amplitude.	CO1	(4)
	b)	Sketch the input and output waveforms of the circuit.		(2)
	c)	Explain the working of the circuit in detail for both the positive and negative half cycles.		(3)
MODULE II				
11	a)	During an experiment to study small-signal transistor characteristics, a student applies a 25-mV peak-to-peak signal from a signal generator to the input of an amplifier. The requirement is to obtain an output of about 0.75 V peak-to-peak so that waveform distortions can be clearly observed on the oscilloscope. Sketch the complete circuit diagram.	CO2	(3)
	b)	Determine the minimum gain needed for the design.		(2)
	c)	Explain in detail, the working of the circuit with the help of necessary diagrams.		(4)
OR				
12	a)	In a home inverter power supply, a linear voltage regulator is used to provide a stable 5 V output for the control circuit, even when the battery voltage varies from 10 V to 14 V and the load current changes. Explain the purpose of voltage regulation in this circuit.	CO2	(2)
	b)	Describe how variations in input voltage and load current affect the output, and how the regulator responds to maintain a steady voltage.		(3)
	c)	Using this scenario, compare the working principle of a series regulator and a shunt regulator, and state which one is better suited for the inverter's control supply, giving reasons.		(4)
MODULE III				
13		A communication link is being designed to send voice signals (300 Hz–3.3 kHz) over a 100 kHz microwave carrier using DSB-SC and SSB techniques.	CO3	
	a)	Derive the mathematical expression for the DSB-SC modulated signal.		(3)
	b)	Compare DSB-SC and SSB in terms of bandwidth, power efficiency, and receiver complexity for this voice transmission.		(3)

	c)	Suggest which system you would recommend for long-distance HF communication and justify your answer.		(3)
OR				
14		A local FM radio station plans to also transmit an AM broadcast to reach areas where FM coverage is weak. The engineer decides to modulate a 1 MHz carrier using a 5 kHz audio tone with a modulation index of 0.6.	CO3	
	a)	Derive the time-domain equation of the AM signal.		(3)
	b)	Draw and explain the frequency spectrum of the signal, clearly indicating carrier and sideband frequencies.		(3)
	c)	Explain how the bandwidth of the AM signal affects the radio station's frequency allocation and interference with neighbouring channels.		(3)
MODULE IV				
15		A local electronics startup is developing a low-cost AM transmitter for educational radio broadcasts. They plan to use a square-law modulator to generate the AM signal.	CO4	
	a)	Explain the working principle of the square-law modulator and derive the expression for the output signal.		(3)
	b)	Using a practical example, discuss how the modulating and carrier signals are combined in this circuit.		(3)
	c)	Suggest one advantage and one limitation of using a square-law modulator in a low-cost transmitter.		(3)
OR				
16		A broadcast equipment manufacturer needs to design an FM demodulator using a Foster-Seeley discriminator for use in home audio systems.	CO4	
	a)	Draw a labelled block/circuit diagram of the Foster-Seeley discriminator and explain its operation.		(3)
	b)	Describe how this circuit can demodulate an FM signal carrying an audio message.		(3)
	c)	Explain how amplitude variations in the received FM signal can affect demodulation accuracy and how the limiter stage helps overcome this problem.		(3)

COURSE DESCRIPTION							
Regulation	2025	L-T-J-P-S	2-0-0-2-4	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
B250902/ CN210D	Programming in C	EST
Pre-requisite		
NIL		

COURSE OBJECTIVES	
1	To develop students' proficiency in the C programming language and enhance their ability to translate algorithms into C programs

COMPETENCY STATEMENT (CC)	
CC 1	Students will be competent to implement algorithms using the C programming language

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)
CO 1	Good understanding of the C language constructs including data types, control structures etc	CC 1	U	M	Rs
CO 2	Ability to create C programs from algorithms using appropriate language constructs.	CC 1	A	M	Rs
CO 3	Ability to select or create appropriate data types to create correct C programs.	CC 1	A	M	Rs
CO 4	Ability to create dynamic linked structures to store data.	CC 1	U	I	Re
CO 5	Ability to write modular C programs.	CC 1	A	M	Rs
CO 6	Ability to use appropriate input/output and other library functions to create programs.	CC 1	U	M	Rs
CO 7	Ability to organize C programs into project folder structure and use build tool.	CC 1	U	I	Re
<p>Cognitive (Revised blooms Level): - R: Remember; U: Understand; A: Apply; An: Analyze; E: Evaluate; C: Create</p> <p>Psychomotor Domain (Dave's): - I-Imitation, M-Manipulation, P-Precision, Ar-Articulation, N-Naturalisation</p> <p>Affective (Krathwohl): - Re-Receiving, Rs-Responding, V-Valuing, O-Organization, Ch-Characterization</p>					

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

TEACHING AND ASSESSMENT SCHEME														
Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme							
							Theory			Practical			Total	
L	T	J	P	S	C	CIA	ESE	Total	CIA	ESE	Total			
2	0	0	2	4	4	120	25	40	65	15	20	35	100	
<p>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</p>														

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Contact Hours
1	C Fundamentals	Structure of a C program; Simple programs (Hello world); Steps of compilation; Introduction to Popular compilers - Clang and LLVM; C language specification, Introduction to gcc; Character Set (ASCII, Unicode); Constants (integer, string, character); Identifiers; Keywords; Defining macros(#define); Basic data types (int, char, float, double); Data type modifiers (signed, unsigned, short, long); Variables; Operators (arithmetic, logic, relational, assignment); Operator precedence; Expressions; Statements - Input and Output statements; (scanf, printf, fscanf, fprintf); if, if-else, nested if, switch, while, do-while, for; break & continue; nested loops	10

2	Advanced Data Types	Single dimensional arrays (int, char, float, double); Defining an array; Array initialization; Accessing array elements Multidimensional arrays;Structure; Defining a Structure variable; Accessing members; Array of structures; Pointer; Declaration; Operations on pointers; Pointer arithmetic;Accessing array elements using pointers;Accessing structure elements using pointers;Functions; Function definition;Function call; Function prototype;Parameter passing	10
3	Functions	Multifile programming;Passing array, structure, pointers to function;Passing array, structure, pointers to function;Recursion;Preprocessor directives (#define, #ifdef);Storage Classes associated with variablesautomatic,static, external and register;Built-in functions; String functions	10
4	Pointers and Files	Pointer to pointer; Pointer to function;Dynamic Memory Allocation;Self-referential structures; Linked Structures like path, cycles, set of paths, staretc;Different types of files in C; Opening & Closing a file; Writing to and Reading from a file; Processing files;Library functions related to file – fseek(), ftell(), fread(), fwrite());Problem Solving using C(Translate algorithm to C program);	10

SELF-LEARNING / TEAM WORK

Sl. No	Self-learning / Team Work Description	Hrs/Semester
1	Problems from The C Programming Language, Brian W. Kernighan and Dennis Ritchie	20
2	C: A Reference Manual by Samuel P. Harbison, Guy Steele Jr.	20
3	Heap implementation as an array and use indexing to access parent/child	10
4	Code Reading (Data Structure or Operating Systems projects) (Sample https://github.com/attractivechaos/klib/blob/master/kalloc.c)	10

SUGGESTED LEARNING RESOURCES

Sl. No.	Title of Book	Author	Publication
Textbook			
1	The C Programming Language	Brian W.Kernighan and Dennis Ritchie	Pearson,2/e,2015
2	Familiarizing C: A Reference Manual	Samuel P. Harbison, Guy Steele Jr.	Mc Graw Hill,4/e,2017

Reference			
1	C The Complete Reference	Herbert Schildt	Mc Graw Hill,4/e,2017
2	Programming with C	Byron S Gottfried	Mc Graw Hill,4/e.2018
3	Problem solving and Program Design in C	Jeri R Hanly.ElliotB.Koffman	Pearson,2/e,2015
Web Resource			
1	https://onlinecourses.nptel.ac.in/noc25_cs119		
2	https://onlinecourses.nptel.ac.in/noc25_cs114		
3	https://onlinecourses.swayam2.ac.in/imb25_mg71		

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	C Fundamentals	Structure of a C program; Simple programs (Hello world); Steps of compilation; Introduction to Popular compilers - Clang and LLVM; Introduction to gcc, C language specification Character Set (ASCII, Unicode) Constants (integer, string, character); Identifiers; Keywords; Defining macros (#define) Basic data types (int, char, float, double) Data type modifiers (signed, unsigned, short, long) Variables; Operators (arithmetic, logic, relational, assignment) Operator precedence; Expressions; Statements - Input and Output statements (scanf,printf,fscanf,fprintf)	L + P	CO1	U	M	Rs	10

		if, if-else, nested if, switch						
		while, do-while, for; break & continue; nested loops						
2	Advanced Data Types	Single dimensional arrays (int, char, float, double); Defining an array; Array initialization; Accessing array elements	L + P	CO 3	A	M	Rs	10
		Multidimensional arrays						
		Structure; Defining a Structure variable; Accessing members; Array of structures						
		Pointer; Declaration; Operations on pointers; Pointer arithmetic						
		Accessing array elements using pointers						
		Accessing structure elements using pointers						
		Functions; Function definition; Function call; Function prototype						
		Parameter passing						
3	Functions	Multifile programming	L + P	CO5	A	M	Rs	10
		Passing array, structure, pointers to function						
		Recursion						
		Preprocessor directives (#define, #ifdef)						
		Storage Classes associated with variables automatic, static, external and register						
		Storage Classes associated with variables automatic, static, external and register						
		Built-in functions; String functions	P	CO6	U	M	Rs	
4	Pointers and Files	Pointer to pointer; Pointer to function	L + P	CO4	U	I	Re	10
		Dynamic Memory Allocation						
		Self-referential structures; Linked Structures like path, cycles, set of paths, star etc						

	Different types of files in C; Opening & Closing a file; Writing to and Reading from a file; Processing files	L + P	CO7	U	I	Rs
	Library functions related to file – fseek(), ftell(), fread(), fwrite()					
	Problem Solving using C(Translate algorithm to C program)	P	CO2	A	M	Rs

PRACTICAL SYLLABUS

Module	Topic	Objective	Relevant COs	Learning Domain Level			Teaching Hours
				C	P	A	
1	Structure of a C program; Datatypes; Operators; Control structures	To understand the basic structure of a C program and to learn how to use data types, operators, and control structures to develop simple and efficient C programs.	CO 1	U	M	Rs	5
2	Multidimensional, Arrays, Structure,	To learn how to declare, initialize, and manipulate multidimensional arrays, and to understand the use of structures for organizing and managing related data efficiently in C programs.	CO 3	A	M	Rs	5
3	Functions; User defined functions; Built in Functions;	To understand the concept of functions in C and to develop the ability to create user- defined functions and effectively use built-in functions to design modular and reusable programs.	CO5, CO6	A	M	Rs	5
4	Pointers	To understand the concept of pointers and learn how to use them for efficient memory management, array manipulation, and function argument passing in C programs.	CO4	U	I	Re	5

		Distribution of Marks (Revised Bloom's Level)	
--	--	--	--

Module	Module Title	R	U	A	An	E	C	Total Marks
1	C Fundamentals	√	√	√				15
2	Advanced Datatypes	√	√	√				15
3	Functions	√	√	√				15
4	Pointers and Files	√	√	√				15

ASSESSMENT PATTERN		
Assessment		Marks
Continuous Internal Assessment		40
1	Internal Examination	15
2	Continuous Lab Evaluation	15
3	Learning Activity/Course Project	5
4	Regularity	5
End Semester Examination - Lab		20
End Semester Examination -Theory		40
Total		100

FIRST SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, DECEMBER 2025 (2025 SCHEME)			
Course Code:	B250902/CN210D		
Course Name:	Programming in C		
Max. Marks	60	Duration:	2 hours 30 minutes
Specify if the question paper is common to different programs			
<i>Use of Data Book / IS codes, etc to be specified by the question paper setter</i>			

PART A			
(Answer all questions. Each question carries 3 marks)			
No.	Question	CO	Marks
1	Develop a C program to check whether a given integer is even or odd using bitwise AND (&) operator.	CO1	(3)
2	What do you mean by Formatted Input? Explain in detail the prototype of 'scanf()' function in C including its argument list and return type.	CO6	(3)
3	Design and implement a C program that efficiently identifies and counts the occurrences of a specific number in a given set of user-provided numerical data. The program should allow the user to input a sequence of numbers and a target number to search for, then output the total count of its occurrences	CO2	(3)
4	Write a C program to define a structure Book (title, author, price). The program should accept the details of a book from the user and display the entered information in a readable format.	CO3	(3)
5	Write a C program to reverse a string without using string handling functions.	CO5	(3)
6	What are the advantages of modular programming?	CO5	(3)
7	With examples show how: (i) an array is passed as argument of a function. (ii) individual elements of an array is passed as argument of a function.	CO4	(3)
8	How do you open a file for reading and writing in C? Write the syntax.	CO7	(3)

PART B			
(Answer any one full question from each module, each question carries 09 marks)			
No.	Question	CO	Marks
MODULE I			
9	a) Given a positive integer n , implement a C program to find the sum of all integers in the range $[1,n]$ inclusive that are divisible by 3, 5, or 7. Example Input: $n = 7$ Output: 21 Explanation: Numbers in the range $[1, 7]$ that are divisible by 3, 5, or 7 are 3, 5, 6, 7. The sum of these numbers is 21.	CO1	(4)

	<p>What will be the output?</p> <pre>#include <stdio.h> int main() { signed int a = -10; unsigned int b = 10; short int c = 30000; long int d = 1000000; printf("Size of signed int: %zu bytes\n", sizeof(a)); printf("Size of unsigned int: %zu bytes\n", sizeof(b)); printf("Size of short int: %zu bytes\n", sizeof(c)); printf("Size of long int: %zu bytes\n\n", sizeof(d)); printf("Signed int a = %d\n", a); printf("Unsigned int b = %u\n", b); printf("Short int c = %d\n", c); printf("Long int d = %ld\n", d); return 0; }</pre>	CO1	(3)
	<p>Explain the difference between primitive (basic) data types and derived data types in C. Provide examples for each category. Why is it important to choose the correct data type for variables in a program?</p>	CO1	(2)
OR			
10	<p>Given an integer n, implement a C program to repeatedly add all its digits until the result has only one digit.</p> <p>Example</p> <p>Input: $n = 38$</p> <p>Output: 2</p> <p>Explanation: The process is</p> <p>38 --> 3 + 8 --> 11</p> <p>11 --> 1 + 1 --> 2</p>	CO1	(4)
	<p>What will be the output of the following program?</p> <pre>#include <stdio.h> int main() { int i = 1 ; while(i<=10); { printf ("%d",i); i++; }</pre>	CO1	(3)

		}		
	b)	<p>Evaluate the following expressions and show their hierarchy.</p> <p>i. $g = \text{big} / 2 + \text{big} * 4 / \text{big} - \text{big} + \text{abc} / 3$; ($\text{abc} = 2.5$, $\text{big} = 2$, assume g to be a float)</p> <p>ii. $\text{on} = \text{ink} * \text{act} / 2 + 3 / 2 * \text{act} + 2 + \text{tig}$; ($\text{ink} = 4$, $\text{act} = 1$, $\text{tig} = 3.2$, assume on to be an int)</p>	CO1	(2)
MODULE II				
11	a)	<p>Define a function with the following specification to check whether an integer array contains three consecutive odd numbers.</p> <p>Function Name: hasThreeConsecutiveOdds()</p> <p>Parameters: array of integers,number of elements in the array</p> <p>Return Type: Returns 1 (true) if the array contains three consecutive odd numbers,Returns 0 (false) otherwise</p> <p>Example</p> <p>Input: $\text{arr} = [2,6,4,1]$</p> <p>Output: false</p> <p>Explanation: There are no three consecutive odds.</p> <p>Example 2:</p> <p>Input: $\text{arr} = [1,2,3,4,5,7,23,12]$</p> <p>Output: true</p> <p>Explanation: $[5,7,23]$ are three consecutive odds.</p>	CO3	(5)
	b)	<p>Write functions with the following specifications to initialize a 3×3 matrix and display its diagonal elements using functions.</p> <p>1. Function Name :displayMatrix()</p> <p>Parameters:2D array (matrix) containing integer elements</p> <p>2. Function Name :displayDiagonals()</p> <p>Parameters:2D array (matrix) containing integer elements</p>	CO3	(4)
OR				
12	a)	<p>You are given an $m \times n$ integer grid accounts where $\text{accounts}[i][j]$ is the amount of money the i^{th} customer has in the j^{th} bank. Return the wealth that the richest customer has.</p> <p>A customer's wealth is the amount of money they have in all their bank accounts. The richest customer is the customer that has the maximum wealth.</p> <p>Define a function with the following specification:</p> <p>Function Name :maximumWealth()</p>	CO3	(5)

		<p>Parameters: 2D integer array representing the wealth of each customer in different banks, number of customers .number of banks (columns).</p> <p>Return Type: returns the maximum wealth (richest customer's total money).</p> <p>Example :</p> <p>Input: accounts = [[1,2,3],[3,2,3]]</p> <p>Output: 6</p> <p>Explanation:</p> <p>1st customer has wealth = 1 + 2 + 3 = 6</p> <p>2nd customer has wealth = 3 + 2 + 3 = 8</p>		
	b)	<p>Create a structure to specify data on students given below: Roll number, Name, Department, Course, Year of joining Assume that there are not more than 450 students in the collage.</p> <p>(a) Write a function to print names of all students who joined in a particular year. Function Name : printStudentsByYear()</p> <p>Parameters: Array of student structures, Number of students, Year to be searched</p> <p>(b) Write a function to print the data of a student whose roll number is given. Function Name : printStudentByRoll()</p> <p>Parameters: Array of student structures, Number of students, Year to be searched, Roll number to be searched</p>	CO3	(4)
MODULE III				
13	a)	<p>A stack is a data structure in which addition of new element or deletion of existing element always takes place at the same end. This end is often known as 'top' of stack. This situation can be compared to a stack of plates in a cafeteria where every new plate taken off the stack is also from the 'top' of the stack.</p> <p>Stack has following operations:</p> <p>Push – to insert an element into the stack</p> <p>Pop – to remove an element from the stack</p> <p>Display – to display all elements in the stack</p> <p>Algorithm for PUSH Operation</p> <ol style="list-style-type: none"> 1. Check if top == MAX - 1 → If true, print "Stack Overflow" and return. 2. Otherwise, increment top by 1 3. Set stack[top] = x 4. Print "Element pushed successfully" 	CO5	(5)

		<p>Algorithm for POP Operation</p> <ol style="list-style-type: none"> 1. Check if top == -1 → If true, print “Stack Underflow” and return. 2. Otherwise, print stack[top] as the deleted element 3. Decrement top by 1 <p>Algorithm for DISPLAY Operation</p> <ol style="list-style-type: none"> 1. If top == -1, print “Stack is Empty” 2. Else, print all elements from stack[top] down to stack[0] <p>Translate the above given algorithm to C Program</p>		
	b)	<p>A software developer is designing a program to generate a sequence of numbers where each term is the sum of the two preceding terms. To implement this logic efficiently, the developer decides to use recursion. Explain how recursion can be applied in this scenario and write a C program to generate the Fibonacci series using a recursive function.</p>	CO5	(4)
OR				
	a)	<p>Write macro definitions with arguments for calculation of area and perimeter of a triangle, a square and a circle. Store these macro definitions in a file called “areaperi.h”. Include this file in your program, and call the macro definitions for calculating area and perimeter for different squares, triangles and circles.</p>	CO5	(5)
14	b)	<p>List the four storage classes in C and mention one feature of each. What will be the output?</p> <pre>#include <stdio.h> int count = 0; void counter() { static int calls = 0; register int i; for (i = 0; i < 1; i++) calls++; printf("Function called %d times\n", calls); } int main() { auto int num = 10; counter();</pre>	CO5	(4)

		<pre> counter(); printf("Global count = %d\n", count); printf("Local num = %d\n", num); return 0; } </pre>		
MODULE IV				
15	a)	In a scientific calculator application, a programmer needs to develop a feature to compute the roots of any quadratic equation. The coefficients of the equation (<i>a</i> , <i>b</i> , and <i>c</i>) are to be passed to the function using pointers. Develop a C function that calculates and displays the roots of the quadratic equation using pointer parameters.	CO4	(5)
	b)	Two persons want to access a file "sample.txt". First person want to read the data from the file. The second person want to read and write the data from and to the file simultaneously. Can you help them to do so by writing the corresponding programming codes?	CO7	(4)
OR				
16	a)	While developing a student record management system, a programmer needs to handle multiple strings representing student names and also access a group of integer marks stored in a single array. To choose the correct approach, the programmer must understand the difference between an array of pointers and a pointer to an array . Explain the difference between these two concepts with suitable examples in C.	CO4	(5)
	b)	In a file management system, a programmer is required to create a utility that duplicates the contents of an existing file into a new file for backup purposes. Develop a C program to copy the contents of one file into another.	CO7	(4)



COURSE DESCRIPTION							
Regulation	2025	L-T-J-P-S	3-1-0-0-4	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
B250004/EC200E	Network Theory	PCT
Pre-requisite		
B250802/MA100A Mathematics for Electrical Science-1 B250906/CN100D Introduction to Electrical and Electronics Engineering		

COURSE OBJECTIVES	
1	To introduce the fundamental concepts of electrical circuits and networks, including circuit variables, sources, and laws governing circuit behaviour.
2	To enable students to use systematic techniques such as mesh and nodal analysis, along with network theorems, for the analysis of DC and AC circuits.
3	To develop the ability to analyse AC circuits using phasors and Laplace transforms, and evaluate their transient and steady-state behaviour.
4	To familiarize students with the concept of network functions and two-port network parameters, and their application in characterizing electrical systems.

COMPETENCY STATEMENT (CC)	
CS03	Apply the concepts of Linear algebra, Complex numbers, Transforms, Calculus, probability, statistics & random variables in Electronics and Communication engineering.
CS40	Design, analyse, and troubleshoot complex electrical circuits by fundamental principles such as Kirchhoff's laws, AC circuit behaviour, power calculations etc.

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 laws and theorems to analyze DC/AC networks using mesh and nodal methods.	CS03,CS40	A	P	V
CO 2	Apply network theorems to analyze DC and AC circuits with independent and dependent sources.	CS03,CS40	A	P	V
CO 3	Analyze transient response of RL, RC, and RLC circuits using Laplace transforms.	CS03,CS40	A	P	V
CO 4	Determine network functions and two-port parameters to evaluate circuit performance.	CS03,CS40	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

Program Outcomes (PO) & Program Specific Outcomes (PSO) Correlation Matrix														
CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	2	2	3				2		2	1	1	
2	3	3	2	2	3				2		2	1	1	
3	3	3		2	2			1	1		2	1	1	
4	3	3		1	1			1	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		
					C	CIA	ESE	Total	
3	1	0	0	4	4	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	Network fundamentals and analysis methods	Fundamentals of Electrical Networks and Circuits, Electrical Sources, Network Laws and Theorems, Network Analysis Techniques	15
2	Network Theorems for DC and AC Circuit Analysis	Network Theorems – Fundamentals and Applications, Linear Network Theorems, Equivalent Circuit Theorems, Power Transfer theorem	15
3	Laplace transforms and transient analysis	Fundamentals of Laplace Transform, Application of Laplace Transform to Circuit Analysis, Transient Response Analysis	15
4	Network functions and two-port parameters	Network Functions and System behaviour, Two-Port Network Representation, Network Properties and Conditions	15

SELF-LEARNING / TEAM WORK		
Sl. No	Self-learning / Team Work Description	Hrs
1	Self -learning - Source transformation, dependent sources: Watch NPTEL videos or other video tutorials, solve advanced problems from reference books	5 Hrs
2	Self - learning - Application of theorems to AC networks: Analyse circuits using simulation tools (Multisim / LTSpice / MATLAB/ PSpice etc), and solve past exam problems	6 Hrs
3	Team work - Transient Response analysis: Work in groups to simulate RL, RC, or RLC circuits with various inputs (step, impulse, sinusoidal), and explain time-domain	6 Hrs

	behaviour. Team can create a 2 to 3 slides summary to share in class and/or Team-based peer discussion sessions can be conducted for sharing difficult problems. Instructor can provide a template for the slide. This can be done in the tutorial hours	
4	Team Work - Two-Port Analysis. Each team can explain a type of two-port parameter (Z, Y, H, T) or solve a sample problem in two port networks. It can be in the online mode with 10 minutes given for each team to explain the problem.	5 Hrs

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Engineering Circuit Analysis	W.Hayt, J. Kemmerly, J. Philips, S. Durbin	McGraw Hill, 8/e
2	Fundamentals of Electric Circuits	Charles K. Alexander, Matthew N. O. Sadiku	McGraw-Hill Education, 7/e
3	Electric Circuits	David.A Bell	Oxford, 7/e
4	Network Analysis	V.Valkenburg	Pearson, 3/e

Reference			
Sl. No.	Title of Book	Author	Publication
1	Electric Circuits – Schaum's Outline Series	Edminister	Mc Graw-Hill,7/e
2	Introductory Circuit Analysis	R.L.Boylestad	Prentice Hall, 12/e
3	Network Analysis with Applications	William D. Stanley	Pearson,4/e
4	Linear circuit analysis	R.A.Decarlo, P.Lin	Oxford, 2/e
5	Circuit Theory analysis and synthesis	Chakkraborty A.K	Danpat Ra, 7/e
6	Network Analysis and Synthesis	Ravish R. Singh	Mc Graw-Hill,2/e

Web Resource	
1	https://onlinecourses.nptel.ac.in/noc22_ee93/preview
2	https://onlinecourses.nptel.ac.in/noc20_ee46/preview

DETAILED SYLLABUS (Self-learning if any to be marked)							
Module	Topic	Mode of Delivery	CO	Learning Domain			Hrs
				C	P	A	
1	Basic Concepts and Circuit Variables: Concept of networks and circuits; circuit variables	L	1	U	I	Re	1
	Electrical Sources : Ideal and practical sources; Independent and dependent sources	L+S	1	A	M	Rs	1

	Tutorial 1 – Classification of sources and basic circuit problems	T	1	A	P	V	1
	Kirchhoff's Laws and Applications: KVL and KCL	L+S	1	A	M	Rs	1
	Source Transformation Techniques: Conversion between voltage and current sources	L+S	1	A	M	Rs	1
	Tutorial 2 – KVL/KCL application and source transformation problems	T	1	An	P	V	2
	Mesh and Nodal Analysis Techniques: Mesh and nodal analysis in DC and AC networks including dependent and independent sources	L+S	1	An	M	Rs	2
	Tutorial 3 – Mesh and Nodal analysis	T	1	An	P	V	2
	Super-mesh and Super-node Analysis: Super mesh and super node analysis for networks containing dependent and independent sources.	L	1	An	M	Rs	2
	Tutorial 4 – Circuit analysis using super mesh and super node concept.	T	1	An	P	V	2
2	Superposition theorem: Principle of linearity; application to DC and AC networks with independent and dependent sources.	L	2	A	M	Rs	2
	Tutorial 5 – Superposition theorem	T	2	A	P	V	3
	Thevenin's and Norton's Theorems: Equivalent-circuit concepts for DC and AC networks; determination of Thevenin and Norton parameters.	L+S	2	An	M	Rs	3
	Tutorial 6 – Thevenin and Norton equivalent problems	T	2	An	P	V	3
	Maximum Power Transfer Theorem: Conditions for maximum power transfer in DC and AC networks with dependent source.	L	2	A	M	Rs	2
	Tutorial 7 – MPT applications and practical examples	T	2	A	P	V	2
3	Introduction to Laplace Transform and Standard Functions: Definition, Laplace transforms of basic signals	L	3	A	M	Rs	2
	Laplace Transform Properties: Basic properties of Laplace transform and initial/final-value theorems (proofs not required)	L+S	3	A	M	Rs	2
	Tutorial 8 – Laplace Transform.	T	3	A	P	V	2
	Inverse Laplace Transform Techniques: Partial-fraction method, standard transform pairs.	L+S	3	A	M	Rs	1
	Tutorial 9 – Inverse Laplace Transforms using standard methods.	T	3	A	P	V	2
	Circuit Transformation to s-Domain Equivalent representation of basic circuits	L	3	A	M	Rs	1

	in s-domain with and without initial conditions						
	Transient Response Analysis of Electrical Networks: Transient response of RL, RC and RLC circuits for impulse, step, exponential and sinusoidal inputs.	L+S	3	An	M	Rs	2
	Tutorial 10 – Transient response analysis	T	3	An	P	V	3
4	Introduction to Two-Port Networks Definitions, notation, and terminal conditions	L	4	A	M	Rs	1
	Network Functions: Driving point and transfer functions, relationship between excitation and response for single-port and two-port systems.	L	4	A	M	Rs	2
	Properties of Network Functions Poles, zeros, causality, and stability — qualitative understanding (no derivation)	L+S	4	A	M	Rs	1
	Tutorial 11 – Finding $Z(s), H(s)$ and interpreting pole-zero plots	T	4	An	P	V	2
	Impedance (Z) and Admittance (Y) Parameters Formulation and computation for simple circuits	L+S	4	A	M	Rs	1
	Tutorial 12 – Computation of Z and Y parameters for basic networks	T	4	A	P	V	2
	Hybrid (h) and Transmission (ABCD) Parameters Matrix representation and inter-relationships among parameter sets	L+S	4	A	M	Rs	2
	Tutorial 13 – Computation of h and $ABCD$ parameters for simple networks	T	4	A	P	V	1
	Reciprocity and Symmetry Conditions Concepts and verification (no derivations required)	L	4	A	M	Rs	1
Tutorial 14 – Identification of reciprocal / symmetric networks and connected combinations	T	4	A	P	V	2	

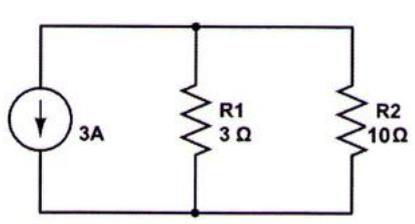
TABLE OF SPECIFICATIONS (ToS) (ESE Question Paper Design)								
Module	Module Title	Distribution of Marks (RBL)						Total Marks
		R	U	A	An	E	C	
1	Network fundamentals and analysis methods		03	9	3			15
2	Network Theorems for DC and AC Circuit Analysis		03	9	3			15
3	Laplace transforms and transient analysis		03	9	3			15
4	Network functions and two-port parameters		03	9	3			15

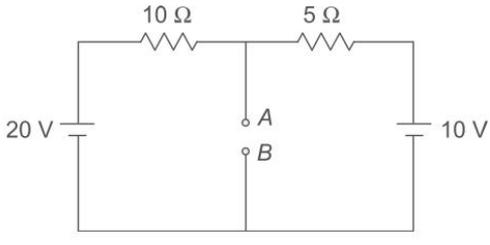
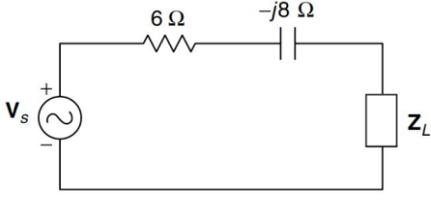
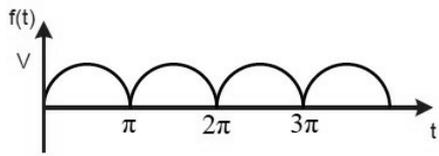
ASSESSMENT PATTERN		
Assessment		Marks
Continuous Internal Assessment		40
1	Internal Examination	20
2	Learning Activity	15
3	Regularity	5
End Semester Examination		60
Total		100

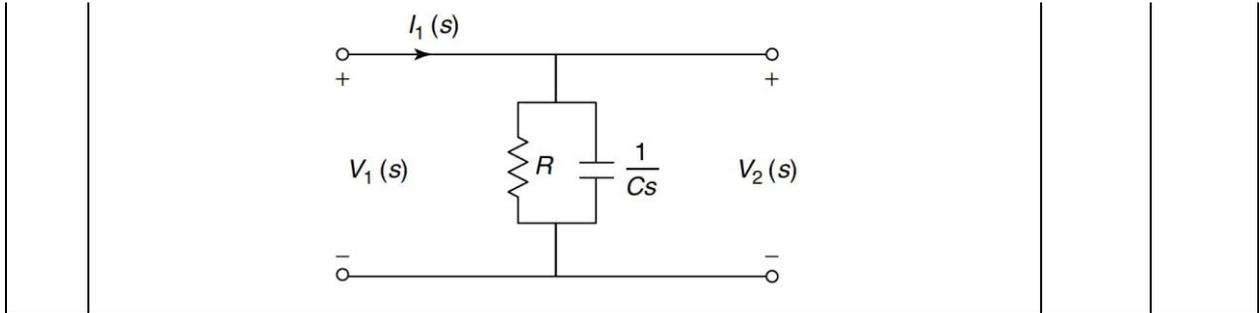
MODEL QUESTION PAPER

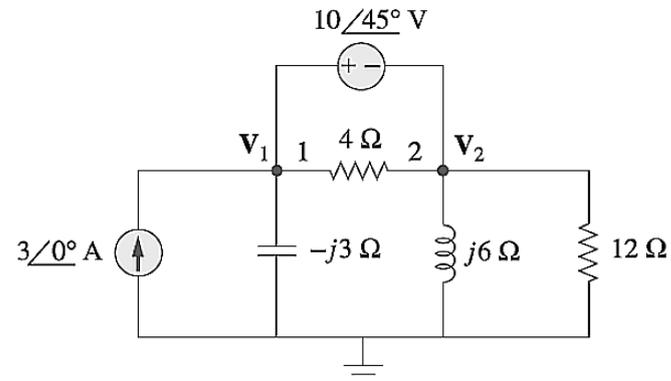
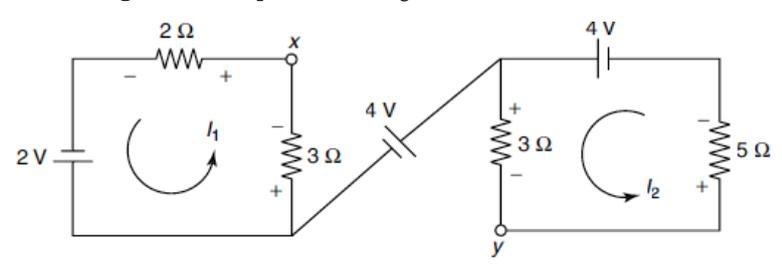
(AN AUTONOMOUS COLLEGE AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY,
THIRUVANATHAPURAM)

FIRST SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, DECEMBER 2025			
(2025 SCHEME)			
Course Code:	B250004/EC200E		
Course Name:	NETWORK THEORY		
Max. Marks	60	Duration:	2 hours 30 minutes
Specify if the question paper is common to different programs			
Use of Data Book / IS codes, etc to be specified by the question paper setter			

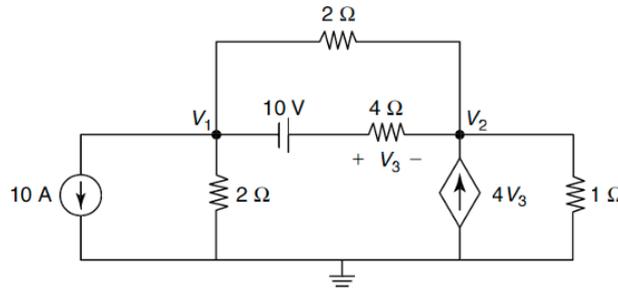
PART A			
(Answer all questions. Each question carries 3 marks)			
No.	Question	CO	Marks
1	At a junction in a power distribution box, three wires carry 2 A each of current into the node, while one wire carries 3 A away toward a device. Assuming the remaining wire carries the unknown current, find the magnitude and direction of this current.	CO1	(3)
2	<p>A 3 A current from a portable power bank divides into two branches, one charging a 3 Ω phone circuit and the other lighting a 10 Ω LED lamp, as shown in the circuit. Find the voltage across the lamp using the source-transformation technique.</p> 	CO1	(3)
3	In a portable electronic device, two small batteries power a circuit that includes resistors acting as sensor loads 10Ω and 5Ω as shown. Simplify the network seen from terminals A-B by replacing it with an equivalent current source and resistance.	CO2	(3)

			
4	<p>An audio amplifier drives a speaker through a series resistor and coupling capacitor, as shown. Determine the speaker impedance Z_L that ensures maximum power delivery to the speaker when: (i) the load is an impedance, and (ii) the load is purely resistive.</p> 	CO2	(3)
5	<p>In an electric vehicle charging system, the alternator output is sinusoidal and passed through a full-wave rectifier. Express the rectified waveform (refer to figure below) in the s-domain for analysis of the charging circuit.</p> 	CO3	(3)
6	<p>The output of a circuit is described by</p> $V(s) = \frac{5}{s(s+4)}$ <p>Find the expression for corresponding time-domain waveform $v(t)$.</p>	CO3	(3)
7	<p>Define driving point function and transfer function with one example each.</p>	CO4	(3)
8	<p>In a biomedical signal acquisition system, a small electrode network is modelled as a two-port system. Determine the transfer impedance $Z_{12}(s)$ to study how the current from one electrode affects the measured voltage at another point.</p>	CO4	(3)



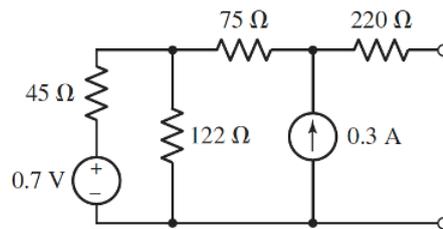
PART B			
<i>(Answer any one full question from each module, each question carries 9 marks)</i>			
No.	Question	CO	Marks
MODULE I			
9	a) Replacing an ideal voltage source by its practical equivalent requires an internal resistance in _____, while a practical current source includes a large internal resistance in _____. If a 5 A current source with 200 Ω internal resistance is converted into its equivalent voltage source, the emf of the source will be _____ V.	CO1	(3)
	b) The circuit below represents part of an AC power network with reactive components. Determine the complex node voltages V_1 and V_2 using phasor analysis, <div style="text-align: center; margin: 10px 0;">  </div>	CO1	(6)
OR			
10	a) Find the voltage between point x and y , <div style="text-align: center; margin: 10px 0;">  </div> <p style="text-align: center; margin-top: 10px;"><i>(Hint: Note the 4V voltage source connected between x and y)</i></p>	CO1	(3)
	b)		CO1

		<p>In a measurement circuit used for sensor calibration, a 10 V supply drives a network containing both passive and dependent elements. Calculate the power output of the 10 V source.</p>		
--	--	--	--	--



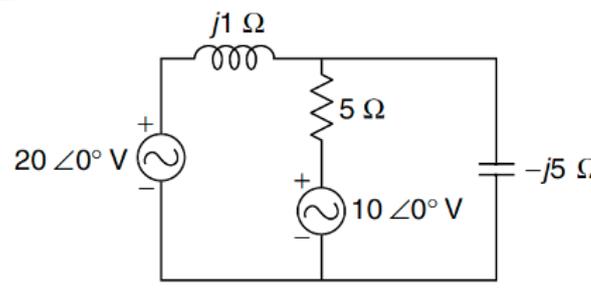
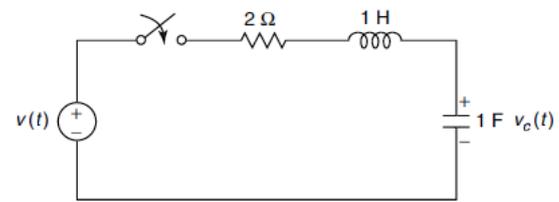
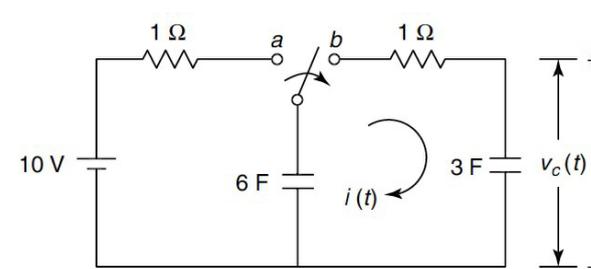
MODULE II

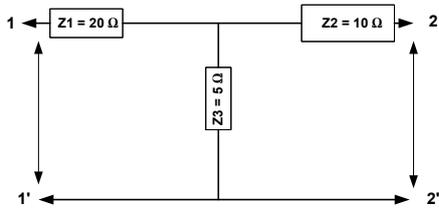
	a)	Compare Thevenin's and Norton's theorem.	CO 2	(2)
11	b)	<p>(i) Employ Thevenin's theorem to obtain a simple two component equivalent circuit across the open terminals. (ii) Use the equivalent circuit to determine the power delivered to a 100 Ohm resistor connected to the open terminals.</p>	CO 2	(7)



OR

		<p>Match column A with column B</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;"></th> <th style="width: 35%;">Column A</th> <th style="width: 10%;"></th> <th style="width: 45%;">Column B</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">(A)</td> <td>Superposition Theorem</td> <td style="text-align: center;">(1)</td> <td>Establishes a specific relation between load and source impedances under which energy transfer from source to load becomes most effective.</td> </tr> <tr> <td style="text-align: center;">(B)</td> <td>Thevenin's Theorem</td> <td style="text-align: center;">(2)</td> <td>Equivalent circuit consists of a single voltage source and impedance as seen from load terminals.</td> </tr> <tr> <td style="text-align: center;">(C)</td> <td>Maximum Power transfer theorem.</td> <td style="text-align: center;">(3)</td> <td>Requires an external excitation to determine the equivalent current when dependent sources are present.</td> </tr> <tr> <td style="text-align: center;">(D)</td> <td>Norton's Theorem with dependant sources</td> <td style="text-align: center;">(4)</td> <td>In AC circuits, it allows independent consideration of voltage and current sources with their respective phasors.</td> </tr> </tbody> </table>		Column A		Column B	(A)	Superposition Theorem	(1)	Establishes a specific relation between load and source impedances under which energy transfer from source to load becomes most effective.	(B)	Thevenin's Theorem	(2)	Equivalent circuit consists of a single voltage source and impedance as seen from load terminals.	(C)	Maximum Power transfer theorem.	(3)	Requires an external excitation to determine the equivalent current when dependent sources are present.	(D)	Norton's Theorem with dependant sources	(4)	In AC circuits, it allows independent consideration of voltage and current sources with their respective phasors.		
	Column A		Column B																					
(A)	Superposition Theorem	(1)	Establishes a specific relation between load and source impedances under which energy transfer from source to load becomes most effective.																					
(B)	Thevenin's Theorem	(2)	Equivalent circuit consists of a single voltage source and impedance as seen from load terminals.																					
(C)	Maximum Power transfer theorem.	(3)	Requires an external excitation to determine the equivalent current when dependent sources are present.																					
(D)	Norton's Theorem with dependant sources	(4)	In AC circuits, it allows independent consideration of voltage and current sources with their respective phasors.																					
12	a)		CO2	(2)																				
	b)	The circuit contains two AC voltage sources of equal frequency. Find the steady-state current through the capacitor, considering the effect of each source individually.	CO2	(7)																				

				
MODULE III				
13	a)	<p>The voltage across a network element has Laplace transform,</p> $V(s) = (s^2 + 1)/s(2s + 3)(s + 5)$ <p>Find the instantaneous voltage at the moment of switching ($t = 0^+$).</p> <p><i>(Hint: Instantaneous voltage represents the initial value of $v(t)$)</i></p>	CO3	(3)
	b)	<p>In the RLC circuit shown below, the input is the source voltage $v(t)$ and the response is the capacitor voltage $v_c(t)$. Determine the impulse response and the step response of the circuit,</p> 	CO3	(6)
OR				
14	a)	<p>A vibration sensor produces a sinusoidal voltage given by $x(t) = 10 \sin(4t)u(t)$. Express this signal in the Laplace domain, so that its frequency-domain characteristics can be studied.</p>	CO3	(3)
	b)	<p>The circuit represents a charge-sharing network used in a portable electronic device. Initially, the 6 F capacitor is charged by a 10 V source (switch at a). At $t = 0$, the switch is moved to b, connecting it to another 3 F capacitor through resistors. Determine the transient current $i(t)$ and the voltage $v_c(t)$ across the 3 F capacitor during the charge-transfer process.</p> 	CO3	(6)
MODULE IV				

15	a)	<p>For a given single-port RC network, the impedance is</p> $Z(s) = \frac{s + 10^3}{s(10^{-3}s + 1)}$ <p>Identify the driving-point impedance function and specify whether it is proper or improper.</p>	CO4	(3)
	b)	<p>From the impedance function obtained, determine the pole and zero locations in the s-plane and sketch their qualitative position.</p>	CO4	(3)
	c)	<p>Using the pole-zero positions obtained in (b), comment on the nature of elements that could realize such an impedance (<i>hint: resistive, inductive, or capacitive behaviour</i>). Justify your answer.</p>	CO4	(3)
OR				
16	a)	<p>Consider the two-port network shown below:</p> <div style="text-align: center;">  </div> <p>Write the mesh equations for the network in terms of loop currents I_1 and I_2. Hence determine the Z-parameters $Z_{11}, Z_{12}, Z_{21}, Z_{22}$.</p>	CO4	(3)
	b)	<p>Using the Z-parameters obtained in (a), check whether the network is reciprocal. Show the required condition.</p>	CO4	(3)
	c)	<p>Using the same Z-parameters, determine whether the network is symmetrical. If it is not symmetrical, explain what change in any one impedance (Z_1, Z_2, or Z_3) would make it symmetrical.</p>	CO4	(3)

COURSE DESCRIPTION							
Regulation	2025	L-T-J-P-S	2-0-1-0-0	Version	25/0	Credits	3
Course Code	Course Name						Course Category
B250908/CN220F	ENTREPRENEURSHIP AND INTELLECTUAL PROPERTY RIGHTS						ESB
Pre-requisite							
Course Code	Course Name						
Nil	Nil						
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Teamwork)							

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 & OUTCOMES		
Competency Statements	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): 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																							
CO	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
32	-	28	-	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	An	E	C	
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	Marks
Continuous Internal Assessment	60
Learning Activity	5
Attendance	5
Internal Examination	20
Course Project	25
End Semester Examination	40
Total	100

SECOND SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, DECEMBER 2025 (2025 SCHEME)			
Course Code:	B250908/CN220F		
Course Name:	ENTREPRENEURSHIP AND INTELLECTUAL PROPERTY RIGHTS		
Max. Marks	40	Duration:	2 hours 30 minutes

PART - A													
<i>(Answer all questions. Each question carries 2 marks)</i>													
<i>No.</i>	<i>Question</i>	<i>CO</i>	<i>Marks</i>										
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 <i>Palakkadan Matta Rice</i> from Kerala.	CO3	(2)										
7	Match the terms in Column A with the appropriate descriptions in Column B . <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Column A</th> <th style="text-align: center;">Column B</th> </tr> </thead> <tbody> <tr> <td>(a) Licensing vs. Assignment</td> <td>(i) Assessing economic worth of IP assets</td> </tr> <tr> <td>(b) Patent Pooling</td> <td>(ii) Fair use, plagiarism, and data ownership</td> </tr> <tr> <td>(c) IP Ethics</td> <td>(iii) Permission vs. complete ownership transfer</td> </tr> <tr> <td>(d) IP Valuation</td> <td>(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 <i>Adobe</i> and <i>Netflix</i> can prevent plagiarism and digital piracy.	CO4	(2)										

PART - B			
<i>(Answer any one full question from each module, each question carries 6 marks)</i>			
<i>No.</i>	<i>Question</i>	<i>CO</i>	<i>Marks</i>
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	<p>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.</p>			
	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	<p>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.</p>			
	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		(3)
	b)	Evaluate the effectiveness of Zomato’s diversification strategy (e.g., Zomato Gold, grocery delivery) in maintaining market competitiveness.	CO2	(2)
	c)	Suggest any two alternative revenue model Zomato could adopt to achieve long-term profitability.		(1)
MODULE III				
13	<p>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 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 “<i>Kanmani Anbodu Kaadhalan</i>” 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.</p> <p>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</p>			

	argue that reducing piracy requires not only enforcement but also accessible pricing models and awareness among youth about IP ethics.		
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/LS900K	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)	
CC1	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)	Psychomotor (P)	Affective (A)
CO1	Evaluate self-awareness to set effective goals and plans	CC 1	A		V
CO2	Evaluate the ability to focus on strengthening the fundamentals of emotional quotient	CC 1	A		V
CO3	Apply techniques to enhance Critical Thinking, Problem-solving and Decision-making skills	CC 1	A		V
CO4	Apply strategies to improve comprehension and communication skills	CC 1	A		Rs
CO5	Present ideas using modern technological platforms	CC 1	A		V
CO6	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	1			
2							2	1	2		1	1			
3	1	2	1	2		2	1	3	2	2	1	1			
4						1		2	3	1	2	1			
5					1			2	3		2	1			
6						2		3	3		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			C	Theory	
						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 Agra Fernandez	Cambridge University Press
3	Guide to writing as an Engineer	David F. Beer and David McMurrey	John Willey. 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:	L, T	I	2	CO1	U			

4.5	Perform a role-play based on the workplace dynamics assimilated through interactions and group discussions	L, T	G	4	CO3	U		R s	
4.6	Students prepare an action plan for their undergraduate journey	L, T	I	2	CO1	R		R s	
5.1	Select a real-life problem that requires a technical solution and list the study materials needed	L, T	G	2	CO3	A		R s	3
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			
5.3	Use any online tech forum to gather ideas for solving the problem chosen	L, T	G	2	CO5	A		R s	
5.4	Arrive at a possible solution using six thinking hat exercise	L, T	G	5	CO3	A n		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			
6.2	Resume preparation	L, T	I	5	CO6	A			2
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	CO2CO5	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		R s	1
11.1	Activities to improve English vocabulary of students	L, T	I/G	4	CO4	U		R e	4
11.2	Activities to help students identify errors in English language usage	L, T	I/G	2	CO4	U		R e	
11.3	Activity to help students identify commonly misspelled words, commonly mispronounced words and confusing words	L, T	I/G	2	CO4	U		R e	
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	CO4CO5	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	CO2CO4CO5	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
Internal Examination	
Learning Activity	100
Regularity	
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	
CS01	Apply basic sciences to address industrial needs effectively.
CS02	Apply the concepts of Linear algebra, Complex numbers, Transforms, Calculus, probability, statistics and random variables in Electronics and Communication engineering.
CS04	Apply the basics of Electronics, Electrical, Mechanical and Civil engineering to solve real-life engineering problems.
CS05	Design, analyse, and troubleshoot complex electrical circuits by fundamental principles such as Kirchhoff's laws, AC circuit behaviour, power calculations etc.
CS06	Design and develop stable systems for engineering applications while analysing both linear and non-linear electronic systems.
CS21	Apply concepts of Digital Signal Processing (DSP) to develop algorithms for image, audio, and video processing.
CS22	Proficiency in embedded programming languages for developing simple embedded systems and applications.
CS23	Designing embedded systems using microcontrollers such as 8051, ATmega or PIC microcontrollers.

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 (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
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			C	CIA	ESE
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	Data Communications and Networking with TCP/IP protocol suite	Behrouz A. Forouzan	McGraw Hill, 6/e
2	Upgrading and Repairing PCs	Scott Mueller	Que Publication, 22/e
3	Make: Getting Started with Arduino	Massimo Banzi, Michael Shiloh	O'Reilly Media, 3/e
4	MATLAB for Engineers	Holly Moore	Pearson Education, 5/e
5	SPICE for circuits and electronics	MH.Rashid	Cenage, 4/e
6	KiCad Like a Pro,	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 <i>(PC Hardware Identification and OS Installation)</i>	<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 <i>(Configuring a simple wired/wireless LAN and test connectivity between devices)</i>	<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 <i>ping</i>, <i>ipconfig/ifconfig</i>, 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 <i>(Arduino programming and digital input/output operations)</i>	<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	<ul style="list-style-type: none"> Interface an LDR + resistor or temperature sensor. 	2	A	P	V	2

<p><i>(Interfacing of sensor with Arduino and display results)</i></p>	<ul style="list-style-type: none"> • Read sensor values using <i>analogRead()</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. 					
<p>Introductory MATLAB and Simulink <i>(Generation and visualization of basic continuous-time-like signals and its spectrum using MATLAB)</i></p>	<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
<p>Introductory MATLAB and Simulink <i>(Modelling and simulation of time response of a first-order system using Simulink)</i></p>	<ul style="list-style-type: none"> • Derive the differential equation of a simple RC or RL circuit (or generic first-order system). • 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). 	3	A	P	V	2
<p>Circuit and PCB design <i>(DC and transient response analysis using LTspice)</i></p>	<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

<p>Circuit and PCB design (PCB design using KiCad)</p>	<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
<p>Course Project</p>	<p>Implement a simple project using the concepts learned above. It could be either hardware based or software based.</p>	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