MITS Kochi
Muthoot Institute of Technology and Science (Autonomous)

B. Tech

in

Electronics Engineering
(VLSI Design & Technology)

2025 REGULATION

CURRICULUM & SYLLABUS

B Tech in Electronics Engineering (VLSI Design & Technology)

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	B250009/EV110B	Fundamentals of Semiconductors	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	B251904/CN110E	Programming in Python	2	1	0	2	3	4	
	K	HMT	B251909/CN900K	Life Skills and Professional Communication	1	1	0	0	0	1	
	U	ESL	B251904/CN930U	Basic Electrical and Electronics Engineering Workshop	0	0	0	2	0	1	
	G	SEC		Skill Enhancement Course							
II	A	BST	B250802/MA200A	Mathematics for Electrical Science-2	3	1	0	0	2	3	24
	B	BSE	B250009/EV200B	AI Foundations for Electronics Engineers	3	0	0	2	3	4	
	C	EST	B250009/EV210C	Electronic Devices & Circuits	2	0	0	2	2	3	
	D	EST	B250009/EV210D	Foundations of C Programming	4	0	0	0	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/CN910K	Health and Wellness	1	0	0	0	0	1	
	U	PCL	B250902/CN230U	Essentials of Embedded and Computing Lab	0	0	0	2	0	1	
	G	SEC		Skill Enhancement Course						1	
III	A	BST		Mathematics for VLSI	3	1	0	0	2	3	25
	B	PCE	B250009/EV310B	Signal Analysis and Processing	3	1	0	3	5	6	
	C	PCE	B250004/EC310C	Logic Circuit Design	3	1	0	3	5	6	
	D	PCB	B250009/EV320D	Solid State Devices	2	1	1	0	4	4	
	E	EST	B250009/EV300E	VLSI fabrication	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	B250009/EV400A	Electromagnetic Foundations for VLSI Design	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	B250009/EV420D	Analog & Digital Communication	2	1	1	0	4	4	
	E	PET	B250009/EV41*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	B250009/EV500A	Digital System Design	3	1	0	0	4	4	23
	B	PCE	B250009/EV510B	FPGA based system Design	3	1	0	3	5	6	
	C	PCE	B250009/EV510C	Digital CMOS Design	3	1	0	3	5	5	
	D	PCB	B250009/EV520D	Embedded Systems Design	2	1	1	0	4	4	
	E	PET	B250009/EV51*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 / Honours	4	0	0	0	4	4	
VI	A	PCT	B250009/EV600A	SOC System Implementation	3	1	0	0	4	4	23
	B	PCE	B250009/EV610B	VLSI Verification and Testing	3	1	0	3	3	5	
	C	PET	B250009/EV61*C	Program/ Industry Linked Elective - Theory	3	1	0	0	2	3	
	D	PCB	B250009/EV620D	Analog VLSI Design	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	B250009/EV71*A	Program/ Industry Linked Elective - Theory	3	1	0	0	2	3	17
	B	PET	B250009/EV71*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	B250009/EV81*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 Behaviour 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

CONTENTS

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	B250009/EV110B	Fundamentals of Semiconductors	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	B251904/CN110E	Programming in Python	2	1	0	2	3	4
K	HMT	B251909/CN900K	Life Skills and Professional Communication	1	1	0	0	0	1
U	ESL	B251904/CN930U	Basic Electrical and Electronics Engineering Workshop	0	0	0	2	0	1
G	SEC	Skill Enhancement Course: NASSCOM or equivalent							1
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work, C- Credit)									

COURSE DESCRIPTION							
Regulation	**2025**	**L-T-J-P-S**	**3-1-0-0-2**	**Version**	**25/1**	**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)

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

COURSE CODE	COURSE NAME	COURSE CATEGORY
B250009/EV110B	**Fundamentals of Semiconductors**	**BSE**
PRE-REQUISITE		
Nil		

PREAMBLE
This course introduces the fundamentals of quantum theory, semiconductor physics, and energy band concepts required to understand electronic materials and devices. It covers optoelectronic devices, optical fiber communication, and laser principles with their applications. The course also provides exposure to modern semiconductor technologies such as MOSFET, FinFET, and MEMS for current electronic systems.

RATIONALE
Understanding semiconductor device physics is essential for VLSI, embedded systems, fabrication technology, and nanoelectronics. The course bridges theory and application through modelling, simulation, and parameter analysis.

COMPETENCY STATEMENT/s
CS03 Apply the principle of solid-state physics in electronic system design.
CS11 Knowledge of Very Large-Scale Integration (VLSI) design principles for creating efficient complex electronic circuits.

CO	CO Statement	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	**Apply** semiconductor fundamentals and carrier concentration concepts using basic simulation tools.	A	M	Rs
CO2	**Describe** semiconductor and advanced electronic materials used in modern devices.	A	M	Rs
CO3	**Describe** semiconductor devices, scaling technologies, and MEMS applications.	A	M	Rs
CO4	**Describe** principles of optical fibres, optoelectronic devices, and lasers used in semiconductor applications.	A	M	V

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

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	Semiconductor Fundamentals	Quantum theory and atomic structure: Bohr atomic model, Quantized energy levels, Wave–particle duality, De Broglie hypothesis, Heisenberg uncertainty principle, Concept of energy quantization; Energy band theory: Conductors, Semiconductors, and insulators, Intrinsic and extrinsic semiconductors: n-type and p-type semiconductor materials, Carrier concentration, Concepts of Fermi level, Crystal structure of silicon.	12
2	Semiconductor Materials	Introduction to semiconductor materials : Elemental and compound semiconductors, Silicon, Polysilicon, SiO_2 - Properties and applications; Wide bandgap semiconductor materials : SiC, GaN; Compound semiconductor materials : GaAs, InP, AlGaAs ; Advanced Electronic Materials : graphene, CNTs, flexible polymers.	11
3	Semiconductor Device Technology	Semiconductor Technology Evolution : Moore's law, Technology scaling concepts, Evolution of electronic chips from micro-scale to nano-scale technologies. Modern Semiconductor Devices: MOSFET, Introduction to FinFET technology. MEMS Technology : Concepts of MEMS.	11
4	Semiconductor Optical Devices	Optical properties of semiconductor materials: propagation of light through optical fibers, types of optical fibers, numerical aperture, Light-sensitive devices: LDR, photodiode, phototransistor, and LED. Lasers : Principles of lasers, Ruby lasers.	12

Sl. No	**Self-learning / Team Work Description**
1.	➢ MATLAB simulation of carrier concentration in intrinsic and extrinsic semiconductors ➢ Learning activity on semiconductor materials and crystal structures
2.	➢ Case study on Si, SiC, and GaN applications in electronics ➢ Study on graphene, CNTs, or flexible polymers ➢ Comparative study of wide bandgap and conventional semiconductor materials ➢ Semiconductor materials used in mobile devices, sensors, AI hardware, and modern electronic systems
3.	➢ Significance of sensors and their applications in day-to-day life ➢ MOSFET characteristic simulation using MATLAB or online simulators ➢ Learning activity on technology scaling and Moore's law trends
4.	➢ Demonstration of optical fiber light propagation and numerical aperture ➢ Identification and testing of LDR, LED, and photodiode characteristics ➢ Seminar/video presentation on laser applications and fiber optic communication systems

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	**Title of Book**	**Author**	**Publication**
1.	Semiconductor Physics and Devices	Donald A. Neamen	4/e, McGraw-Hill, 2021
2.	Physics of Semiconductor Devices	S.M. Sze, Kwok K. Ng	4/e, Wiley, 2021
3.	Optoelectronics and Photonics	S. O. Kasap	3/e, Pearson Education, 2022.
4.	A Textbook of Engineering Physics	M N Avadhanulu, P G Kshirsagar, TVS Arun Murthy	11/e, S. Chand, 2018

References			
Sl. No.	**Title of Book**	**Author**	**Publication**
1.	Concepts of Modern Physics	Arthur Beiser	Tata McGraw-Hill Publications 6th Edition, 2003
2.	Introduction to Solid State Physics	Charles Kittel	Wiley India Edition 2019
3.	Semiconductor Devices Fundamentals	Robert F Pierret	Pearson Education 1995
4.	Fundamentals of Semiconductor Devices	M.K. Achuthan & K.N. Bhatt	2/e, McGraw-Hill, 2017
5.	Introduction to Semiconductor Materials and Devices	M.S. Tyagi	John Wiley & Sons, 2004
6.	Fundamentals of Semiconductor Devices	B.L. Anderson & R.L. Anderson	2/e, McGraw-Hill, 2017

Web Resources	
1.	nptel.ac.in/courses/115102124
2.	https://www.youtube.com/watch?v=Kp-jS6NHsB8&list=PLF178600D851B098F
3.	nptel.ac.in/courses/108106181

DETAILED SYLLABUS								
Module	**Title**	**Topic**	**Mode of Delivery**	**CO**	**Learning Domain**			**Hrs**
					C	**P**	**A**	
1	**Quantum Theory and Atomic Structure**	Introduction to atomic structure Niels Bohr atomic model	L	1	U	M	Rs	1
		Quantized energy levels, Electron transitions and photon emission/absorption, Wave–particle duality	L		U	M	Rs	1
		Basic quantum concepts: de Broglie wavelength, Heisenberg uncertainty principle (introductory level),Concept of energy quantization	L		U	M	Rs	2
	Energy Band Theory and Semiconductor Basics	Formation of energy bands in solids, Valence band and conduction band, Forbidden energy gap,Energy band diagrams	L		U	M	V	3
		Classification of materials: • Conductors • Semiconductors • Insulators Concept of electrical conductivity based on band structure	L		U	M	V	2
	Semiconductor Materials and Carrier Fundamentals	Intrinsic semiconductors	L		U	M	V	1
		Extrinsic semiconductors n-type semiconductors p-type semiconductors	L		U	M	V	2
		Majority and minority carriers	L		U	M	V	1
		Doping process and impurity atoms	L		U	M	V	1
		Carrier concentration basics	L		U	M	V	2
		Introduction to Fermi level in intrinsic and extrinsic semiconductors	L		U	M	V	2

	Crystal Structure and Semiconductor Materials	Crystal structure of Silicon Covalent bonding in semiconductors	L		U	M	V	5
		Lattice structure and unit cell basics						
	Hands on Activities	**Simulation :**MATLAB simulation of carrier concentration in intrinsic and extrinsic semiconductors	P		U	M	V	4
2	**Elemental and compound semiconductors**	Introduction to elemental and compound semiconductors: Gallium Arsenide (GaAs), Indium Phosphide (InP), Silicon Carbide (SiC)	L	2	U	M	Rs	2
		Comparison of elemental and compound semiconductors, Applications.	L					
		Properties of silicon	L,S					
		Applications of silicon in electronic devices	L		U	M	Rs	2
		Introduction to polysilicon, Applications of polysilicon in semiconductor technology	L					2
		Properties of SiO_2, Applications of SiO_2 in semiconductor fabrication and insulation	L					2
	Wide Bandgap Semiconductor Materials	Basic properties of SiC, Applications of SiC in power electronics	L		U	M	V	2
		Basic properties of GaN, Applications of GaN in high-frequency and high-power devices	L,S					
	Compound Semiconductor Materials	Compound semiconductor materials: GaAs, InP, AlGaAs.	L,S		U	M	V	2
	Advanced Electronic Materials	Graphene : Basic structure and properties, Applications in electronics	L,S		U	M	Rs	1
		Carbon Nanotubes (CNTs) : Introduction and properties, Applications in nanoelectronics	L		U	M	Rs	2
		Flexible Polymer Materials : Introduction to flexible polymers , Applications in flexible electronics and sensors	L		U	M	Rs	2
	Activity	➢ Case study on Si, SiC, and GaN applications in electronics ➢ Study on graphene, CNTs, or flexible polymers ➢ Comparative study of wide bandgap and conventional semiconductor materials	S		U	M	V	4
	Evolution of	Moore's Law	L	3	U	M	Rs	1

3	**Semiconductor Technology**	Technology scaling concepts, Constant field and constant voltage scaling.	L,S		U	M	V	1
		Evolution from micro-scale to nano-scale technologies, Challenges in nano-scale device fabrication	L,S		U	M	Rs	2
	Modern Semiconductor Devices	MOSFET: structure, working, and types.	L		U	M	V	2
		Short channel effects in MOSFET	L		U	M	V	1
		Introduction to FinFET technology, FinFET structure and operation, Advantages of FinFET over MOSFET	L		U	M	Rs	3
	MEMS Technology	Introduction to MEMS (Micro-Electro-Mechanical Systems)	L,S		U	M	Rs	1
		Basic concept of micro-sensors and micro-actuators	L,S		U	M	Rs	2
		MEMS components (cantilevers, beams, microstructures)	L		U	M	Rs	2
		Applications of MEMS in sensors and consumer electronics.	L,S		U	M	Rs	1
	Simulation	➢ MOSFET characteristic simulation using MATLAB or online simulators	P		U	M	V	4
	Activity	Applications of MEMS	S		U	M	V	4
4	**Optical Properties of Semiconductor Materials**	Introduction to optical properties of semiconductors	L	4	U	M	Rs	1
		Propagation of light through optical fibers	L		U	M	Rs	3
		Types of optical fibers, Numerical aperture and its significance						
	Optoelectronic Devices	LDR (Light Dependent Resistor), Photodiode, Phototransistor : Principle of photoconductivity, Construction and working, Applications	L		U	M	V	4
		LED and its applications	L		U	M	V	2
	Lasers	Principles of Laser	L		U	M	Rs	4
		Absorption, spontaneous emission, and stimulated emission						
		Population inversion concept						
		Optical resonator (mirrors) and amplification of light						
		Properties of laser						
		Ruby Laser :Construction ,Working ,Characteristics ,Applications						
	Simulation	Simulation of LDR, LED, and photodiode characteristics by varying light intensity/voltage and plotting their response curves using tools like Proteus or MATLAB.	P		U	M	V	4
	Activity	Test LDR, LED, and photodiode to demonstrate real-time light sensing, switching, and signal response based on varying light intensity.	S					4

Practical Syllabus							
Module	**Topic**	**Objective**	**Relevant COs**	**Learning Domain Level**			**Teaching Hours**
				C	P	A	
1	Simulation on carrier concentration in Semiconductor materials	To analyze the carrier concentration in semiconductors	CO1	A	M	Rs	3
2	Case study on different semiconductor materials	To study different semiconductor materials used for various applications	CO2	U	M	Rs	2
3	Simulation on MOSFET characteristics	To analyze the drain characteristics of MOSFET device	CO3	A	M	Rs	4
4	Case study on applications of MEMS.	To study MEMS devices and its real time applications in various fields	CO3	U	M	Rs	2
5	LED Characteristics	To determine the characteristics of an LED	CO4	A	M	Rs	2
6	Photo diode Characteristics	To determine the characteristics of a photo diode	CO4	A	M	Rs	2
7	Numerical Aperture	To determine numerical aperture of an optical fiber	CO4	A	M	Rs	2

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	Quantum Theory and Excess carriers in semiconductors		√	√				15
2	Semiconductor Materials		√	√				15
3	MOSFET scaling and short channel effects.		√	√				15
4	Optical properties of semiconductors and working principle of different optoelectrical devices		√	√				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 Examinations	20
2	Regularity	5
3	Continuous Lab Evaluation	15
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 2026 (2025 SCHEME)			
Course Code:	B250009/EV110B		
Course Name:	Fundamentals of Semiconductors		
Max. Marks	60	**Duration:**	2 hours 30 minutes
Use of Calculator permitted			

PART A

(Answer all questions. Each question carries 3 marks)

No.	***Question***	***CO***	***Marks***
1	A scientist working in a spectroscopy laboratory is studying the light emitted by hydrogen atoms. During an experiment, an electron in a hydrogen atom falls from the third energy level (n = 3) to the second energy level (n = 2), producing a visible spectral line. Using the Bohr model of the hydrogen atom: i) Calculate the energies of the third and second energy levels. ii) Determine the energy of the photon emitted during the transition.	CO1	3
2	Based on the observations about semiconductor materials and quantum concepts, state whether the following statements are True or False: i) Intrinsic semiconductors contain equal electron and hole concentrations. ii) The Fermi level of an intrinsic semiconductor lies close to the conduction band. iii) Silicon crystal structure is based on covalent bonding. iv) Doping increases the conductivity of a semiconductor. v) Conductors have a large forbidden energy gap. vi) De Broglie proposed wave-particle duality.	CO1	3
3	Match the items in Column A with the correct description in Column B. Each option can be used only once. **Column A** / **Column B** a Silicon — i Flexible Electronics b Silicon Carbide — ii High Power Devices c Graphene — iii CMOS Fabrication d GaN — iv High Electron Mobility e CNT — v Nanoelectronics f Polymers — vi Wearable Devices vii Due to strong electric field in lightly doped junction viii Concentration gradient	CO2	3
4	Wide-bandgap semiconductors such as silicon carbide (SiC) and gallium nitride (GaN) are increasingly preferred in high-power and high-frequency	CO2	3

	electronic applications. List any three advantages of wide-bandgap semiconductor materials over conventional silicon.		
5	Semiconductor technology has continuously reduced the minimum feature size of integrated circuits from 10 µm in 1970 to 5 nm today to improve performance and increase transistor density. Based on this technological evolution: i) Identify the trend demonstrated by this reduction in feature size. ii) Name the law that predicts and explains this trend in semiconductor technology. iii) Mention one major challenge faced when designing and manufacturing devices at the nanoscale.	CO3	3
6	For the next generation of high-performance and low-power processors, it is necessary to evaluate the transition from conventional MOSFET technology to FinFET technology. As a device engineer, compare MOSFET and FinFET technologies with respect to: i) Device structure ii) Channel control by the gate iii) Susceptibility to short-channel effect	CO3	3
7	An optical communication engineer is testing a newly manufactured optical fiber for use in a high-speed data transmission network. The core and cladding refractive indices of the fiber are measured as: • Core refractive index, n_1 = 1.48 • Cladding refractive index, n_2 = 1.46 To evaluate the light-gathering capability of the fiber, calculate its Numerical Aperture (NA).	CO4	3
8	During the testing of an optoelectronic communication system, an engineer encounters several devices and technologies used in optical applications. Complete the following statements: i) The principle responsible for coherent light generation in laser systems is _____. ii) The operation of an LDR is based on the phenomenon of _____. iii) The active medium used in a Ruby laser is _____. iv) An LED converts electrical energy into _____ energy. v) In an optical fiber communication system, light is guided through the fiber core by the principle of _____. vi) A photodiode converts incident light energy into _____ energy.	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)	In the design of nanoscale semiconductor devices, a better understanding of quantum physics concepts is required. Explain the following quantum concepts and discuss how each helps in understanding the behavior of electrons in modern semiconductor and optoelectronic devices: i) Bohr atomic model ii) Quantized energy levels iii) De Broglie hypothesis iv) Heisenberg uncertainty principle v) Energy quantization vi) Wave-particle duality.	CO1	6

	b)	Semiconductor devices exhibit different electrical characteristics depending on the position of the Fermi level. Describe the concept of the Fermi level in intrinsic and extrinsic semiconductors using suitable energy band diagrams.	CO1	3
OR				
10	a)	A materials engineer is selecting suitable materials for electrical wiring, semiconductor chips, and insulating layers in an electronic device. The selection is based on the energy band structure of the materials. With neat diagrams, explain: i) Formation of energy bands in solids ii) Conductors iii) Semiconductors iv) Insulators Compare the band structures of conductors, semiconductors, and insulators, and justify their suitability for the above applications.	CO1	6
	b)	To achieve the desired conductivity in electronic devices, pure semiconductors are often modified by adding controlled impurities. Describe the difference between intrinsic and extrinsic semiconductors. Also, discuss the role of donor and acceptor impurities in altering the electrical properties of semiconductors.	CO1	3
MODULE II				
11	a)	An electronics manufacturer is evaluating different semiconductor materials for applications ranging from consumer electronics to electric vehicles and high-frequency communication systems. Compare Silicon (Si), Silicon Carbide (SiC), and Gallium Nitride (GaN) in terms of their properties, advantages, and applications.	CO2	6
	b)	During the fabrication of integrated circuits, a thin layer of silicon dioxide is formed on silicon wafers. Explain the importance and functions of SiO_2 in semiconductor device fabrication.	CO2	3
OR				
12	a)	A consumer electronics company is developing a foldable smartphone with a flexible display, lightweight structure, and high-speed electronic circuits. The design team is evaluating advanced materials to improve flexibility, conductivity, and mechanical strength. Discuss the structure, properties, and applications of the following materials and justify their suitability for such next-generation devices: i) Graphene ii) Carbon Nanotubes (CNTs) iii) Flexible polymer materials	CO2	6
	b)	Semiconductor manufacturers select different materials for electronic and optoelectronic applications based on their composition and performance requirements; differentiate between elemental and compound semiconductors with suitable examples.	CO2	3
MODULE III				
13	a)	A semiconductor company plans to reduce the dimensions of a MOSFET by half in order to increase the number of transistors on a chip. The design engineers are evaluating both constant voltage scaling and constant field scaling approaches. i) Differentiate between constant voltage scaling and constant field scaling. ii) Which scaling approach is more effective in controlling electric field strength within the device? Justify your answer.	CO3	6

		iii) Discuss the effect of scaling on any two of the following parameters: power consumption, device speed, packing density, and reliability.		
	b)	As MOSFETs are scaled down to nanoscale dimensions for modern VLSI applications, device behavior deviates from ideal characteristics. Explain short-channel effects in MOSFETs and their impact on device performance in integrated circuits.	CO3	3
		OR		
14		A semiconductor R&D team is developing a next-generation smart electronic system that integrates high-speed digital processing with advanced sensing capabilities using n-channel MOSFETs in microprocessor circuits and MEMS-based sensors in consumer electronics.		
	a)	Help the team by describing the structure and working of an n-channel MOSFET with neat diagrams. Also discuss its regions of operation.	CO3	6
	b)	Assist in explaining MEMS technology and discuss any three applications of MEMS in consumer electronics.	CO3	3
		MODULE IV		
15	a)	A telecommunications company is developing a high-speed communication system that uses optical fiber links for long-distance data transmission and photodiodes for efficient signal detection at the receiver end to ensure fast, reliable, and noise-free communication. Help the design team in developing a high-speed optical communication system by explaining optical fiber communication. Discuss: i) Propagation of light through optical fibers ii) Types of optical fibers iii) Numerical Aperture iv) Applications of optical fibers in communication networks	CO4	6
	b)	Assist the team in designing the optical receiver section of the communication system by illustrating the working of a photodiode and briefly explaining its applications in optical communication systems.	CO4	3
		OR		
16	a)	A research laboratory is developing laser-based systems for high-precision industrial processing and medical applications, requiring a clear understanding of laser fundamentals and ruby laser operation. Explain the principle of laser operation. Discuss: i) Absorption ii) Spontaneous emission iii) Stimulated emission iv) Population inversion v) Optical resonator	CO4	6
	b)	Describe the construction, working, and applications of Ruby Laser.	CO4	3

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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**			**CIA**	**ESE**	**Total**	**CIA**	**ESE**	**Total**	
4	0	0	0	2	**90**	**C**	40	60	100				100
						3							
***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:	.....

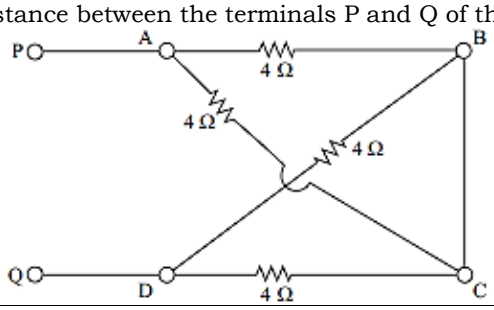
FIRST SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR (2025 SCHEME)			
Course Code:	**B251904/CN900D**		
Course Name:	**INTRODUCTION TO ELECTRICAL & ELECTRONICS ENGINEERING**		
Max. Marks	**60**	**Duration**:	**2 hours 30 minutes**
Specify if the question paper is common to different programmes			
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)

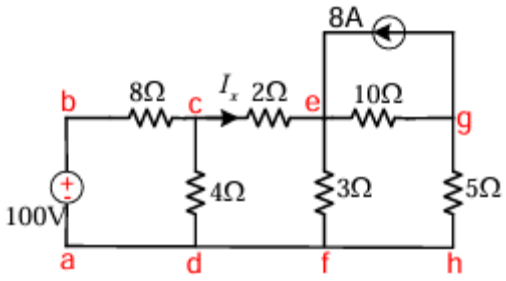
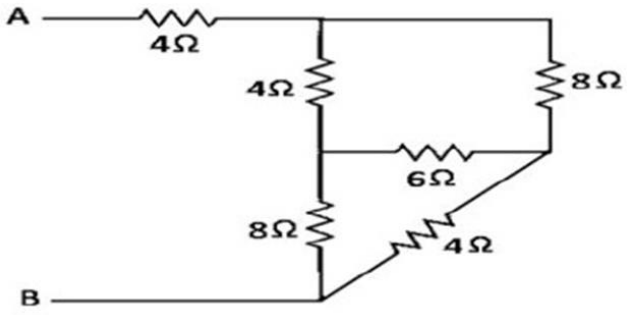
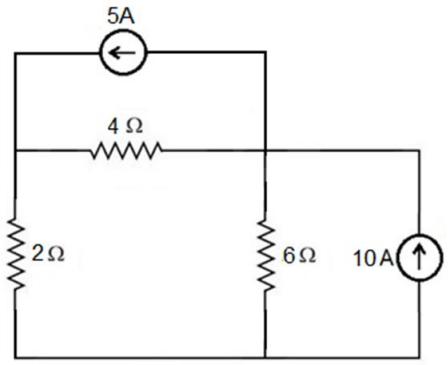
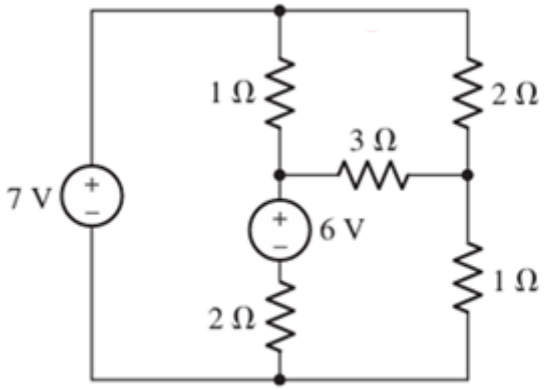
No.	***Question***	***CO***	***Marks***
1	Calculate the resistance between the terminals P and Q of the network shown. 	CO1	(3)
2	Differentiate between electric resistance and magnetic reluctance.	CO2	(3)
3	Electromotive force (emf) can be generated in two ways – statically induced and dynamically induced. 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. ii) Determine the power factor of the system. iii) Compute the total power consumed.	CO4	(5)
OR				
8	a	An R–L–C series circuit is used as part of an AC filtering system. By adjusting the inductance, the current peaks at 0.5 A while operating at 230 V, 50 Hz supply. At this point, a voltage of 350 V is recorded across the capacitor. i) Calculate the resistance of the circuit. ii) Determine the capacitance of the capacitor. iii) Find the inductance of the inductor when the circuit is in resonance.	CO4	(4)
	b	An industrial motor acting as a balanced three phase load consists of three coils each having resistance of 4Ω and inductance 0.02H. It is connected to a 415V, 50Hz, 3-phase ac supply. Determine the phase voltage, phase current, power factor and active power when the load is connected in star.	CO4	(5)

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**	**1**	**CREDITS**	**4**
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE CODE	COURSE NAME	COURSE CATEGORY
B251904/CN110E	PROGRAMMING IN 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,	L,T	1	U	M	Rs	3,2

		developing an algorithm, writing the program, testing & evaluating the solution						
		Essentials of Python programming – variables, numeric and string data types, math module, Python Standard Library, I/O (print, input), operators & precedence	L,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	L,T	3	A	M	Rs	1,2

		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).						
		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	L,T	4	A	M	Rs	1,1

		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?						
		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, input/output, and simple execution in Python	3	A	M	Rs
2	To understand and apply different primitive data types in Python	3	A	M	Rs
3	To practice arithmetic operators and precedence in Python	3	A	M	Rs
4	To familiarize string operations and indexing	3	A	M	Rs
5	To understand built-in libraries and formatting	3	U	M	Rs
6	To apply data structures and library usage	3	A	M	Rs
7	To apply selection control structure	3	A	M	Rs
8	To apply formulas and I/O	3	A	M	Rs
9	To practice nested iteration and control flow	3	A	P	Rs
10	To apply iteration and conditions with efficiency	3	A	P	Rs
11	To apply recursion for mathematical problems	3	A	P	Rs
12	To practice recursion basics	3	A	P	Rs
13	To strengthen recursive algorithm design	3	A	P	Rs
14	To apply recursion for number theory problems	3	A	P	Rs
15	To apply modularization and conditionals	3	A	Ar	V
16	To understand modular programming and reuse	3	A	Ar	V
17	To apply modularization by selective import of functions	3	A	Ar	V
18	To apply string validation logic	4	A	P	Rs

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:	B251904/CN110E		
Course Name:	PROGRAMMING IN PYTHON		
Max. Marks	**60**	**Duration:**	**2 hours 30 minutes**
CE, ME, EEE, VLSI			
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	With the help of a suitable example, explain the membership operator in Python.	1	3
2	List the operator precedence rules supported in Python.	1	3
3	Draw a flowchart to find and display the factorial of a given number.	2	3
4	Develop the algorithm, flowchart, and pseudocode to find the sum of 'n' numbers entered by the user.	2	3
5	Compare and contrast pre-test and post-test looping constructs in Python with examples.	3	3
6	Write a Python program to read two matrices and display its sum.	3	3
7	Compare and contrast the greedy approach and dynamic programming approach.	4	3
8	Write an algorithm to calculate the nth Fibonacci number using the dynamic programming approach.	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)	Develop a program that finds all prime numbers up to a given integer n. Elaborate the steps involved in computer-based problem-solving process to solve this problem.	1	6
	b)	Let A =127, B = 63 Predict the output of the expressions: A & B, A | B and A >> 3.	1	3
OR				
10	a)	A delivery driver in a new city does not know all the streets but chooses routes based on experience, such as avoiding busy roads and taking familiar turns. Which problem-solving strategy is the driver using? Discuss how this strategy helps in making quick decisions and where it might lead to errors.	1	6
	b)	You are given the area of a circle. Write a Python program using the math module to calculate the radius of the circle.	1	3
MODULE II				
11	a)	Develop the algorithm, flowchart, and pseudocode to find the reverse of a number and to check if it is palindrome or not.	2	6
	b)	Illustrate how a switch-case statement can be represented in pseudocode.	2	3
OR				
12	a)	You visit a shop to buy a new mobile. During the festive season, the shop offers a 10% discount on all mobiles. Additionally, customers can exchange their old mobiles for a flat price of ₹1000. Draw a flowchart to input the original price of the mobile and print its selling price. Note that all customers may not have an old mobile for exchange. Also prepare algorithm and pseudocode for the given problem.	2	6
	b)	Illustrate how a loop or repetition can be represented in a flowchart.	2	3
MODULE III				

13	a)	Create a telephone directory using a dictionary, where the name of the individual is the key and the telephone number is the value. Write a Python program that allows the user to perform the following operations: 1. Add a contact – add a new name and phone number. 2. Update a contact – modify the phone number of an existing contact. 3. Delete a contact – remove an existing contact. 4. Search for a contact – retrieve the phone number by name. 5. Display all contacts. 6. Exit the program. Use a menu-driven approach.	3	5
	b)	Write a program that accepts the lengths of three sides of a triangle as inputs. The program should output whether or not the triangle is a right-angled triangle (recall the Pythagorean theorem). Implement the solution using functions.	3	4
		OR		
14	a)	A person deposits a fixed amount every year into a retirement account that earns compound interest. Given the initial deposit, annual contribution, interest rate, and number of years, write a recursive program to calculate the total savings at retirement. Do not use loops or built-in financial functions.	3	5
	b)	Sarah is a data analyst working for a marketing agency. She is given a list of customer ages from a recent survey conducted by her company. The list contains a mix of integers representing ages and some strings due to data entry errors. Sarah needs to clean the data by removing erroneous entries (non-integer values) and then analyze the data to find: 1. The youngest and oldest customers. 2. The average age of the customers. 3. The most common age in the list.	3	4
		MODULE IV		
15	a)	With the help of a neat diagram, demonstrate the merge sort algorithm to sort the following set of numbers: [20, 30, 10, 7, 23, 17, 100, 2].	4	5
	b)	You are organizing a security system for your office where each employee has a 4-digit PIN code for access. Due to a system malfunction, you forgot the correct PIN but know that it is a 4-digit number (0000–9999). Write an algorithm to determine the correct PIN using a brute-force approach. Explain the logic behind trying all possible combinations.	4	4
		OR		
16	a)	A company selling coffee gives a sticker with every cup purchased. There are '*n*' different stickers in total. Collecting all '*n*' different stickers earns you a free cup of coffee. Using a randomized approach, design an algorithm to estimate how many cups of coffee you need to buy on average to collect all '*n*' stickers.	4	5
	b)	You want to watch as many movies as possible at a film festival. Each movie has a start and end time, and you can only watch one at a time. Given an array of movies with their start and end times, write an algorithm to find the maximum number of movies you can watch in full.	4	4

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COURSE DESCRIPTION							
REGULATION	**2025**	**L-T-J-P-S**	**1-1-0-0-0**	**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/CN900K	LIFE SKILLS AND PROFESSIONAL COMMUNICATION	HMT
PRE-REQUISITE		
NIL		

PREAMBLE
The course focuses on developing self-awareness, emotional intelligence, critical thinking, problem-solving, decision-making, and professional communication skills through structured activities such as self-reflection exercises, role-storming, group discussions, presentations, report writing, networking with professionals, and the use of digital platforms. The course emphasizes goal setting, workplace readiness, teamwork, English language proficiency, profile building, and effective use of technology through experiential learning, enabling students to apply these competencies in academic, personal, and professional contexts.

RATIONALE
Engineering graduates require more than technical knowledge to succeed in today's dynamic professional environment.The course prepares engineering students for real-world professional demands by emphasizing the practical application of personal, interpersonal, and communication skills in workplace contexts. Through role-based activities and direct interaction with professionals, learners gain exposure to real organisational expectations, workplace behaviour, and ethical decision-making. The course strengthens critical thinking, teamwork, and professional communication in English, enabling students to apply these competencies effectively in academic settings, internships, and early career roles while supporting continuous professional development.

COMPETENCY STATEMENT/s
Learners demonstrate essential life skills and professional communication skills, enabling them to adapt confidently to personal, academic, and professional challenges and contribute meaningfully to society.

CO	CO Statement	Cognitive (C)	Psychomotor (P)	Affective (A)
CO 1	Apply insights gained through self-reflection to set effective goals and plans.	A		V
CO 2	Analyse the role of emotional intelligence and empathy in responding to challenging situations.	An		V
CO 3	Apply techniques to enhance Critical Thinking, Problem-solving and Decision-making skills	A		V
CO 4	Apply strategies to improve comprehension and communication skills	A		Rs
CO 5	Present ideas using modern technological platforms	A		V
CO 6	Utilize digital networking platforms to build a professional network.	A		V

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

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

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Personal Growth & Self-management	1.Group formation and self-introduction 2. Preparation of Gantt chart 3. Online personality development test 4.Role-storming exercise	7
2	Workplace & Interpersonal Skills	1.Presentation on instances of empathy and emotional intelligence 2.Networking with professionals to develop workplace skills through LinkedIn 3. Minutes of the Meeting 4.Preparation of Action Plan & Resume Preparation	7
3	Problem-Solving & Creative thinking	1.Identifying real-life problem that requires a technical solution 2. Six thinking hat exercises 3. Report Writing 4.Video presentation on diversity aspects	8
4	English Language communication & Professional Development	1.Listening test. 2.Activities to improve English vocabulary of students 3. Group Discussion 4.Video content for podcasts on technological interventions/research work tried out in Kerala context	8

Sl. No	Self-learning / Team Work Description	Hrs
1	Complete a self-paced online tutorial on how to prepare Gantt Chart on Excel	1
2	Network with a professional through LinkedIn, conduct an informational interview on workplace skills and career development as suggested in Activity 4.2	1
3	Learn the basics of video editing using any freely available editing software and apply the acquired skills to edit the group video/podcast by incorporating appropriate visuals, captions, audio, and transitions.	1

SUGGESTED LEARNING RESOURCES

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

5	Effective Technical Communication	Ashraf Rizvi	McGraw Hill Education

Reference			
Sl. No.	Title of Book	Author	Publication
1	Life Skills for Engineers	Remesh S., Vishnu R.G	Ridhima Publication
2	Soft Skills & Employability Skills	Sabina Pillai andAgna Fernandez	Cambridge University Press
3	Guide to writing as an Engineer	David F. Beer and David McMurrey	John Willey. New York
4	LinkedIn Profile Optimization	Donna Serdula	

Web Resource	
1	www.16personalities.com.
2	TED Talks on Life Skills
3	www.linkedin.com/learning

DETAILED SYLLABUS									
Sl.No	**Activity**	**Mode of Delivery**	**Group/ Individual (G/I)**	**Mark**	**COs**	**Learning Domain**			**Hrs**
						C	**P**	**A**	
1.1	Group formation and self introduction among the group members	L	G			R		Re	3
1.2	Familiarizing the activities and preparation of the time plan for the activities	L	G			R		Re	
1.3	Preparation of Gantt chart based on the time plan	L, T	G	5	CO1	A		Rs	
2.1	Take an online personality development test and prepare a self reflection report	L, T	I	5	CO1	U		V	4
2.2	Role-storming exercise: Students assume the role of a recruiter from a reputed organization looking to hire fresh B.Tech graduates. Write from the employer's POV about ●Skills required as a B.Tech graduate ●Attitudes, habits, approaches required and activities to be practiced during their B.Tech years, in order to achieve the set goals	L, T	I	4	CO1	U		Rs	

2.3	Discuss the skills and other essential qualities of a B.Tech graduate identified through role storming exercise by each student within their own group and Exhibit/present the inputs in the class in the form of a mind map .	L,T	G	5	CO1	U		Rs	
3	Choose a character from a book, movie, media report, or real-life situation who faced a challenging situation or emotional crisis. Prepare a short presentation explaining how the character managed the situation, the role of empathy and emotional intelligence in their response, and the lessons that can be learned from their experience.	L,T	I	5	CO2	An		V	3
4.1	Create a LinkedIn Profile	L, T	I	2	CO6	A		Rs	4
4.2	Each student connects and networks with 1 professional from industry/ public sector organizations/ other agencies/NGOs /academia (through LinkedIn). Interact with them to understand their workplace details including ●workplace skills required ●their work experience ●activities they have done to enhance their employability during their B.Tech years ●suggestions on the different activities to be done during B.Tech years Prepare a documentation of this	L,T	I	5	CO2 CO6	A		V	
4.3	Discuss the different workplace details & work readiness activities assimilated by each through the interactions within their group and compile the inputs collected by the individuals Prepare the Minutes of the discussions	L, T	G	3	CO2	A		Rs	
4.4	Students prepare an action plan for their undergraduate journey (semester wise)	L, T	I	3	CO1	U		Rs	

4.5	Resume preparation	L, T	I	5	CO6	A		Rs	
5.1	Select a real-life problem that requires a technical solution. Prepare a brief abstract describing the problem and its impact. Also list out the study materials needed to reach the solution.	L, T	G	5	CO3	A		Rs	4
5.2	Arrive at a possible solution using six thinking hat exercise	L, T	G	5	CO3	An		V	
5.3	Prepare a report based on the problem- solving experience	L,T	G	2	CO4	A		Rs	
6	Prepare a short video presentation on diversity aspects observed in our society (3 to 5 minutes)	L, T	G	10	CO2 CO5	A		V	4
7.1	Take an online listening test	L, T	I	3	CO4	U		Rs	4
7.2	Activities to improve English vocabulary of students (Vocabulary Test)	L, T	I/G	3	CO4	U		Re	
7.3	Group Discussion	L, T	I	5	CO3 CO4	A		Rs	
8	Presentation by groups on the experience of using online collaboration tools in various group activities and time management and the improvement in English language communication through this course	L, T	G	10	CO4 CO5	A		V	3
9	Each group prepares video content for podcasts on innovative technological interventions/research work tried out in Kerala context by academicians/professionals/Govt. agencies/research institutions/private agencies/NGOs/other agencies ●Upload the video content to podcasting platforms or YouTube	L, T	G	10	CO2 CO4 CO5	A		V	1
10	Portfolio Submission		I	5	CO6	A		V	

DETAILS OF LEARNING ACTIVITIES

Activity 1.1 : NA
Activity 1.2 : NA

Activity : 1.3 , 2.1 , 2.2, 2.3, 4.1, 4.2, 4.3, 4.4, 4.5, 5.1, 5.2, 5.3, 7.1,7.2 , 10

Performance Level	**Description**	**Marks Awarded**
Submitted	Activity completed and Submitted within the stipulated time as per the given instructions	Full Marks
Not Submitted	Activity not submitted/Completed	0 Marks

Activity 3: 5 Marks

Assessment Criteria	**Excellent (5-4 marks)**	**Good (3-2 marks)**	**Needs Improvement (1 mark)**
Content	Clearly explains the situation, empathy, emotional intelligence, and key lessons	Explains the situation and key ideas with minor gaps	Explanation is unclear or incomplete with limited analysis
Delivery	Confident, clear, engaging, with effective eye contact and time management	Clear presentation with minor issues in confidence or delivery	Unclear, lacks confidence, poor engagement, or ineffective time management

Activity 6 & Activity 9: 10 Marks

Assessment Criteria	**Excellent (10-8 marks)**	**Good (7-5 marks)**	**Needs Improvement (4-1 marks)**
Content	Accurate, relevant, and well-organized with clear key points.	Relevant and well-organized.	Incomplete or unclear.
Delivery	Clear, confident, and engaging.	Clear and confident.	Unclear or difficult to follow.
Technical & Visual quality	High-quality audio, smooth editing, and effective visuals (for video).	Good audio and editing with appropriate visuals.	Poor audio, editing, or visual quality.

Activity 7.3 : 5 Marks

Assessment Criteria	Excellent (5-4 marks)	Good (3-2 marks)	Needs Improvement (1 mark)
Content	Relevant, logical, and well-supported ideas.	Relevant and logical ideas.	Unclear or irrelevant ideas.
Delivery	Clear, confident, and effective communication.	Clear communication with adequate confidence.	Unclear or hesitant communication.
Teamwork	Actively participates, listens, and collaborates effectively.	Participates and collaborates with the group	Limited participation or collaboration.

Activity 8 : 10 Marks

Assessment Criteria	Excellent (10-8 marks)	Good (7-5 marks)	Needs Improvement (4-1 marks)
Content	Clear, relevant, and well-organized with appropriate examples.	Relevant and well-organized	Incomplete or unclear.
Delivery	Clear, confident, and engaging presentation.	Clear and confident presentation.	Unclear or poorly organized presentation.
Teamwork & Participation	All members participate actively and collaborate effectively.	Most members participate and collaborate.	Limited participation or poor collaboration.

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

COURSE DESCRIPTION							
Regulation	**2025**	**L-T-J-P-S**	**0-0-0-2-0**	**Version**	**25/1**	**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**