MITS Kochi
Muthoot Institute of Technology and Science (Autonomous)

B. TECH

ELECTRONICS & COMMUNICATION ENGINEERING

CURRICULUM & SYLLABUS (Version-1)

SEMESTER-1

2025 REGULATION

B. Tech

ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM & SYLLABUS

SEMESTER 1

2025 REGULATION

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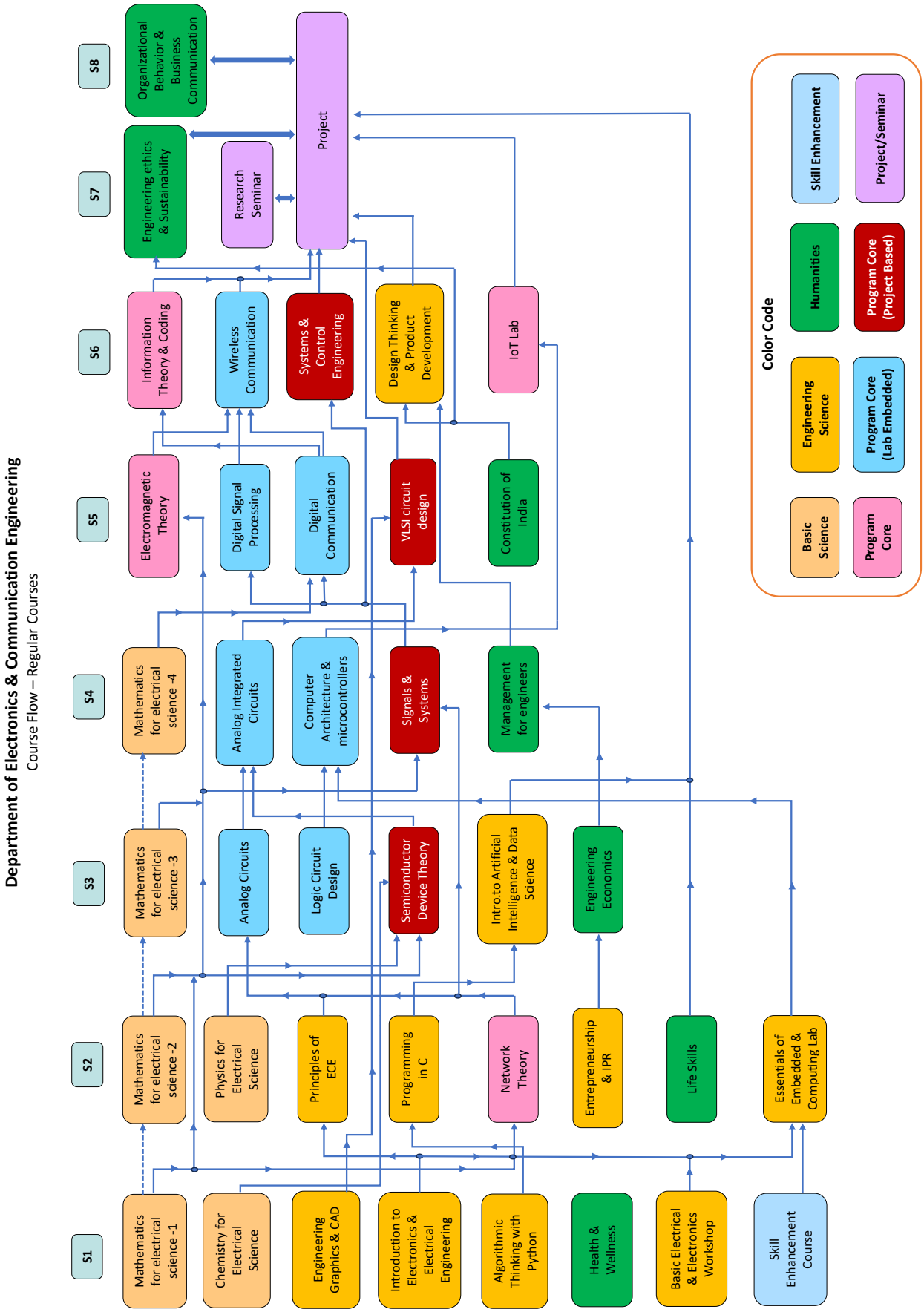
CONTENTS

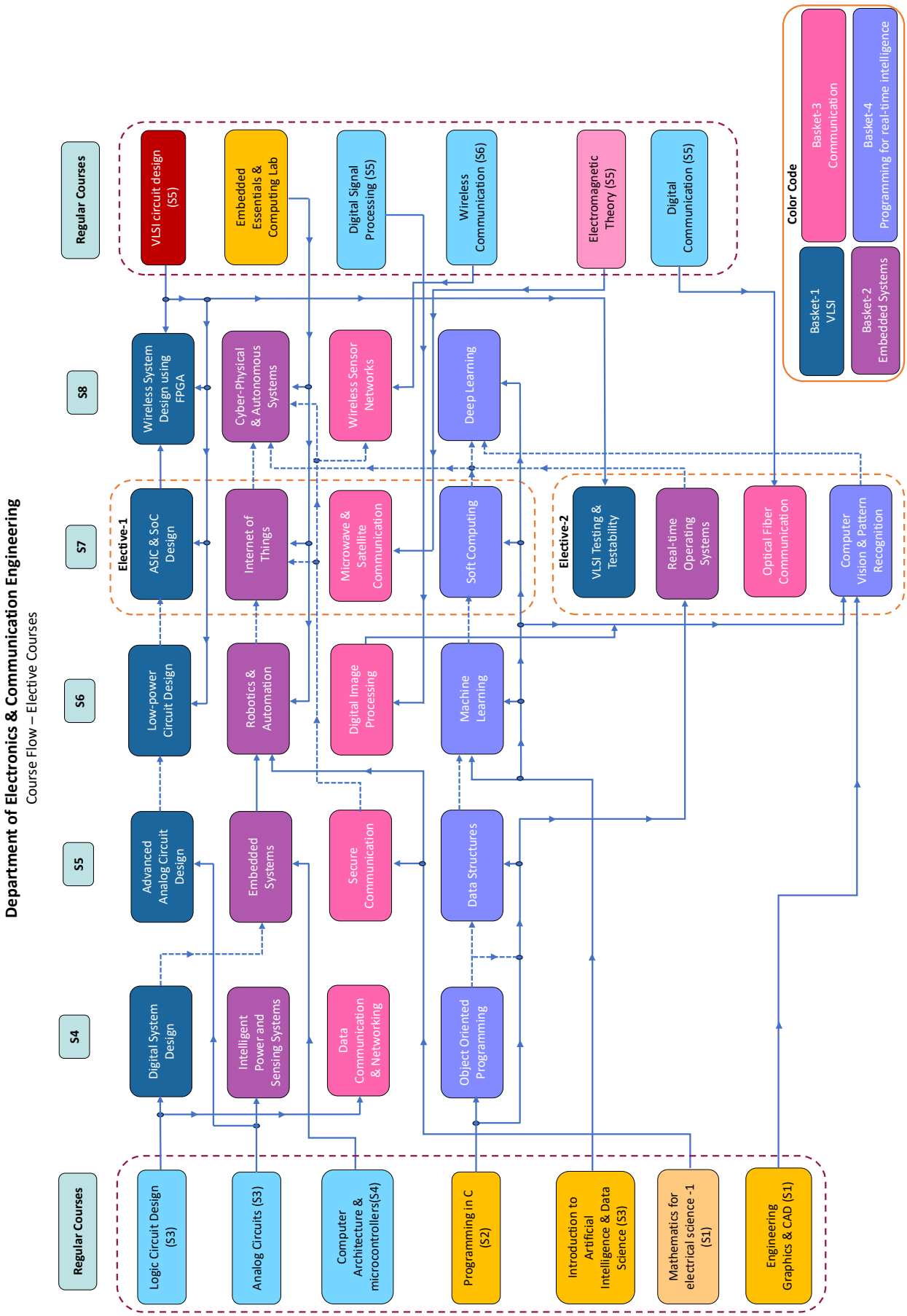
B Tech in Electronics and Communication Engineering

CURRICULUM STRUCTURE

SEM	SLOT	COURSE CATEGORY	COURSE CODE	COURSE NAME	L	T	J	P	S	C	CREDIT / SEM
I	A	BST	B251803/MA100A	Mathematics for Electrical Science-1	3	1	0	0	2	3	20
	B	BSE	B251802/CH910B	Chemistry for Electrical Science	3	0	0	2	3	4	
	C	EST	B251907/CN100C	Engineering Graphics and Computer Aided Drawing	4	0	0	0	2	3	
	D	EST	B251904/CN900D	Introduction to Electrical and Electronics Engineering	4	0	0	0	4	4	
	E	ESE	B251905/CN110E	Algorithmic Thinking with Python	2	1	0	2	3	4	
	K	HMT	B251909/CN910K	Health and Wellness	1	0	0	1	0	1	
	U	ESL	B251904/CN930U	Basic Electrical and Electronics Engineering Workshop	0	0	0	2	1	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
S1
S2
S3
S4
S5
S6
S7
S8
Mathematics for electrical science -1
Chemistry for Electrical Science
Engineering Graphics & CAD
Introduction to Electronics & Electrical Engineering
Algorithmic Thinking with Python
Health & Wellness
Basic Electrical & Electronics Workshop
Skill Enhancement Course
Mathematics for electrical science -2
Physics for Electrical Science
Principles of ECE
Programming in C
Network Theory
Entrepreneurship & IPR
Life Skills
Essentials of Embedded & Computing Lab
Mathematics for electrical science -3
Analog Circuits
Logic Circuit Design
Semiconductor Device Theory
Intro.to Artificial Intelligence & Data Science
Engineering Economics
Mathematics for electrical science -4
Analog Integrated Circuits
Computer Architecture & microcontrollers
Signals & Systems
Management for engineers
Electromagnetic Theory
Digital Signal Processing
Digital Communication
VLSI circuit design
Constitution of India
Information Theory & Coding
Wireless Communication
Systems & Control Engineering
Design Thinking & Product Development
IoT Lab
Engineering ethics & Sustainability
Research Seminar
Project
Organizational Behavior & Business Communication
Color Code
Basic Science
Program Core
Engineering Science
Program Core (Lab Embedded)
Humanities
Program Core (Project Based)
Skill Enhancement
Project/Seminar


Department of Electronics & Communication Engineering
Course Flow – Elective Courses
Regular Courses
S4
S5
S6
S7
S8
Regular Courses
Logic Circuit Design (S3)
Analog Circuits (S3)
Computer Architecture & microcontrollers(S4)
Programming in C (S2)
Introduction to Artificial Intelligence & Data Science (S3)
Mathematics for electrical science -1 (S1)
Engineering Graphics & CAD (S1)
Digital System Design
Intelligent Power and Sensing Systems
Data Communication & Networking
Object Oriented Programming
Advanced Analog Circuit Design
Embedded Systems
Secure Communication
Data Structures
Low-power Circuit Design
Robotics & Automation
Digital Image Processing
Machine Learning
Elective-1
ASIC & SoC Design
Internet of Things
Microwave & Satellite Communication
Soft Computing
Elective-2
VLSI Testing & Testability
Real-time Operating Systems
Optical Fiber Communication
Computer Vision & Pattern Recognition
Wireless System Design using FPGA
Cyber-Physical & Autonomous Systems
Wireless Sensor Networks
Deep Learning
VLSI circuit design (S5)
Embedded Essentials & Computing Lab
Digital Signal Processing (S5)
Wireless Communication (S6)
Electromagnetic Theory (S5)
Digital Communication (S5)
Color Code
Basket-1 VLSI
Basket-2 Embedded Systems
Basket-3 Communication
Basket-4 Programming for real-time intelligence

SEMESTER-1

CONTENTS

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 ____ / ____ / 2026

Chairperson, BoS

Name: Dr Abhilash Antony Designation: Professor & HoD

Signature: _____ Date: _____

ACADEMIC COUNCIL

Approved by the **Academic Council** in its meeting held on ____ **/** ____ **/ 2026**

PRINCIPAL

Recommended for implementation from the Academic year 2026-2027.

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	B251803/MA100A	Mathematics for Electrical Science-1	3	1	0	0	2	3
B	BSE	B251802/CH910B	Chemistry for Electrical Science	3	0	0	2	3	4
C	EST	B251907/CN100C	Engineering Graphics and Computer Aided Drawing	4	0	0	0	2	3
D	EST	B251904/CN900D	Introduction to Electrical and Electronics Engineering	4	0	0	0	4	4
E	ESE	B251905/CN110E	Algorithmic Thinking with Python	2	1	0	2	3	4
K	HMT	B251909/CN910K	Health and Wellness	1	0	0	1	0	1
U	ESL	B251904/CN930U	Basic Electrical and Electronics Engineering Workshop	0	0	0	2	1	1
I	SEC	Skill Enhancement Course: NASSCOM or equivalent							1
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work, C- Credit)									

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

Course Code	Course Name	Course Category
B251803/MA100A	**MATHEMATICS FOR ELECTRICAL SCIENCE-1**	**BST**
Pre-requisite		
The basic knowledge in matrices and calculus.		

PREAMBLE
This course explores fundamental mathematical techniques essential to engineering analysis and design. It begins with linear algebra, covering systems of linear equations, matrix rank, and Gauss elimination, along with eigenvalues, eigenvectors, and diagonalization of matrices. The course then develops methods for solving homogeneous and non-homogeneous ordinary differential equations of second and higher order, using techniques such as undetermined coefficients and variation of parameters. It further introduces the Laplace transform as an operational tool for solving initial value problems, including those involving discontinuous and impulsive inputs. Finally, the course covers Fourier series, enabling the representation of periodic functions and signals as sums of sinusoidal components.

RATIONALE
• Provides the mathematical foundation required to model and analyze electrical circuits, electronic systems, and engineering problems. • Develops linear algebra concepts such as matrices, eigenvalues, and eigenvectors for solving systems of linear equations arising in electrical network analysis and engineering computations. • Equips students with ordinary differential equation techniques to model and analyze the dynamic behaviour of electrical circuits, electrical machines, and control systems. • Introduces Laplace transforms as an efficient tool for analyzing linear systems, circuit transients, and solving initial value problems in electrical and electronic engineering. • Familiarizes students with Fourier series for representing periodic signals, enabling applications in harmonic analysis, communication systems, signal processing, and power quality studies.

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.

CO	CO Statement	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	**Solve** linear systems of equations by applying the properties of matrices and vectors.	Applying		Responding
CO2	**Employ** appropriate methods for solving linear differential equations with constant coefficients arising in engineering applications.	Applying		Responding
CO3	**Apply** Laplace transform to find the solution of Initial value problem.	Applying		Responding
CO4	**Apply** Taylor and Fourier series methods to obtain series explanation of given functions.	Applying		Responding

TEACHING AND ASSESSMENT SCHEME													
Teaching Scheme / Week					**Hours / Semester**	**Credit**	**Examination Scheme**						
							Theory			**Practical**			**Total**
L	**T**	**J**	**P**	**S**	90	**C**	**CIA**	**ESE**	**Total**	**CIA**	**ESE**	**Total**	
3	1	0	0	2		3	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	Hrs
1	**Linear Algebra**	Linear systems of equations, Row echelon form and rank of a matrix, Linear Independence, 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 ωx, k sin ωx and their linear combinations). **(Text 1: Relevant topics from sections 2.1, 2.2, 2.7, 2.10)**	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)**	12
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

Sl. No	Self-learning / Team Work Description
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).**
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).**
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)**.
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)**.

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	15th 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 & amp; 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	Title	Topic	Mode of Delivery	CO	Learning Domain			Hrs
					C	P	A	
1	**Linear Algebra**	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	**Ordinary Difference Equation**	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 Tranform**	Laplace Transform and its inverse	L	CO3	U			2
		Linearity. First shifting theorem(s-shifting)	L	CO3	U			1
		Tutorial Problems	T	CO3	U		Rs	1
		Transform of Derivatives	L	CO3	U			1
		Solution of differential equation using Laplace transform	L	CO3	A			2
		Tutorial Problems	T	CO3	A		Rs	1
		Unit step function, Second shifting theorem	L	CO3	U			2
		Dira delta function and its transform	L	CO3	U			1
		Tutorial Problems	T	CO3	U		Rs	1
		Convolution theorem in finding inverse Laplace transform of products of functions	L	CO3	U			1

		Tutorial Problems	T	CO3	U		Rs	1
4	**Fourier Series**	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) (Use √)

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

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:	B251803/ MA100A		
Course Name:	MATHEMATICS FOR ELECTRICAL SCIENCE-1		
Max. Marks	**60**	**Duration:**	2 hours 30 minutes
Common to EC & EE			

PART A

(Answer all questions. Each question carries 3 marks)

No.	***Question***	***CO***	***Marks***
1	Determine the row echelon form of the matrix $\begin{bmatrix}1 & 2 & 3\\2 & 4 & 6\\1 & 1 & 1\end{bmatrix}$ 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: $x,\ xlnx$.	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 $f(t) = t^2e^{3t}$.	CO 3	(3)
7	Construct the half-range cosine series for $f(x) = e^x$ in (0,1).	CO 4	(3)
8	Obtain the Fourier series representation of $f(x) = x^2 - 2$ for $-2 < x < 2$.	CO 4	(3)

PART B

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

No.		***Question***	***CO***	***Marks***
		MODULE I		
9	a)	Find the values of λ and μ so that the given system of equations $x + y + z = 6, x + 2y + 3z = 10, x + 2y + \lambda z = \mu$ has i) No solution. ii) Infinite solutions. iii) Unique solution.	CO 1	(5)
	b)	Determine the eigenvalues and corresponding eigenvectors of the matrix $A = \begin{bmatrix}-2 & 2 & -3\\2 & 1 & -6\\-1 & -2 & 0\end{bmatrix}$.	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 $(3D^2 + 27I)y = 3cosx + \cos 3x$.	CO 2	(5)
	b)	Use variation of parameters to obtain the solution of the linear ordinary differential equation $y'' - 2y' + y = e^x lnx$.	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 (–π, π) 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**	**25/1**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	COURSE NAME	COURSE CATEGORY
B251802/CH910B	**Chemistry For Electrical Science**	BSE
PRE-REQUISITE		
Concepts of chemistry introduced at the plus two level especially Electrochemistry, Polymers, and Volumetric Analysis.		

PREAMBLE

This course enables students to apply core concepts of electrochemistry, materials science, spectroscopy, and environmental chemistry to solve real-world engineering problems in energy storage, corrosion control, electronic materials, and sustainable development.

RATIONALE

- The course is designed to connect basic chemical principles with engineering applications.
- Electrochemistry supports understanding of batteries, fuel cells, corrosion and prevention methods.
- Nanomaterials, polymers, and organic electronic materials are included to provide students with an understanding of advances in electronics, energy storage, and emerging technologies.
- Spectroscopic and microscopic techniques provide essential tools for material characterization.
- Water chemistry, waste management, and climate change topics promote sustainable engineering practices and environmental responsibility.

COMPETENCY STATEMENT

Demonstrate the ability to apply core principles of chemistry to design, develop, and characterize materials and systems for sustainable technological applications, including energy storage, corrosion protection, electronic devices, and water/waste management.

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

TEACHING AND ASSESSMENT SCHEME

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

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

SYLLABUS (Major Topics)

Module	Title	Major Topics	Hrs
1	Electrochemistry and Corrosion	Electrochemical Cell-Electrode potential- Nernst equation - Reference electrodes –Electrochemical series - Glass Electrode & pH Measurement-Conductivity. Li-ion battery & H2-O2 fuel cell. Corrosion –Electrochemical corrosion - Galvanic series - Corrosion	9

		control methods – Electroplating of copper - Electroless plating of copper.	
2	Materials for Electronic Applications	Nanomaterials - Classification -Synthesis -Carbon Nanotubes, Graphene & Carbon Quantum Dots – Polymers - Fire Retardant Polymers- Conducting Polymers-Polyaniline-Organic electronic materials and devices-Organic Light Emitting Diode (OLED) & Dye-Sensitized Solar Cells (DSSC). Materials used in Quantum computing Technology, Super capacitors, Spintronics.	9
3	Molecular Spectroscopy and Analytical Techniques	Spectroscopy-Types of spectra- Molecular energy levels - Beer Lambert's law – Electronic Spectroscopy-Instrumentation-Applications – Vibrational spectroscopy –Number of vibrational modes - Vibrational modes of CO_2 and H_2O – Applications. Thermal Analysis: Dielectric Thermal Analysis (DETA) of Polymers-Electron Microscopic Techniques: SEM	9
4	Environmental Chemistry	Water characteristics - Hardness -Degree of hardness (Numericals)- Water softening methods – Water disinfection methods – Dissolved oxygen (DO), BOD and COD. Waste Management: Sewage water treatment- E Waste-Methods of disposal. Chemistry of climate change- Greenhouse Gases and Green house effect- Sustainable Development Goals.	9

Sl. No	Self-learning / Team Work Description
1	Cells and Batteries– Primary and Secondary cells- Construction, working and applications of Lead acid battery, Nickel -cadmium battery **(8 hours)**.
2	Polymers- Classification-Types of Polymerisation-Copolymers. Sensors- Physical, chemical and bio sensors- introduction and applications **(8 hours)**.
3	Molecular Orbital Theory and Shape of Molecules. Application of spectroscopy in Biomedical field **(8 hours)**.
4	Estimation of Hardness – EDTA Method and Estimation of Dissolved Oxygen-Winkler's method. Health impacts of E- waste **(8 hours)**.
5	Pre- lab work **(16 hours)**.
6	Practice Problems (**20 hours**)

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. KGaA
6	Organic Electronics Materials and Devices	Shuichiro Ogawa	Springer Tokyo
7	Principles and Applications of Thermal Analysis	Gabbot, P	Oxford: Blackwell Publishing

Web Resource / Virtual Lab	
1	https://onlinecourses.nptel.ac.in/noc25_mm35/preview
2	https://onlinecourses.nptel.ac.in/noc25_ch51/preview
3	https://nptel.ac.in/courses/104106075
4	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cy48
5	https://mas-iiith.vlabs.ac.in/List%20of%20experiments.html
6	https://mas-iiith.vlabs.ac.in/exp/uv-visible-spectroscopy/simulation.html
7	https://inoc-amrt.vlabs.ac.in/exp/water-analysis-chemical-parameters/simulation.html
8	https://ec-iitr.vlabs.ac.in/exp/water-hardness/simulation.html
9	https://bc1-iitk.vlabs.ac.in/exp/ion-exchange-column/simulation.html

DETAILED SYLLABUS

Module	Title	Topic	Mode of Delivery	CO	Learning Domain			Hrs
					C	P	A	
1	Electrochemistry and Corrosion Science	Electrochemical Cell- Electrochemical Cell and Electrode potential	L	CO1	U			1
		Nernst equation for single electrode and cell (Numerical problems)	L	CO1	A		Rs	1
		Nernst Equation-Numerical Problems	L	CO1	A		Rs	1
		Electrochemical series and applications	L	CO1	A		V	1
		Reference electrodes – SHE & Calomel electrode – Construction and Working	L	CO1	U			1
		Glass Electrode & pH Measurement Conductivity-Measurement using Digital conductivity meter.	L, P	CO1	A	M	V	1
		Li-ion battery & H2-O2 fuel cell (acid electrolyte only) construction and working.	L	CO1	U			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			1
2	Materials for Electronic Applications	Nanomaterials Classification based on Dimension & Materials	L	CO2	U			1
		Synthesis – Sol gel & Chemical Reduction - Applications of nanomaterials	L	CO2	U			1
		Carbon Nanotubes- structure, properties & application.	L	CO2	U			1
		Graphene & Carbon Quantum Dots – structure, properties & application.	L	CO2	U			1
		Polymers -Fire Retardant Polymers- Halogenated & Non-	L	CO2	U		Rs	1

		halogenated polymers (Examples only) Conducting Polymers-Classification						
		Polyaniline- 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			1
		Construction, working and applications of Dye-Sensitized Solar Cells (DSSC)	L	CO2	U			1
		Materials used in Quantum computing Technology. Super capacitors, Spintronics	L	CO2	U			1
3	**Molecular Spectroscopy and Analytical Techniques**	Spectroscopy Types of spectra and Molecular Energy Levels	L	CO3	U			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	A		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	A		Rs	1
		Vibrational modes of CO_2 and H_2O – Applications	L,P	CO3	A	M	V	1
		Thermal Analysis Dielectric Thermal Analysis (DETA) of Polymers-Working and Application.	L	CO3	U		Rs	1
		Electron Microscopic Techniques SEM - Principle, instrumentation and Applications.	L	CO3	U			1
4	**Environmental Chemistry**	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 (Numericals)	L	CO4	A		Rs	1
		Water softening methods-Ion exchange process- Principle, procedure and advantages. Reverse osmosis – principle, process and advantages	L	CO4	A			1
		Water disinfection methods – chlorination-Break point chlorination, ozone and UV irradiation.	L	CO4	A			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	L	CO4	U			1

		diagram -Trickling filter and UASB process.						
		E- Waste, Methods of disposal – recycle, recovery and reuse.	L	CO4	U			1
		Chemistry of climate change-Greenhouse Gases and Green house effect-Sustainable Development- an introduction to Sustainable Development Goals.	L	CO4	U			1

LAB COMPONENT DESIGN				
Objective	**CO**	**Learning Domain**		
		C	P	A
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
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
To synthesize urea-formaldehyde resin and determine its percentage yield.	CO2	A	M	V
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
To determine the molar absorptivity (ε) of a coloured compound such as potassium permanganate by measuring absorbance at its λmax and applying Beer-Lambert's law.	CO3	A	M	V
To analyse the IR spectrum of given compounds based on characteristic absorption bands and to characterize the unknown compounds	CO3	A	M	V
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
To determine the total hardness of a given water sample by complexometric titration using ethylenediaminetetraacetic acid (EDTA) as the titrant and Eriochrome Black T as the indicator.	CO4	A	M	V

TABLE OF SPECIFICATIONS (ToS) (ESE Question Paper Design) (Use √)								
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 Assessment	15
2	Learning Activity	
3	Regularity	5
End Semester Examination – Lab		0
End Semester Examination – Theory		**60**
Total		**100**

MITS Muthoot Institute of Technology and Science Kochi (Autonomous)

MODEL QUESTION PAPER

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER B. TECH DEGREE END SEMESTER EXAMINATION, DECEMBER 2026 (2025 SCHEME)			
Course Code:	**B251904/CH910B**		
Course Name:	**CHEMISTRY FOR ELECTRICAL SCIENCE**		
Max. Marks	**60**	**Duration**:	**2 hours 30 minutes**

FOR ECE and EEE

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	Design and sketch a reversible cell for the reaction, $2Al\ (s) + 3Fe^{2+}\ (aq) \rightarrow 2Al^{3+}\ (aq) + 3Fe\ (s)$	CO1	(3)
2	You are designing a battery pack for an electric vehicle where thermal stability, safety under mechanical stress and the risk of fire are critical. Compare $LiCoO_2$ and $LiFePO_4$, and justify which material is the safer positive electrode, considering the chemical transformations that occur during full charging.	CO1	(3)
3	A research lab needs to synthesize TiO_2 nanoparticles for incorporating in solar cells. Should they use the sol–gel method or chemical reduction? Explain the suitable chemical method.	CO2	(3)
4	Match the following with proper justification in one or two sentences. i) Polyacetylene — i) Drug delivery vehicle ii) Carbon nanotube — ii) Polaron iii) Fullerene — iii) Luminescence iv) Parchment model	CO2	(3)
5	In the analysis of atmospheric gases using IR spectroscopy, identify which molecule among $\mathbf{O_2}$ and $\mathbf{O_3}$ is IR active. Justify your answer and calculate the number of vibrational modes for the IR-active molecule.	CO3	(3)
6	A 0.064 M dye solution is analysed using a UV–visible spectrophotometer with a cuvette of 1 cm path length. The solution shows 40% transmittance at 580 nm. Calculate its absorbance and molar extinction coefficient.	CO3	(3)
7	A rapidly expanding software development firm is upgrading its entire IT infrastructure. This upgrade will result in the decommissioning of 500 obsolete desktop computers, outdated server racks, and a large bin of faulty lithium-ion laptop batteries. As an engineer, formulate a sustainable e-waste management strategy.	CO4	(3)
8	A municipal water sample analysis gives: $Ca(HCO_3)_2$ = 162 mg/L and $MgSO_4$ = 120 mg/L. Calculate total hardness in ppm.	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)	As an engineer how can you design an automated system to continuously monitor the acidity of industrial effluent being discharged into a nearby river. Identify the electrodes for pH monitoring. Describe the pH determination with the help of a neat diagram.	CO1	(5)
	b)	A steel pipeline carrying acidic water undergoes corrosion in the presence of hydrogen ions and dissolved oxygen. (i) Write the electrochemical reactions for hydrogen evolution and oxygen absorption corrosions of iron in acidic medium. (ii) Calculate the emf for both types of corrosion and determine which process is thermodynamically more favorable and justify your answer.	CO1	(4)
		OR		
10	a)	During the Apollo space mission, a hydrogen–oxygen fuel cell was used to generate electricity and water for the spacecraft. Explain the construction and working of the hydrogen–oxygen fuel cell, which uses acid electrolyte in it.	CO1	(5)
	b)	Calculate the amount of electrical energy available from a dry cell corresponding to the consumption of 6.55gm of Zn metal. **Hint**: EMF = 1.5V, atomic weight of Zn = 65.5gm	CO1	(4)
		MODULE II		
11	a)	A hardware engineering team is designing a new generation of flexible, wearable health-monitoring patches. Traditional metallic wires are too rigid, heavy, and prone to breaking when the patient moves. To solve this, the team explores the use of conducting polymers for the patch's electronic circuits. To help the team to select the right material, identify the suitable conducting polymer and classify conducting polymers based on the mechanism of conduction.	CO2	(5)
	b)	Aerospace engineering increasingly relies on nanomaterials for enhanced performance. Name a one -dimensional carbon-based nanomaterial suitable for such applications and discuss the property that makes it suitable. Also describe its structural features.	CO2	(4)
		OR		
12	a)	There is an increasing demand for energy-efficient, lightweight, and flexible display panels used in displays of smartphones, televisions, and wearable devices. Explain the construction and working principle of an Organic Light Emitting Diode (OLED) and discuss its applications in modern electronic display technology.	CO2	(5)
	b)	A hardware engineering firm is developing a "smart packaging" solution that uses printed RFID (Radio Frequency Identification) tags to track inventory in real-time. To print these electronic circuits onto thin plastic	CO2	(4)

		films, the team needs a high-conductivity ink. They decide to synthesize Silver Nanoparticles (AgNPs) to serve as the functional pigment in the ink. Identify the specific chemical synthesis method used to produce these silver nanoparticles and explain the process with suitable chemical equation.		
MODULE III				
13	a)	i) In a UV–visible spectroscopic analysis, a sample of cyclohexane shows no absorption peak, whereas benzene exhibits a characteristic absorption at 255 nm. Explain the reason for this observation. ii) Sketch a sample UV-visible spectrum and discuss why UV–visible absorption bands are generally broad.	CO3	(5)
	b)	A hardware security firm is investigating a batch of high-end specialized plastic casings for a new line of secure laptops. They suspect the supplier has substituted the specified high-performance polycarbonate (PC) with a cheaper, less durable polymer blend. To verify the chemical identity of the casing without destroying it, the firm uses the technique Infrared (IR) Spectroscopy. Justify why IR spectroscopy is an effective tool for identifying the specific polymer used in the laptop casing. Apart from polymer identification, discuss three other critical applications of IR spectroscopy in industrial or environmental monitoring.	CO3	(4)
OR				
14	a)	For examining microcracks and hydration products in a coastal concrete structure, Scanning Electron Microscopy (SEM) is chosen over optical microscopy. Why SEM is preferred over optical microscopy and explain its working.	CO3	(5)
	b)	Draw and explain the energy level diagram of ethene and butadiene in electronic spectroscopy.	CO3	(4)
MODULE IV				
15	a)	A semiconductor fabrication facility requires Ultra-Pure Water to wash silicon wafers during the photolithography process. Presence of Ca^{2+} and Mg^{2+} can lead to scale formation causing permanent hardware defects. The facility decides to install an automated Ion Exchange Unit containing both cation and anion exchange resins to treat the incoming municipal water. How do they remove hardness-causing ions from water? Formulate the specific ion-exchange reactions occurring at both the Cation Exchange Column and the Anion Exchange Column.	CO4	(5)
	b)	Describe how chlorine and ozone disinfect water, highlighting the chemical reactions involved. Which of these methods is more suitable for municipal water treatment, and justify your choice.	CO4	(4)
OR				
16	a)	A rapidly growing Smart City is facing a crisis, its untreated domestic sewage is being discharged into a nearby river leading to a massive outbreak of waterborne diseases and a total loss of aquatic biodiversity. The municipal board is tasked with designing a modern Sewage Treatment Plant to not only clean the water but also recycle it for industrial cooling in nearby data centres. Explain different steps of sewage water treatment in detail. Identify the specific Sustainable Development Goal (SDG) related to this.	CO4	(5)
	a)	Compare aerobic oxidation and anaerobic oxidation, include any four points.	CO4	(4)

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

COURSE CODE	COURSE NAME	COURSE CATEGORY
B251907/CN100C	Engineering Graphics and Computer Aided Drawing	EST
PRE-REQUISITE		
NIL		

PREAMBLE
Engineering Graphics is the foundation of technical communication in engineering. The course develops students' ability to visualize, interpret, and represent engineering components using standard drawing practices. It introduces orthographic and isometric projections, sections of solids, development of surfaces, and basic Computer-Aided Drawing (CAD), providing essential graphical skills for engineering design and manufacturing.

RATIONALE
• **Spatial Visualization and Technical Communication:** To develop spatial visualization skills and the ability to communicate engineering concepts through standard engineering drawings. • **Engineering Drawing Competency:** To build proficiency in preparing and interpreting orthographic, sectional, isometric, and development drawings in accordance with engineering drawing standards. • **Foundation for Engineering Design:** To establish a strong foundation in graphical problem-solving, precision, and visualization skills required for engineering design, manufacturing, and computer-aided drafting (CAD).

COMPETENCY STATEMENT/s
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

CO	CO Statement	Cognitive (C)	Psychomotor (P)	Affective (A)
CO 1	Draw the orthographic projection of points and lines located in different quadrants	A		Rs
CO 2	Generate multi-view orthographic projections of engineering objects by visualizing them in different positions	A		Rs
CO 3	Plot sectional views and development of surfaces for engineering objects.	A		Rs
CO 4	Prepare pictorial drawings using the principles of isometric projection	A		Rs
CO 5	Sketch simple 2D drawings using CAD tools.	A		Rs

TEACHING AND ASSESSMENT SCHEME

Teaching Scheme / Week					Hours / Semester	Credit	Examination Scheme						
							Theory			Practical			Total
L	T	J	P	S		C	CIA	ESE	Total	CIA	ESE	Total	
4				30	90	3	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	Hrs
1	Orthographic projection of points and lines	Introduction: Relevance of technical drawing in engineering field. Orthographic Projection of points in different quadrants, Projection of straight lines inclined to one plane and inclined to both planes. Trace of a line. (Line rotation method only)	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 positions 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

Sl. No	Self-learning / Team Work Description
1	Application problems from projection of lines
2	Application problems from development of surfaces
3	https://www.autodesk.in/campaigns/autocad-tutorials
4	https://knowledge.autodesk.com/support/autocad/getting-started?sort=score
5	https://all3dp.com/autocad-tutorial-beginners/

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
Online Learning App	
1	A R STUDY DESK – Engineering Graphics: Your Animated Notebook (EGYAN)

DETAILED SYLLABUS								
Module	**Title**	**Topic**	**Mode of Delivery**	**CO**	**Learning Domain Level**			**Hrs**
					C	**P**	**A**	
1	Orthographic projection of points and lines	Orthographic projection of points in different quadrants	CL	CO1	A		Rs	2
1		Orthographic projection of lines inclined to one plane and both the planes	CL	CO1	A		Rs	10
1		Orthographic projection of lines – self learning - application level problems	SL	CO1	A		Rs	6
2	Orthographic projection of solids	Orthographic projection of solids with axis inclined to both the planes	CL	CO2	A		Rs	12
3	Sections of solids and Development of surfaces	Sections of Solids when sectioned using different section planes.	CL	CO3	A		Rs	8
3		Development of surfaces - Cylinder, Cone, prisms, Pyramids and Cube	CL	CO4	A		Rs	8
3		Development of surfaces – self learning Application Problems	SL	C04	A		Rs	6
4	Isometric projection	Isometric projection of solids and compound solids	CL	CO5	A		Rs	10
5	Computer Aided Drawing (CAD)	Drafting of 2D drawings	CL	CO7	A		Rs	6
5		CAD - self learning	SL	CO7	A		Rs	18

TABLE OF SPECIFICATIONS (ToS) (ESE Question Paper Design) (Use √)								
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
5	Computer aided Drawing (CAD)		√					No ESE
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
End Semester Examination - Theory		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:	**B251907/CN100C**		
Course Name:	**Engineering Graphics and Computer Aided Drawing**		
Max. Marks	**60**	**Duration**:	2 hours 30 minutes
(EEE, ECE, CSE, AI, AD, CY, VLSI)			

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

No.	*Question*	*CO*	*Marks*
	MODULE 1		
1	A line AB has its end A 20mm above HP and 25mm in front of VP. The other end B is 45mm above HP and 55mm in front of VP. The distance between the end projectors is 60mm. Draw its projections. Also find the true length and true inclinations of the line with HP and VP.	CO1	(15)
2	The top view of a line PQ is 60mm long measures 50mm, while the length of its front view is 40mm. Its end P is in the VP and is 10mm below the HP. Draw the projections of the line and find its inclination with HP and VP.	CO1	(15)
	MODULE 2		
3	Draw the projections of a pentagonal prism of 30mm base side and 60mm height which is resting on its base edge on the ground such that its axis is inclined at 45^0 to HP and the resting base edge at 30^0 to VP.	CO2	(15)
4	A square pyramid, base 30mm side and axis 60mm long has a triangular face on the ground and the vertical plane containing the axis makes an angle of 45^0 with the VP. Draw its projections.	CO2	(15)
	MODULE 3		
5	A square prism of base side 30mm and height 75mm rests on the HP on one of its ends with two of its rectangular faces equally inclined to the VP. It is cut by a plane perpendicular to the VP and inclined at 60^0 to the HP meeting the axis at 15mm from the top. Draw the elevation, sectional plan and true shape of the section. What are the maximum width W and length L of the section?	CO3	(15)
6	A vertical cone of 35mm diameter and axis 50mm is cut by a section plane which makes 45^0 to HP and bisects the axis of the cone. Draw the development of the lateral surface of the truncated cone.	CO4	(15)
	MODULE 4		
7	A square pyramid of side 30mm and axis length 50mm is resting centrally on the top of a cube of side 50mm. Draw the isometric view of the solids.	CO5	(15)
8	A cylinder 50mm base diameter and 70mm high is resting on its base on the HP. It is surmounted centrally by a sphere of 30mm diameter. Draw the isometric projection of the solids.	CO5	(15)

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

COURSE CODE	COURSE NAME	COURSE CATEGORY
B251904/CN900D	**INTRODUCTION TO ELECTRICAL AND ELECTRONICS ENGINEERING**	**EST**
PRE-REQUISITE		
The basic knowledge of single variable calculus.		

PREAMBLE

This course is formulated to provide first-year engineering students with a robust foundation in the fundamental concepts of electrical and electronics engineering. It transitions learners from the basic principles of single-variable calculus to applied engineering methodologies. The curriculum spans a wide spectrum of essential topics, beginning with core DC and AC circuit analysis and magnetic circuits, and progressing through semiconductor devices. To ensure students are prepared for contemporary technological landscapes, the course also integrates modern domains such as communication systems, electronic instrumentation, and the Internet of Things (IoT).

RATIONALE

- **Electrical Fundamentals and Circuit Analysis:** To equip students with the analytical skills needed to evaluate and solve DC, single-phase, and three-phase AC circuits, while fostering a core understanding of magnetic circuits and electromagnetic induction.
- **Electronic Devices and System Design:** To impart fundamental knowledge on the working principles and characteristics of semiconductor devices—such as diodes, BJTs, and MOSFETs—laying the essential groundwork for electronic circuit design.
- **Modern Applications and Emerging Technologies:** To bridge foundational theory with contemporary industry practices by introducing communication systems, electronic instrumentation tools, and practical Internet of Things (IoT) applications in various real-life domains.

COMPETENCY STATEMENTS

Analyse and troubleshoot complex electrical circuits using fundamental principles

Apply principles of solid-state physics in electronic system design

Design and analyse communication systems with modulation and demodulation

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

TEACHING AND ASSESSMENT SCHEME												
Teaching Scheme / Week					**Hours / Semester**	**Credit**	**Examination Scheme**					
							Theory			**Practical**		**Total**
L	**T**	**J**	**P**	**S**	**120**	**C**	**CIA**	**ESE**	**Total**	**CIA**	**ESE**	**Total**	
4	0	0	0	4		4	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	Hrs
1	Analysis of Circuits	Equivalent resistance, mesh analysis, Node analysis	10
1, 2	Concepts of Magnetic circuits and Electromagnetic Induction	Basic terminologies in magnetic circuits, Series and Parallel magnetic circuits	6
2	Analysis of AC Circuits	AC Fundamentals, Analysis of single-phase circuits, Analysis of balanced three phase circuits	14
3	Introduction to Electronics devices & circuits	Passive & active components, Diodes, voltage regulator, power supply, BJT, FET	16
4	Introduction to telecommunication & Instrumentation	Wired communication, AM, FM, Wireless communication, Instrumentation	14

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

SUGGESTED LEARNING RESOURCES

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

Reference			
Sl. No.	Title of Book	Author	Publication
1	Electrical Engineering Fundamentals	Del Toro V	Pearson Education 2/e 2019
2	Engineering Circuit Analysis	Hayt W H, Kemmerly J E, and Durbin S M	Tata McGraw-Hill
3	Electrical and Electronic Technology	Hughes	Pearson Education
4	Basic Electrical Engineering	D C Kulshreshtha	Tata McGraw Hill 2/e 2019

5	Electronics Fundamentals: Circuits, Devices & Applications	Thomas Floyd, David Buchla	Pearson, 8/e
6	Electronics: A system approach	Neil Storey	Pearson 6/e, 2017
7	Electronic Communication	Dennis Roddy &John Coolen	Pearson, 4/e, 2008
8	Principles of Electronics Communication Systems	FrenzelL.E	McGraw Hill, 4/e, 2016

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

DETAILED SYLLABUS

Module	Title	Topic	Mode of Delivery	CO	Learning Domain			Hrs
					C	P	A	
1	Analysis of DC Circuits	Introduction to Electrical Engineering, Basic Terminology, including voltage, current, power, resistance, emf,	CD	CO1	A			1
		Resistances in series and parallel, Current and Voltage Division Rules	L					1
		Capacitors & Inductors: V-I relations and energy stored. Ohm's law	L					1
		star-delta conversion (resistive networks only) -problems.	L				Rs	1
		Numerical problems	T, S	CO1	A		V	2
		Mesh current method – matrix representation - Solution of network equations.	L, T, S					1
		Numerical problems	T					1
		Node voltage methods-matrix representation-solution of network equations by matrix methods - numerical problems.	L, T, S					1
		Numerical problems	T					2
		Basic Terminology: MMF, field strength, flux density, reluctance - comparison between electric and magnetic circuits	L	CO2	U		Rs	1
		Series and parallel magnetic circuits with composite materials	L					1
2	Analysis of AC Circuits	Faraday's laws, Lenz's law, statically induced and dynamically induced emfs, problems	L	CO2	U		Rs	1
		Self-inductance and mutual inductance, coefficient of coupling	L					1

		Generation of alternating voltages-Representation of sinusoidal waveforms: frequency, period	L	CO3	A		V	1
		Average and RMS values and form factor of waveforms - Numerical Problems	L, T, S					2
		Phasor representation of sinusoidal quantities. Trigonometric, Rectangular, Polar and complex forms.	L					1
		Analysis of simple AC circuits: Purely resistive circuit	L	CO3	A		V	1
		Analysis of simple AC circuits: Purely inductive & capacitive	L, T, S					2
		circuits; Inductive and capacitive reactance, concept of impedance.						
		Average Power, Power factor						
		Analysis of RL, RC and RLC series Circuits- active, reactive and apparent power.						2
		Numerical Problems	T					2
		Generation of three phase voltages, advantages of three phase systems, star and delta connections	L	CO4	U		Rs	1
		Relation between line and phase voltages, line and phase currents - Numerical problems.	L, T, S					1
		Numerical Problems	T					2
3	Introduction to Electronics devices & circuits	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	Introduction to telecommunication & Instrumentation	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

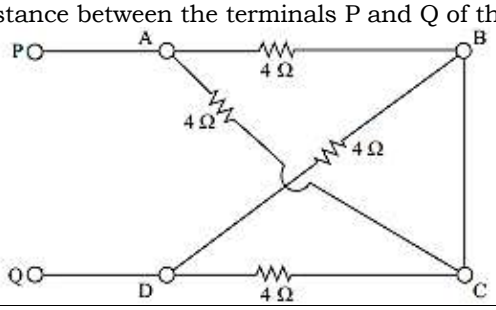
		Introduction to wireless communication, Block diagram of GSM, Comparison of 3G, 4G, 5G & 6G technologies	L, S	CO6	U	I	Rs	2
		Block diagram of electronic instrumentation system, Digital Multimeter,	L	CO6	U	I	Rs	2
		Function generator, Introduction to CRO & Lissajous patterns						2
		IoT based smart homes, IoT in healthcare, IoT in agriculture (case study only)	L, S	CO6	U	I	V	3

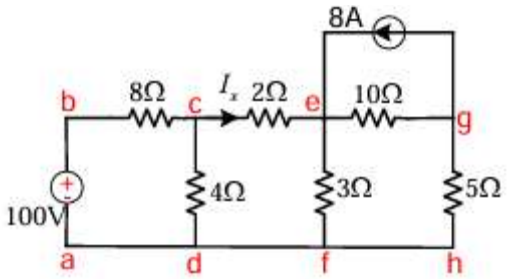
TABLE OF SPECIFICATIONS (ToS) (ESE Question Paper Design)								
Module	Module Title	Distribution of Marks (RBL)						Total Mark
		R	U	A	An	E	C	
1	Analysis of DC Circuits	√	√	√				15
2	Analysis of AC Circuits	√	√	√				15
3	Introduction to Electronics devices & circuits		√	√				15
4	Introduction to telecommunication & Instrumentation		√	√				15
This ToS shall be treated as a general guideline for students and teachers for distribution of marks								

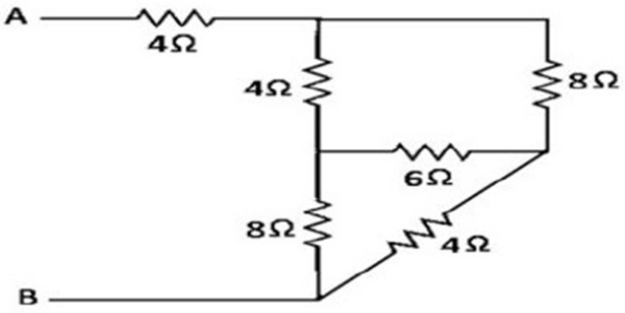
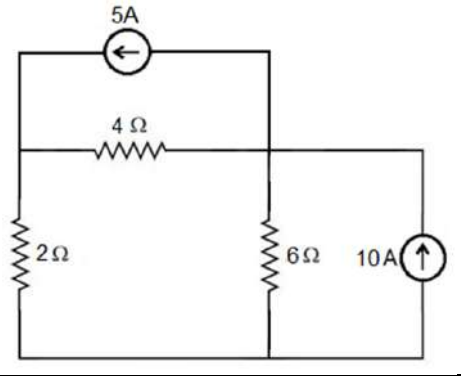
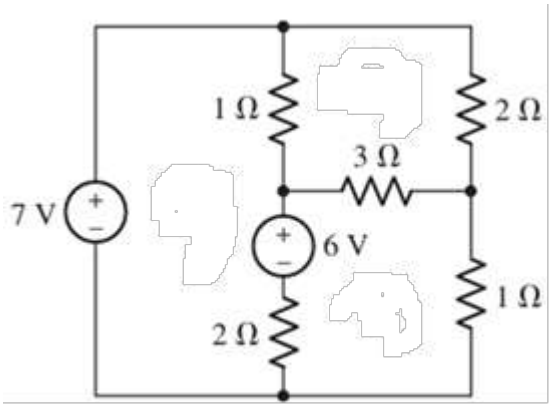
ASSESSMENT PATTERN	
Assessment	**Marks**
Continuous Internal Assessment	**40**
1. Internal Examination	**20**
2. Learning Activity	**15**
3. Regularity	**5**
End Semester Examination	**60**
Total	**100**

			Total Pages: 4
Register No.:	.....	Name:	.....

FIRST SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR (2025 SCHEME)			
Course Code:	**B251904/CN900D**		
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			
• ***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)

	b	Apply star-delta transformation to determine the equivalent resistance R_{AB}. 	CO1	(4)
		OR		
6	a	Apply Nodal analysis to solve the node voltages in the circuit shown. 	CO1	(4)
	b	Apply mesh analysis to determine the three mesh currents in the circuit shown below. 	CO1	(5)
		MODULE II		
7	a	A technician is testing a device that uses a capacitor to limit current flow. When connected directly to a 230 V AC source, the device draws 1 A current. To protect sensitive components, the current needs to be reduced to 0.5 A by adding a resistor in series. i) Determine the frequency of the applied voltage. ii) Calculate the resistance required to be connected in series with the capacitor to limit the current to 0.5 A, assuming frequency remains unchanged. iii) Compute the phase angle between supply voltage and current after inserting the resistor, and state whether current leads or lags the voltage.	CO4	(4)
	b	An industrial motor is connected to a 3-phase, 400V supply through a delta-connected impedance network. Each phase of the network has an impedance of 8+j6 Ω. i) Calculate the line current drawn by the motor system.	CO4	(5)

		ii) Determine the power factor of the system. iii) Compute the total power consumed.		
OR				
8	a	An R–L–C series circuit is used as part of an AC filtering system. By adjusting the inductance, the current peaks at 0.5 A while operating at 230 V, 50 Hz supply. At this point, a voltage of 350 V is recorded across the capacitor. i) Calculate the resistance of the circuit. ii) Determine the capacitance of the capacitor. iii) Find the inductance of the inductor when the circuit is in resonance.	CO4	(4)
	b	An industrial motor acting as a balanced three phase load consists of three coils each having resistance of 4Ω and inductance 0.02H. It is connected to a 415V, 50Hz, 3-phase ac supply. Determine the phase voltage, phase current, power factor and active power when the load is connected in star.	CO4	(5)

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

PART 2 – B				
MODULE 3 & 4				
(Answer any one full question from each module, each question carries 9 marks)				
No.		***Question***	***CO***	***Marks***
MODULE III				
5		You are designing a power supply circuit for a portable radio that requires a steady DC voltage. The circuit includes a rectifier to convert the AC mains supply to DC before the voltage is regulated.		
	a	Identify and sketch the type of rectifier used in the circuit.	CO5	(3)
	b	Describe the working principle of the above rectifier in the power supply circuit.	CO5	(3)
	c	Sketch the waveforms of the input AC voltage, the rectified output voltage, and the regulated output voltage supplied to the radio.	CO5	(3)
OR				
6		An electronics trainee is testing a MOSFET using a multimeter. When the voltage measured between the gate and source is 0 V, the device does not conduct between drain and source. However, on applying a positive gate to source voltage, current begins to flow from drain to source.		
	a	Identify the type and illustrate the construction of MOSFET.	CO5	(3)
	b	Justify the trainee's observations regarding the operation of this MOSFET when tested under different gate to source voltages.	CO5	(4)
	c	Interpret the drain characteristics of this MOSFET with the help of a neat sketch, identifying the different regions of operation.	CO5	(2)
MODULE IV				
7		A broadcast engineer is planning to transmit an audio signal of frequency range 300 Hz – 3.4 kHz directly over a long distance to multiple locations. After setting up the transmission, he notices that at the receiver end, the signal is highly attenuated and gets distorted with noise, making the speech almost unintelligible.		

	a	Identify the reason for the poor reception of the directly transmitted audio signal and suggest a suitable method to overcome this issue.	CO6	(4)
	b	Describe any two techniques that enable effective transmission of signals over long distances, and illustrate your explanation with neat sketches.	CO6	(5)
OR				
8		You are assigned to troubleshoot an electrical circuit in a lab where a resistor, capacitor, and a battery are connected. The circuit is not functioning as expected, and you suspect faulty components.		
	a	Recommend a suitable instrumentation system that can be used to perform the necessary measurements in this scenario, and draw its block diagram.	CO6	(4)
	b	How does the suggested instrument function in measuring battery current and resistance.	CO6	(5)

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

COURSE CODE	COURSE NAME	COURSE CATEGORY
B251905/CN110E	ALGORITHMIC THINKING WITH PYTHON	ESE
PRE-REQUISITE		
Nil		

PREAMBLE

This course introduces students to the fundamentals of computational thinking and problem solving using Python programming. It emphasizes the systematic development of algorithms through pseudocode and flowcharts before translating them into Python programs. Students gain proficiency in Python programming constructs, functions, recursion, modular programming, and data structures while developing the ability to design, implement, test, and debug programs. The course also provides an introductory understanding of major algorithm design paradigms, enabling students to build efficient and structured solutions to real-world computational problems.

RATIONALE

- Develop computational thinking and problem-solving skills through algorithm design and structured programming.
- Equip students with the ability to design solutions using pseudocode, flowcharts, and Python programming.
- Build proficiency in Python programming concepts, including functions, recursion, modular programming, and data structures.
- Introduce fundamental algorithm design paradigms for solving computational problems efficiently.
- Prepare students for advanced computing courses and real-world software development applications.

COMPETENCY STATEMENT/s

CC1: Apply the basic engineering concepts to solve near to real-life engineering problems
CC2: Demonstrates proficiency in the Python programming language

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

TEACHING AND ASSESSMENT SCHEME

Teaching Scheme / Week					Hours / Semester	Credit	Examination Scheme						
							Theory			Practical			Total
L	T	J	P	S	120	C	CIA	ESE	Total	CIA	ESE	Total	
2	1	0	2	3		4	25	60	85	15	0	15	100

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

SYLLABUS (Major Topics)

Module	Title	Major Topics	Hrs
1	Foundations of Problem-Solving and Python Basics	Problem-Solving Strategies, The Problem-Solving Process, Essentials of Python Programming	10
2	Algorithm Design with Pseudocode and Flowcharts	Pseudocode, Flowcharts	10

3	Modular Problem-Solving with Python: Control Structures to Recursion	Selection and Iteration, Decomposition and Modularization, Recursion	13
4	Fundamental Computational Approaches to Problem-Solving	Divide-and-Conquer Approach, Dynamic Programming Approach, Greedy Algorithm Approach	12

Sl. No	**Self-learning / Team Work Description**
1	Pre-Lab Practical Learning
2	Case study: Pick simple problems (e.g., finding prime numbers) document steps: understanding, model, algorithm, coding, testing.
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.
4	Compare recursive vs iterative solutions for factorial & Fibonacci. Trace recursion using call-stack diagrams.
5	Study simple brute-force problems: padlock, password guessing. Write small brute-force code (e.g., linear search).

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 / Virtual Lab	
1.	https://opentextbc.ca/h5ppsychology/chapter/problem-solving/
2.	https://onlinecourses.nptel.ac.in/noc21_cs32/preview

DETAILED SYLLABUS

Module	**Title**	**Topic**	**Mode of Delivery**	**CO**	**Learning Domain**			**Hrs**
					C	**P**	**A**	
1	Foundations of Problem-Solving and Python Basics	**Problem-solving strategies** – definition, importance, trial & error, heuristics, means-ends analysis, backtracking (working backward)	L	1	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,T	1	U	M	Rs	3,2
		Essentials of Python programming – variables, numeric and string data types, math module, Python Standard Library, I/O (print, input), operators & precedence	L,T	1	U	M	Rs	2,1

		Case study: Pick simple problems (e.g., prime numbers) and document steps (understanding, model, algorithm, coding, testing)	S	1	U	M	Rs	15
2	Algorithm Design with Pseudocode and Flowcharts	**Pseudocode Representation** – meaning & definition, reasons for using pseudocode, constructs of pseudocode (sequencing, selection – if-else, case structure; repetition – for, while, repeat-until loops)	L	2	A	M	Rs	1
		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	2	A	M	Rs	2,2
		Flowcharts – symbols: start/end, arithmetic operation, I/O, decision, module call, loop (hexagon), flow-lines, connectors (on-page & off-page)	L	2	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	L,T	2	A	M	Rs	1,2
		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	2	A	M	Rs	10
3	Modular Problem-Solving with Python: Control Structures to Recursion	**Selection and iteration using Python** – if-else, elif, for loop, range, while loop	L	3	A	M	Rs	2
		Sequence data types in Python – list, tuple, set, strings, dictionary	L	3	A	M	Rs	1
		Creating and using arrays in Python (using NumPy library)	L	3	A	M	Rs	1
		Decomposition and modularization – problem decomposition as a strategy for solving complex problems, modularization, motivation for modularization	L	3	A	M	Rs	2
		Functions in Python – defining & using functions, functions with multiple return values. The idea should be demonstrated using Merge Sort and the problem of returning the top three integers from a list of n ≥ 3 integers (examples). (Not limited to these exercises; more can be worked out if time permits).	L,T	3	A	M	Rs	1,2
		Recursion – definition, reasons for using recursion, the call stack, recursion and the stack, avoiding circularity in recursion	L	3	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	3	A	M	Rs	1,2
		Self-learning: Compare recursive vs iterative solutions for factorial & Fibonacci; trace recursion using call-stack diagrams	S	3	A	M	Rs	10
4	Fundamental Computational Approaches to Problem-Solving	**Brute-force Approach** – Introductory diagrammatic/algorithmic explanation (analysis not required). Example: Padlock, Password guessing	L	4	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	4	A	M	Rs	2
		Dynamic Programming Approach – introductory diagrammatic/algorithmic explanation (analysis not required). Example: Fibonacci series. Recursion vs Dynamic Programming	L,T	4	A	M	Rs	1,1
		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,T	4	A	M	Rs	2,2
		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,T	4	A	M	Rs	1,1
		Self-learning – Study simple brute-force problems: padlock, password guessing. Write small brute-force code (e.g., linear search).	S	4	A	M	Rs	10

LAB COMPONENT DESIGN					
	Objectives	**CO**	**Learning Domain**		
			C	P	A
1	To practice basic syntax, operators and user input handling	3	A	M	Rs
2	To familiarize string operations and indexing	3	A	M	Rs
3	To understand built-in libraries and formatting	3	U	M	Rs
4	To apply data structures and library usage	3	A	M	Rs
5	To apply selection control structure	3	A	M	Rs
6	To apply formulas and I/O	3	A	M	Rs
7	To practice nested iteration and control flow	3	A	P	Rs
8	To apply iteration and conditions with efficiency	3	A	P	Rs
9	To apply recursion for mathematical problems	3	A	P	Rs
10	To practice recursion basics	3	A	P	Rs
11	To strengthen recursive algorithm design	3	A	P	Rs
12	To apply recursion for number theory problems	3	A	P	Rs
13	To apply modularization and conditionals	3	C	P	V
14	To understand modular programming and reuse	3	C	P	V
15	To apply string validation logic	3	A	P	Rs
16	To apply sorting, merging and algorithm design	3	A	P	V
17	To apply loops, decision making and simulate game strategy	3	A	P	V
18	To apply probability simulation, decision analysis and algorithmic reasoning	4	A	P	V

TABLE OF SPECIFICATIONS (ToS) (ESE Question Paper Design) (Use √)								
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 Assessment	5
3	Learning Activity	
4	Regularity	5
5	Course Project	
6	Lab Examination	10
End Semester Examination		60
Total		**100**

MODEL QUESTION PAPER

			Total Pages: .....
Register No.:	.....	Name:	.....

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

FIRST SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, DECEMBER 2026 (2025 SCHEME)			
Course Code:	B251905/ CN110E		
Course Name:	ALGORITHMIC THINKING WITH PYTHON		
Max. Marks	**60**	**Duration:**	**2 hours 30 minutes**
CSE,CSE-AI, AI&DS, CSE-CY, ECE			
Use of Data Book / IS codes, etc to be specified by the question paper setter			

PART A

(Answer all questions. Each question carries 3 marks)

No.	***Question***	***CO***	***Marks***
1	Distinguish between trial-and-error strategy and divide-and-conquer strategy with suitable real-life examples.	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?	1	3
3	Draw a flowchart to compute the sum of the first n odd numbers.	2	3
4	Write pseudocode to check whether a given number is prime or not.	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)	3	3
6	Predict the output of the following expressions: 7 % 3 * 2 "10" * 3 bool([])	3	3
7	Differentiate between top-down and bottom-up approaches in Dynamic Programming.	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.	4	3

PART B

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

No.		***Question***	***CO***	***Marks***
		MODULE I		
9	a)	Explain how the backtracking strategy can be applied to solve a real-life problem, for example, planning steps to reach a financial savings goal.	1	5
	b)	Write a Python program to convert a temperature given in Celsius to Fahrenheit and Fahrenheit to Celsius (Hint: °F = (°C × 9/5) + 32).	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.	1	5
	b)	Write a Python program to calculate the bill amount for an item given its quantity sold, value, discount, and tax.	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.	2	5
	b)	Draw a flowchart to compute the sum of digits of an integer.	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.).	2	5
	b)	Develop an algorithm to check whether a given year is a leap year.	2	4
		MODULE III		
13	a)	Differentiate recursion and iteration. Write a recursive program to find factorial of a number.	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).	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	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%]	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.	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.	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.	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.	4	4

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COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**1-0-0-1-0**	**VERSION**	**25/1**	**CREDITS**	**1**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	COURSE NAME	COURSE CATEGORY
B251909/CN910K	HEALTH & WELLNESS	HMT
PRE-REQUISITE		
Nil		

PREAMBLE

This course aims to develop awareness and practice of holistic well-being among engineering students. It emphasizes the importance of physical activity, mental health, stress management, nutrition, and lifestyle choices in enhancing personal and professional effectiveness. Through practical strategies and wellness activities, students will learn to manage academic and life stress, maintain physical fitness, and build emotional resilience. The course nurtures habits that support lifelong health, enabling students to perform optimally in demanding engineering environments while promoting a balanced and sustainable lifestyle.

RATIONALE

Engineering education is intellectually demanding and often associated with high levels of academic stress, sedentary routines, and irregular lifestyles, which can negatively impact students' physical and mental well-being. This course addresses these challenges by promoting awareness and adoption of healthy lifestyle practices through physical activity, stress management, emotional regulation, and balanced nutrition. By integrating wellness into the engineering curriculum, the course aims to enhance students' personal resilience, concentration, emotional stability, and overall quality of life. The knowledge and habits developed through this course support long-term professional effectiveness, reduce burnout, and foster a culture of well-being, which is essential for sustaining productivity and innovation in engineering practice

COMPETENCY STATEMENT/s

Demonstrate a commitment to a healthy lifestyle through regular physical activity and avoidance of addictive substances to promote holistic wellness.

CO	CO Statement	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	Explain the importance of physical activity in maintaining the human metabolic system	Understand		Receive
CO2	Practice life style management strategies to improve mental health and wellness.	Understand	Manipulation	Respond
CO3	Practice healthy life style through regular physical activities and abstaining from addictive substances	Understand	Manipulation	Characterize

TEACHING AND ASSESSMENT SCHEME

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

2	Mental health awareness & balanced diet	Understanding mental health addiction and related issues resources for mental wellness.	
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	First Aid Essentials	First aid and principles of first aid.	

Sl. No	**Self-learning / Team Work Description**
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).

SUGGESTED LEARNING RESOURCES

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

Reference			
Sl. No.	Title of Book	Author	Publication
1	Fit to be Well Essential Concept.	Thygerson, A.,Thyge son , S.M.,& Thygerson, J. S.	Jones & Bartlett Learning 2018
2	Introduction to physical education, fitness, and sports	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/artic1es/PMC2879108/
3	https:/ /yoga.ayush.gov.in/
4	https:/ /www.mindful.org/

DETAILED SYLLABUS								
Module	**Title**	**Topic**	**Mode of Delivery**	**CO**	**Learning Domain**			**Hrs**
					C	**P**	**A**	
1	Human Body system	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 programme.	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	Health & well ness	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	Modern Life styles & diseases	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	2
		Meaning, Aims and objectives of yoga Classification and importance of Yogic Asanas (Sitting, Standing,lying) Pranayama and Its Types- Active Lifestyle and Stress Management LThrough Yoga.	L	CO2	U		O	1

		Understand on substance abuse and addiction psychoactive substance &its ill effects -alcohol opioids- cannabis -sedative - cocaine- other stimulants including caffeine - hallucinogens- tobacco - volatile solvents.	L	CO2	U		O	1
4	First Aid	First aid and principles of First Aid: Primary survey: ABC (Airway, Breathing, Circulation). Qualities of a Good First Aider First aid measures for:Cuts,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

INTERNAL EVALUATION DETAILS

1. LEARNING ACTIVITY

Activity	**Criteria**	**Split up mark**		**Total**
Presentation	Content and quality of presentation (can be assessed on knowledge & clarity of information)	12	Excellent 11-12 Good 6 -10 Need to improve <5	20
	Communication & Interaction	6	Excellent 5-6 Good 3-4 Need to improve <2	
	Time management	2	On time -2 Exceeded Time- <1	

2. ACTIVITY EVALUATION

Activity - 1

Scoring for V Sit Reach Test for Males

Level	**Benchmark Score**	**Measurement**
1	1	<11
2	2	12-13
3	3	14-17
4	3.5	18-19
5	4	20-21
6	4.5	22
7	5	23

Scoring for V Sit Reach Test for Females

Level	Benchmark Score	Measurement
1	1	<14
2	2	15-16
3	3	17-19
4	3.5	20-21
5	4	22
6	4.5	23
7	5	>23

Activity - 2

Scoring for Partial Curl Up - 30 seconds Test for Males

Level	Benchmark Score	Numbers
1	1	<25
2	2	25-30
3	3	31-34
4	3.5	35-38
5	4	39-43
6	4.5	44-49
7	5	>50

Scoring for Partial Curl Up - 30 seconds Test for Females

level	Benchmark Score	Numbers
1	1	<18
2	2	18-24
3	3	25-28
4	3.5	29-32
5	4	33-36
6	4.5	37-43
7	5	>43

Activity - 3

Scoring for Push Ups for Male

level	Benchmark Score	Numbers
1	1	<4
2	2	4-10
3	3	11-18
4	3.5	19-24
5	4	25-30
6	4.5	31-36
7	5	>37

Scoring for Modified Push Ups for Female

level	Benchmark Score	Numbers
1	1	0-1
2	2	2-5
3	3	6-10
4	3.5	11-15
5	4	14-19
6	4.5	20-23
7	5	>24

Activity – 4

Scoring for 2Km Run/walk for Male

Level	Benchmark Score	Minutes: Seconds
1	1	>11:30-12:00
2	2	10:31-11:29
3	3	9:31-10:30
4	3.5	8:31-9:30
5	4	7:31-8;30
6	4.5	7:00-7:30
7	5	>6:59

Scoring for 2Km Run/walk for Female

Level	Benchmark Score	Minutes: Seconds
1	1	13:31-14:00
2	2	12:31-13:30
3	3	11;31-12:30
4	3.5	10:3-11:30
5	4	9:31=10:30
6	4.5	8:31-9:30
7	5	<8:30

ASSESSMENT PATTERN		
Assessment		**Marks**
Continuous Internal Assessment		50
1	Internal Examination	-
2	Learning Activity	20
3	Activity Evaluation	20
4	Regularity	10
End Semester Examination - Theory		
Total		**50**

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

COURSE CODE	COURSE NAME	COURSE CATEGORY
B251904/CN930U	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP**	**ESL**
PRE-REQUISITE		
NIL		

PREAMBLE

The course is a foundational, one-credit practical course designed for first-year engineering students, requiring no prior prerequisites. This workshop bridges the gap between theoretical knowledge and real-world application by providing immersive, hands-on exposure to fundamental tools, instruments, and practices in both electrical and electronics engineering. The syllabus is carefully structured to build practical competency, guiding students from basic domestic wiring and safety protocols through to PCB fabrication, soldering, and electronic circuit simulation.

RATIONALE

- **Safety and Electrical Wiring Proficiency:** To instil crucial safety protocols—particularly precautionary measures against electric shocks—and develop practical skills in domestic electrical wiring, including the setup of PVC conduits, staircase wiring, and power distribution systems using protective devices like MCBs and ELCBs.
- **Component and Instrument Familiarization:** To familiarize students with standard electrical accessories, batteries, and electronic components, while teaching them to interpret datasheets and utilize essential testing instruments such as Multimeters, Cathode Ray Oscilloscopes (CROs), and Function Generators.
- **Hands-on Circuit Assembly and Fabrication:** To cultivate physical engineering skills through practical exercises in Printed Circuit Board (PCB) fabrication, soldering, and component interconnection, enabling students to successfully assemble and test functional circuits, such as a fixed voltage power supply.
- **Modern Simulation Practices:** To introduce contemporary engineering workflows by teaching students how to construct, analyze, and verify basic electronic circuits virtually using Electronic Design Automation (EDA) software like Multisim.

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

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

TEACHING AND ASSESSMENT SCHEME												
Teaching Scheme / Week					Hours / Semester	Credit	Examination Scheme					
							Theory			Practical		Total
L	T	J	P	S	36	C	CIA	ESE	Total	CIA	ESE	Total	
0	0	0	2	1		1	-	-	-	100	0	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)			
Sl.No.	Title	Major Topics	Hrs
1	Basic wiring and safety measures	Demonstration of precautionary measures against electric shock	6
2	Identification and use of electric accessories	Demonstrate the use of components and instruments to construct and test simple circuits	6
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)	6
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)	6

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

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/ Virtual Lab	
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

LAB COMPONENT DESIGN

Objective	CO	Learning Domain		
		C	P	A
Demonstrate essential safety and first-aid procedures for electric shocks, and identify the specifications of various cables, protection devices, switches, and batteries	CO1 CO2	U	I	Rs
Perform domestic wiring exercises, including PVC conduit wiring, staircase wiring with two-way switches, and fluorescent lamp control.	CO3	A	M	V
Assemble and wire a single-phase power distribution system equipped with protective devices and an energy meter.	CO3	A	M	V
Measure potential across resistance elements using a rheostat, and utilize a CRO to measure and plot voltage waveforms from low-voltage step-up/step-down transformers.	CO2	U	I	Rs
Identify various active, passive, and electromechanical components, interpret their datasheets, and draw standard circuit diagrams using BIS/IEEE symbols.	CO4	A	P	V
Operate basic electronic testing instruments (Multimeter, CRO, Function Generator) and tools to test the functionality and characteristics of discrete electronic components.	CO5	A	P	V
Design and fabricate a single-sided Printed Circuit Board (PCB), and practice various interconnection and safe soldering methods.	CO6	A	Ar	V
Assemble and physically test a functional electronic circuit (e.g., fixed voltage power supply), and simulate basic electronic circuits using EDA software like Multisim.	CO6	A	Ar	V

ASSESSMENT PATTERN

Assessment	Marks
Continuous Internal Assessment	**100**
1. Continuous Lab Evaluation	60
2. Internal Examination	30
3. Regularity	10
4. Course Project	-
End Semester Examination - Lab	**-**
Total	**100**