



B. TECH

COMPUTER SCIENCE & ENGINEERING
CURRICULUM & SYLLABUS

SEMESTER 1&2

2025 REGULATION

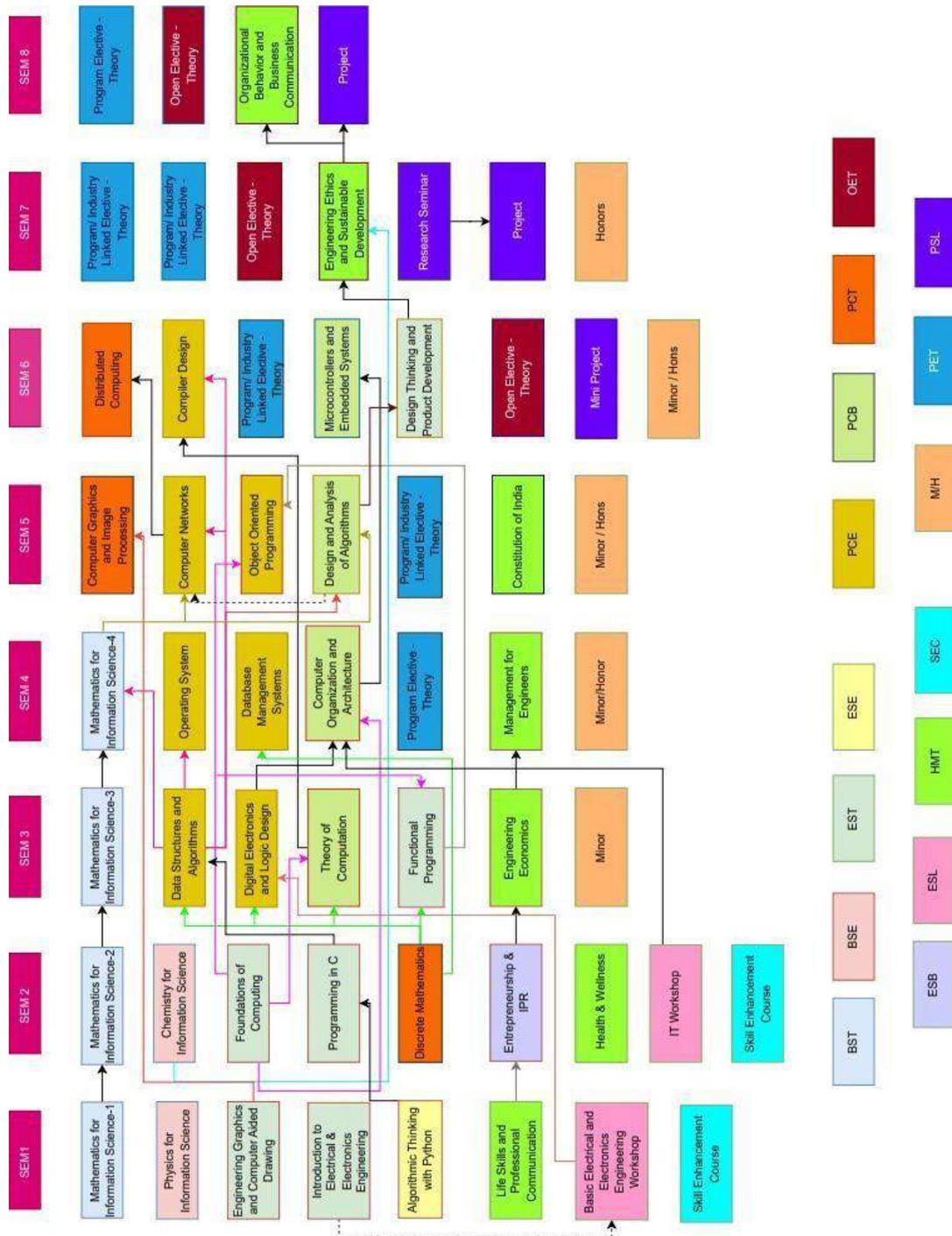
**B.Tech COMPUTER
SCIENCE & ENGINEERING
2025 REGULATION
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SYLLABUS**

B.TECH. IN COMPUTER SCIENCE AND ENGINEERING CURRICULUM STRUCTURE

SEM	SLOT	COURSE CATEGORY	COURSE CODE	COURSE NAME	L	T	J	P	S	C	CREDIT / SEM
I	A	BST	B250904/MA100A	Mathematics for Information Science-1	3	1	0	0	2	3	20
	B	BSE	B250904/PH910B	Physics for Information Science	3	0	0	2	3	4	
	C	EST	B250906/CN100C	Engineering Graphics and Computer Aided Drawing	2	0	0	2	3	3	
	D	EST	B250906/CN100D	Introduction to Electrical and Electronics Engineering	4	0	0	0	4	4	
	E	ESE	B250905/CN110E	Algorithmic Thinking with Python	2	0	0	2	3	4	
	K	HMT	B250908/CN900K	Life Skills and Professional Communication	1	1	0	0	0	1	
	U	ESL	B250906/CN930U	Basic Electrical and Electronics Engineering Workshop	0	0	0	2	0	1	
		SEC		Skill Enhancement Course							
II	A	BST	B250904/MA200A	Mathematics for Information Science-2	3	1	0	0	2	3	24
	B	BSE	B250904/CH910B	Chemistry for Information Science	3	0	0	2	3	4	
	C	EST	B250005/CS200C	Foundations of Computing	3	1	0	0	2	3	
	D	EST	B250903/CN210D	Programming in C	2	0	0	2	4	4	
	E	PCT	B250904/CN200E	Discrete Mathematics	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	1	0	1	
	U	ESL	B250904/CN230U	IT Workshop	0	0	0	2	0	1	
		SEC		Skill Enhancement Course						1	
III	A	BST	B250904/MA300A	Mathematics for Information Science - 3	3	1	0	0	2	3	25
	B	PCE	B250902/CN310B	Data Structures and Algorithms	3	1	0	3	5	6	
	C	PCE	B250005/CS310C	Digital Electronics and Logic Design	3	1	0	3	5	6	
	D	PCB	B250005/CS320D	Theory of Computation	2	1	1	0	4	4	
	E	EST	B250005/CS300E	Functional Programming	3	0	0	0	5	4	
	F	HMT	B250908/HU900F	Engineering Economics	3	0	0	0	1	2	
			B250908/CN900F	Management for Engineers							
	M		Minor	3	1	0	0	4	4		
IV	A	BST	B250904/MA400A	Mathematics for Information Science - 4	3	1	0	0	2	3	24
	B	PCE	B250904/CN410B	Operating Systems	3	1	0	3	5	6	
	C	PCE	B250902/CN410C	Database Management Systems	3	1	0	3	5	6	
	D	PCB	B250005/CS420D	Computer Organization and Architecture	2	1	1	0	4	4	
	E	PET	B250***/**41*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 / Hons	3	1	0	0	4	4		
V	A	PCT	B250005/CS500A	Computer Graphics and Image Processing	3	1	0	0	4	4	23
	B	PCE	B250005/CS510B	Computer Networks	3	1	0	3	5	6	
	C	PCE	B250005/CS510C	Object Oriented Programming	3	1	0	3	5	5	

	D	PCB	B250005/CS520D	Design and Analysis of Algorithms	2	1	1	0	4	4	
	E	PET	B250***/**51*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		Minor / Hons	4	0	0	0	4	4	
VI	A	PCT	B250005/CS600A	Distributed Computing	3	1	0	0	4	4	23
	B	PCE	B250902/CN610B	Compiler Design	3	1	0	3	3	5	
	C	PET	B250***/**61*C	Program/ Industry Linked Elective - Theory	3	1	0	0	2	3	
	D	PCB	B250005/CS620D	Microcontrollers and Embedded Systems	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	
	U	PSL	B250902/CN630U	Mini Project	0	0	0	3	1	2	
		M/H		Minor / Hons					6	3	
VII	A	PET	B250***/**71*A	Program/ Industry Linked Elective - Theory	3	1	0	0	2	3	17
	B	PET	B250***/**72*B	Program/ Industry Linked Elective - Theory	3	1	0	0	2	3	
	C	HMT	B250908/CN700C	Engineering Ethics and Sustainable Development	3	0	0	0	1	2	
	J	OET	B250908/CN7**J	Open Elective - Theory	3	0	0	0	3	3	
	T	PSL	B250908/CN700T	Research Seminar	2	0	0	0	2	2	
	U	PSL	B250908/CN740U	Project	0	0	6	0	2	4	
		H									
VIII	A	PET	B250***/**81*A	Program Elective - Theory	3	1	0	0	2	3	11
	J	OET	B250908/CN8**J	Open Elective - Theory	3	0	0	0	3	3	
	K	HMT	B250908/CN800K	Organizational Behavior and Business Communication	2	0	0	0	0	1	
	U	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	

Course Flow diagram – Core courses



B.TECH. IN COMPUTER SCIENCE AND ENGINEERING

PROGRAM ELECTIVE BASKET

Sem	Basket 1	
	Course Code	Course Name
4	B250602/CN411E	Signals and Systems
5	B250005/CS511E	Digital Signal Processing
6	B250005/CS611C	High Performance Computing
7	B250005/CS711A	Real-Time Systems
7	B250005/CS721B	Quantum Computing
8	B250602/CN811A	IoT and Embedded Systems

Sem	Basket 2	
	Course Code	Course Name
4	B250005/CS412E	Pattern Recognition Techniques
5	B250502/CN512E	Data Mining and Warehousing
6	B250903/CN612C	Data Analytics and Visualization
7	B250005/CS712A	Algorithms for Data Science
7	B250005/CS722B	Foundations of Game Theory and Mechanism Design
8	B250902/CN812A	Natural Language Processing

Sem	Basket 3	
	Course Code	Course Name
4	B250603/CN413E	Software Engineering
5	B250603/CN513E	Software Project Management
6	B250603/CN613C	Software Testing
7	B250005/CS713A	Formal Methods in Software Engineering
7	B250603/CN723B	Web Programming
8	B250005/CS813A	Software Architecture

Sem	Basket 4	
	Course Code	Course Name
4	B250005/CS414E	Soft Computing
5	B250005/CS514E	Artificial Intelligence
6	B250005/CS614C	Machine Learning
7	B250005/CS714A	Deep Learning
7	B250005/CS724B	Computer Vision
8	B250005/CS814A	Prompt Engineering

Sem	Basket 5	
	Course Code	Course Name
4	B250005/CS415E	Foundations of Cryptography
5	B250005/CS515E	Fundamentals of Cyber Security
6	B250005/CS615C	Information Security
7	B250005/CS715A	Blockchain and Cryptocurrency
7	B250005/CS725B	Cloud Computing
8	B250005/CS815A	Topics in Security

Semester 1

APPROVAL

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

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

BOARD OF STUDIES (BOS)

Approved in the Board of Studies Meeting of the Computer Science and Engineering held on ____/ ____/ 20 .

Chairperson, BoS

Name: _____ Designation: _____

Signature: _____ Date: _____

ACADEMIC COUNCIL

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

PRINCIPAL

Recommended for implementation from the Academic year 2025-2026.

Name: Dr.Neelankantan P C

Signature: _____ Date: _____

SEMESTER 1 CURRICULUM

SLOT	COURSE CATEGORY	COURSE CODE	COURSE NAME	L	T	J	P	S	C
A	BS	B250904/MA100A	Mathematics for Information Science-1	3	1	0	0	2	3
B	BS	B250904/PH910B	Physics for Information Science	3	0	0	2	3	4
C	ES	B250906/CN100C	Engineering Graphics and Computer Aided Drawing	2	0	0	2	3	3
D	ES	B250906/CN100D	Introduction to Electrical and Electronics Engineering	4	0	0	0	4	4
E	ES	B250905/CN110E	Algorithmic Thinking with Python	2	0	0	2	3	4
K	HM	B250908/CN900K	Life Skills and Professional Communication	1	1	0	0	0	1
U	ES	B250906/CN930U	Basic Electrical and Electronics Engineering Workshop	0	0	0	2	0	1
G	Skill Enhancement Course: NASSCOM or equivalent								1
<i>(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work, C- Credit)</i>									

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

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

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

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

COURSE OUTCOMES (CO)					
Course Outcomes (CO): At the end of this course, learners will be able to:					
CO	CO Statement	CC Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	Apply the concepts of calculus to find tangent, normal, and concavity of single variable functions.	CC1	A		Rs
CO2	Apply the concepts of partial derivatives in finding directional derivatives, local extrema, and absolute extrema of multivariable functions.	CC1	A		Rs
CO3	Solve optimization problems using the method of Lagrange multipliers, graphical method, and method of steepest descent.	CC2	A		Rs
<p>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</p>					

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

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme		
L	T	J	P	S	C		Theory		
						CIA	ESE	Total	
3	1	0	0	2	3	40	60	100	
<p>L: Lecture (One unit is of one-hour duration), T: Tutorial (One unit is of one-hour duration), P: Practical (One unit is of one-hour duration), J: Project (One unit is of one-hour duration), S: Self-Learning & Team Work (One unit is of one-hour duration), CIA: Continuous Internal Assessment, ESE: End Semester Examination</p>									

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

SELF-LEARNING / TEAM WORK		
Sl.No	Self-learning / Team Work Description	Hrs
1	Relations, functions, types of functions, limits of functions, continuity at a point, continuous functions (2 hours) . Practice problems on continuity of functions, derivatives (2 hours) , Practice problems on rate of change, tangents & normal (2 hours) , Practice problems on maxima & minima of functions, concavity (2 hours) . Team Work - Formulate and solve real-life problem situations by identifying the appropriate mathematical function, determining its critical points, and applying suitable techniques to find the local or absolute extrema of the function (1 hour) .	9
2	Practice problems on Limits & continuity for functions of two variables (3 hours) , Practice problems on partial derivatives of first & higher order derivatives (3 hours) , Practice problems on chain rule for two variables (3 hours) .	9
3	Practice problems on chain rule for three variables (2 hours) , Practice problems on directional derivatives & gradient (3 hours) , Practice problems on linearization of a function & extreme values of a function (3 hours) . Team Work - Analyze real-life problem situations by modelling them using multivariable functions, determine the critical points and apply suitable optimization techniques to identify local and global extrema of the functions (1 hour) .	9
4	Basics of Linear programming problems, concept of global and local optimum (2 hours) Practice problems on Lagrange Multipliers with one constraint & two constraints (2 hours) , Practice problems on Method of Steepest Descent (2 hours) , Practice problems on formulation of LPP & finding the solution by graphical method (2 hours) . Team Work - Formulate & apply the graphical method to solve the real-life linear programming problems by representing the constraints as feasible regions and identifying the optimal solution to maximize or minimize the objective function (1 hour) .	9

SUGGESTED LEARNING RESOURCES

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

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

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

DETAILED SYLLABUS (Self-learning if any to be marked)							
Module	Topic	Mode of Delivery	CO	Learning Domain			Hrs
				C	P	A	
1	Introduction to the subject and syllabus	L	CO1	U			1
	Relations, functions, types of functions, limits of functions, continuity at a point, continuous functions.	S	CO1	U			
	Limits of Function Values, Continuity at a point, Continuous Functions.	L	CO1	U			1
	Rates of Change: Derivative at a Point Derivative as a Function, Second and Higher-Order Derivatives, Instantaneous Rates of Change	L	CO1	U			1
	Tutorial	T	CO1	U		Rs	1
	Chain Rule, Implicit Differentiation	L	CO1	U			2
	Linearization	L	CO1	U			1
	Tutorial	T	CO1	U		Rs	1
	Extreme Values of Functions on Closed Intervals.	L	CO1	A			2
	The Mean Value Theorem (without proof).	L	CO1	U			1
	Tangents and Normal Lines, Concavity: The Second Derivative Test for Concavity.	L	CO1	A			1
Tutorial	T	CO1	U		Rs	1	
2	Functions of Several Variables: Domains and Ranges	L	CO2	U			1
	Level curves of functions two variables	L	CO2	U			1
	Limits for functions of two variables	L	CO2	U			1
	Tutorial	T	CO2	U		Rs	1
	Continuity for functions of two variables	L	CO2	U			1
	Partial derivatives of functions of more than two variables	L	CO2	U			2
	Tutorial	T	CO2	U		Rs	1
	Partial derivatives and continuity	L	CO2	U			1
	Second - order partial derivatives	L	CO2	U			1
	The mixed derivative theorem, The Chain Rule: Functions of two variables	L	CO2	U			2
	Tutorial	T	CO2	U		Rs	1
	The Chain Rule: Functions of three Variables	L	CO2	U		Rs	1
	Directional Derivatives in the Plane, Interpretation of the Directional Derivative	L	CO2	A			2
	Gradient	L	CO2	U			1

3	Tutorial	T	CO2	U	Rs	1
	Properties of the Directional Derivative	L	CO2	U		1
	The Linearization of a Function of Two Variables.	L	CO2	U		1
	Local Extreme Values for Functions of Two Variables: Relative extrema	L	CO	A		2
	Tutorial	T	CO2	U	Rs	1
	First derivative theorem for local extreme values	L	CO2	A		1
	Critical point, saddle point	L	CO2	U		1
	Second Derivative Test for Local Extreme Values, Absolute Maxima and Minima on Closed Bounded Regions	L	CO2	A		2
	Tutorial	T	CO2	U	Rs	1
4	Basics of Linear programming problem, concepts of Global and local optimum	S	CO3			
	Constrained Maxima and Minima	L	CO3	U		1
	The Method of Lagrange Multipliers with one constraint	L	CO3	A		2
	Tutorial	T	CO3	U	Rs	1
	The Method of Lagrange Multipliers with two constraints	L	CO3	A		2
	Method of Steepest Descent (only two variables)	L	CO3	A		2
	Tutorial	T	CO3	U	Rs	1
	LPP - formation	L	CO3	U		1
	Solution of LPP using graphical method	L	CO3	A		2
Tutorial	T	CO3	U	Rs	1	

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

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

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

ASSESSMENT PATTERN

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

Total Pages:

Register No.: Name:

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

FIRST SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, DECEMBER 2025 (2025 SCHEME)

Course Code:	B250904/MA100A		
Course Name:	MATHEMATICS FOR INFORMATION SCIENCE-1		
Max. Marks	60	Duration:	2 hours 30 minutes
Common to CS, CY, AI, AD.			

PART A

(Answer all questions. Each question carries 3 marks)

No.	Question	CO	Marks
1	An object is dropped from the top of a 200 m high tower. Its height above ground after t sec is $(200 - 5t^2)$ m. How fast is it falling 5 sec after it is dropped?	CO1	(3)

2	Find the linearisation of $f(x) = 3\sqrt{x}$ at $x = -8$.	CO1	(3)
3	Determine $\frac{\partial}{\partial x}(x^2y + e^{xy})$.	CO2	(3)
4	A cost function is given by $C(x, y) = \frac{xy}{x^2+y^2}$, test the continuity at the origin.	CO2	(3)
5	Find the direction in which the function $f(x, y) = \frac{x^2}{2} + \frac{y^2}{2}$ increases most rapidly at the point (1,1).	CO2	(3)
6	Express $\frac{\partial w}{\partial r}$ and $\frac{\partial w}{\partial s}$ in terms of r and s, if $w = x + 2y + z^2$, $x = \frac{r}{s}$, $y = r^2 + \ln s$, $z = 2r$	CO2	(3)
7	Using the method of Lagrange multipliers, solve for the point(s) that maximize the function $f(x, y) = x^2 + y^2$ given that $(x, y) = x + y - 1 = 0$.	CO3	(3)
8	A garment manufacturer has a production line making two styles of shirts. Style I needs 200g of cotton thread, 300g of Dacron thread and 300g of linen thread. Corresponding requirements of style II are 200g, 200g and 100g. The net contributions are Rs.19.50 for style I and Rs.15.90 for style II. The available inventory of cotton thread, Dacron thread and linen thread are, respectively, 24 kg, 26 kg and 22 kg. The manufacturer wants to determine the number of each style to be produced with the given inventory. Formulate the LPP model.	CO3	(3)
PART B			
(Answer any one full question from each module, each question carries 9 marks)			
No.	Question	CO	Marks
MODULE I			
9	a) Determine the ranges of values of x for which $y = x^4 - 6x^3 + 12x^2 + 4x + 10$ is concave up or down. Also find the point of inflexion.	CO1	(5)
	b) Evaluate $\lim_{x \rightarrow 2} \frac{x^2 - 4}{\sqrt{x+2} - \sqrt{3x-2}}$	CO1	(4)
OR			
10	a) Find all points (x, y) on the graph of $g(x) = \frac{1}{3}x^3 - \frac{3}{2}x^2 + 1$ with tangent lines parallel to the line $8x - 2y = 1$.	CO1	(5)
	b) The displacement of a particle moving along a straight line is given by $y = \frac{(x-2)(2x^2+3x-2)}{x^4}$. Find the velocity and acceleration of the particle at the point $x = 2$.	CO1	(4)
MODULE II			
11	a) Verify mixed derivative theorem for $w = \tan^{-1}\left(\frac{y}{x}\right)$.	CO2	(5)
	b) Determine the rate of change of x with respect to z at the point $(x, y, z) = (1, -1, 3)$, if the relation $xz + y \ln x - x^2 + 4 = 0$ defines x as a function of two independent variables y and z and the partial derivatives exist.	CO2	(4)
OR			
12	a) The steady-state temperature distribution of a thin rectangular plate is modelled by $u(x, y) = e^x \sin y + e^y \cos x$. Verify whether $u(x, y)$ satisfies Laplace's equation.	CO2	(5)
	b) The displacement of a particle in space is given by $w = \ln(x^2 + y^2 + z^2)$ where the coordinates vary with time as $x = \cos t$, $y = \sin t$, $z = 4\sqrt{t}$. Find the rate of change of w with respect to time when $t = 3$.	CO2	(4)
MODULE III			
13	a) A storage company plans to construct a rectangular box, open at the top, with a volume of 32 cubic feet. Determine the dimensions of the box that will minimize the total surface area, thereby reducing the amount of wood required.	CO2	(5)
	b) Is there a direction \mathbf{u} in which the rate of change of $f(x, y) = x^2 - 3xy + 4y^2$ at $P(1,2)$ equals 14? Give reasons for your answer.	CO2	(4)
OR			
14	a) Find three positive numbers whose sum is 36 and such that the sum of their squares is as small as possible.	CO2	(5)
	b) A flat circular plate has the shape of the region $x^2 + y^2 \leq 1$. The plate including the boundary where $x^2 + y^2 = 1$, is heated so that the temperature at the point $T(x, y)$ is given by $x^2 + 2y^2 - x$. Find the temperature at the hottest and coldest points on the plate.	CO2	(4)
MODULE IV			
a)	Solve the following linear programming problem graphically: Maximize $z = 2x + 3y$ subject to the constraints: $x + y \leq 30$, $y \geq 3$, $0 \leq y \leq 12$, $x - y \geq 0$, $0 \leq x \leq 20$.	CO3	(5)

15	b)	Find the dimension of the rectangle of the greatest area that can be inscribed in the ellipse $\frac{x^2}{2} + \frac{y^2}{2} = 1$ with sides parallel to the coordinate axes by the method of Lagrange multipliers.	CO3	(4)
OR				
	a)	The plane $x + y + z = 1$ cuts the cylinder $x^2 + y^2 = 1$ in an ellipse. Find the points on the ellipse that lie closest to and farthest from the origin.	CO3	(5)
16	b)	Minimize the quadratic function $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2$ starting from the point (1,1), using the method of steepest descent with a fixed step size $t = 0.01$.	CO3	(4)

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

Course Code	Course Name	Course Category
B250904/PH910B	PHYSICS FOR INFORMATION SCIENCE	BS
Pre-requisite		
Basics of electricity, basics of dual nature of matter and radiation, basics of semiconductor materials and devices.		

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

COMPETENCY STATEMENT (CC)	
CC1	Demonstrate ability to apply microscopic theories of electrical conductivity to solve basic problems in electrical conductivity of metals and superconductors.
CC2	Demonstrate ability to apply the principles of semiconductors and quantum mechanics to solve basic problems in semiconductor circuits and atomic structure.

COURSE OUTCOME (CO)					
Course Outcomes (CO): At the end of this course, learners will be able to:					
CO	CO Statement	CC Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	Apply free electron theory and BCS theory to find electrical conductivity in metals and superconductors.	CC1	A		
CO2	Apply the Schrodinger equation to a one-dimensional quantum mechanical system for finding energy levels in such systems	CC2	A		
CO3	Apply the theory of semiconductors in a p-n junction under forward and reverse biased conditions	CC2	A	M	Rs
CO4	Apply the theory of semiconductors to characterize semiconductor devices and circuits	CC2	A	M	Rs
Cognitive (Revised blooms Level): - R: Remember; U: Understand; A: Apply; An: Analyse; E: Evaluate; C: Create Psychomotor Domain (Dave's): - I-Imitation, M-Manipulation, P-Precision, Ar-Articulation, N-Naturalisation Affective (Krathwohl): - Re-Receiving, Rs-Responding, V-Valuing, O-Organization, Ch-Characterization					

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

TEACHING AND ASSESSMENT SCHEME													
Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme						
L	T	J	P	S			Theory			Practical			Total
					C	CIA	ESE	Total	CIA	ESE	Total		
3	0	0	2	3	4	120	25	60	85	15	0	15	100
L: Lecture (One unit is of one-hour duration), T: Tutorial (One unit is of one-hour duration), P: Practical (One unit is of one- hour duration), J: Project (One unit is of one-hour duration), S: Self-Learning & Team Work (One unit is of one-hour duration), CIA: Continuous Internal Assessment, ESE: End Semester Examination													

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Electrical conductivity	Electrical conductivity of metals, Band theory, Superconductivity	9
2	Quantum mechanics	Uncertainty principle, Schrodinger equation, Particle in one-dimensional potential well	9
3	Semiconductor physics	Intrinsic carrier concentration, Extrinsic semiconductor, Diode equation	9
4	Semiconductor devices	Half wave rectifier, full wave rectifier, Semiconductor laser, photo diode, solar cell, Light emitting diode	9

SELF-LEARNING / TEAM WORK		
Sl. No	Self-learning / Team Work Description	Hrs
1	Resistivity and conductivity (Self-Learning 1) - Atomic structure and band theory (Self-Learning 2) - Isotopic effect and critical field (Self-Learning 3)	6
2	de Broglie waves (Self-Learning 4) - Uncertainty principle (Self-Learning 5) - Quantum computers (Self-Learning 6)	6
3	Intrinsic semiconductors (Self-Learning 7) - Extrinsic semiconductors (Self-Learning 8) - LED (Self-Learning 9) - Zener diode as voltage regulator (Self-Learning 10) - Tunnel diode (Self-Learning 11)	10
4	Semiconductor laser (Self-Learning 12)- Photo diode (Self-Learning 13) - Solar cell (Self-Learning 14) - Half wave rectifier (Self-Learning 15) - Full wave rectifier (Self-Learning 16)	10
5	Prelab assignment 1-10	20
6	Practice problems 1-6	12

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	A Textbook of Engineering Physics	MN Avadhanulu, P G Kshirsagar, TVS ArunMurthy	S. Chand 11th Edition, 2018
2	Engineering Physics	H K Malik, A.K. Singh,	McGraw Hill, 2th Edition, 2017

Reference			
Sl. No.	Title of Book	Author	Publication
1	Advanced Engineering Physics	Premlet B	Phasor Books 10th Edition, 2017
2	A Text Book of Engineering Physics	I. Dominic and. A. Nahari	Owl Books Revised Edition, 2016
3	Semiconductor Devices	Kanaan Kano	PHI Learning, 2008
4	Semiconductor Physics and Devices	Donald A Neamen, Dhrubes Biswas	McGraw Hill Education, 4th Edition, 2017

Web Resource	
1	https://nptel.ac.in/courses/113104012
2	https://archive.nptel.ac.in/courses/115/103/115103108/
3	https://nptel.ac.in/courses/115106066
4	https://nptel.ac.in/courses/108108122

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

Module	Title	Topic	Mode of Delivery	CO	Learning Domain			Hrs
					C	P	A	
1	Electrical conductivity	Classical free electron theory, Electrical conductivity in metals	L	CO1	A	M	Rs	1
		Expression for electrical conductivity in metals	L	CO1	A	M	Rs	1
		Fermi energy	L	CO1	A	M	Rs	1
		Practice problems 1	S	CO1	A			
		Prelab assignment 1	S	CO1	A			
		Self-Learning 1	S	CO1	A			
		Fermi Dirac distribution, Variation of Fermi function with temperature, Fermi energy	L	CO1	A	M	Rs	1
Energy bands, Classification of materials into conductors, semiconductors and insulators	L	CO1	A	M	Rs	1		

		Superconductivity, Transition temperature, Critical field, Meissner effect	L	CO1	A	M	Rs	1
		Prelab assignment 2	S	CO1	A			
		Self-Learning 2	S	CO1	A			
		Type I and Type II superconductors	L	CO1	A	M	Rs	1
		BCS theory	L	CO1	A	M	Rs	1
		Applications of superconductors	L	CO1	A	M	Rs	1
		Practice problems 2	S	CO1	A			
2	Quantum Mechanics	Prelab assignment 3	S	CO2	A			
		Self-Learning 3	S	CO2	A			
		Uncertainty principle, conjugate observables	L	CO2	A	M	Rs	1
		Application of uncertainty principle – Absence of electron inside nucleus, Natural line broadening	L	CO2	A	M	Rs	1
		Wave function, properties, physical interpretation	L	CO2	A	M	Rs	1
		Practice problems 3	S	CO2	A			
		Prelab assignment 4	S	CO2	A			
		Self-Learning 4	S	CO2	A			
		Formulation of time dependent Schrodinger equation	L	CO2	A	M	Rs	1
		3	Semiconductor Physics	Time independent Schrodinger equation	L	CO2	A	M	Rs	1
Time independent Schrodinger equation	L			CO2	A	M	Rs	1
Prelab assignment 5	S			CO2	A			
Self-Learning 5	S			CO2	A			
Particle in a one-dimensional potential well	L			CO2	A	M	Rs	1
Derivation of eigen values and normalized wave function	L			CO2	A	M	Rs	1
Quantum mechanical tunnelling	L			CO2	A	M	Rs	1
Prelab assignment 6	S			CO3	A			
Self-Learning 6	S			CO3	A			
Intrinsic semiconductor	L			CO3	A	M	Rs	1
derivation of density of electrons in conduction band	L			CO3	A	M	Rs	1
Density of holes in valence band	L			CO3	A	M	Rs	1
Practice problems 4	S			CO3	A			
Prelab assignment 7	S			CO3	A			
Self-Learning 7	S			CO3	A			
Intrinsic carrier concentration, variation of intrinsic carrier concentration with temperature, Extrinsic semiconductor	L			CO3	A	M	Rs	1
Formation of p-n junction, Fermi level in semiconductors, intrinsic and extrinsic	L			CO3	A	M	Rs	1
Energy band diagram of p-n junction, charge flow across p-n junction	L			CO3	A	M	Rs	1
Practice problems 5	S			CO3	A			
Prelab assignment 8	S			CO3	A			
Self-Learning 8, Self-Learning 9	S			CO3	A			
Forward and reverse biased p-n junction	L			CO3	A	M	Rs	1
I-V characteristics of p-n junction	L			CO3	A	M	Rs	1
Diode equation	L			CO3	A	M	Rs	1
Self-Learning 10, Self-Learning 11	S			CO3	A			

Semiconductor Devices	Prelab assignment 9	S	CO4	A			
	Self-Learning 12	S	CO4	A			
	Half wave rectifiers	L	CO4	A	M	Rs	1
	Full wave rectifier	L	CO4	A	M	Rs	1
	Practice problems 6	S	CO4	A			
	Prelab assignment 10	S	CO4	A			
	Self-Learning 13	S	CO4	A			
	Semiconductor laser, applications	L	CO4	A	M	Rs	1
	Photo detectors -Junction photo diode	L	CO4	A	M	Rs	1
	PIN photodiodes	L	CO4	A	M	Rs	1
	Self-Learning 14	S	CO4	A			
	Solar cell – construction and working	L	CO4	A	M	Rs	1
	VI characteristics - Efficiency, Stringing of solar cells to solar panel	L	CO4	A	M	Rs	1
	Light Emitting Diode, Applications	L	CO4	A	M	Rs	1
Self-Learning 15, Self-Learning 16	S	CO4	A				

PRACTICAL SYLLABUS

Topic	Objective	CO	Learning Domain			Hrs
			C	P	A	
Diffraction grating	To determine the wavelength of laser using grating	CO4	A	M	Rs	2
Diode characteristics	To determine the characteristics of a diode	CO3	A	M	Rs	2
Cathode Ray Oscilloscope	To determine voltage and frequency of an electronic signal from function generator	CO3	A	M	Rs	2
LED characteristics	To determine the characteristics of an LED	CO4	A	M	Rs	2
Solar cell	To determine the characteristics of a solar cell	CO4	A	M	Rs	2
Numerical aperture	To determine numerical aperture of an optical fiber	CO4	A	M	Rs	2
Zener diode characteristics	To determine the characteristics of a zener diode	CO4	A	M	Rs	2
Half wave rectifier	To determine input and output waveforms through a half wave rectifier	CO4	A	M	Rs	2
Full wave rectifier	To determine input and output waveforms through a half wave rectifier	CO4	A	M	Rs	2
Photo diode characteristics	To determine the characteristics of a photo diode	CO4	A	M	Rs	2

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

Module	Module Title	Distribution of Marks (RBL)						Total Marks
		R	U	A	An	E	C	
1	Electrical conductivity	√	√	√				15
2	Quantum Mechanics	√	√	√				15
3	Semiconductor Physics	√	√	√				15
4	Semiconductor 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 Examination	20
2. Continuous Lab Evaluation	10
3. Learning Activity	
4. Attendance	5
5. Course Project	
6. Internal Examination (Lab)	5
End Semester Examination	60
Total	100

Total Pages:			
Register No.:	.....	Name:	.....
(AN AUTONOMOUS COLLEGE AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANATHAPURAM)			
FIRST SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, DECEMBER 2025 (2025 SCHEME)			
Course Code:	B250904/PH910B		
Course Name:	PHYSICS FOR INFORMATION SCIENCE		
Max. Marks	60	Duration:	2 hours 30 minutes
Common to Computer Science branches			
Use of Calculators are permitted.			

PART A			
<i>(Answer all questions. Each question carries 3 marks)</i>			
No.	Question	CO	Marks
1	Free electron theory is used only for metals. What are its drawbacks?	CO1	(3)
2	Meissner effect is the hallmark of superconductivity. Explain it with the help of a diagram.	CO1	(3)
3	Physical meaning of wave function was given by Max Born. What was his interpretation of wave function?	CO2	(3)
4	Alpha particles with energy less than nuclear potential barrier can cross it. How will you explain it?	CO2	(3)
5	Intrinsic semiconductor is not suitable for device fabrication. Give reason.	CO3	(3)
6	Width of the depletion region varies with biasing in a pn junction. Explain it with the help of a diagram.	CO3	(3)
7	Photo diode is a light sensitive device. Explain its working.	CO4	(3)
8	Distinguish between PIN and junction photo diodes.	CO4	(3)

PART B			
<i>(Answer any one full question from each module, each question carries 9 marks)</i>			
No.	Question	CO	Marks
MODULE I			
9	a) Starting with postulates of free electron theory, derive an expression for electrical conductivity of metals with free electrons.	CO1	(6)
	b) Estimate the collision time of conduction electrons in a metal if its resistivity is $1.54 \times 10^{-8} \Omega\text{m}$ and has 5.8×10^{28} conduction electrons/m ³ .	CO1	(3)
OR			
10	a) Type II superconductors are commonly used for practical applications. Give an account of type I and type II superconductor with examples. Give four applications of superconductors.	CO1	(6)
	b) Lead in the superconducting state has critical temperature of 7.26 K and a critical field of $8 \times 10^5 \text{ A/m}$ at 0 K. Determine the critical field at 5 K.	CO1	(3)
MODULE II			
11	a) Write the Schrodinger's equation for a particle in a one dimensional potential well and obtain the expression for normalized wave function and energy eigen values.	CO2	(6)
	b) Calculate the separation between the two lowest energy levels of an electron in a one dimensional box of width 4 \AA in Joules.	CO2	(3)
OR			
12	a) Using separation of variable method, solve time-dependent Schrodinger equation and obtain the time-independent Schrodinger equation.	CO2	(6)
	b) Calculate the uncertainty in velocity of an electron which is confined in a 10 \AA box.	CO2	(3)

MODULE III			
13	a) Derive an expression for electron density in conduction band and hole density in valence band, thereby give an expression for intrinsic carrier concentration.	CO3	(6)
	b) If the effective mass of an electron is equal to twice the effective mass of hole, determine the position of the Fermi level in an intrinsic semiconductor from the centre of forbidden gap at room temperature.	CO3	(3)
OR			
14	a) Derive diode equation for a pn junction and draw its VI characteristics graph	CO3	(6)
	b) Current flowing in a p-n junction is $0.2 \mu\text{A}$ at room temperature when a large		

	b)	reverse bias voltage is applied. Calculate the current when a forward bias of 0.1 V is applied.	CO3	(3)
MODULE IV				
15	a)	Give an expression for wavelength of light emitted by an LED. Explain the working of an LED with the help of a circuit diagram. What is your inference about white light produced from an LED?	CO4	(6)
	b)	Calculate the wavelength of light emitted from an LED with a band gap of 2 eV.	CO4	(3)
OR				
16	a)	Give an account of construction and working of a solar cell. Draw the VI characteristics graph and give expression for fill factor and efficiency. Distinguish between series stringing and parallel stringing of solar cells.	CO4	(6)
	b)	A solar cell (10 cm x 10 cm) produces a voltage of 0.5 V and a current up to 2.5A. If the intensity of solar radiation is 800 W/m ² , calculate the efficiency of solar cell.	CO4	(3)

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

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

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

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

COURSE OUTCOMES (CO)					
Course Outcomes (CO): At the end of this course, learners will be able to:					
CO	CO Statement	CC Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	Draw the orthographic projection of points and lines located in different quadrants	CC1	A		
CO2	Generate multi-view orthographic projections of engineering objects by visualizing them in different positions	CC1	A		
CO3	Plot sectional views of engineering solids	CC1	A		
CO4	Develop surfaces of engineering objects	CC1			
CO5	Prepare pictorial drawings using the principles of isometric projection	CC1	A		
CO6	Sketch simple 2D drawings using CAD tools	CC2	U		Rs

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

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

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

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

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

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
		Introduction: Relevance of technical drawing in the engineering field. Types	

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

SELF-LEARNING / TEAM WORK

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

SUGGESTED LEARNING RESOURCES

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

Reference

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

Web Resource

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

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

Module	Topic	Mode of Delivery	CO	Learning Domain			Hrs
				C	P	A	
1	Introduction: Relevance of technical drawing in the engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing.	CL	CO1	A			1

	Orthographic projection of points	CL	CO1	A			1
	Projection of straight lines inclined to one plane	CL	CO1	A			1
	Projection of straight lines inclined to both planes	CL	CO1	A			4
	Trace of a line.	CL	CO1	A			1
	Inclination of lines with reference planes.	CL	CO1	A			1
	True length and true inclinations of line inclined to both the reference planes.	CL	CO1	A			3
	Orthographic projection of lines (Additional numerical problems – Self learning)	SL	CO1	A			6
2	Orthographic projection of solids- Introduction	CL	CO2	A			1
	Orthographic Projection of Simple solids such as Triangular, Rectangular, Square, Pentagonal and Hexagonal Prisms and Pyramids, Cube, Cone and Cylinder	CL	CO2	A			2
	Projection of solids in simple position including profile view.	CL	CO2	A			2
	Projection of solids with axis inclined to one of the reference planes	CL	CO2	A			2
	Projection of solids with axis inclined to both reference planes	CL	CO2	A			5
3	Sections of Solids- Introduction	CL	CO3	A			1
	Sections of Prisms, Pyramids, Cube, True shape	CL	CO3	A			3
	Section of Cone and Cylinder with axis in vertical position, True shape	CL	CO3	A			4
	Development of Surfaces- Introduction	CL	CO4	A			1
	Development of surfaces of the solids and solids cut by different section planes	CL	CO4	A			1
	Development of surfaces (additional problems) – self learning	SL	CO4	A			6
4	Isometric projection- Introduction	CL	CO5	A			1
	Isometric scale- Isometric View and Projections of Prisms, Pyramids, Cone, Cylinder, Sphere, Hemisphere	CL	CO5	A			4
	Projections of combination of solids	CL	CO5	A			5
5	Computer Aided Drawing (CAD)- Introduction	CL	CO6	A			1
	Creating two-dimensional drawing with dimensions using suitable software	CL	CO6	A		Re	5
	CAD - self learning- Questions in 2D drawing	SL	CO6	A		Re	18

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

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

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

ASSESSMENT PATTERN

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

Total Pages: ...1....			
Register No.:	.....	Name:	.....
(AN AUTONOMOUS COLLEGE AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANATHAPURAM)			
FIRST SEMESTER B. TECH DEGREE REGULAR EXAMINATION, DECEMBER 2025 (2025 SCHEME)			
Course Code:	B250906/CN100C		
Course Name:	Engineering Graphics and Computer Aided Drawing		
Max. Marks	60	Duration:	2 hours 30 minutes
Common to EEE, ECE, CSE, AI, AD, CY			

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

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

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

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

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

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

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

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

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

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

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

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

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

SUGGESTED LEARNING RESOURCES

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

Reference			
Sl. No.	Title of Book	Author	Publication
1	Electrical Engineering Fundamentals	Del Toro V	Pearson Education 2/e 2019
2	Engineering Circuit Analysis	Hayt W H, Kemmerly J E, and Durbin S M	Tata McGraw-Hill
3	Electrical and Electronic Technology	Hughes	Pearson Education
4	Basic Electrical Engineering	D C Kulshreshtha	Tata McGraw Hill 2/e 2019
5	Electronics Fundamentals: Circuits, Devices & Applications	Thomas Floyd, David Buchla	Pearson, 8/e
6	Electronics: A system approach	Neil Storey	Pearson 6/e, 2017
7	Electronic Communication	Dennis Roddy & John Coolen	Pearson, 4/e, 2008
8	Principles of Electronics Communication Systems	Frenzell.E	McGraw Hill, 4/e, 2016

Web Resource	
1	https://www.coursera.org/learn/linear-circuits-dcanalysis (Module 1)
2	https://www.coursera.org/lecture/linear-circuits-ac-analysis/1-4-circuit-analysis-with-ac-impedances-gArJ6 (Module 1)

3	https://www.coursera.org/lecture/linear-circuits-ac-analysis/1-2-phasors-rEHhg (Module 2)
4	https://nptel.ac.in/courses/117106108
5	https://ocw.mit.edu/courses/ec-s06-practical-electronics-fall-2004/
6	https://nptel.ac.in/courses/108101091
7	https://nptel.ac.in/courses/117105143

DETAILED SYLLABUS (Self-learning if any to be marked)							
Module	Topic	Mode of Delivery	CO	Learning Domain			Hrs
				C	P	A	
1	Introduction to Electrical Engineering, Basic Terminology, including voltage, current, power, resistance, emf,	CD	CO1	A			1
	Resistances in series and parallel, Current and Voltage Division Rules	L					1
	Capacitors & Inductors: V-I relations and energy stored. Ohm's law	L					1
	star-delta conversion (resistive networks only) - problems.	L				Rs	1
	Numerical problems	T, S	CO1	A		V	2
	Mesh current method - matrix representation - Solution of network equations.	L, T, S					1
	Numerical problems	T					1
	Node voltage methods-matrix representation- solution of network equations by matrix methods - numerical problems.	L, T, S					1
	Numerical problems	T					2
	Basic Terminology: MMF, field strength, flux density, reluctance - comparison between electric and magnetic circuits	L	CO2	U		Rs	1
Series and parallel magnetic circuits with composite materials	L					1	
2	Faraday's laws, Lenz's law, statically induced and dynamically induced emfs, problems	L	CO2	U		Rs	1
	Self-inductance and mutual inductance, coefficient of coupling	L					1
	Generation of alternating voltages- Representation of sinusoidal waveforms: frequency, period	L	CO3	A		V	1
	Average and RMS values and form factor of waveforms - Numerical Problems	L, T, S					2
	Phasor representation of sinusoidal quantities. Trigonometric, Rectangular, Polar and complex forms.	L					1
	Analysis of simple AC circuits: Purely resistive circuit	L	CO3	A		V	1
	Analysis of simple AC circuits: Purely inductive & capacitive	L, T, S					2
	circuits; Inductive and capacitive reactance, concept of impedance.						
	Average Power, Power factor						
	Analysis of RL, RC and RLC series Circuits- active, reactive and apparent power.						2
Numerical Problems	T					2	
Generation of three phase voltages, advantages of three phase systems, star and delta connections	L	CO4	U		Rs	1	
Relation between line and phase voltages, line and phase currents - Numerical problems.	L, T, S					1	
Numerical Problems	T					2	
3	Passive & Active components	L, T	CO5	U	I	Rs	1
	Rectifiers: Full-wave & Bridge - Ripple factor (with & without capacitor filter)						2
	Zener voltage regulator, Line & load regulation	L, T, S	CO5	U	I	Rs	2
	Block diagram of regulated DC power supply						1

	BJT Construction & working, V-I characteristics of BJT	L, T	CO5	U	I	Rs	2
	CE configuration: Input-output characteristics						1
	Comparison of CE, CB & CC configurations	L	CO5	U	I	Rs	1
	Concept of biasing & load line, Transistor as a switch (circuit & working)	L, T	CO5	U	I	Rs	2
	Transistor as an amplifier, RC coupled amplifier: Circuit diagram & frequency response	L, T	CO5	U	I	Rs	2
	Basics of FETs (MOSFET) - Construction & working of N & P channel MOSFET (Drain & Transfer characteristics)	L, S	CO5	U	I	Rs	2
4	General block diagram of a communication system	L, T	CO6	U	I	Rs	1
	Need for modulation, Concept of AM & angle modulation (no derivation)						2
	Basic concept of wired communication, Wired channels: twisted pair, coaxial cable, fiber optic cable	L	CO6	U	I	Rs	2
	Introduction to wireless communication, Block diagram of GSM, Comparison of 3G, 4G, 5G & 6G technologies	L, S	CO6	U	I	Rs	2
	Block diagram of electronic instrumentation system, Digital Multimeter,	L	CO6	U	I	Rs	2
	Function generator, Introduction to CRO & Lissajous patterns						2
	IoT based smart homes, IoT in healthcare, IoT in agriculture (case study only)	L, S	CO6	U	I	V	3

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

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

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

ASSESSMENT PATTERN

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

Register No.:		Name:	
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THIRUVANATHAPURAM)

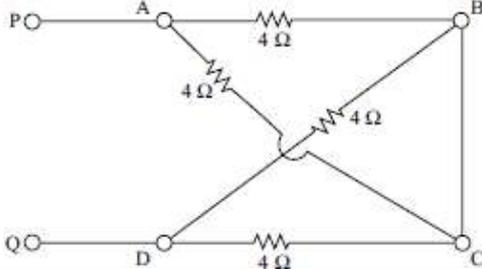
FIRST SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, DECEMBER 2025 (2025 SCHEME)			
Course Code:	B250906/CN100D		
Course Name:	INTRODUCTION TO ELECTRICAL & ELECTRONICS ENGINEERING		
Max. Marks	60	Duration:	2 hours 30 minutes
Specify if the question paper is common to different programmes			
<i>Use of Data Book / IS codes, etc to be specified by the question paper setter</i>			
<ul style="list-style-type: none"> Students should write answers to Questions of Part 1 between the pages 1 and 15 and answers to Questions of Part 2 between pages 16 and 30 of the answer booklet. No additional answer books /sheets will be provided. No separate minimum marks are required to pass. 			

PART 1- ELECTRICAL ENGINEERING (30 MARKS)

PART 1 - A

MODULE 1 & 2

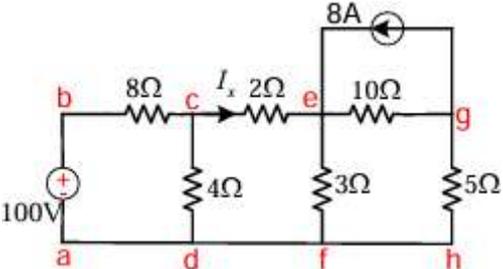
(Answer all questions. Each question carries 3 marks)

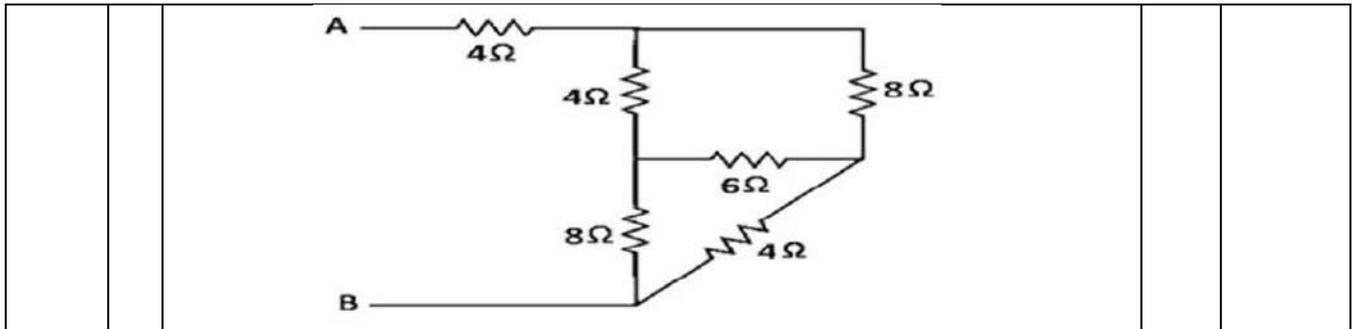
No.	Question	CO	Marks
1	Calculate the resistance between the terminals P and Q of the network shown. <div style="text-align: center;">  </div>	CO1	(3)
2	Differentiate between electric resistance and magnetic reluctance.	CO2	(3)
3	Electromotive force (emf) can be generated in two ways – statically induced 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 . <div style="text-align: center;">  </div>	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)
		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)
		MODULE II		

OR				
8	a	An R-L-C series circuit is used as part of an AC filtering system. By adjusting the inductance, the current peaks at 0.5 A while operating at 230 V, 50 Hz supply. At this point, a voltage of 350 V is recorded across the capacitor. i) Calculate the resistance of the circuit. ii) Determine the capacitance of the capacitor. iii) Find the inductance of the inductor when the circuit is in resonance.	CO4	(4)

b	An industrial motor acting as a balanced three phase load consists of three coils each having resistance of 4Ω and inductance $0.02H$. It is connected to a $415V$, $50Hz$, 3-phase ac supply. Determine the phase voltage, phase current, power factor and active power when the load is connected in star.	CO4	(5)
(Use of Data Book / IS codes, etc to be specified by the question paper setter)			
<ul style="list-style-type: none"> • Students should write answers to Questions of Part 1 between the pages 1 and 15 and answers to Questions of Part 2 between pages 16 and 30 of the answer booklet. No additional answer books /sheets will be provided. • No separate minimum marks are required to pass. 			
PART 2 - ELECTRONICS ENGINEERING (30 MARKS)			
PART 2 - A			
MODULE 3 & 4			
(Answer all questions. Each question carries 3 marks)			
No.	Question	CO	Marks
1	The colour bands Violet, Blue, Brown, and Gold are observed on a resistor. Analyse whether this resistor is suitable for a circuit that specifies the resistance must remain between 730Ω and 780Ω . Support your conclusion with appropriate calculations.	CO5	(3)
2	Calculate emitter current I_E in a BJT if the value of β is 50 and $I_B = 20\mu A$	CO5	(3)
3	Discuss the role of IoT in transforming traditional agricultural practices.	CO6	(3)
4	Discuss how the information signal affects the carrier in AM and FM, and critically compare their advantages and limitations.	CO6	(3)
PART 2 - B			
MODULE 3 & 4			
(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 $0V$, 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 $300Hz - 3.4kHz$ directly over a long distance to multiple locations. After setting up the transmission, he notices that at the receiver end, the signal is highly attenuated and gets distorted with noise, making the speech almost unintelligible.		
	a) Identify the reason for the poor reception of the directly transmitted audio signal and suggest a suitable method to overcome this issue.	CO6	(4)
	b) Describe any two techniques that enable effective transmission of signals over long distances, and illustrate your explanation with neat sketches.	CO6	(5)
OR			
8	You are assigned to troubleshoot an electrical circuit in a lab where a resistor, capacitor, and a battery are connected. The circuit is not functioning as expected, and you suspect faulty components.		
	a) Recommend a suitable instrumentation system that can be used to perform the necessary measurements in this scenario, and draw its block diagram.	CO6	(4)
	b) How does the suggested instrument function in measuring battery current and resistance.	CO6	(5)

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

Course Code	Course Name	Course Category
B250905/CN110E	ALGORITHMIC THINKING WITH PYTHON	ES
Pre-requisite		
NIL		

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

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

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

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

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

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

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

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

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Foundations of Problem-Solving and Python Basics	Problem-Solving Strategies, The Problem-Solving Process, Essentials of Python Programming	7
2	Algorithm Design with Pseudocode and Flowcharts	Pseudocode, Flowcharts	9

3	Modular Problem-Solving with Python: Control Structures to Recursion	Selection and Iteration, Decomposition and Modularization, Recursion: -	10
4	Fundamental Computational Approaches to Problem-Solving	Divide-and-Conquer Approach, Dynamic Programming Approach, Greedy Algorithm Approach	10

SELF-LEARNING / TEAM WORK

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

SUGGESTED LEARNING RESOURCES

Text Book

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

Reference

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

Web Resource

1	https://opentextbc.ca/h5ppspsychology/chapter/problem-solving/
2	https://onlinecourses.nptel.ac.in/noc21_cs32/preview

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

Module	Topic	Mode of Delivery	CO	Learning Domain			Hrs
				C	P	A	
1	Problem-solving strategies – definition, importance, trial & error, heuristics, means-ends analysis, backtracking (working backward)	L	CO1	U	M	Rs	2
	The problem-solving process – computer as a model of computation, understanding the problem, formulating a model, developing an algorithm writing the program, testing & evaluating the solution	L	CO1	U	M	Rs	3
	Essentials of Python programming – variables, numeric and string data types, math module, Python Standard Library, I/O (print, input), operators & precedence	L	CO1	U	M	Rs	2
	Case study: Pick simple problems (e.g., prime numbers) and document steps (understanding, model, algorithm, coding, testing)	S	CO1	U	M	Rs	12
2	Pseudocode Representation – meaning & definition, reasons for using pseudocode, constructs of pseudocode (sequencing, selection – if-else, case structure; repetition – for, while, Repeat - until loops)	L	CO2	A	M	Rs	3
	Sample problems using pseudocode – evaluate expression ($d=a+b*c$), simple interest, larger of two numbers, smallest of three numbers, grade computation (KTU scale), numbers 1–50 in descending order, sum of	L	CO2	A	M	Rs	3

	n numbers (all loop types), factorial, largest of n numbers (more may be added)						
	Flowcharts – symbols: start/end, arithmetic operation, I/O, decision, module call, loop (hexagon), flow-lines, connectors (on-page & off- page)	L	CO2	A	M	Rs	2
	Flowcharts for sample problems – construct diagrams for problems listed earlier (expression evaluation, interest, factorial, largest number, etc.); use of tools like RAPTOR suggested	L	CO2	A	M	Rs	1
	Self-learning – Group activity: Each team takes a real-world scenario (e.g., ATM withdrawal process, online shopping checkout) and develops pseudocode with sequencing, selection, and repetition	S	CO2	A	M	Rs	12
3	Selection and iteration using Python – if-else, elif, for loop, range, while loop	L	CO3	A	M	Rs	2
	Sequence data types in Python – list, tuple, set, strings, dictionary	L	CO3	A	M	Rs	2
	Creating and using arrays in Python (using NumPy library)	L	CO3	A	M	Rs	1
	Decomposition and modularization – problem decomposition as a strategy for solving complex problems, modularization, motivation for modularization	L	CO3	A	M	Rs	2
	Functions in Python – defining & using functions, functions with multiple return values. The idea should be demonstrated using Merge Sort and the problem of returning the top three integers from a list of $n \geq 3$ integers (examples). (Not limited to these exercises; more can be worked out if time permits).	L	CO3	A	M	Rs	1
	Recursion – definition, reasons for using recursion, the call stack, recursion and the stack, avoiding circularity in recursion	L	CO3	A	M	Rs	1
	Sample recursive problems – finding nth Fibonacci number, GCD of two integers, factorial of a positive integer, adding two positive integers, sum of digits of a positive number (Not limited to these exercises; more can be worked out if time permits).	L	CO3	A	M	Rs	1
Self-learning: Compare recursive vs iterative solutions for factorial & Fibonacci; trace recursion using call-stack diagrams	S	CO3	A	M	Rs	10	
4	Brute-force Approach – Introductory diagrammatic / algorithmic explanation (analysis not required). Example: Padlock, Password guessing	L	CO4	A	M	Rs	2
	Divide-and-Conquer Approach – Introductory diagrammatic / algorithmic explanation (analysis not required). Example: The Merge Sort Algorithm. Advantages of Divide and Conquer Approach. Disadvantages of Divide and Conquer Approach	L	CO4	A	M	Rs	2
	Dynamic Programming Approach – introductory diagrammatic/algorithmic explanation (analysis not required). Example: Fibonacci series. Recursion vs Dynamic Programming	L	CO4	A	M	Rs	2
	Greedy Algorithm Approach – Introductory diagrammatic/algorithmic explanation (analysis not required). Example: Given an array of positive integers each indicating the completion time for a task, find the maximum number of tasks that can be completed in the limited amount of time you have. Motivations for the Greedy Approach. Characteristics of the Greedy Algorithm. Greedy Algorithms vs Dynamic Programming	L	CO4	A	M	Rs	2
	Randomized Approach – Introductory diagrammatic/algorithmic explanation (analysis not required). Example: Coupon Collector Problem – A company selling jeans gives a coupon for each pair of jeans. There are n different coupons. Collecting n	L	CO4	A	M	Rs	2

	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	CO4	A	M	Rs	11

PRACTICAL SYLLABUS

Module	Objective	CO	Learning Domain			Hrs
			C	P	A	
1	To practice basic syntax, operators and user input handling	3	A	M	Rs	1
1	To familiarize string operations and indexing	3	A	M	Rs	1
1	To understand built-in libraries and formatting	3	U	M	Rs	1
1	To apply data structures and library usage	3	A	M	Rs	1
3	To apply selection control structure	3	A	M	Rs	1
1	To apply formulas and I/O	3	A	M	Rs	1
3	To practice nested iteration and control flow	3	A	P	Rs	1
3	To apply iteration and conditions with efficiency	3	A	P	Rs	1
3	To apply recursion for mathematical problems	3	A	P	Rs	1
3	To practice recursion basics	3	A	P	Rs	1
3	To strengthen recursive algorithm design	3	A	P	Rs	1
3	To apply recursion for number theory problems	3	A	P	Rs	1
3	To apply modularization and conditionals	3	C	P	V	1
3	To understand modular programming and reuse	3	C	P	V	1
3	To apply string validation logic	3	A	P	Rs	1
4	To apply sorting, merging and algorithm design	3	A	P	V	1
4	To apply loops, decision making and simulate game strategy	3	A	P	V	2
4	To apply probability simulation, decision analysis and algorithmic reasoning	4	A	P	V	2

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

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

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

ASSESSMENT PATTERN

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

Register No.:	Name:
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(AN AUTONOMOUS COLLEGE AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY,
THIRUVANATHAPURAM)

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

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

PART B			
<i>(Answer any one full question from each module, each question carries 9 marks)</i>			
No.	Question	CO	Marks
MODULE I			
9	a) Explain how the backtracking strategy can be applied to solve a real-life problem, for example, planning steps to reach a financial savings goal.	CO 1	(5)
	b) Write a Python program to convert a temperature given in Celsius to Fahrenheit and Fahrenheit to Celsius (Hint: °F = (°C × 9/5) + 32).	CO 1	(4)
OR			
10	a) A student is preparing for multiple competitive exams with limited time. Describe how the Means-Ends Analysis approach can be applied to plan an effective study schedule.	CO 1	(5)
	b) Write a Python program to calculate the bill amount for an item given its quantity sold, value, discount, and tax.	CO 1	(4)
MODULE II			
11	a) Write pseudocode to simulate a simple ATM withdrawal system. The system should check balance, deduct the amount, and display the remaining balance.	CO 2	(5)
	b) Draw a flowchart to compute the sum of digits of an integer.	CO 2	(4)
OR			
12	a) Write pseudocode to compute the average marks of N students and classify them into "Pass" and "Fail" categories (Criteria to consider as pass is greater than or equal to 50 marks out of 100.).	CO 2	(5)
	b) Develop an algorithm to check whether a given year is a leap year.	CO 2	(4)
MODULE III			
13	a) Differentiate recursion and iteration. Write a recursive program to find factorial of a number.	CO 3	(5)
	b) Write a Python function to accept a list of integers and return a new list containing only the perfect numbers (Hint: A perfect number is a positive integer equal to the sum of its proper divisors, e.g., 6, 28, 496).	CO 3	(4)
OR			
14	a) Write a Python program using function to print 'n' lines of the following pattern.	CO 3	(5)

		1 1 2 1 2 3 1 2 3 4		
	b)	You have tuples representing election results: (Candidate Name, Votes Received). Write a program to find the candidate with the maximum votes. Also calculate the percentage of votes each candidate received. Sample Input: [("Alice", 3400), ("Bob", 2800), ("Charlie", 1500)] Output: Winner: Alice Vote Percentages: [47.22%, 38.89%, 13.89%]	CO 3	(4)
MODULE IV				
15	a)	Illustrate the process of sorting the array [15, 8, 3, 12, 6, 10, 4, 1] using the merge sort algorithm. Draw a diagram showing how the array is split and merged at each stage.	CO 4	(5)
	b)	Compare Greedy Algorithms and Dynamic Programming in terms of their approach, solution guarantee, and applicable scenarios. Provide examples where each approach is preferred.	CO 4	(4)
OR				
16	a)	A company wants to allocate jobs to machines to minimize total cost. Formulate this as an optimization Problem and describe how dynamic programming can be applied.	CO 4	(5)
	b)	A student has exams for 5 subjects, each requiring different preparation times (Subject A – 2 hrs, Subject B – 4hrs, Subject C – 1 hr, Subject D – 3hrs, Subject E – 5hrs). Given a total of 10 study hours, design a Greedy Strategy to maximize the number of subjects covered. Show the sequence of subjects chosen and the total number of subjects.	CO 4	(4)

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

Course Code	Course Name	Course Category
B250908/CN900K	LIFE SKILLS AND PROFESSIONAL COMMUNICATION	HM
Pre-requisite		
NIL		

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

COMPETENCY STATEMENT (CC)	
CC1	Learners demonstrate essential life skills and professional communication skills, enabling them to adapt confidently to personal, academic, and professional challenges and contribute meaningfully to society.

COURSE OUTCOMES (CO)					
Course Outcomes (CO): At the end of this course, learners will be able to:					
CO	CO Statement	CC Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	Evaluate self-awareness to set effective goals and plans	CC 1	A		V
CO2	Evaluate the ability to focus on strengthening the fundamentals of emotional quotient	CC 1	A		V
CO3	Apply techniques to enhance Critical Thinking, Problem-solving and Decision-making skills	CC 1	A		V
CO4	Apply strategies to improve comprehension and communication skills	CC 1	A		Rs
CO5	Present ideas using modern technological platforms	CC 1	A		V
CO6	Establish a professional network using networking platforms	CC 1	An		O

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

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

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

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

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

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Personal Growth & Self-management	1. Group formation and self-introduction 2. Preparation of Gantt chart 3. Online personality development test 4. Role-storming exercise	5
2	Workplace & Inter personal Skills	1. Presentation on instances of empathy 2. Networking with professionals to develop workplace skills 3. Role- Play 4. Report writing	7
3	Problem-Solving & Creative thinking	1. Identifying real-life problem that requires a technical solution 2. Six thinking hat exercises 3. Group Discussion 4. Video presentation on diversity aspects	9
4	English Language communication & Professional Development	1. Online Interview skills development session. 2. Listening test 3. Activities to improve English vocabulary of students 4. Video content for podcasts on technological interventions/research work tried out in Kerala context	9

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

SUGGESTED LEARNING RESOURCES

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

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

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

DETAILED SYLLABUS (Self-learning if any to be marked)									
Sl. No	Activity	Mode of Delivery	Group/ Individual (G/I)	Mark	COs	Learning Domain			Hrs
						C	P	A	
1.1	Group formation and self-introduction among the group members	L	G			R		Re	2

1.2	Familiarizing the activities and preparation of the time plan for the activities	L	G			R		Re	
1.3	Preparation of Gantt chart based on the time plan	L, T	G	5	CO1	A		Re	
2.1	Take an online personality development test	L, T	I	2	CO1	U		V	3
2.2	Role-storming exercise 1: Students assume 2 different roles given below and write about their; <ul style="list-style-type: none"> Strengths Areas for improvement Concerns Areas in which he/she hesitates to take advice Goals/Expectations from the point of view of the following assumed roles: i) parent/guardian/mentor ii) friend/sibling/cousin 	L, T	I	2	CO1	U		Rs	
2.3	Role-storming exercise 2: Students assume the role of their teacher and write about <ul style="list-style-type: none"> Skills required as a B.Tech graduate Attitudes, habits, approaches required and activities to be practiced during their B.Tech years, in order to achieve the set goals 	L, T	I	2	CO1	U		Rs	
2.4	Discuss the skills identified through role storming exercise by each one within their own group and improvise the list of skills	L, T	G	2	CO1	R		Re	
2.5	Exhibit/present the mind map prepared based on the role-storming exercise in the class	L, T	G	2	CO1	U		Re	
3	Prepare a presentation on instances of empathy the students have observed in their own life or in other's life	L, T	I	5	CO2	U		V	3
4.1	Each student connects and networks with a minimum of 3 professionals from industry/ public sector organizations/ other agencies/NGOs /academia (at least 1 through LinkedIn)	L, T	I	2	CO2	U		Rs	4
4.2	Interact with them to understand their workplace details including <ul style="list-style-type: none"> workplace skills required their work experience activities they have done to enhance their employability during their B.Tech years Suggestions on the different activities to be done during B.Tech years. Prepare a documentation of this	L, T	I	4	CO2	U		Rs	
4.3	Discuss the different workplace details & work readiness activities assimilated by each through the interactions within their group and compile the inputs collected by the individuals. Prepare the Minutes of the discussions	L, T	G	2	CO2	U		Rs	

4.4	Report preparation based on the discussions	L, T	G	3	CO4	R			
4.5	Perform a role-play based on the workplace dynamics assimilated through interactions and group discussions	L, T	G	4	CO3	U		Rs	
4.6	Students prepare an action plan for their undergraduate journey	L, T	I	2	CO1	R		Rs	
5.1	Select a real-life problem that requires a technical solution and list the study materials needed	L, T	G	2	CO3	A		Rs	
5.2	Listen to TED talks & video lectures from renowned Universities related to the problem and prepare a one-page summary (Each group member should select a different resource)	L, T	I	2	CO4	U			
5.3	Use any online tech forum to gather ideas for solving the problem chosen	L, T	G	2	CO5	A		Rs	
5.4	Arrive at a possible solution using six thinking hat exercise	L, T	G	5	CO3	An		V	3
5.5	Prepare a report based on the problem- solving experience	L, T	G	2	CO4	A			
6.1	LinkedIn profile creation	L, T	I	2	CO6	U			
6.2	Resume preparation	L, T	I	5	CO6	A			
6.3	Self-introduction video	L, T	I	3	CO6	A		V	2
7	Prepare a presentation on instances of demonstration of emotional intelligence	L, T	I	2	CO2	A		V	3
8	Prepare a short video presentation on diversity aspects observed in our society (3 to 5 minutes)	L, T	G	5	CO2 CO5	A		V	3
9	Take online Interview skills development sessions like robotic interviews; self-reflect and report	L, T	I	2	CO6	U		V	1
10	Take an online listening test self- reflect and report	L, T	I	2	CO6	U		Rs	1
11.1	Activities to improve English vocabulary of students	L, T	I/G	4	CO4	U		Re	
11.2	Activities to help students identify errors in English language usage	L, T	I/G	2	CO4	U		Re	
11.3	Activity to help students identify commonly misspelled words, commonly mispronounced words and confusing words	L, T	I/G	2	CO4	U		Re	
11.4	Write a self-reflection report on the improvement in English language communication through this course	L, T	I	2	CO4	A		V	4
11.5	Presentation by groups on the experience of using online collaboration tools in various group activities and time management experience as per the Gantt chart prepared	L, T	G	5	CO4 CO5	A		V	
12.1	Each group prepares video content for podcasts on innovative technological interventions/research work tried out in Kerala context by academicians/professionals/Go vt. agencies/research institutions/private agencies/NGOs/other agencies	L, T	G	10	CO2 CO4 CO5	A		V	1

12.2	Upload the video content to podcasting platforms or YouTube	T	G	2	CO5	U			
12.3	Add the link of the podcast in their LinkedIn profile	T	G	2	CO5	U			

ASSESSMENT PATTERN	
Assessment	Marks
Continuous Internal Assessment	100
Internal Examination	
Learning Activity	100
Attendance	
Course Project	
End Semester Examination	
Total	100

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

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

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

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

COURSE OUTCOMES					
Course Outcomes (CO): At the end of this course, learners will be able to:					
CO	CO Statement	CC Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	Demonstrate safety measures against electric shocks.	CC1	U		Rs
CO2	Identify the tools used for electrical wiring, electrical accessories, wires, cables, batteries and standard symbols	CC1 CC2	U	I	Rs
CO3	Illustrate the connection diagram using suitable accessories for wiring simple electrical circuits	CC1	A	M	V
CO4	Demonstrate the use of components and instruments to construct and test simple circuits	CC1 CC3	A	M	Rs
CO5	Perform PCB fabrication, soldering, and interconnections to build and test simple circuits.	CC4 CC5	A	P	V
CO6	Construct basic electronic circuits such as rectifiers and amplifiers, and verify their operation through simulation using EDA tools	CC1 CC3 CC5	An	Ar	V

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

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

6	3	2	2	1	3				1	1			
Correlation [3 – High, 2 -Medium, 1 – Low]													

TEACHING AND ASSESSMENT SCHEME													
Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme						
L	T	J	P	S			Practical						
C	CIA	ESE	Total										
0	0	0	2	0	1	30	50	50	100				

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

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

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

SUGGESTED LEARNING RESOURCES

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

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

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

PRACTICAL SYLLABUS.						
Topic	Objective	CO	Learning Domain			Hrs
			C	P	A	
a) Demonstrate the precautionary steps adopted in case of Electrical shocks.	Demonstrate essential safety procedures and first-aid steps to be followed in case of electric shock.	CO1	U	I	Rs	2
b) Identify different types of cables, wires, switches, fuses, fuse carriers, MCB, ELCB and MCCB, familiarize the ratings.	Identify and understand the types, ratings, and applications of various electrical cables, protection devices, and switches.	CO2	U	I	Rs	
Wiring of a simple light circuit for light/ fan point (PVC conduit wiring) and a 6A plug socket with individual control.	PVC conduit wiring for light/fan point and 6A plug socket – Perform PVC conduit wiring for a light/fan point and a 6 A plug socket with individual control.	CO3	A	M	V	2
Wiring of light/fan circuit using two-way switches. (Staircase wiring)	Wire a light/fan circuit controlled from two different locations using two-way switches.	CO3	A	M	V	2
Wiring of fluorescent lamp and a power plug (16 A) socket with a control switch.	Connect and control a fluorescent lamp and a 16 A power plug socket using a control switch.	CO3	A	M	V	2
Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and Energy meter.	Assemble and wire a single- phase power distribution system with protective and metering devices.	CO3	A	M	V	2
Familiarisation of step up and step-down transformers, (use low voltage transformers). Measurement and representation of voltage and waveform to scale in graph sheet with the help of CRO.	Identify and understand the operation of step-up and step-down transformers using low-voltage models. Measure and plot voltage waveforms to scale on a graph sheet using a Cathode Ray Oscilloscope.	CO2	U		Rs	2
Familiarisation of rheostats, measurement of potential across resistance elements and introducing the concept of relative potential using a DC circuit.	Use a rheostat to measure potential across resistance elements and illustrate relative potential in a DC circuit.	CO2	U		Rs	
a) Identify battery specifications using different types of batteries. (Lead acid, Li Ion, NiCd etc.) b) Familiarize different types of earthing (Pipe, Plate Earthing, Mat Schemes) and ground enhancing materials (GEM).	Identify the specifications and characteristics of different types of batteries such as Lead-acid, Li-ion, and NiCd.	CO2	U		Rs	2
Familiarization of Electronic Components	To identify active, passive, and electro mechanical components along with connectors, fuses, switches, relays, heat sinks, and displays, and to learn their specifications, circuit symbols, and approximate cost.	CO4	A	M	Rs	2
Drawing of Circuit Diagrams & Data Sheets	To draw electronic circuit diagrams using BIS/IEEE standard symbols and to interpret data sheets of commonly used discrete components and ICs.	CO4	A	P	V	2
Familiarization of Instruments & Tools	To operate basic electronic testing instruments such as Multimeter, Function Generator, DC Power Supply, CRO, and DSO, and to familiarize with commonly used tools including soldering iron, de-soldering pump, and crimping tools.	CO5	A	M	Rs	2

Testing of Components using multi-meter	To test the electrical characteristics and functionality of basic electronic components such as resistors, capacitors, diodes, BJTs, and JFETs using appropriate testing methods.	CO5	A	P	V	2
PCB Study and Fabrication	To study different types of printed circuit boards (single-sided, double-sided, and plated through hole) and to design and fabricate a simple single-sided PCB.	CO6	A	Ar	V	2
Soldering & Interconnection Practice	To study various interconnection methods such as breadboard, crimping, and soldering, and to practice soldering of connectors and assembling simple circuits on a PCB.	CO6	An	Ar	V	2
Assembly & Testing of Simple Circuit	To assemble and test an electronic circuit, for a fixed voltage power supply using transformer, rectifier diode, capacitor filter, and Zener/IC regulator and verify it's working.	CO6	An	Ar	V	2
Introduction to EDA tool	Simulation of basic electronic circuit using Multisim	CO6	An	P	V	2

ASSESSMENT PATTERN

Assessment Method	Marks
Continuous Internal Assessment	50
1. Continuous Lab Evaluation	45
2. Internal Examination	-
3. Attendance	5
4. Course Project	-
End Semester Examination	50
Total	100

Semester 2

APPROVAL

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

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

BOARD OF STUDIES (BOS)

Approved in the Board of Studies Meeting of the Computer Science and Engineering held on ____/ ____/ 20 .

Chairperson, BoS

Name: _____ Designation: _____

Signature: _____ Date: _____

ACADEMIC COUNCIL

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

PRINCIPAL

Recommended for implementation from the Academic year 2025-2026.

Name: Dr.Neelankantan P C

Signature: _____ Date: _____

SEMESTER 2

CURRICULUM

SLOT	COURSE CATEGORY	COURSE CODE	COURSE NAME	L	T	J	P	S	C
A	BST	B250904/MA200A	Mathematics for Information Science-2	3	1	0	0	2	3
B	BSE	B250904/CH910B	Chemistry for Information Science	3	0	0	2	3	4
C	EST	B250005/CS200C	Foundations of Computing	3	1	0	0	2	3
D	EST	B250903/CN210D	Programming in C	2	0	0	2	4	4
E	PCT	B250904/CN200E	Discrete Mathematics	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	1	0	1
U	ESL	B250904/CN230U	IT Workshop	0	0	0	2	0	1
G	Skill Enhancement Course: NASSCOM or equivalent								1
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work, C- Credit)									

COURSE DESCRIPTION							
Regulation	2025	L-T-J-P-S	3-1-0-0-2	Version	25/0	Credits	3
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							
Course Code		Course Name				Course Category	
B250904/MA200A		Mathematics for Information Science - 2				BST	
Pre-requisite							
The basic knowledge of matrices & vectors.							
COURSE OBJECTIVES							
1	To develop a fundamental understanding of linear systems of equations, matrix methods such as Gaussian elimination, rank, eigenvalues, eigenvectors, and diagonalization, and to apply them in solving algebraic problems.						
2	To acquire knowledge of vector spaces, subspaces, and spanning sets, and to apply basis, dimension, and transition matrices in understanding coordinate representations.						
3	To introduce inner product spaces and their properties, and to apply orthogonality, Gram-Schmidt process, and least squares methods to solve approximation and projection problems.						
4	To apply the theory of linear transformations to compute kernel, range, rank, and nullity, and to represent transformations using matrices in analytical and engineering context						
COMPETENCY STATEMENT (CC)							
CC 1	Demonstrate the ability to apply matrix methods to solve linear systems, compute eigenvalues and eigenvectors, and use diagonalization to simplify matrix computations.						
CC 2	Demonstrate the ability to apply concepts of vector spaces and inner product spaces to construct bases and orthonormal sets, solve least squares problems, and use matrices, rank, and nullity to represent linear transformations.						
COURSE OUTCOMES (CO)							
Course Outcomes (CO): At the end of this course, learners will be able to:							
CO	CO Statement			CC Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO 1	Solve linear systems of equations by applying the properties of matrices and vectors.			CC 1	A	-	Rs
CO 2	Explain the concept of vector space, basis and transition matrix.			CC 2	U	-	Rs
CO 3	Apply the concept of inner product spaces in the ortho normalization process.			CC 2	A	-	Rs
CO 4	Use the theory of matrix algebra to find the rank and nullity of linear transformations.			CC 2	A	-	Rs
Cognitive (Revised blooms Level): - R: Remember; U: Understand; A: Apply; An: Analyse; E: Evaluate; C: Create Psychomotor Domain (Dave's): - I-Limitation, M-Manipulation, P-Precision, Ar-Articulation, N-Naturalisation Affective (Krathwohl): - Re-Receiving, Rs-Responding, V-Valuing, O-Organization, Ch-Characterization							

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

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme		
L	T	J	P	S			Theory		
					CIA		ESE	Total	
3	1	0	0	2	3	90	40	60	100
L: Lecture (One unit is of one-hour duration), T: Tutorial (One unit is of one-hour duration), P: Practical (One unit is of one-hour duration), J: Project (One unit is of one-hour duration), S: Self-Learning & Team Work (One unit is of one-hour duration), CIA: Continuous Internal Assessment, ESE: End Semester Examination									

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Linear Algebra	Linear systems of equations, Solution by Gauss elimination, Row echelon form and rank of a matrix, Fundamental theorem for linear systems - homogeneous and non-homogeneous (without proof), Eigenvalues and Eigenvectors of matrices, Diagonalization of matrices. [Relevant topics from Text 1- sections 7.3, 7.4, 7.5, 8.1, 8.4]	10
2	Vector Spaces	Vector Spaces, Examples of vector space – R^n , $M_{m \times n}$ and P_2 only, Subspaces, Examples as subspaces of R^n , $M_{m \times n}$, Linear combinations of vectors in a vector space, Spanning sets, Linear dependence and independence, Basis for a vector space, The dimension of vector space, Coordinate representation in R^n , Change of basis in R^n : Transition Matrix (without proof). [Relevant topics from Text 2 - sections 4.2, 4.3, 4.4, 4.5, 4.7]	12
3	Inner Product Spaces	Vector length and unit vector, Dot product and angle between two vectors, The Cauchy- Schwarz Inequality, Inner product, Examples as R^n and $M_{2 \times 2}$, Properties of inner products, Definitions of length, distance and angle, Orthogonal projections in inner product spaces, Orthogonal and orthonormal sets, Orthogonal and orthonormal basis, Gram-Schmidt ortho normalization process (without proof), The least squares problem, Orthogonal Subspaces, Solving the least square problems. [Relevant topics from Text 2 - sections 5.1, 5.2, 5.3, 5.4]	10
4	Linear Transformations	Linear Transformations, Properties of linear transformations, Linear Transformation given by a matrix, Rotation in R^2 , Projection in R^3 , Kernel of a Linear Transformation and its basis, Range of a Linear Transformation and its basis, Rank and Nullity of a Linear Transformation, Sum of Rank and Nullity (without proof), Matrices for Linear Transformations. [Relevant topics from Text 2 - sections 6.1, 6.2, 6.3]	10

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	Elementary Linear Algebra	Ron Larson	Cengage Learning 8th edition, 2017

Reference			
Sl. No.	Title of Book	Author	Publication
1	Mathematics for Machine Learning	Marc Peter Deisenroth, A. Aldo Faisal & Cheng Soon Ong	Cambridge University Press 1st edition, 2020
2	Linear algebra and learning from data	Gilbert Strang Wellesley	Cambridge Press 1st edition, 2019
3	Elementary Linear Algebra	Stephen Andrilli & David Hecker	Academic Press Inc. 4th edition, 2010
4	Elementary Linear Algebra	Howard Anton, Chris Rorres	Wiley 11th edition, 2019

Web Resource	
1	nptel.ac.in/courses/111101115
2	nptel.ac.in/courses/111104137
3	nptel.ac.in/courses/111102012

DETAILED SYLLABUS (Self – learning if any to be marked)								
Module	Topic	Mode of Delivery	CO	Learning Domain			Hrs	
				C	P	A		
1	Matrix operations and properties	S	CO1	U				
	Linear systems of equations	L	CO1	U			1	
	Solution by Gauss elimination, Tutorial Problems	L T	CO1	A U			1 1	
	Row echelon form and rank of a matrix	L	CO1	A		Rs	1	
	Fundamental theorem for linear systems - homogeneous and non-homogeneous (without proof)	L	CO1	A			2	
	Eigenvalues and Eigenvectors of matrices	L	CO1	U			2	
	Tutorial Problems	T	CO1	U		Rs	1	
	Symmetric matrix, Skew-symmetric matrix, Orthogonal Matrix	S	CO1	U				
	Properties of eigenvalues of Symmetric matrix, Skew-symmetric matrix, Orthogonal Matrix	S	CO1	U				
	Diagonalization of matrices	L	CO1	A			2	
	Tutorial Problems	T	CO1	U		Rs	1	
	2	Vector Spaces	L	CO2	U			1
		Examples of vector space – R^n , $M_{m \times n}$ and P_2 only	L	CO2	U			1
Subspaces, Examples as subspaces of R^n , $M_{m \times n}$		L	CO2	U			1	
Tutorial Problems		T	CO2	U		Rs	1	
Linear combinations of vectors in a vector space		L	CO2	U			1	
Spanning sets		L	CO2	U			1	
Linear dependence and independence		L	CO2	U			1	
Tutorial Problems		T	CO2	U		Rs	1	
Basis for a vector space		L	CO2	U			2	
The dimension of vector space		L	CO2	U			1	
Coordinate representation in R^n		L	CO2	U			1	
Change of basis in R^n : Transition Matrix (without proof)		L	CO2	U			2	
Tutorial Problems		T	CO2	U		Rs	1	
3	Vector length and unit vector Dot product and angle between two vectors	S	CO3	U				
	The Cauchy- Schwarz Inequality	L	CO3	U			1	
	Inner product, Examples as R^n and $M_{2 \times 2}$	L	CO3	U			1	
	Properties of inner products	L	CO3	U			1	
	Tutorial Problems	T	CO3	U		Rs	1	
	Definitions of length, distance and angle	L	CO3	U			1	
	Orthogonal projections in inner product spaces	L	CO3	A			1	
	Orthogonal and orthonormal	L	CO3	U			1	

	sets						
	Orthogonal and orthonormal basis	L	CO3	A			1
	Gram-Schmidt ortho normalization process (without proof)	L	CO3	A			1
	Tutorial Problems	T	CO3	U		Rs	1
	The least squares problem	L	CO3	A			1
	Orthogonal Subspaces	L	CO3	U			1
	Tutorial Problems	T	CO3	U		Rs	1
4	Linear Transformations	L	CO4	U			1
	Properties of linear transformations	L	CO4	U			1
	Linear Transformation given by a matrix	L	CO4	U			1
	Tutorial Problems	T	CO4	U		Rs	1
	Rotation in R^2 , Projection in R^3	L	CO4	A			1
	Kernel of a Linear Transformation and its basis	L	CO4	U			1
	Range of a Linear Transformation and its basis	L	CO4	U			1
	Tutorial Problems	T	CO4	U		Rs	1
	Rank and Nullity of a Linear Transformation	L	CO4	U			1
	Sum of Rank and Nullity (without proof)	L	CO4	U			1
	Matrices for Linear Transformations	L	CO4	U			2
	Tutorial Problems	T	CO4	U		Rs	1

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

Module	Module Title	Distribution of Marks (RBL)						Total Marks
		R	U	A	An	E	C	
1	Linear Algebra	✓	✓	✓				15
2	Vector Spaces	✓	✓					15
3	Inner Product Spaces	✓	✓	✓				15
4	Linear Transformations	✓	✓	✓				15

ASSESSMENT PATTERN

Assessment	Marks
Continuous Internal Assessment	40
1. Internal Examination	20
2. Learning Activity	15
3. Regularity	5
4. Course Project	0
End Semester Examination	60
Total	100

Register No.:	.....	Name:	.....
SECOND SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, DECEMBER 2025 (2025 SCHEME)			
Course Code:	B250904/MA200A		
Course Name:	MATHEMATICS FOR INFORMATION SCIENCE-2		
Max. Marks	60	Duration:	2 hours 30 minutes
Common to CS, CY, AI, AD.			
PART A			
<i>(Answer all questions. Each question carries 3 marks)</i>			
No.	Question	CO	Marks
1	Choose the number q so that (if possible) the ranks of $A = \begin{bmatrix} 6 & 4 & 2 \\ -3 & -2 & -1 \\ 9 & 6 & q \end{bmatrix}$ are (a) 1, (b) 2, (c) 3.	CO1	(3)
2	If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ has eigen values 4 and 7, find the second row of A .	CO1	(3)
3	Union of two subspaces of a vector space V is not necessarily a subspace of V . Substantiate.	CO2	(3)
4	Check whether the set of vectors $\{(1,2,3), (0,1,2), (-2,0,1)\}$ are linearly independent or not.	CO2	(3)
5	For polynomials $p = a_0 + a_1x + a_2x^2$ and $q = b_0 + b_1x + b_2x^2$ in P^2 the inner product is defined by $\langle p, q \rangle = a_0b_0 + a_1b_1 + a_2b_2$. Let $p(x) = 1 - 2x^2$, $r(x) = x + 2x^2$ and $q(x) = 4 - 2x + x^2$, then: (a) Find the angle between q and r . (b) Verify Cauchy Schwarz inequality for p and q .	CO3	(3)
6	Find the vector v in the direction of $u = (1, 2, 2)$ with length 3.	CO3	(3)
7	Determine whether $T: R^2 \rightarrow R^3$ given by $T(x, y) = (x^2, xy, y^2)$ is a linear transformation or not.	CO4	(3)
8	Let $T: R^2 \rightarrow R^2$ be a linear transformation defined by $T(x, y) = (x - y, x + 3y)$. Find the standard matrix for T .	CO4	(3)
PART B			
<i>(Answer any one full question from each module, each question carries 9 marks)</i>			
No.	Question	CO	Marks
MODULE I			
9	a) There are three servers processing tasks in a distributed computing environment. Each server handles a different number of tasks, and you want to balance the workload based on current processing capacities. Let x, y and z be the number of tasks processed by servers 1, 2, and 3 respectively, such that $x + y + z = 6, x + 2y + 3z = 10, x + 2y + \alpha z = \beta$. Determine the values of α and β so that 1. the workload distribution is unique, 2. the workload distribution is not possible, 3. there are multiple possible workload distributions.	CO1	(5)
	b) Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 11 & -4 & -7 \\ 7 & -2 & -5 \\ 10 & -4 & -6 \end{bmatrix}$	CO1	(4)
OR			
10	a) Diagonalize the matrix $\begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$.	CO1	(5)
	b) In a computer simulation, the total processing time T depends linearly on three tasks: input loading (x), computation (y), and data transfer (z). For three different test runs, the observations are $x + y + z = 1, x + 2y + 4z = 2, x + 4y + 10z = 4$. Use the Gauss elimination method to determine the time contribution of each task.	CO1	(4)
MODULE II			
	a) Determine whether the given subsets of R^3 are vector subspaces;	CO2	(5)

11		1. the plane of vectors (x, y, z) that satisfy $y - x + z = 0$. 2. the plane of vectors whose third component is -1 .		
	b)	Let W be the subspace of all symmetric 2×2 matrices over \mathbb{R} . Find a basis and dimension of W .	CO2	(4)
OR				
12	a)	Given $B = \{(1, 3), (-2, -2)\}$ and $B' = \{(-12, 0), (-4, 4)\}$ are two bases of \mathbb{R}^2 and $[x]_{B'} = [-1 \ 3]$. 1. Find the transition matrix from B' to B . 2. Find the coordinate matrix $[x]_B$, given the coordinate matrix $[x]_{B'}$.	CO2	(5)
	b)	Check whether the set $W = \{(x, y): x \geq 0, y \text{ is a real number}\}$ along with the standard operations is a vector space or not?	CO2	(4)
MODULE III				
13	a)	Apply the Gram-Schmidt orthonormalization process to transform the basis $B = \{(1, 0, -1), (1, 0, 3), (0, 1, 2)\}$ for \mathbb{R}^3 into an orthonormal basis.	CO3	(6)
	b)	Find $(u + v) \cdot (2u - v)$ when $u \cdot u = 4$, $u \cdot v = -5$ and $v \cdot v = 10$.	CO3	(3)
OR				
14	a)	A hardware retailer wants to know the demand for a rechargeable power drill as a function of price. The ordered pairs $(25, 82)$, $(30, 75)$, $(35, 67)$ and $(40, 55)$ represent the price x (in dollars) and the corresponding monthly sales y . (a) Find the least squares regression line for the data. (b) Estimate the demand when the price is \$32.95.	CO3	(6)
	b)	Find the orthogonal projection of $u = (-3, -1)$ onto $v = (6, 3)$ in \mathbb{R}^2 .	CO3	(3)
MODULE IV				
15	a)	Find the Kernel of the linear transformation $T: \mathbb{R}^2 \rightarrow \mathbb{R}^2$ defined by $T(X) = AX$ where $A = \begin{bmatrix} 1 & -1 & -2 \\ -1 & 2 & 3 \end{bmatrix}$.	CO4	(5)
	b)	Let $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3$ be a linear transformation such that $T(1, 1, 1) = (2, 0, -1)$, $T(0, -1, 2) = (-3, 2, -1)$ and $T(1, 0, 1) = (1, 1, 0)$. Find $T(-2, 1, 0)$.	CO4	(4)
OR				
16	a)	Let $T: \mathbb{R}^3 \rightarrow \mathbb{R}^2$ be a linear transformation defined by $T(x, y, z) = (3x - 2z, 2y - z)$. Find the matrix for T relative to the bases $B = \{(1, 0, 1), (1, -1, 0), (0, 1, 1)\}$ and $C = \{(1, 1), (1, 0)\}$.	CO4	(5)
	b)	Find the rank and nullity of the linear transformation $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3$ defined by the matrix $A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$.	CO4	(4)

COURSE DESCRIPTION							
Regulation	2025	L-T-J-P-S	3-0-0-2-3	Version	25/0	Credits	4
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							
Course Code		Course Name				Course Category	
B250904/CH910B		CHEMISTRY FOR INFORMATION SCIENCE				BS	
Pre-requisite							
Concepts of chemistry introduced at the plus two levels especially Electrochemistry, Polymers, Structure of Molecules, Environmental Pollution and Volumetric Analysis.							
COURSE OBJECTIVES							
1	To equip students with a thorough understanding of electrochemical principles and their applications in energy storage and corrosion science, enabling them to address challenges in areas such as battery development, corrosion prevention, and pH measurement.						
2	To explore the synthesis, properties, and applications of nanomaterials, conducting polymers and advanced devices which are relevant in the field of electronics, quantum computing, and energy technology.						
3	To understand the principles and applications of spectroscopic and microscopic techniques for material characterization and analysis at the atomic and molecular levels.						
4	To develop an understanding of water chemistry, pollution control, e-waste management, and the role of chemistry in achieving sustainable development goals.						
COMPETENCY STATEMENT (CC)							
CC 1	Demonstrate the ability to apply fundamental principles of electrochemistry, materials science, and spectroscopy to design and develop materials and systems for various technological applications, including energy storage, corrosion protection, and advanced materials characterization.						

CC 2	Demonstrate the ability to apply the principles of water chemistry and waste management to analyze water quality parameters, and implement sustainable strategies for waste reduction and resource recovery.
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COURSE OUTCOME (CO)

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

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

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

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

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

TEACHING AND ASSESSMENT SCHEME

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

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

SYLLABUS (Major Topics)

Module	Title	Major Topics	Hrs
1	Electrochemistry and Corrosion	Electrochemical Cell-Electrode potential- Nernst equation - Reference electrodes –Electrochemical series - Glass Electrode & pH Measurement-Conductivity. Li-ion battery & H ₂ -O ₂ fuel cell. Corrosion –Electrochemical corrosion - Galvanic series – Corrosion control methods – Electroplating of copper - Electroless plating of copper.	9
2	Materials for Electronic Applications	Nanomaterials – Classification - Synthesis - Carbon Nanotubes, Fullerenes, Graphene & Carbon Quantum Dots – Polymers - Fire Retardant Polymers - Conducting Polymers - Polyaniline & Polypyrrole - Organic electronic materials and devices - Organic Light Emitting Diode (OLED) & Dye-Sensitized Solar Cells (DSSC). Materials used in Quantum computing Technology, Super capacitors, Spintronics.	9

3	Molecular spectroscopy and Analytical Techniques	Spectroscopy - Types of spectra- Molecular energy levels - Beer Lambert's law – Electronic pectroscopy - Instrumentation- Applications – Vibrational spectroscopy –Number of vibrational modes - Vibrational modes of CO ₂ and H ₂ O – Applications. Thermal Analysis: Dielectric Thermal Analysis (DETA) of Polymers- Electron Microscopic Techniques: SEM	9
4	Environmental Chemistry	Water characteristics – Hardness - Degree of hardness (Numericals) - Water softening methods – Water disinfection methods – Dissolved oxygen (DO), BOD and COD. Waste Management: Sewage water treatment- E Waste-Methods of disposal. Chemistry of climate change- Greenhouse Gases- Ozone Depletion-Sustainable Development- Sustainable Development Goals.	9
SELF-LEARNING / TEAM WORK			
Sl. No	Self-learning / Team Work Description		Hrs
1	Cells and Batteries– Primary and Secondary cells- Construction, working and applications of Lead acid battery, Nickel cadmium battery and Nickel metal hybrid battery.		12
2	Polymers- Classification-Types of Polymerisation-Copolymers. Sensors- physical, chemical and bio sensors- introduction and applications		12
3	Structure of Atom, Molecular Orbital Theory and Shape of Molecules. Application of spectroscopy in daily life		12
4	Estimation of Hardness – EDTA Method and Estimation of Dissolved Oxygen-Winkler's method. Health impacts of E- waste		12
5	Pre- lab work		60

SUGGESTED LEARNING RESOURCES

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

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

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

DETAILED SYLLABUS (Self-learning if any to be marked)								
Module	Title	Topic	Mode of Delivery	CO	Learning Domain			Hrs
					C	P	A	
1	Electrochemistry and Corrosion Science	Electrochemical Cell and Electrode potential	L	CO1	U		Rs	1
		Nernst equation for single electrode and cell Numerical problems)	L,P	CO1	A	M	V	1
		Nernst Equation- Numerical Problems	L	CO1	A		Rs	1
		Electrochemical series and applications	L,P	CO1	A	M	V	1
		Reference electrodes – SHE & Calomel electrode – Construction and Working	L	CO1	U		Rs	1
		Glass Electrode & pH Measurement Conductivity- Measurement using Digital conductivity meter.	L,P	CO1	A	M	V	1
		Li-ion battery & H ₂ -O ₂ fuel cell (acid electrolyte only) construction and working.	L	CO1	U		Rs	1
		Corrosion Electrochemical corrosion mechanism (acidic & alkaline medium)	L	CO1	U		Rs	1
		Galvanic series - Corrosion control methods - Cathodic Protection - Sacrificial anodic protection and impressed current cathodic protection. Electroplating of copper - Electroless plating of copper.	L	CO1	U		Rs	1
		Construction, working and applications of Lead acid battery, Nickel cadmium battery and Nickel metal hybrid battery.	S	CO1	U		Rs	
2	Materials for Electronic Applications	Nanomaterials Classification based on Dimension & Materials ⁷	L	CO2	U		Rs	1
		Synthesis – Sol gel & Chemical Reduction - Applications of nano materials	L	CO2	U		Rs	1
		Carbon Nanotubes, Fullerenes- structure, properties & application.	L	CO2	U		Rs	1
		Graphene & Carbon Quantum Dots – structure, properties & application.	L	CO2	U		Rs	1
		Polymers Fire Retardant Polymers- Halogenated & Non-halogenated polymers (Examples only) Conducting Polymers-Classification	L	CO2	U		Rs	1
		Polyaniline- synthesis, properties and applications. Polypyrrole-synthesis, properties and applications	L,P	CO2	A	M	V	1
		Organic electronic materials and devices Construction, working and applications of Organic Light Emitting Diode (OLED)	L	CO2	U		Rs	1

		Construction, working and applications of Dye-Sensitized Solar Cells (DSSC)	L	CO2	U		Rs	1
		Materials used in Quantum computing Technology. Super capacitors, Spintronics	L	CO2	U		Rs	1
		Polymers- Classification-Types of Polymerisation-Copolymers. Sensors- Physical, chemical and bio sensors- introduction and applications	S	CO2	U		Rs	
3	Molecular Spectroscopy and Analytical Techniques	Spectroscopy Types of spectra and Molecular Energy Levels	L	CO3	U		Rs	1
		Beer Lambert's law – Numerical problems	L,P	CO3	A	M	V	1
		Beer-Lambert's law-Numerical Problems	L	CO3	A		Rs	1
		Electronic Spectroscopy – Principle, Types of electronic transitions	L	CO3	U		Rs	1
		Role of conjugation in absorption maxima. Instrumentation-applications	L,P	CO3	A	M	V	1
		Vibrational spectroscopy – Principle Number of vibrational modes	L	CO3	U		Rs	1
		Vibrational modes of CO2 and H2O – Applications	L,P	CO3	A	M	V	1
		Thermal Analysis Dielectric Thermal analysis (DETA) of Polymers - Working and Application.	L	CO3	U		Rs	1
		Electron Microscopic Techniques SEM-principle, instrumentation and Applications.	L	CO3	U		Rs	1
		Structure of Atom, Molecular Orbital Theory and Shape of Molecules. Application of spectroscopy in daily life	S	CO3	U		Rs	
4	Environmental Chemistry	Water Characteristics Hardness - Types of hardness-Temporary and Permanent	L	CO4	U		Rs	1
		Disadvantages of hard water. Degree of hardness	L,P	CO4	A	M	V	1
		Degree of hardness (Numericals)	L	CO4	A		Rs	1
		Water softening Methods-Ion exchange process- Principle, procedure and advantages. Reverse osmosis – principle, process and advantages	L	CO4	U		Rs	1
		Water disinfection methods – Chlorination-Break point chlorination, ozone and UV irradiation.	L	CO4	U		Rs	1
		Dissolved oxygen (DO), BOD and COD- Definition & Significance.	L,P	CO4	A	M	V	1

	Waste Management Sewage water treatment- Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process.	L	CO4	U		Rs	1
	E Waste, Methods of disposal – recycle, recovery and reuse.	L	CO4	U		Rs	1
	Chemistry of climate change- Greenhouse Gases- Ozone Depletion. Sustainable Development- an introduction to Sustainable Development Goals.	L	CO4	U		Rs	1
	Estimation of Hardness – EDTA Method and Estimation of Dissolved Oxygen-Winkler's method Health impacts of E- waste	S	CO4	U		Rs	

PRACTICAL SYLLABUS						
Topic	Objective	CO	Learning Domain			Hrs
			C	P	A	
Calibration of pH meter and determination of pH of a solution.	To calibrate a digital pH meter using standard buffer solutions and to accurately determine the pH of the given unknown solutions.	CO1	A	M	V	2
Determination of cell constant and conductance of solutions.	To determine the cell constant of a conductivity cell using a standard KCl solution and to measure the conductance of given solutions using a digital conductivity meter.	CO1	A	M	V	2
Verification of Nernst equation for Electro chemical cell.	To verify the Nernst equation by measuring the electrode potential of a given electrochemical cell at different ion concentrations and comparing the experimental values with theoretical values	CO1	A	M	V	2
Estimation of iron in iron ore.	To estimate the percentage of iron present in a given iron ore sample using a redox titration method with potassium permanganate as the titrant.	CO1	A	M	V	2
Synthesis of polymers						
(a)Urea-formaldehyde resin	To synthesis the polymers such as urea-formaldehyde resin and phenol-formaldehyde resin and hence to note their yield.	CO2	A	M	V	2
(b)Phenol-formaldehyde resin.						
Determination of wavelength of absorption maximum and colorimetric estimation of Fe ³⁺ in solution.	To determine the wavelength of maximum absorption of Fe ³⁺ using a colorimeter and to estimate the concentration of Fe ³⁺ in a given solution based on Beer-Lambert's law.	CO3	A	M	V	2
Determination of molar absorptivity of a compound (KMnO ₄ or any water-soluble food colorant).	To determine the molar absorptivity (ϵ) of a coloured compound such as potassium permanganate by measuring absorbance at its λ_{max} and applying Beer-Lambert's law.	CO3	A	M	V	2
Analysis of IR spectra.	To analyse the IR spectrum of given compounds based on characteristic absorption bands and to	CO3	A	M	V	2

	characterize the unknown compounds					
Estimation of dissolved oxygen by Winkler's method.	To estimate the amount of dissolved oxygen (DO) present in a water sample using Winkler's iodometric method, which is essential for assessing water quality and aquatic life sustainability.	CO4	A	M	V	2
Estimation of total hardness of water-EDTA method.	To determine the total hardness of a given water sample by complexometric titration using ethylenediaminetetraacetic acid (EDTA) as the titrant and Eriochrome Black T as the indicator.	CO4	A	M	V	2

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

Module	Module Title	Distribution of Marks (RBL)						Total Marks
		R	U	A	An	E	C	
1	Electrochemistry and Corrosion Science	√	√	√				15
2	Materials for Electronic Applications	√	√	√				15
3	Molecular Spectroscopy and Analytical Techniques	√	√	√				15
4	Environmental Chemistry	√	√	√				15

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

ASSESSMENT PATTERN

Assessment		Weightage
Continuous Internal Assessment		40
1	Internal Examination	20
2	Continuous Lab Evaluation	10
3	Learning Activity	
4	Regularity	5
5	Course Project	
6	Internal Examination (Lab)	5
End Semester Examination _ Theory		60
Total		100

Total Pages:

Register No.:	Name:
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SECOND SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, DECEMBER 2025 (2025 SCHEME)

Course Code:	B250904/CH910B
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Course Name:	Chemistry for Information Science
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Max. Marks	60	Duration:	2 hours 30 minutes
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Common to AI, AD and CY

PART A

(Answer all questions. Each question carries 3 marks)

No.	Question	CO	Marks
1	Design and sketch the electrochemical cell for the following cell reaction. $2 \text{Al (s)} + 3 \text{Fe}^{2+} \text{(aq)} \rightarrow 2\text{Al}^{3+} \text{(aq)} + 3 \text{Fe (s)}$ Formulate the Nernst equation at 25°C and write the half-cell reactions.	CO1	(3)
2	Write any three differences between electrochemical series and galvanic series.	CO1	(3)

3	Aluminium oxide (Al_2O_3) nanoparticles can be synthesized by the sol-gel method. Explain the sol-gel process for the preparation of metal oxide nanoparticles.	CO2	(3)
4	Graphene is widely used in supercapacitors. Which properties of graphene make it suitable for this application?	CO2	(3)
5	IR spectroscopy can be used to differentiate intra molecular and inter molecular hydrogen bonds. Explain with an example.	CO3	(3)
6	The absorbance of a 0.02M dye solution in ethanol is 0.48 when measured in a 1 cm cell at 5200\AA . If the path length is tripled and the concentration is reduced to one-third, calculate the new absorbance value.	CO3	(3)
7	Chemical methods such as chlorination and ozonation make drinking water safe and contribute to Sustainable Development Goal 6. Explain how?	CO4	(3)
8	A water sample contains 18.2mg/L $Ca(HCO_3)_2$, 9.3mg/L $Mg(HCO_3)_2$, 10.5mg/L $MgCl_2$ and 15.6 mg/L $CaSO_4$. Calculate the temporary and permanent hardness of water and what will happen if 10.5mg/L $NaHCO_3$ is added?	CO4	(3)

PART B					
<i>(Answer any one full question from each module, each question carries 9 marks)</i>					
No.	Question			CO	Marks
MODULE I					
9	a)	With the help of a neat labelled diagram, explain the construction and working principle of a glass electrode pH measurement system. Justify why glass electrodes are preferred over hydrogen electrodes for pH measurement.	CO1	(5)	
	b)	Emf of an electrochemical cell is 1.6178V at 20°C and 1.6214V at 30°C . If the cell reaction involves 2 electrons, find the standard emf of the cell and the reaction quotient.	CO1	(4)	
OR					
10	a)	With the help of electrochemical equations, show that rusting of iron is more severe in oxygen rich acidic medium than alkaline medium.	CO1	(5)	
	b)	Calculate the conductivity of a given sample of water at 298K which shows a conductance of $620\mu\text{S}$ in the given cell at 298K. A standard solution of 0.1M KCl shows a conductance of 12.34mS in that cell. (Given that conductivity of 0.1 M KCl at 298K is 0.01288Scm^{-1}).	CO1	(4)	
MODULE II					
11	a)	Dye-Sensitized Solar Cells (DSSC) are considered a sustainable energy device. With the help of a neat labelled diagram explain the working of DSSC.	CO2	(5)	
	b)	Suggest how fullerenes can be used in targeted drug delivery systems. Also discuss any three properties of fullerene.	CO2	(4)	
OR					
12	a)	Describe one chemical synthesis method of Polyaniline and Polypyrrole. How does the structure influence their conductivity? List any two applications of Polyaniline and Polypyrrole.	CO2	(5)	
	b)	Classify nanomaterials based on dimension and type of materials.	CO2	(4)	
MODULE III					
13	a)	Draw the molecular orbital energy diagram of i) 1, 3-butadiene, (ii) 1,3,5-hexatriene and iii) benzene to explain their UV-Vis absorption spectrum.	CO3	(5)	
	b)	Use vibrational spectroscopy to distinguish between Carbon dioxide and Water molecule. Sketch their vibrational modes and predict which of them are IR active and why?	CO3	(4)	
OR					
14	a)	Propose how Scanning Electron Microscopy (SEM) can be used in material characterization for nanotechnology with the help of a suitable diagram. Discuss any two applications of SEM.	CO3	(5)	
	b)	State Beer-Lambert's law and deduce the integrated form. Discuss the plot of absorbance versus concentration and what does the slope of the graph represents?	CO3	(4)	
MODULE IV					

15	a)	The ion exchange process is widely used in boiler feed water treatment. Explain with the help of a diagram how this method prevents scale formation in boilers and improves the efficiency of power plants. How the exhausted resins are regenerated?	CO4	(5)
	b)	Break point chlorination is widely applied in municipal water treatment plants. Explain how this method ensures safe drinking water, and compare its effectiveness with UV irradiation in terms of residual disinfection.	CO4	(4)
OR				
16	a)	A rapidly growing city faces frequent water pollution issues due to the discharge of untreated sewage into nearby rivers. As an engineer, suggest how you would design a sewage treatment system incorporating primary, secondary, and tertiary stages.	CO4	(5)
	b)	An electronic manufacturing company generates a large amount of obsolete circuit boards and plastic casings. If you are assigned to design an effective disposal strategy, which methods of e-waste disposal would you apply for each type of waste, and why?	CO4	(4)

COURSE DESCRIPTION							
Regulation	2025	L-T-J-P-S	3-1-0-0-2	Version	25/0	Credits	3
Course Code	Course Name					Course Category	
B250005/CS200C	FOUNDATIONS OF COMPUTING					EST	
Pre-requisite							
Course Code	Course Name						
Nil	Nil						
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Teamwork)							
COURSE OBJECTIVES							
1	The course sets the context for the rest of the computer science and engineering programs by introducing the student to the notion of computation and the allied concepts of information and complexity both from a theoretical and practical perspective.						
COMPETENCY & OUTCOMES							
Competency Statements	CC 1	Demonstrate an understanding of computation both from a theoretical and practical perspective.					
	CC 2	Demonstrate an understanding of two major aspects of computing namely information theory and complexity.					
Course Outcomes (CO): At the end of this course, learners will be able to:							
CO	CO Statement	CC Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)		
CO 1	Explain the origins of computation from the development of formal logic and the foundations of mathematics.	CC 1	U	M	Rs		
CO 2	Demonstrate an understanding of major computational models such as the Turing Machine and Lambda Calculus and the significance of the Church- Turing Thesis.	CC 1	U	I	Rs		
CO 3	Explain the Von Neumann architecture and the historical significance of the stored- program concept.	CC 1	U	-	Rs		
CO 4	Understand the x86 microprocessor architecture and demonstrate the ability to write and execute simple programs.	CC 1	U	M	Rs		
CO 5	Understand the concept of entropy and its role in information theory.	CC 2	U	-	Rs		
CO 6	Understand the applications of entropy in efficient representation of data in memory and secure communication.	CC 2	U	-	Rs		
CO 7	Understand the application of complexity measures to classify computational problems.	CC 2	U	-	Rs		
CO 8	Demonstrate the understanding of complex systems and the ability to identify them.	CC 2	U	I	Rs		
Cognitive (Revised blooms Level): - R: Remember; U: Understand; A: Apply; An: Analyse; E: Evaluate; C: Create Psychomotor Domain (Dave's): - I-Imitation, M-Manipulation, P-Precision, Ar-Articulation, N-Naturalisation Affective (Krathwohl): - Re-Receiving, Rs-Responding, V-Valuing, O-Organization, Ch-Characterization							

COURSE ARTICULATION MATRIX

CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes												
	WK									PO											PSO	
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2
1	1		1					1		1				1	3					3	2	
2	3	1	2							3				1	2		1			3	2	
3	2		2							2				1				1			2	1
4			3	1	1					2				3							2	1
5	3	2	3							3					1		1			1	2	
6	3	2	3	1	1		1			3		1			1					1	2	
7	3	1	1	1	1					3			1		2		1			2	2	
8	3	2	1	2	1	1	1		1	3			1	1	3	3	1	1	1	3	2	

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

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

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

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Contact Hours
1	History of Computation	Origin of Algorithms (Euclid’s GCD algorithm), The Beginnings of Formal Logic, Cantor’s Diagonalization, Birth of Types and Von Neumann’s Classes, Hilbert’s Final Demands and Entscheidungsproblem, Gödel’s Incompleteness Theorem Reference 1 (GCD Algorithm), 2 (Diagonalization argument, Entscheidungsproblem), 3, 4 (Godel’s theorem) Web Resource 1 (Syllogism), 3 (Origins of algorithms)	10
2	Abstract Models of Computation and x86 Microprocessor	Models of Computing- Turning Machine, Lambda Calculus, Church-Turing Thesis; Von Neumann Architecture- The Stored-Program Concept; x86 Microprocessor- Architecture, Basic instruction set, Simple programs (arithmetic, logical etc.); Evolution of Microprocessor- x85 to ARM. Reference 1 (Turning machine), 5 (Lambda calculus), 14 (x86)	10
3	Information Theory for Computation	Computing systems as complex information processing systems; Part I: Information Theory Shannon’s Entropy- Definition, Huffman’s Encoding, The combinatorial approach, Relation to information and randomness; Entropy in Efficient Storage- Worst-case Entropy, Storage scheme, Classification of Representation; Entropy in Communication System- Wiretap channel model, Definition of Channel capacity, Definition of Secrecy capacity, BSC (Binary symmetric channel), Simple Wiretap coding scheme (simple Arduino based experiment to understand channel capacity). Reference 6 ,7 (Entropy), 8 (Huffman coding),9 (Secrecy capacity), 10 (Worst-case entropy) Web Resource 2 (Combinatorial approach to entropy)	10

4	Complexity and Computation	<p>Part II Complex Systems: Origins of Complex systems, Computational Irreducibility- Cellular Automata, Simulation of Convey's Game of life (simulation using a C program); Complex Systems - Definition, properties, organisation, and examples of complex systems; Complexity of Problems- Time and Space Complexity (P and NP); Kolmogorov Complexity;</p> <p>Reference 11(Computational irreducibility), 12(Complex systems), 2 (Complexity of problems), 13 (Kolmogorov Complexity)</p>	10
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SELF-LEARNING / TEAM WORK		
Sl. No	Self-learning / Team Work Description	Hrs
1	Euclid's axiomatic method (Self-study)	2
2	Russell's Paradox (Self-study)	2
3	Introduction to Types and Von Neumann's Classes (Self-study)	3
4	Huffman's Encoding (Self-study)	3
5	Classification of Representations: Optimum Representation, Succinct Representation, Compact Representation (Self-study)	5
6	Read the book - Godel, Escher and Bach: An Eternal Golden Braid by Hofstadter, Douglas R	30

SUGGESTED LEARNING RESOURCES

References			
Sl. No.	Title of Book	Author	Publication
1	The Art of Computer Programming, Volume 1: Fundamental Algorithms	Knuth, D E	Addison-Wesley
2	Introduction to the Theory of Computation	Sipser, Michael	Cengage Learning (2013), 3 ed.
3	Godel's Theorem Simplified	Gensler, Harry J	University Press of America, 1984
4	Godel's Theorem A Very Short Introduction	Moore, A.W	Oxford University Press, 2022
5	Lambda – Calculus and Combinators – An Introduction.	Hindley, J. Roger and Seldin, jonathan P.	Cambridge University Press, 2008
6	Elements of Information Theory	Cover, Thomas M and Thomas, Joy A	Wiley-Interscience, 2006, 3rd ed.
7	Mathematical Foundations of Information Theory	Khinchin, A.I	Dover Publications Inc, 1957
8	Lossless Compression Handbook (Chapter 4)	Sayood, Khalid (editor)	Academic Press, 2003
9	Physical-Layer Security From Information Theory to Security Engineering	Bloch, Matthieu and Barros, Joao	Cambridge University Press, 2011
10	Compact Data Structures	Navarro, Gonzalo	Cambridge University Press, 2016
11	A New Kind of Science	Wolfram, Steven	Wolfram Media
12	The Architecture of Complexity	Simon, H. A	Facets of Systems Science. International Federation for Systems Research International Series on Systems Science and Engineering, vol 7. Springer, Boston, MA.
13	An Introduction to Kolmogorov Complexity and Its Applications	Li, Ming and Vitanyi, Paul	Springer, 1993
14	A Textbook of Microprocessors and Microcontrollers:	Kaler, R.S	I.K. International Publishing House, 2011

Web Resource	
1	https://www.logicinaction.org/
2	Paper by Kolmogorov, A.N
3	Algorithms of Ancient India

DETAILED SYLLABUS (Self-learning if any to be marked)									
Module	Major Topic	Sub Topic	Mode of Delivery	Relevant COs	Learning Domain Level			Hrs	
					C	P	A		
1	Origin of Algorithms	Algorithmic thinking in early civilizations, Euclid's Algorithm	L	CO1	U	-	Rs	1	
		Concept of correctness proof							
		Need for logic in computation							
	The Beginnings of Formal Logic	Aristotle's Syllogism	L	CO1	U	M	Rs	2	
		Boole's Laws of Thought and symbolic reasoning							
		Frege and the birth of predicate logic							
	Cantor's Diagonalization	Cantor's diagonalization method - Countable and uncountable sets	L	CO1	U	-	Rs	2	
									The foundational crisis in mathematics
									Hilbert's Program - axiomatic foundation for mathematics
									Euclid's axiomatic method (Self-study)
Birth of Types and Von Neumann's Classes	Introduction to Types and Von Neumann's Classes (Self-study)	L	CO 1	U	-	Rs	1		
								Russell's Paradox (Self-study)	
Hilbert's Final Demands and Entscheidungs problem	Concepts of completeness, consistency, and decidability	L	CO 1	U	-	Rs	2		
								The Entscheidungs problem	
								Contributions of Alan Turing - Turing Machine and Halting Problem	
Gödel's Incompleteness Theorem	Statement, proof idea, and implications on formal systems	L	CO 1	U	-	Rs	2		
								Contributions of Alonzo Church - Lambda Calculus	
2	Models of Computing	Definition and need for computational models	L	CO 2	U	-	Rs	2	
		Structure and operation of Turing Machines, Example problems using TM							
	Lambda Calculus	Lambda Calculus Definition	L	CO 2	U	I	Rs	2	
		Free and bound variables, Substitutions							
		Arithmetic - addition, multiplication							
		Conditionals - logical operations							
Von Neumann	Recursion	L	CO 3	U	-	Rs	1		
	Church-Turing Thesis - Relationship between Turing Machines and Lambda Calculus								

	Architecture	Architecture: The Stored-Program Concept						
		Von Neumann's "First draft of a report on EDVAC" and Harvard Architecture						
	x86 microprocessor	Basic Architecture	L	CO 4	U	M	Rs	5
		Basic Instructions						
		Example Programs – Arithmetic and Logical Operations						
	Evolution of Microprocessor (Self-study)	Evolution of Microprocessor- x85 to ARM	L	CO 4	U	-	Rs	
		Microcontroller difference						
3	Computing Systems as Complex Information Processing Systems	Microprocessor as a complex information processing system	L	C05	U	-	Rs	1
		Computer networks as complex information processing system						
	Information Theory for Computation	Introduction to Information Theory	L	C05	U	-	Rs	2
		Definition of Shannon's Entropy						
		Huffman's Encoding (Self-study)						
		The Combinatorial Approach Relation to information & Randomness						
	Entropy in Efficient Storage	Entropy in Efficient Storage	L	C06	U	-	Rs	3
		Worst-case Entropy						
		Example: Permutation[n] Storage Schemes						
		Classification of Representations: Optimum Representation, Succinct Representation, Compact Representation (Self-study)						
	Entropy in Communication System	Entropy in Communication System	L	C06	U	-	Rs	4
		Wiretap Channel Model						
		Definition of Channel Capacity						
		Definition of Secrecy Capacity						
		Binary Symmetric Channel (BSC)						
		Examples of Capacity Calculation						
		BSC Wiretap Example						
		Simple Wiretap Coding Scheme						
		Example of Wiretap Coding Scheme						
4	Introduction to Complex Systems	Introduction to Complex Systems	L	C08	U	-	Rs	2
		Origins of Complex Systems						
		Computational Irreducibility						
	Cellular Automata	Cellular Automata	L	C08	U	I	Rs	2
		Simulation of Conway's Game of Life						
	Complex Systems	Complex Systems	L	C08	U	-	Rs	3
		Properties of Complex Systems						
		Organization of Complex Systems						

		Examples of Complex Systems - In nature and engineering						
	Complexity of Problems	Time (P and NP) and Space Complexity	L	CO7	U	-	Rs	2
		List of problems in P and NP						
	Kolmogorov Complexity	Definition	L	CO7	U	-	Rs	1

PRACTICAL SYLLABUS							
Module	Topic	Objective	CO	Learning Domain Level			Hrs
				C	P	A	
1	Write simple Prolog statements to understand syllogism/formal logic	Be able to understand practical applications of formal logic.	CO1	U	M	Rs	1
2	Write simple Lambda expressions in Emacs	Be familiar with the basics of writing functional programs.	CO2	U	M	Rs	1
3	Write simple X86 assembly programs on the kit	Understand how low-level computer programming works.	CO4	U	M	Rs	1
4	Setup a simple Arduino based experiment to understand channel capacity	Understand the practical implications of the measure of channel capacity.	CO6	U	M	Rs	1
5	Perform cellular automata simulation using appropriate tools (Python programs, Mathematica programs etc.)	Be able to simulate cellular automata and be able to detect complexity.	CO8	U	M	Rs	1

TABLE OF SPECIFICATIONS (ToS) (ESE Question Paper Design)									
Module	Module Title	Teaching Hours	Distribution of Marks (RBL)						Total Marks
			R	U	A	An	E	C	
1	History of Computation	10	5	5					10
2	Abstract Models of Computation and x86 Microprocessor	10	5	5					10
3	Information Theory for Computation	10	5	5					10
4	Complexity and Computation	10	5	5					10

ASSESSMENT PATTERN		
Assessment		Weightage
Continuous Internal Assessment		60
1	Learning Activity	15
2	Internal Examinations	20
3	Regularity	5
4	Experiential Learning Activity a) Continuous Lab Evaluation (x86 experiments) b) Course Project (Group Project (Module IV) and any experiments from Practical Syllabus except Experiment 3)	20
End Semester Examination		40
Total		100

Register No.:	Name:	Total Pages:
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(AN AUTONOMOUS COLLEGE AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY,
THIRUVANATHAPURAM)

SECOND SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, JULY 2026 (2025 SCHEME)				
Course Code:		B250005/CS200C		
Course Name:		Foundations of Computing		
Max. Marks		60	Duration: 2:30 hours	
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				
(Answer any one full question from each module, each question carries 10 marks)				
No.		Questions	CO	Marks
MODULE I				
1	a)	Consider two sets A and B with n and m elements each. Write an algorithm to find the union of A and B. Prove that the algorithm is correct. What are the logical assumptions you have made in obtaining the correctness proof?	CO 1	(6)
	b)	Explain the Entscheidungs problem. How did Alan Turing conclude that no general algorithm can solve it?	CO 1	(6)
	c)	What is Russell's paradox? How was the paradox resolved using classes and types?	CO 1	(3)
OR				
2	a)	Write down the GCD algorithm and its correctness proof.	CO 1	(6)
	b)	Describe Cantor's diagonalization method. How was it used to show that a set of rationals are countable?	CO 1	(6)
	c)	Define completeness, consistency, and decidability properties of an axiomatic system.	CO 1	(3)
MODULE II				
3	a)	Explain von Neumann architecture using a block diagram. Compare how programs were input into a computer before and after the von Neumann architecture was introduced.	CO 3	(3)
	b)	Explain Entscheidungsproblem. How did Turing conclude that it cannot have a general algorithm to solve it?	CO 2	(6)
	c)	A graph $G=(V,E)$ where V is the set of vertices and E is the set of edges such that $(u,v) \in E$ where $u,v \in V$. Let $D(v) = \{(u,v) | (u,v) \in E, u \text{ and } v \in V\}$. $|D(v)|$ is the degree of the vertex v. In order to make the computation of degree of a vertex easy it is stored in memory 17B3:0300 for all $|V|$ vertices. Implement a lookup table so that given a vertex we can fetch its degree.	CO 4	(6)
OR				
4	a)	Write a program to multiply and divide a number by 2 using bit shift operations.	CO 4	(2)
	b)	Fluid Control Ltd got a project to automatically switch on and off a water motor based on the water level in the tank. The client requires the product to be as compact as possible. As the chief architect of the company will you choose a microprocessor or a microcontroller to implement the project? Why?	CO 4	(6)
	c)	Design a Turing machine to add two natural numbers. Pick the input representation appropriately.	CO 2	(6)
	d)	Compare von Neumann architecture with Harvard architecture.	CO 3	(1)
MODULE III				
5	a)	Derive the formula for channel capacity C for Binary Symmetric Channel from Shannon's entropy.	CO 5	(6)
	b)	Define secrecy capacity using a wiretap channel setup. Construct two wiretap channel setup that demonstrates high secrecy capacity and a low secrecy capacity by selecting the crossover probabilities carefully and calculating the secrecy capacity for each.	CO 6	(6)
	c)	What is the worst-case entropy of a set of bit strings of length n that represent even numbers? Suggest a representation for storing any element from the set of bits given above.	CO 6	(3)
OR				
6	a)	Explain how mutual information is used to define channel capacity. 1. Show that when the input is not random the channel capacity is reduced.	CO 6	(6)

		2. Show that when the input is random and crossover probability is 0.5 channel capacity is reduced. 3. Intuitively explain the difference between the reduction in channel capacity in the above two cases.														
	b)	Consider the wiretap channel setup as follows. Arya wants to send information to Eldose over a channel with crossover probability 0.1. Mr X wants to eavesdrop but has a channel that has a crossover probability of 0.25. In order to evade eavesdropping by Mr X, Arya decides to encode her messages using randomness as follows. For bit 0 she uses one of the following codes 000,011,101,110 and for bit 1 she uses one of the following codes 111,100,010,001 at random. Now she wants to check if this encoding is sufficient that Eldose can decode her message whereas Mr X cannot. To help her you have to answer the following questions assuming a BSC channel: <ol style="list-style-type: none"> 1. Compute the mutual information for the channel to Eldose for a single bit. 2. Compute the mutual information for the channel to Mr X for a single bit. 3. Compute the mutual information for 3-bit codeword in each case above. 4. Calculate the secrecy rate from mutual information computed in parts a and b above. 5. Is her encoding scheme good enough from the secrecy rate obtained in part d? 	CO 6	(6)												
	c)	Arya claims that the dice that she made when rolled has the following probability distribution. <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <tr> <td style="padding: 5px;">1</td> <td style="padding: 5px;">2</td> <td style="padding: 5px;">3</td> <td style="padding: 5px;">4</td> <td style="padding: 5px;">5</td> <td style="padding: 5px;">6</td> </tr> <tr> <td style="padding: 5px;">0.2</td> <td style="padding: 5px;">0.3</td> <td style="padding: 5px;">0.1</td> <td style="padding: 5px;">0.1</td> <td style="padding: 5px;">0.1</td> <td style="padding: 5px;">0.3</td> </tr> </table> <p>However, her friend Eldose challenges Arya by saying that this probability distribution is faulty.</p> <ol style="list-style-type: none"> 1. What is the mistake in the probability distribution? 2. Is this dice good for playing a game (example, snake and ladder)? Justify. 3. Change the distribution such that the uncertainty of obtaining any number from 1 to 6 is maximized. 	1	2	3	4	5	6	0.2	0.3	0.1	0.1	0.1	0.3	CO 5	(3)
1	2	3	4	5	6											
0.2	0.3	0.1	0.1	0.1	0.3											
7	a)	Rule 90 is given by $s_i(t+1) = s_i(t) \oplus s_{i+1}(t)$ where \oplus is the XOR function described below: <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <tr> <td style="padding: 5px;">$1 \oplus 1$</td> <td style="padding: 5px;">0</td> </tr> <tr> <td style="padding: 5px;">$1 \oplus 0$</td> <td style="padding: 5px;">1</td> </tr> <tr> <td style="padding: 5px;">$0 \oplus 1$</td> <td style="padding: 5px;">1</td> </tr> <tr> <td style="padding: 5px;">$0 \oplus 0$</td> <td style="padding: 5px;">0</td> </tr> </table> <p>Consider the binary string 0000001000000 at time $t=0$. Give the evolution of the string for next 3 generations when Rule 90 is applied. Assume periodic boundary conditions. Rule 204 is given by $s_i(t+1) = s_i(t)$. Is this rule computationally reducible? Show the evolution of the binary string 0000001000000 for 2 generations.</p>	$1 \oplus 1$	0	$1 \oplus 0$	1	$0 \oplus 1$	1	$0 \oplus 0$	0	CO 8	(6)				
$1 \oplus 1$	0															
$1 \oplus 0$	1															
$0 \oplus 1$	1															
$0 \oplus 0$	0															
	b)	Define Kolmogorov complexity. Can it be measured? Does the digits of have more Kolmogorov complexity than the string 1^n (a string of n 1's)? Justify your answer.	CO 8	(6)												
	c)	State the problem of sorting a list of \mathbb{Z} integers and one efficient algorithm to solve it. To which class does the problem belong?	CO 7	(3)												
OR																
8	a)	Consider a set S of binary strings of length 9999999999. <ol style="list-style-type: none"> 1. What is the minimum number of bits required to store any binary string of S? 2. Show that the binary string in S with all 1's can be represented using less bits than the minimum number of bits for S? 3. Using the above two demonstrate that Kolmogorov complexity is not same as Shannon's entropy for the measure of information content. 4. Which has more Kolmogorov complexity - 1^n (a string of n 1's) or the 	CO 8	(6)												

		digits of π ? Justify.		
b)	(a)	How is a complexity system different from a “simple” system? Give examples.	CO 8	(6)
	(b)	How are complex systems organized? Why do they prefer this organization?		
	(c)	MITS utilizes the service of the housekeeping company CleanFloor Ltd. to keep its premises clean. CleanFloor Ltd. has four workers and two supervisors. Let workers P1,P2 work under supervisor M1 and P3,P4 work under supervisor M2. We like to study the interaction among the staff of CleanFloor Ltd. Under what assumption will the interaction among the staff exhibit near-decomposibility?		
c)		Define P and NP classes of problems and list some example problems from these classes.	CO 7	(3)

COURSE DESCRIPTION							
Regulation	2025	L-T-J-P-S	2-0-0-2-4	Version	25/0	Credits	4
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							
Course Code		Course Name				Course Category	
B250903/CN210D		PROGRAMMING IN C				EST	
Pre-requisite							
Nil							

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

COMPETENCY STATEMENT (CC)	
CC1	Students will be competent to implement algorithms using the C programming language

COURSE OUTCOMES (CO)					
Course Outcomes (CO): At the end of this course, learners will be able to:					
CO	CO Statement	CC Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO 1	Good understanding of the C language constructs including data types, control structures etc	CC 1	U	M	Rs
CO 2	Ability to create C programs from algorithms using appropriate language constructs.	CC 1	A	M	Rs
CO 3	Ability to select or create appropriate data types to create correct C programs.	CC 1	A	M	Rs
CO 4	Ability to create dynamic linked structures to store data.	CC 1	U	I	Re
CO 5	Ability to write modular C programs.	CC 1	A	M	Rs
CO 6	Ability to use appropriate input/output and other library functions to create programs.	CC 1	U	M	Rs
CO 7	Ability to organize C programs into project folder structure and use build tool.	CC 1	U	I	Re

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

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

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

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

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

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hours
1	C Fundamentals	Structure of a C program; Simple programs (Hello world); Steps of compilation; Introduction to Popular compilers - Clang and LLVM; C language specification, Introduction to gcc; Character Set (ASCII, Unicode); Constants (integer, string, character); Identifiers; Keywords; Defining macros(#define); Basic data types (int, char, float, double); Data type modifiers (signed, unsigned, short, long); Variables; Operators (arithmetic, logic, relational, assignment); Operator precedence; Expressions; Statements - Input and Output statements; (scanf, printf, fscanf, fprintf); if, if-else, nested if, switch, while, do-while, for; break & continue; nested loops	10
2	Advanced Data Types	Single dimensional arrays (int, char, float, double); Defining an array; Array initialization; Accessing array elements Multidimensional arrays; Structure; Defining a Structure variable; Accessing members; Array of structures; Pointer; Declaration; Operations on pointers; Pointer arithmetic; Accessing array elements using pointers; Accessing structure elements using pointers ;Functions; Function definition ;Function call; Function prototype; Parameter passing	10
3	Functions	Multifile programming; Passing array, structure, pointers to function; Passing array, structure, pointers to function; Recursion; Preprocessor directives (#define, #ifdef); Storage Classes associated with variables automatic, static, external and register ;Built-in functions; String functions	10
4	Pointers and Files	Pointer to pointer; Pointer to function; Dynamic Memory Allocation; Self-referential structures; Linked Structures like path, cycles, set of paths, staretc; Different types of files in C; Opening & Closing a file; Writing to and Reading from a file; Processing files; Library functions related to file – fseek(), ftell(), fread(), fwrite(); Problem Solving using C(Translate algorithm to C program);	10

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

SUGGESTED LEARNING RESOURCES

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

Reference			
Sl. No.	Title of Book	Author	Publication
1	C The Complete Reference	Herbert Schildt	Mc Graw Hill,4/e,2017
2	Programming with C	Byron S Gottfried	Mc Graw Hill,4/e.2018
3	Problem solving and Program Design in C	Jeri R Hanly, ElliotB. Koffman	Pearson,2/e,2015

Web Resource	
1	https://onlinecourses.nptel.ac.in/noc25_cs119
2	https://onlinecourses.nptel.ac.in/noc25_cs114
3	https://onlinecourses.swayam2.ac.in/imb25_mg71

DETAILED SYLLABUS (Self-learning if any to be marked)							
Module	Topic	Mode of Delivery	COs	Learning Domain			Hrs
				C	P	A	
1	Structure of a C program; Simple programs (Hello world); Steps of compilation; Introduction to Popular compilers - Clang and LLVM; Introduction to GCC, C language specification	Lecture Practical	CO1	U	M	Rs	10
	Character Set (ASCII, Unicode)						
	Constants (integer, string, character); Identifiers; Keywords; Defining macros (#define)						
	Basic data types (int, char, float, double)						
	Data type modifiers (signed, unsigned, short, long)						
	Variables; Operators (arithmetic, logic, relational, assignment)						
	Operator precedence; Expressions; Statements - Input and Output statements (scanf, printf, fscanf, fprintf)						
	if, if-else, nested if, switch						
while, do-while, for; break & continue; nested loops							
2	Single dimensional arrays (int, char, float, double); Defining an array; Array initialization; Accessing array elements	Lecture Practical	CO3	A	M	Rs	10
	Multidimensional arrays						
	Structure; Defining a Structure variable; Accessing members; Array of structures						
	Pointer; Declaration; Operations on pointers; Pointer arithmetic						
	Accessing array elements using pointers						
	Accessing structure elements using pointers						
	Functions; Function definition; Function call; Function prototype						
	Parameter passing						
3	Multifile programming	Lecture Practical	CO5	A	M	Rs	10
	Passing array, structure, pointers to function						
	Recursion						
	Preprocessor directives (#define, #ifdef)						
	Storage Classes associated with variables automatic, static, external and register						
	Storage Classes associated with variables automatic, static, external and register						
Built-in functions; String functions	Practical	CO6	U	M	Rs		
4	Pointer to pointer; Pointer to function	Lecture Practical	CO4	U	I	Re	10
	Dynamic Memory Allocation						
	Self-referential structures; Linked Structures like path, cycles, set of paths, star etc	Lecture Practical	CO7	U	I	Rs	
	Different types of files in C; Opening & Closing a file; Writing to and Reading from a file; Processing files						
	Library functions related to file – fseek(), ftell(), fread(), fwrite()						
	Problem Solving using C (Translate algorithm to C program)	Practical	CO2	A	M	Rs	

PRACTICAL SYLLABUS							
Module	Topic	Objective	Relevant COs	Learning Domain Level			Teaching Hours
				C	P	A	
1	Structure of a C program; Datatypes; Operators; Control Structures	To understand the basic structure of a C program and to learn how to use data types, operators, and control structures to develop simple and efficient C programs.	CO 1	U	M	Rs	5

2	Mutidimensional,Ar rays, Structure,	To learn how to declare, initialize, and manipulate multidimensional arrays, and to understand the use of structures for organizing and managing related data efficiently in C programs.	CO 3	A	M	Rs	5
3	Functions; User defined functions; Built in Functions;	To understand the concept of functions in C and to develop the ability to create user-defined functions and effectively use built- in functions to design modular and reusable programs.	CO 5, CO 6	A	M	Rs	5
4	Pointers	To understand the concept of pointers and learn how to use them for efficient memory management, array manipulation, and function argument passing in C programs.	CO4	U	I	Re	5

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

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

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

ASSESSMENT PATTERN

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

Register No.:	Name:
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(AN AUTONOMOUS COLLEGE AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANATHAPURAM)

SECOND SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, APRIL 2025 (2025 SCHEME)

Course Code:	B250903/CN210D		
Course Name:	PROGRAMMING IN C		
Max. Marks	60	Duration:	2 hours 30 minutes

CSE

PART A

(Answer all questions. Each question carries 3 marks)

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

PART B

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

No.	Question	CO	Marks
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MODULE I

9	a)	Given a positive integer n, implement a C program to find the sum of all integers in the range [1,n] inclusive that are divisible by 3, 5, or 7. Example Input: n = 7 Output: 21 Explanation: Numbers in the range [1, 7] that are divisible by 3, 5, or 7 are 3, 5, 6, 7. The sum of these numbers is 21.	CO1	(4)
	b)	What will be the output ? #include <stdio.h> int main() { signed int a = -10; unsigned int b = 10; short int c = 30000; long int d = 1000000; printf("Size of signed int: %zu bytes\n", sizeof(a)); printf("Size of unsigned int: %zu bytes\n", sizeof(b)); printf("Size of short int: %zu bytes\n", sizeof(c)); printf("Size of long int: %zu bytes\n\n", sizeof(d)); printf("Signed int a = %d\n", a); printf("Unsigned int b = %u\n", b); printf("Short int c = %d\n", c); printf("Long int d = %ld\n", d); return 0;} 	CO1	(3)
	c)	Explain the difference between primitive (basic) data types and derived data types in C. Provide examples for each category. Why is it important to choose the correct data type for variables in a program?	CO1	(2)

OR				
10	a)	<p>Given an integer n, implement a C program to repeatedly add all its digits until the result has only one digit.</p> <p>Example Input: n = 38 Output: 2 Explanation: The process is 38 --> 3 + 8 --> 11 11 --> 1 + 1 --> 2</p>	CO1	(4)
		<p>What will be the output of the following program?</p> <pre>#include <stdio.h> int main() { int i = 1 ; while(i<=10); { printf("%d",i); i++; }}</pre>	CO1	(3)
	b)	<p>Evaluate the following expressions and show their hierarchy.</p> <p>i. $g = \text{big} / 2 + \text{big} * 4 / \text{big} - \text{big} + \text{abc} / 3$; (abc = 2.5, big = 2, assume g to be a float)</p> <p>ii. $\text{on} = \text{ink} * \text{act} / 2 + 3 / 2 * \text{act} + 2 + \text{tig}$; (ink = 4, act = 1, tig = 3.2, assume on to be an int)</p>	CO1	(2)
MODULE II				
11	a)	<p>Define a function with the following specification to check whether an integer array contains three consecutive odd numbers.</p> <p>Function Name: hasThreeConsecutiveOdds() Parameters: array of integers, number of elements in the array Return Type: Returns 1 (true) if the array contains three consecutive odd numbers, Returns 0 (false) otherwise</p> <p>Example Input: arr = [2,6,4,1] Output: false Explanation: There are no three consecutive odds.</p> <p>Example 2: Input: arr = [1,2,3,4,5,7,23,12] Output: true Explanation: [5,7,23] are three consecutive odds.</p>	CO3	(5)
	b)	<p>Write functions with the following specifications to initialize a 3×3 matrix and display its diagonal elements using functions.</p> <ol style="list-style-type: none"> Function Name :displayMatrix() Parameters:2D array (matrix) containing integer elements Function Name :displayDiagonals() Parameters:2D array (matrix) containing integer elements 	CO3	(4)
OR				
12	a)	<p>You are given an m x n integer grid accounts where accounts[i][j] is the amount of money the ith customer has in the jth bank. Return the wealth that the richest customer has. A customer's wealth is the amount of money they have in all their bank accounts. The richest customer is the customer that has the maximum wealth.</p> <p>Define a function with the following specification: Function Name :maximumWealth() Parameters:2D integer array representing the wealth of each customer in different banks, number of customers .number of banks (columns). Return Type: returns the maximum wealth (richest customer's total money).</p> <p>Example : Input: accounts = [[1,2,3],[3,2,3]] Output: 6 Explanation: 1st customer has wealth = 1 + 2 + 3 = 6 2nd customer has wealth = 3 + 2 + 3 =8</p>	CO3	(5)
	b)	<p>Create a structure to specify data on students given below: Roll number, Name, Department, Course, Year of joining Assume that there are not more than 450 students in the collage.</p> <p>(a) Write a function to print names of all students who joined in a</p>	CO3	(4)

		<p>particular year. Function Name : printStudentsByYear() Parameters:Array of student structures,Number of students,Year to be searched</p> <p>(b) Write a function to print the data of a student whose roll number is given. Function Name : printStudentByRoll() Parameters:Array of student structures,Number of students,Year to be searched,Roll number to be searched</p>		
MODULE III				
13	a)	<p>A stack is a data structure in which addition of new element or deletion of existing element always takes place at the same end. This end is often known as 'top' of stack. This situation can be compared to a stack of plates in a cafeteria where every new plate taken off the stack is also from the 'top' of the stack.</p> <p>Stack has following operations: Push - to insert an element into the stack Pop - to remove an element from the stack Display - to display all elements in the stack</p> <p>Algorithm for PUSH Operation</p> <ol style="list-style-type: none"> 1. Check if top == MAX - 1 → If true, print "Stack Overflow" and return. 2. Otherwise, increment top by 1 3. Set stack[top] = x 4. Print "Element pushed successfully" <p>Algorithm for POP Operation</p> <ol style="list-style-type: none"> 1. Check if top == -1 → If true, print "Stack Underflow" and return. 2. Otherwise, print stack[top] as the deleted element 3. Decrement top by 1 <p>Algorithm for DISPLAY Operation</p> <ol style="list-style-type: none"> 1. If top == -1, print "Stack is Empty" 2. Else, print all elements from stack[top] down to stack[0] <p>Translate the above given algorithm to C Program</p>	CO5	(5)
	b)	<p>A software developer is designing a program to generate a sequence of numbers where each term is the sum of the two preceding terms. To implement this logic efficiently, the developer decides to use recursion. Explain how recursion can be applied in this scenario and write a C program to generate the Fibonacci series using a recursive function.</p>	CO5	(4)
OR				
14	a)	<p>Write macro definitions with arguments for calculation of area and perimeter of a triangle, a square and a circle. Store these macro definitions in a file called "areaperi.h". Include this file in your program, and call the macro definitions for calculating area and perimeter for different squares, triangles and circles.</p>	CO5	(5)
	b)	<p>List the four storage classes in C and mention one feature of each. What will be the output?</p> <pre>#include <stdio.h> int count = 0; void counter() { static int calls = 0; register int i; for (i = 0; i < 1; i++) calls++; printf("Function called %d times\n", calls); } int main() { auto int num = 10; counter(); counter(); printf("Global count = %d\n", count); printf("Local num = %d\n", num); return 0; }</pre>	CO5	(4)
MODULE IV				
15	a)	<p>In a scientific calculator application, a programmer needs to develop a feature to compute the roots of any quadratic equation. The coefficients of the equation (a, b, and c) are to be passed to the function using pointers. Develop a C function that calculates and displays the roots of the quadratic equation using pointer parameters.</p>	CO4	(5)

	b)	Two persons want to access a file "sample.txt". First person want to read the data from the file. The second person want to read and write the data from and to the file simultaneously. Can you help them to do so by writing the corresponding programming codes?	CO7	(4)
OR				
16	a)	While developing a student record management system, a programmer needs to handle multiple strings representing student names and also access a group of integer marks stored in a single array. To choose the correct approach, the programmer must understand the difference between an array of pointers and a pointer to an array . Explain the difference between these two concepts with suitable examples in C.	CO4	(5)
	b)	In a file management system, a programmer is required to create a utility that duplicates the contents of an existing file into a new file for backup purposes. Develop a C program to copy the contents of one file into another.	CO7	(4)

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

Course Code	Course Name	Course Category
B250904/CN200E	DISCRETE MATHEMATICS	PCT
Pre-requisite		
Basic knowledge of algebra, logic, and analytical reasoning skills.		

COURSE OBJECTIVES	
1	To equip students with the ability to analyse and solve problems using discrete mathematical techniques.
2	To give a deeper understanding of mathematical logic, set theory, and proof techniques such as direct proofs, proof by contradiction, and mathematical induction.

COMPETENCY STATEMENT (CC)	
CC1	Demonstrate the ability to apply propositional and predicate logic, proof techniques, and fundamental counting principles including permutations, combinations, and the pigeonhole principle to solve discrete mathematical problems.
CC2	Demonstrate proficiency in analysing sets, relations, functions, algebraic structures such as groups and fields, and applying generating functions to solve linear recurrence relations systematically.

COURSE OUTCOMES (CO)					
Course Outcomes (CO): At the end of this course, learners will be able to:					
CO	CO Statement	CC Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	Check the validity of predicates in Propositional and Quantified Propositional Logic using truth tables, deductive reasoning and inference theory on Propositional Logic	CC1	A		Rs
CO2	Solve counting problems by applying the elementary counting techniques – Rule of Sum, Rule of Product, Permutation, Combination, Binomial Theorem, Pigeonhole Principle and Principle of Inclusion and Exclusion.	CC1	A		Rs
CO3	Classify binary relations into various types and illustrate an application for each type of binary relation, in Computer Science.	CC1	U		Rs
CO4	Illustrate an application for Partially Ordered Sets and Complete Lattices in Computer Science	CC2	U		Rs
CO5	Explain Generating Functions and solve First Order and Second Order Linear Recurrence Relations with Constant Coefficients	CC2	A		Rs
CO6	Illustrate the abstract algebraic systems - Semigroups, Monoids, Groups, Homomorphism and Isomorphism of Monoids and Groups.	CC2	U		Rs

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

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

5	3	3	3	3							2	3	1	
6	3	3	3	3							2	3	3	
Correlation [3 – High, 2 -Medium, 1 – Low]														

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

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

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Sets, Functions, and Relations	Sets and Subsets, Venn Diagrams, Set Operations, Set Identities, Generalized Unions and Intersections, The Principle of Inclusion-Exclusion (Basic and Generalized versions), and applications. Function definition, Injections, Surjections and Bijections, Inverse Functions, and Compositions of Functions, Cardinality of Sets, Cantor diagonalization argument Relations and Their Properties, Composition of relations, n-ary Relations, Representing Relations Using Matrices, Equivalence Relations, Equivalence Classes, Partial Orderings, Hasse Diagrams, Maximal and Minimal Elements, Lattices (Text 1 - Relevant topics from sections 2.1, 2.2, 2.3, 2.5, 8.5,9.1-9.6)	11
2	Mathematical logic and proofs	Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference Introduction to Proofs, Methods of Proving Theorems - Direct proof, Indirect proof (Proof by Contradiction), Proof by Contradiction, Proof by counter examples, The Pigeonhole Principle. (Text 1 - Relevant topics from sections 1.1-1.8, 6.2)	11
3	Induction and Recurrences	Mathematical Induction, Weak and Strong induction Recursive (Inductive) definitions and recurrence relations, Modelling with Recurrence Relations, Solving Linear Recurrence Relations (homogeneous and nonhomogeneous), Generating Functions, Using Generating Functions to Solve Recurrence Relations. (Text 1 - Relevant topics from sections 5.1-5.3, 8.1-8.4)	11
4	Group theory	Groups - Definition, Examples, and Elementary Properties, Abelian group, Permutation group, Subgroup, Homomorphisms, Isomorphisms, and Cyclic Groups, Cosets and Lagrange's Theorem. (Reference Text 1 - Relevant topics from sections 11.4-11.10, 14.5-14.11)	11

SELF-LEARNING / TEAM WORK		
Sl. No	Self-learning / Team Work Description	Hrs
1	Basic set theory revision: sets, subsets, power sets, set operations (1 hour) . Practice problems on set identities and Venn diagrams (1 hour) . Practice problems on Principle of Inclusion-Exclusion with applications (2 hours) , Practice problems on functions: injections, surjections, bijections, composition, and inverse functions (1 hour) . Study Cantor diagonalization argument and cardinality concepts (1 hour) . Practice problems on relations: properties, composition, matrix representation (1 hour) . Practice constructing Hasse diagrams for partial orders and identifying maximal/minimal elements in lattices (1 hour) . Team Work - Model real-world relationships using functions and relations. Create Hasse diagrams for ordering systems (software dependencies, task scheduling, organizational hierarchies). Apply inclusion-exclusion principle to solve combinatorial problems in computer science applications (1 hour) .	9

2	Practice constructing truth tables for complex propositional logic statements (1 hour) , practice problems on propositional equivalences and logical laws (2 hours) , practice problems on predicates, quantifiers, and nested quantifiers (1 hour) , practice applying rules of inference to construct valid arguments (1 hour) , practice direct proofs and proof by contraposition (1 hour) , practice proof by contradiction and proof by counter examples (1 hour) , practice problems on pigeonhole principle with applications (1 hour) . Team Work - Formulate and prove mathematical statements using different proof techniques. Analyze real-life scenarios and apply pigeonhole principle (e.g., hashing collisions, network routing). Construct formal proofs for algorithm correctness using propositional logic and rules of inference (1 hour) .	9
3	Study mathematical induction principle and practice simple induction proofs (1 hour) , practice weak induction problems (summation formulas, divisibility) (1 hour) , practice strong induction problems (1 hour) , study recursive definitions and formulate recurrence relations from problem statements (1 hour) , practice solving first-order linear homogeneous recurrence relations (1 hour) , practice solving first-order linear non-homogeneous recurrence relations (1 hour) , study generating functions and their properties (1 hour) , practice using generating functions to solve recurrence relations (1 hour) . Team Work - Analyze algorithms and derive recurrence relations (divide-and-conquer, dynamic programming). Prove algorithm properties using mathematical induction. Apply generating functions to solve counting problems in combinatorics and analyze algorithm time complexity (1 hour) .	9
4	Study group definition with examples (integers, matrices, permutations) (1 hour) , practice verifying group properties and identifying abelian groups (1 hour) , study permutation groups and practice composition operations (1 hour) , practice identifying and verifying subgroups (1 hour) , homomorphisms and isomorphisms with examples (1 hour) , practice problems on cyclic groups and generators (1 hour) . Study cosets and Lagrange's theorem (1 hour) , practice applications of Lagrange's theorem to find orders of elements and subgroups (1 hour) . Team Work - Explore applications of group theory in cryptography (RSA, Diffie-Hellman), coding theory, and computer graphics (transformations, symmetries). Analyze the algebraic structure of operations in modular arithmetic and error-correcting codes (1 hour) .	9

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Discrete Mathematics and its Applications	Kenneth H. Rosen, Kamala Krithivasan	McGraw Hill, 8/e, 2021

Reference			
Sl. No.	Title of Book	Author	Publication
1	Schaum's Outline of Discrete Mathematics	Marc Lipson, Seymour Lipschutz	McGraw-Hill, 3/e, 2021
2	Discrete Mathematics	Kenneth A. Ross, Charles R.B. Wright	Pearson, 5/e, 2012

Web Resource	
1	https://nptelvideos.com/lecture.php?id=6033
2	https://nptelvideos.com/lecture.php?id=6024
3	https://nptelvideos.com/lecture.php?id=6051
4	https://nptelvideos.com/lecture.php?id=6058

DETAILED SYLLABUS (Self-learning if any to be marked)							
Module	Topic	Mode of Delivery	CO	Learning Domain			Hrs
				C	P	A	
1	Sets, notation, subsets, operations, Venn diagrams	L	CO3	U			1
	Basic set theory revision	S	CO3	U		Rs	2
	Set identities, laws, duality	L	CO3	U			1
	Practice: set identities and Venn diagrams	S	CO3	A		Rs	2
	Tutorial	T	CO3	A			1

	Inclusion-Exclusion (basic & generalized)	L	CO2	U			2
	Practice: Inclusion-Exclusion applications	S	CO2	A		Rs	2
	Functions: definition, injections, surjections, bijections	L	CO3	U			2
	Composition, inverse, cardinality, Cantor diagonalization	L	CO3	U			1
	Practice: functions problems	S	CO3	A		Rs	2
	Study: Cantor diagonalization	S	CO3	A		Rs	2
	Tutorial	T	CO3	A			1
	Relations: properties, composition, n-ary, matrices	L	CO3	U			2
	Practice: relations problems	S	CO3	A		Rs	2
	Equivalence relations, classes	L	CO3	U			1
	Partial orders, Hasse diagrams, lattices	L	CO4	U			1
	Practice: Hasse diagrams and lattices	S	CO4	A		Rs	2
	Tutorial	T	CO4	A			1
	Real-world modelling, Hasse diagrams, inclusion- exclusion	S	CO4	A		Rs	2
2	Propositions, connectives, truth tables	L	CO1	U			1
	Practice: truth tables (complex)	S	CO1	A		Rs	3
	Logical equivalences, laws of logic	L	CO1	U			1
	Principle of duality	L	CO1	U			1
	Practice: equivalences and laws	S	CO1	A		Rs	3
	Tutorial	T	CO1	A			1
	Predicates, quantifiers, negation, nested quantifiers	L	CO1	U			2
	Practice: predicates and nested quantifiers	S	CO1	A		Rs	2
	Tutorial	T	CO1	A			1
	Valid arguments, rules of inference, resolution	L	CO1	U			2
	Practice: rules of inference	S	CO1	A		Rs	3
	Tutorial	T	CO1	A			1
	Direct proof, contraposition, contradiction, Counter example	L	CO1	U			2
	Practice: proof techniques	S	CO1	A		Rs	2
	Tutorial	T	CO1	U			1
	Basic and generalized pigeonhole principle	L	CO2	A			1
	Practice: pigeonhole applications	S	CO2	A		Rs	2
	Proof construction, pigeonhole, applications, algorithm correctness	L	CO2	U			1
3	Weak and Strong induction principles	L	CO1	U			2
	Study: induction principle, practice proofs	S	CO1	A		Rs	2
	Induction proofs: summation, divisibility, inequalities	L	CO1	U			2
	Practice: weak and strong induction	S	CO1	A		Rs	3
	Tutorial	T	CO1	A			1
	Recursive definitions and functions	L	CO4	U			2
	Study: recursive definitions, formulate recurrences	S	CO4	A		Rs	2
	Modelling with recurrence relations	L	CO5	U			1
	Solving linear homogeneous recurrences	L	CO5	U			1
	Practice: homogeneous recurrences	S	CO5	A		Rs	3
	Solving non-homogeneous recurrences	L	CO5	U			1
	Practice: non-homogeneous recurrences	S	CO5	A		Rs	3
	Tutorial	T	CO5	A			1
	Generating functions: properties, solving recurrences	L	CO5	U			1
	Study and practice: generating functions	S	CO5	A		Rs	3
	Tutorial	T	CO5	A			1
Algorithm analysis, induction proofs, generating functions	L	CO5	U			1	

4	Binary operations, group definition, properties, examples	L	CO6	U			2
	Study: group definition with examples	S	CO6	A		Rs	2
	Abelian groups	L	CO6	U			2
	Practice: verifying group and abelian properties	S	CO6	A		Rs	2
	Tutorial	T	CO6	A			1
	Permutations, cycle notation, composition	L	CO6	U			2
	Study and practice: permutation groups	S	CO6	A		Rs	2
	Tutorial	T	CO6	A			1
	Subgroups: definition, tests	L	CO6	U			1
	Practice: identifying subgroups	S	CO6	A		Rs	2
	Cyclic groups, generators, order	L	CO6	U			1
	Practice: cyclic groups	S	CO6	A		Rs	2
	Tutorial	T	CO6	A			1
	Homomorphisms and isomorphisms	L	CO6	U			1
	Study: homomorphisms and isomorphisms with examples	S	CO6	A		Rs	2
	Tutorial	T	CO6	A			1
Cosets, Lagrange's theorem, applications	L	CO6	U			1	
Study and practice: Lagrange's theorem	S	CO6	A		Rs	2	
Tutorial	T	CO6	A			1	
Applications: cryptography, coding theory, graphics	L	CO6	U			1	

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

Module	Module Title	Distribution of Marks (RBL)						Total Marks
		R	U	A	An	E	C	
1	Sets, Functions, and Relations	√	√	√				15
2	Mathematical logic and proofs	√	√	√				15
3	Induction and Recurrences	√	√	√				15
4	Group theory	√	√	√				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

Total Pages:	
Register No.:	Name:

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

SECOND SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, APRIL 2025 (2025 SCHEME)			
Course Code:	B250904/CN200E		
Course Name:	DISCRETE MATHEMATICS		
Max. Marks	60	Duration:	2 hours 30 minutes
Common to CS, CY, AI, AD.			

(Answer any one full question from each module, each question carries 15 marks)				
No.		Question	CO	Marks
MODULE I				
1	a)	Define the following with one example each (i) Universal set (ii) Power set (iii) Complement of a set	CO1	(2)
	b)	Match the following: Column A Column B 1. $A - B$ (a) All elements in A or B 2. $A \cup B$ (b) Elements in A but not in B 3. $A \cap B$ (c) Common elements of A and B 4. A' (d) Elements not in A	CO1	(3)
	c)	Prove the following set identity using laws of set algebra: $(A \cup B)' = A' \cap B'$	CO1	(4)
	d)	Construct a truth table for $(p \rightarrow q) \wedge (q \rightarrow r) \Rightarrow (p \rightarrow r)$. Comment on its validity.	CO1	(4)
	e)	Use mathematical induction to prove that $1 + 3 + 5 + \dots + (2n - 1) = n^2$.	CO1	(2)
OR				
2	a)	Define tautology and contradiction with an example.	CO1	(2)
	b)	Fill in the Blanks: 1. The negation of $p \rightarrow q$ is _____. 2. The dual of $A + AB = A$ is _____. 3. $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ represents the _____ law.	CO1	(3)
	c)	Determine whether the propositions $p \vee (p \rightarrow q)$ and $q \vee (p \rightarrow q)$ are equivalent using truth tables.	CO1	(4)
	d)	Prove that $\neg(p \vee q) \Leftrightarrow (\neg p \wedge \neg q)$ by truth table.	CO1	(4)
	e)	Using the principle of duality, find the dual of $(A + B')(A' + B)$.	CO1	(2)
MODULE II				
3	a)	Define the following: (i) Reflexive relation (ii) Symmetric relation (iii) Transitive relation	CO2 CO3	(2)
	b)	Match the Following: Column A Column B 1. Identity Relation 1. $\forall a, b \in A, (a, b) \in R \Rightarrow (b, a) \in R$ 2. Symmetric Relation 2. $\forall a \in A, (a, a) \in R$ 3. Transitive Relation 3. $\forall a, b, c \in A, (a, b), (b, c) \in R \Rightarrow (a, c) \in R$ 4. Universal Relation 4. $A \times A$	CO2 CO3	(3)
	c)	Let $A = \{1,2,3\}$ and $R = \{(1,1), (1,2), (2,3), (3,3)\}$. Check whether R is reflexive, symmetric, and transitive.	CO2 CO3	(4)
	d)	Let $f: R \rightarrow R$ be defined as $f(x) = 3x + 5$. Prove that f is one-to-one and onto.	CO2 CO3	(4)
	e)	If $f(x) = x^2 + 1$ and $g(x) = \sqrt{x} - 1$, show that $g(f(x)) = |x|$ for all $x \geq 0$.	CO2 CO3	(2)
	OR			
4	a)	Define function, domain, and codomain.	CO2 CO3	(2)
	b)	Fill in the Blanks: 1. If $f: A \rightarrow B$ and $g: B \rightarrow C$, then $g \circ f: A \rightarrow C$ is called the _____. 2. A one-to-one and onto function is called a _____. 3. The number of relations on a set of n elements is _____.	CO2 CO3	(3)

	c)	Let $A = \{1,2,3\}$ and $B = \{4,5,6\}$. Define a relation $R = \{(1,4), (2,5), (3,6)\}$. Is R a function?	CO2 CO3	(4)
	d)	Prove that the inverse of a bijective function is also bijective.	CO2 CO3	(4)
	e)	If $f(x) = 2x + 3$, find $f^{-1}(x)$ and verify that $f(f^{-1}(x)) = x$.	CO2 CO3	(2)
MODULE III				
5	a)	Define graph, loop, and degree of a vertex.	CO4	(2)
	b)	Match the Following: <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Column A</p> <ol style="list-style-type: none"> 1. Eulerian Graph 2. Hamiltonian Graph 3. Spanning Tree 4. Complete Graph </div> <div style="width: 45%;"> <p>Column B</p> <ol style="list-style-type: none"> a) Contains all vertices connected b) Traverses each edge exactly once c) Traverses each vertex exactly once d) $n(n-1)/2$ edges </div> </div>	CO4	(3)
	c)	Determine whether a simple graph with 5 vertices each of degree 3 exists. Justify your answer.	CO4	(4)
	d)	Draw a tree with 6 vertices having degree sequence $(3,2,1,1,1,1)$. Verify that the sum of degrees equals $2(n-1)$.	CO4	(4)
	e)	Write an algorithm (or pseudo-code) for Depth-First Search (DFS) traversal of a graph.	CO4	(2)
OR				
6	a)	Define isomorphic graphs. Give one example pair.	CO4	(2)
	b)	Fill in the Blanks: <ol style="list-style-type: none"> 1. In a simple connected planar graph, $v - e + f = \underline{\hspace{2cm}}$. 2. A connected graph without cycles is called a <u> </u>. 3. The number of edges in a complete graph with n vertices is <u> </u>. 	CO4	(3)
	c)	Find the adjacency matrix and incidence matrix of the following graph: $V = \{A, B, C\}$, $E = \{AB, AC, BC\}$.	CO4	(4)
	d)	Use Kruskal's algorithm to find the minimum spanning tree for the following weighted graph: Vertices: $\{A, B, C, D\}$; Edges: $AB=2, AC=3, AD=5, BC=4, CD=6$.	CO4	(4)
	e)	Prove that a tree with n vertices has exactly $n - 1$ edges.	CO4	(2)
MODULE IV				
7	a)	Define semigroup, monoid, and group with one example each.	CO5 CO6	(2)
	b)	Fill in the Blanks: <ol style="list-style-type: none"> 1. In a group, every element has a unique <u> </u>. 2. The identity element in Boolean algebra satisfies $A + 0 = \underline{\hspace{2cm}}$. 3. The complement law in Boolean algebra states that $A + A' = \underline{\hspace{2cm}}$. 	CO5 CO6	(3)
	c)	Verify that $(Z, +)$ is an abelian group but (Z, \times) is not.	CO5 CO6	(4)
	d)	Simplify the Boolean expression $F = A'B + AB' + A'B'$ using Boolean laws.	CO5 CO6	(4)
	e)	Design the logic circuit for $F(A, B, C) = (A + B')(B + C)$.	CO5 CO6	(2)
OR				
8	a)	Define lattice and complemented lattice with examples.	CO5 CO6	(2)
	b)	Match the Following: <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Column A</p> <ol style="list-style-type: none"> a) Idempotent Law b) Identity Law c) Involution Law d) Absorption Law </div> <div style="width: 45%;"> <p>Column B</p> <ol style="list-style-type: none"> a) $A + 0 = A$ b) $A + A = A$ c) $(A')' = A$ d) $A + AB = A$ </div> </div>	CO5 CO6	(3)
	c)	Prove that $A + AB = A$ using Boolean algebra postulates.	CO5 CO6	(4)
	d)	Find the minimal form of $F(A, B, C) = \sum m(0,2,5,6,7)$ using Karnaugh Map.	CO5 CO6	(4)
	e)	Write the canonical POS and SOP form of $F(A, B) = A' + B$.	CO5 CO6	(2)

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

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

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

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

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

CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									PO										PSO			
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1										3					1		1	1		2			
2										3			2	1	2	1	2	2	2	3			
3										2			1	2	2	2	1	1	2	3			
4										3			2	2	2	2	2	1	2	3			
5										3			2	3	3	2	2	3	3	3			

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

TEACHING AND ASSESSMENT SCHEME										
Teaching Scheme / Week				Self-Learning (S) / Semester	Total Hours / Semester	Credits C	Examination Scheme			
L	T	J	P				Theory			Total
32	-	28	-	30	90	3	CIA	ESE	Total	100
							60	40	100	

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

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Contact Hours
1	Entrepreneurship Fundamentals	Introduction to Innovation and Entrepreneurship – Entrepreneurial mindset – Types of entrepreneurs – Idea generation – Design thinking – Startup ecosystem – Government initiatives.	8
2	Business Planning and Startup Management	Market research and validation – Business model canvas – Revenue and pricing strategies – Business plan preparation – Prototype and MVP development – Risk management.	8
3	Fundamentals of IPR	Introduction to IPR – Patents, Trademarks, Copyrights, Industrial Designs – Patentability, filing procedures – Patent databases and search – Infringement-Rights and obligations – Case studies.	8
4	IPR Management and Commercialization	IP strategy for startups – Licensing, technology transfer – IPR in digital era – Emerging trends in AI and software patents – Ethical issues and Indian IP policy framework.	8

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

SUGGESTED LEARNING RESOURCES

Sl. No.	Title of Book	Author	Publication
Text Book			
1	The Engineering Handbook	Richard C.Dorf	CRC Press
2	Business Model Generation	Alexander Osterwalder & Yves Pigneur	Wiley
3	Innovation and Entrepreneurship for Engineers	Bharat Bhushan and Seema Bhushan	CRS Press
4	Indian Patent Law	P. Narayanan	Eastern Book Company
5	The Law of Copyright and Designs	B.L. Wadehra	Universal Law
6	Intellectual Property Rights (Including IPR in the Digital Age)	Prabuddha Ganguli	Tata McGraw-Hill Education

Web Resource

1	https://onlinecourses.nptel.ac.in/noc25_mg81
2	https://nptel.ac.in/courses/110107094
3	https://onlinecourses.nptel.ac.in/noc22_hs59

DETAILED SYLLABUS (Self-learning if any to be marked)							
Module	Major Topic & Sub Topic	Mode of Delivery	Relevant COs	Learning Domain Level			Teaching Hours
				C	P	A	
1	Introduction to Innovation and Entrepreneurship – Meaning, need, and importance	L	CO1	U		Re	1
	Entrepreneurial mindset – Characteristics and motivation of entrepreneurs	L	CO1	U		Re	1
	Types of entrepreneurs – Intrapreneurs, social, tech-based, women entrepreneurs	L	CO1	U		Re	1
	Idea generation techniques – Creativity, brainstorming, problem identification	L	CO1	U		Re	1
	Design thinking- Empathy, define, ideate, prototype, and testing	L	CO1	U		Re	1
	Startup ecosystem – Incubators, accelerators, funding agencies	L	CO1	U		Re	1
	Government initiatives for startups – Startup India, Make in India, MSME schemes	L	CO1	U		Re	1
	Self-Learning 1	S	CO1	U		Re	
	Self-Learning 2	S	CO1	U		Re	
	Case study / activity – Successful Indian startups and their founders	L	CO1	U		Re	1
2	Market research and validation – Identifying customer needs	L	CO2	An		V	1
	Business model canvas – Key partners, activities, value proposition	L	CO2	An		V	1
	Revenue and Pricing strategies – Cost based and value based pricing	L	CO2	An		V	1
	Business plan preparation – Structure and key Components	L	CO2	An		V	1
	Self-Learning 3	S	CO2	An		V	
	Prototype and MVP development – Concept and significance	L	CO2	An		V	1
	Self-Learning 4	S	CO2	An		V	
	Risk management – Types of risks and mitigation plans	L	CO2	An		V	1
	Startup funding sources – Angel investors, venture capital crowdfunding.	L	CO2	An		V	1
	Self-Learning	S	CO2	An		V	
	Case study / activity – Analyze a startup's business model canvas	L	CO2	An		V	1
	3	Introduction to IPR Need, importance, and categories	L	CO3	U		Re	1
Patents – Concepts, requirements, and types		L	CO3	U		Re	1
Trademarks and Copyrights – Differences, examples, and protection		L	CO3	U		Re	1
Industrial Designs and Geographical Indications – Overview		L	CO3	U		Re	1
Self-Learning 6		S	CO3	U		Re	

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

TABLE OF SPECIFICATIONS (ToS) FOR QUESTION PAPER DESIGN

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

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

ASSESSMENT PATTERN

Assessment	Marks
Continuous Internal Assessment	60
Learning Activity	5
Attendance	5
Internal Examination	20
Course Project	25
End Semester Examination	40
Total	100

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

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

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

PART - A
(Answer all questions. Each question carries 2 marks)

No.	Question	CO	Marks
1	The five stages of Design Thinking are _____, Define, Ideate, _____ and Test.	CO1	(2)
2	Compare entrepreneurs and intrapreneurs in terms of their approach to innovation	CO1	(2)
3	Analyse the role of market validation in reducing startup failure risk.	CO2	(2)
4	Evaluate the importance of Minimum Viable Product (MVP) development.	CO2	(2)
5	The criteria for patentability include novelty, _____step and _____ applicability.	CO3	(2)
6	Analyse how Geographical Indications (GIs) help in protecting regional products such as <i>Palakkadan Matta Rice</i> from Kerala.	CO3	(2)
7	Match the terms in Column A with the appropriate descriptions in Column B . <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>(a) Licensing vs. Assignment</p> <p>(b) Patent Pooling</p> <p>(c) IP Ethics</p> <p>(d) IP Valuation</p> </div> <div style="width: 45%;"> <p>1. Assessing economic worth of IP assets</p> <p>2. Fair use, plagiarism, and data ownership</p> <p>3. Permission vs. complete ownership transfer</p> <p>4. Sharing IP among multiple holders</p> </div> </div>	CO4	(2)
8	Suggest two ways companies like <i>Adobe</i> and <i>Netflix</i> can prevent plagiarism and digital piracy.	CO4	(2)

PART - B
(Answer any one full question from each module, each question carries 6 marks)

No.	Question	CO	Marks
MODULE I			
9	Kerala has witnessed a steady rise in youth-led entrepreneurship through initiatives like Kerala Startup Mission (KSUM) , which provides incubation, mentorship, and seed funding support. Programs such as Young Innovators Programme (YIP) encourage school and college students to identify real-world problems and propose innovative solutions. Many student startups—ranging from agritech to renewable energy—have evolved from these programs and are now scaling globally		
a)	Analyse how Kerala's startup ecosystem supports the development of an entrepreneurial mindset among students.	CO1	(2)
b)	Explain how design thinking principles can be applied to initiatives like YIP to improve innovation outcomes		(2)
c)	Evaluate the challenges faced by youth entrepreneurs in Kerala in accessing funding and markets.		(1)
d)	Suggest one policy-level improvement that could further strengthen Kerala's entrepreneurial ecosystem.		(1)
OR			
10	In Kerala, there has been a growing presence of social and women entrepreneurs who are redefining business with a focus on sustainability and inclusivity. Initiatives like Kudumbashree and WE Mission (Women Entrepreneurship Mission) have empowered thousands of women to start micro and small-scale ventures across sectors like food processing, handicrafts, and local tourism. Meanwhile, social entrepreneurs such as G. Venu (Natanakairali) and Jose Kutty Panackal (Farmvent) have used innovation to address social and environmental issues. These ventures not only create employment but also promote sustainable development aligned with the UN SDGs.		
a)	Differentiate between social entrepreneurs and commercial entrepreneurs with suitable examples from Kerala	CO1	(2)
b)	Analyse how programs like Kudumbashree and WE Mission contribute to women entrepreneurship development.		(2)
c)	Evaluate the role of social entrepreneurship in achieving sustainable and		(1)

	inclusive growth in Kerala.		
d)	Suggest one initiative the state government can introduce to strengthen the social entrepreneurship ecosystem.		(1)
MODULE II			
11	A group of engineering graduates from Kochi developed an IoT-based smart irrigation system that optimizes water usage for farmers in Palakkad. With the support of KSUM's incubation center and an angel investor from Thrissur, the team built a Minimum Viable Product (MVP). However, scaling the product across India required a clear business model, pricing strategy, and risk assessment plan.		
a)	Construct the key components of a Business Model Canvas for this smart irrigation startup.	CO2	(3)
b)	Suggest an appropriate pricing strategy and justify your choice.		(2)
c)	Analyse two major risks this startup may face during national expansion and suggest mitigation strategies		(1)
OR			
12	Founded in 2015, Zomato evolved from a simple restaurant discovery website to a multi-service platform offering food delivery, dining experiences, and grocery delivery. The startup adopted a commission-based revenue model, where it earned a percentage from restaurant orders, and later diversified into subscription models like Zomato Gold. Despite rapid expansion, Zomato faced major financial and operational challenges, including high delivery costs, customer retention issues, and intense competition from Swiggy. To remain sustainable, the company had to rethink its pricing strategy, manage investor expectations, and explore new sources of income such as advertising and cloud kitchens. This journey demonstrates how startup success depends not only on innovation but also on effective business planning, risk management, and strategic funding decisions.		
a)	Analyse Zomato's business model and identify how it balances value creation for customers and revenue generation for the company	CO2	(3)
b)	Evaluate the effectiveness of Zomato's diversification strategy (e.g., Zomato Gold, grocery delivery) in maintaining market competitiveness.		(2)
c)	Suggest any two alternative revenue model Zomato could adopt to achieve long-term profitability.		(1)
MODULE III			
13	In 2023, India's Patent Office rejected Johnson & Johnson's patent extension request for its popular tuberculosis (TB) drug Bedaquiline . The company had sought to extend its patent beyond the original expiry date, claiming a new version of the same compound. However, the Patent Office ruled that the new version did not meet the criteria of novelty and inventive step under the Indian Patent Act, Section 3(d) . As a result, Indian manufacturers were allowed to produce generic versions of Bedaquiline, reducing the cost of TB treatment from thousands of rupees per month to less than a few hundred. This decision was celebrated by public health organizations and patient-rights groups, as it made life-saving TB medicines affordable to thousands of patients in India and other developing nations.		
a)	Explain why the Indian Patent Office rejected Johnson & Johnson's patent extension for Bedaquiline.	CO3	(3)
b)	Analyse how Section 3(d) of the Patent Act helps prevent "evergreening" of pharmaceutical patents.		(2)
c)	Evaluate the social and economic impact of this decision on TB treatment and Indian healthcare.		(1)
OR			
14	In early 2024, a major copyright controversy emerged in the Indian film industry when legendary composer Ilaiyaraaja issued a legal notice to the producers of the Malayalam film Manjummel Boys , which featured his iconic Tamil song " <i>Kanmani Anbodu Kaadhalan</i> " from the 1991 film Guna. The song, deeply emotional and nostalgic, was used in a key scene of Manjummel Boys, which later became a massive box-office success across India. According to Ilaiyaraaja, the filmmakers had not obtained his personal permission to use the song, even though they had secured a license from the audio label that owned the recording rights. He claimed that under the Indian Copyright Act, 1957 , a composer retains moral and authorial rights over their work — including the right to be acknowledged and to object to unauthorized or distorted use. He argued that simply acquiring a "sound recording licence" from a music company does not override the composer's ownership of musical and lyrical rights. This case reignited a larger debate in India's creative industry about ownership, moral rights, and licensing practices. Many musicians and lyricists supported Ilaiyaraaja, asserting that composers often lose control of their creations to record labels. Others argued that such disputes could discourage filmmakers from reviving classic songs. Eventually, media reports suggested that the matter was settled out of court, with the Manjummel Boys team reportedly compensating Ilaiyaraaja around ₹60 lakhs for the use of the song. The controversy highlighted the urgent need for clearer copyright awareness and ethical licensing		

	practices in Indian cinema.			
	a)	Explain the types of rights Ilaiyaraaja holds under the Copyright Act, 1957, including economic and moral rights	CO3	(2)
	b)	Analyse why obtaining permission from a record label may not be sufficient to legally use a musical composition in a film.		(2)
	c)	Evaluate how this case impacts future relationships between composers, producers, and music companies in the Indian film industry.		(1)
	d)	Suggest one measure — legal, educational, or institutional — that could help prevent such copyright disputes in India's creative sector.		(1)
MODULE IV				
15	<p>With rapid advances in artificial intelligence (AI), India faces new challenges in defining ownership, authorship, and accountability for creative works generated by machines. AI tools such as ChatGPT, Midjourney, and Bard are now widely used by students, designers, and businesses. While these tools accelerate creativity and productivity, they also raise legal and ethical questions about originality, plagiarism, and copyright.</p> <p>In 2024, the Indian Ministry of Electronics and Information Technology initiated discussions on a framework for AI-generated content ownership and data protection, emphasizing transparency and responsible innovation.</p> <p>Globally, courts and IP offices are divided: some countries allow limited copyright protection for AI-assisted works, while others — including India — still require human authorship as the basis for copyright registration.</p> <p>The debate highlights a social tension: how can society protect creators' rights while encouraging the open, democratic use of emerging technologies? Without clear IP policies, both human creators and innovators risk exploitation, plagiarism, and loss of credit for their work.</p>			
	a)	Explain the challenges India faces in defining copyright ownership for AI-generated works.	CO4	(2)
	b)	Analyse the ethical implications of using AI tools for creative and academic content generation		(2)
	c)	Evaluate whether India should extend partial IP protection to AI-assisted works. Support your view with reasons.		(1)
	d)	Suggest one policy or guideline that could balance innovation and ethical IP use in the AI era.		(1)
OR				
16	<p>Over the past decade, India has witnessed explosive growth in digital entertainment and online media platforms such as Netflix, Hotstar, Zee5 and SonyLIV. However, this growth has been accompanied by a surge in digital piracy, which severely affects the creative economy.</p> <p>According to a 2024 report by the Motion Picture Association (MPA), India ranks among the top five countries in illegal film downloads and streaming site traffic. The Cinematograph (Amendment) Act 2023 introduced strict penalties — including imprisonment — for individuals or groups involved in unauthorised recording or exhibition of films. Despite these legal measures, piracy persists through mirror sites, Telegram channels, and illegal OTT apps.</p> <p>This issue raises broader ethical and social questions: while piracy deprives creators and investors of revenue, it also exposes the affordability gap in India's digital ecosystem. Many argue that reducing piracy requires not only enforcement but also accessible pricing models and awareness among youth about IP ethics.</p>			
	a)	Explain how licensing and distribution rights contribute to fair commercialization of digital content in India.	CO4	(2)
	b)	Analyse the effectiveness of India's new anti-piracy laws in addressing the social and economic impacts of film piracy.		(2)
	c)	Evaluate the ethical dilemma between access and ownership in the context of digital piracy.		(1)
	d)	Suggest one initiative that could reduce piracy while ensuring affordable access to digital content.		(1)

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

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

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

COMPETENCY STATEMENT (CC)	
CC1	Demonstrate a commitment to a healthy lifestyle through regular physical activity and avoidance of addictive substances to promote holistic wellness.

COURSE OUTCOMES (CO)					
Course Outcomes (CO): At the end of this course, learners will be able to:					
CO	CO Statement	CC Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	Explain the importance of physical activity in maintaining the human metabolic system.	CC1	U		Re
CO2	Practice life style management strategies to improve mental health and wellness.	CC1	U	M	Rs
CO3	Practice healthy life style through regular physical activities and abstaining from addictive substances	CC1	U	M	Ch

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

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

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

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme		
L	T	J	P	S			Theory		
					C	CIA	ESE	Total	
1			1		1	30	30		30

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

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Physical well-being and fitness.	Human Body Systems. Quantifying Physical Activity Energy Expenditure. FITT principle	4
2	Mental health awareness & balanced diet	Understanding Mental Health, Addiction and Related Issues, Resources for Mental Wellness.	4

3	Health and wellness through lifestyle management	Manage common hypokinetic diseases and disorders. Meaning, Aims and objectives of yoga. Understanding on substance abuse and addiction	4
4	First Aid Essentials	First aid and principles of first aid	2

SELF-LEARNING / TEAM WORK

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

SUGGESTED LEARNING RESOURCES

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

Reference

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

Web Resource

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

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

Module	Topic	Mode of Delivery	CO	Learning Domain			Hrs
				C	P	A	
1	Human Body Systems related to Physical activity and its functions: Respiratory System - Cardiovascular System. Musculoskeletal System and the Major Muscle groups of the Human Body.	L	CO1	u		Re	1
	Quantifying Physical Activity Energy Expenditure and Metabolic equivalent of task (MET). Exercise Continuum: Light- intensity physical activity, Moderate intensity physical activity, Vigorous - intensity physical activity.	L	CO1	u		Re	1
	Defining Physical Activity, Aerobic Physical Activity, Anaerobic Physical Activity, Exercise and Health-Related Physical Fitness. FITT	L	CO1	u		V	1

	principle to design an Exercise programme.						
	Components of Health – related Physical Fitness : Cardiorespiratory Fitness- Muscular strength- Muscular endurance- Flexibility- Body composition.	L	CO1	u		Re	1
2	Concept of Health and Wellness: Health and wellness differentiation, Factors affecting health and wellness. Mental health and Factors affecting mental health Sports and Socialization: Sports and character building - Leadership through Physical Activity and Sports	L	CO2	u		V	2
	Diet and nutrition: Exploring Micro and Macronutrients: Concept of Balanced diet Carbohydrate & the Glycemic Index Animal & Plant -based Proteins and their Effects on Human Health Dietary Fats & their Effects on Human Health Essential Vitamins and Minerals	L	CO2	u		Rs	2
3	Life style management strategies to prevent manage common hypokinetic diseases and disorders - Obesity Cardiovascular diseases - Diabetes –Osteoporosis - Musculoskeletal disorders (e.g.,Osteoarthritis, Low back pain, Kyphosis, lordosis, flat-foot, Knock knee	L	CO2	u		Re	1
	Meaning, Aims and objectives of yoga Classification and importance of Yogic Asanas(Sitting, Standing, lying) Pranayama and Its Types- Active Lifestyle and Stress Management Through Yoga	L	CO2	u		0	1
	Understand on substance abuse and addiction psychoactive substance & its ill effects -alcohol opioids- cannabis -sedative - cocaine- other stimulants including caffeine hallucinogens- tobacco - volatile solvents.	L	CO2	u		0	1
4	First aid and principles of First Aid: Primary survey: ABC (Airway, Breathing, Circulation). Qualities of a Good First Aider First aid measures for:- Cuts and scrapes - Bruises- Sprains Strains- Fractures Burns Nosebleeds.	L	3	u		Rs	1
	First Aid Procedures: Cardiopulmonary Resuscitation (CPR) Heimlich Maneuver - Applying a sling Sports injuries: Classification (Soft Tissue Injuries -Abrasion, Contusion, Laceration, Incision, Sprain & Strain)	L	3	u		Rs	1

Module	Topic	Objective	CO	Learning Domain Level			Teaching Hours
				C	P	A	
	Stretching exercise (V sit and reach)	Improving Flexibility through Stretching Exercises	CO3		M		12
	Strength exercises (Partial Curl Up & Push Up)	Improving Flexibility through Stretching Exercises.	CO3		M		
	Endurance exercises (Run & Walk)	To assess and improve cardiovascular endurance	CO3		M		

ASSESSMENT PATTERN		
Assessment		Marks
Continuous Internal Assessment		50
1	Internal Examination	
2	Activity Evaluation	20
3	Learning Activity	20
4	Regularity	10
5	Course Project	
End Semester Examination		
Total		50

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
B250904/CN2305	IT WORKSHOP	
Pre-requisite		
NIL		

COURSE OBJECTIVES
The IT Workshop lab course aims to familiarize students with basic computer hardware components and system setup, provide hands-on experience with Linux operating system commands and editors, and introduce essential development tools such as compilers, debuggers, and version control using Git. The course also enables learners to create and manage technical documents using LaTeX, perform basic networking tasks and file transfer between systems, develop foundational skills in web development using HTML, CSS, and JavaScript, explore data analysis and visualization using MATLAB, and instil awareness of fundamental cybersecurity practices.

COMPETENCY STATEMENT(CC)	
CC1	Apply the knowledge of computer hardware components, peripherals, and interfaces, to assemble, configure, and maintain functional computer systems and networking.
CC2	Troubleshoot system and network configurations using operating system commands and networking tools to ensure efficient operation and connectivity.
CC3	Design and develop web and implement version control and documentation tools for collaborative software development.
CC4	Familiarize text editors and perform program compilation and debugging

COURSE OUTCOMES					
Course Outcomes (CO): At the end of this course, learners will be able to:					
CO	CO Statement	CC Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	Identify the key components of computer system and networking hardware used in modern computing environments.	CC1	U	I	Re
CO2	Demonstrate the use of essential operating system commands to manage files, users, and processes effectively, after the installation and configuration of operating systems.	CC1 CC2	A	M	Rs
CO3	Demonstrate file sharing and communication between computer systems.	CC2	A	P	V
CO4	Deploy simple web pages using HTML, CSS and Javascript, by incorporating features such as form validation and image sliders on a local webserver.	CC3	A	Ar	O
CO5	Apply development and documentation tools such as Visual Studio Code, Matlab, Git, and LaTeX for effective coding, version control, collaboration, and preparation of professional technical documents.	CC3	A	Ar	Ch
CO 6	Practice basic cybersecurity measures like permissions and encryption.	CC4	A	P	V
CO 7	Apply text editors and debugging tools to write, compile and debug C programs.	CC4	A	Ar	O
Cognitive (Revised blooms Level): - R: Remember; U: Understand; A: Apply; An: Analyse; E: Evaluate ; C: Create Psychomotor Domain (Dave's): - I-Imitation, M-Manipulation, P-Precision, Ar-Articulation, N-Naturalisation Affective (Krathwohl): - Re-Receiving, Rs-Responding, V-Valuing, O-Organization, Ch-Characterization					

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

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					Credit	Hours/ Semester	Examination Scheme		
L	T	J	P	S			Practical		
			2		C	CIA	ESE	Total	
					1	60	40	100	
L: Lecture (One unit is of one-hour duration), T: Tutorial (One unit is of one-hour duration), P: Practical (One unit is of one-hour duration), J: Project (One unit is of one-hour duration), S: Self-Learning & Team Work (One unit is of one-hour duration), CIA: Continuous Internal Assessment, ESE: End Semester Examination									

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Computer Systems & Linux Environment	Computer Hardware and Peripherals, Boot Process & OS Installation, Working with Text editors (Vim/ emacs/ nano /Vi), C program compilation and debugging, Shell Programming (Bash)	12
2	Web Development Basics	HTML structure, tags, links, CSS styling and layout, Basic JavaScript interactivity, Hosting a web page locally	4
3	Development Environments Repositories & Documentation	Git basics: init, clone, commit, push, branch, Documentation with LaTeX: reports, equations, tables, Perform Import data, perform statistical analysis and visualize it using Matlab, Understand the concept of image representation as 2D matrix and perform image operations (imread(), imresize(), rgb2gray(), imshow(), imhist())	6
4	Networking and Security	Configure basic network and monitor it using Wireshark, Various types of cyber threats, its risk factors and defense mechanisms.	4
SELF-LEARNING / TEAM WORK			
Sl. No	Self-learning / Team Work Description		Hrs
1	Deploy webpages using HTML, CSS and JavaScript		2
2	Prepare a document for your webpage using Latex		2
3	Upload your code and document in your git		2

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	The Architecture of Computer Hardware, Systems Software, & Networking: An Information Technology Approach.	Irv Englander	Wiley, 5/e, 2014
2	Mastering Git : Attain expert level proficiency with Git for enhanced productivity and efficient Collaboration	Jakub Narebski	Packt ,1/e, 2016
3	Web Design with HTML, CSS, JavaScript, and JQuery	Jon Duckett	Wiley, 1/e, 2014
4	MATLAB: Data Analysis and Visualization	Antonio Siciliano	World Scientific Publishing Co., 2008

Reference			
Sl. No.	Title of Book	Author	Publication
1	Linux Command Line and Shell Scripting Bible	Richard Blum and Christine Bresnahan	Wiley, 2021, 4th Edition
2	Learning the vi and Vim Editors	Arnold Robbins	O'Reilly Media, 2016.
3	Learning GNU Emacs,	Debra Cameron	O'Reilly Media, 2004.
4	Network Security Essentials: Applications and Standard	William Stallings	Pearson, 2023
5	Digital Image Processing Using MATLAB	Rafael C. Gonzalez et al	Pearson

Web Resource	
1	https://www.tutorialspoint.com/computer_hardware/index.htm
2	https://www.cisco.com/c/en/us/solutions/small-business/resource-center/networking.html
3	https://www.wireshark.org/docs/wsug_html_chunked/
4	https://linuxconfig.org/bash-scripting-tutorial-for-beginners
5	https://www.w3schools.com/howto/howto_js_slideshow.asp
6	https://www.latex-project.org/help/
7	https://git-scm.com/doc
8	https://code.visualstudio.com/docs

PRACTICAL SYLLABUS						
Topic	Objective	CO	Learning Domain			Hrs
			C	A	P	
Computer Hardware and Peripherals	Familiarize with CPU, motherboard, storage, interface cards, I/O devices, and networking hardware	1	U	I	Re	2
Boot Process & OS Installation	Installation of Linux and Windows OS and Understand boot process	2	U	M	Rs	2
Working with Text editors (Vim/emacs/nano/Vi)	Create program files, compile and debug it	7	A	P	V	2
C program compilation and debugging		7	A	P	V	2
Unix/Linux Basic Commands	Execute essential Unix / Linux commands to manage files, users, and processes	2	A	M	Rs	2
Shell Programming (Bash)	Write basic shell scripts to perform different tasks	4	C	Ar	O	2
Web Page Development	Create HTML, CSS, JS web pages with forms and validation	4	C	Ar	O	2
LaTeX & Documentation Tool	Prepare technical documents using LaTeX	5	A	Ar	Ch	2
Development Environments & Repositories	Use Matlab for statistical data analysis and its visualization	5	A	Ar	Ch	2
	Use Git, Bitbucket for collaborative coding	5	A	Ar	Ch	2
Networking Configuration and monitoring	Configure basic network and monitor it using Wireshark	3	A	P	V	2
Cyber Threats and defense mechanism	Understand various types of cyber threats and enable learners to analyse risk factors and recommend suitable defence mechanisms.	6	A	P	V	2

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