MITS Kochi
Muthoot Institute of Technology and Science
(Autonomous)

B. TECH
COMPUTER SCIENCE & ENGINEERING (CYBER SECURITY)
CURRICULUM & SYLLABUS

2025
REGULATION

B.Tech

COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)

2025 REGULATION

CURRICULUM & SYLLABUS

CONTENTS

SEMESTER II

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/PH910B	Physics for Information Science	3	0	0	2	3	4
C	EST	B250008/CY200C	Foundations of Cyber Security	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/CN900K	Life Skills and Professional Communication	1	1	0	0	0	1
U	ESL	B250904/CN230U	IT Workshop	0	0	0	2	0	1
	SEC		Skill Enhancement Course						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 orthonormalization 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**-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**									**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**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**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 $M_{2\times2}$, 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 orthonormalization 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**

SELF-LEARNING / TEAM WORK

Sl. No	Self-learning / Team Work Description	Hrs
1	Symmetric matrix, Skew-symmetric matrix, Orthogonal Matrix, Properties of eigenvalues of Symmetric matrix, Skew-symmetric matrix, Orthogonal Matrix **(1 hour)**	**9**

	Practice problems on solving systems of linear equations using Gauss elimination **(1 hour)**, finding eigenvalues and eigenvectors **(2 hours)**, diagonalization **(2 hours),** quadratic forms and their canonical forms **(2 hours)** Team Work - Solve mathematically and write a Python program that computes the eigenvalues and corresponding eigenvectors of matrices and visualize the eigenvectors as arrows originating from the origin **(1 hour).**	
2	Addition and scalar multiplication of polynomials, matrices and vectors in R^n **(1 hour)**, Practice problems on example of vector spaces, subspaces **(2 hours),** Practice problems on Linear dependence and independence of vectors **(2 hours)**, Practice problems on basis vector space and dimension of a vector space **(2 hours)**, **Team Work -** Given two bases B and B' of R^2 and a vector v expressed in basis B**.** Solve mathematically and write a Python program that compute the transition matrix $P_{B\to B'}$, Also convert the coordinates of v from basis B to basis B′ and visualize both bases and the vector before and after the transformation **(2 hours)**.	**9**
3	Vector length and unit vector, Dot product and angle between two vectors **(1 hour),** Practice problems on orthogonal projections in inner product spaces **(2 hours)**, Practice problems on Gram-Schmidt orthonormalization process **(2 hours)**, Practice problems on the least squares problem **(2 hours).** **Team Work -** Solve mathematically and write a Python program that takes linearly independent vectors as input, apply the Gram-Schmidt process to convert them into an orthonormal set. Also plot the original and orthonormal vectors in 3D **(2 hours)**.	**9**
4	Practice problems on Linear Transformation given by a matrix **(2 hours)**, Practice problems on Rotation in R^2, Projection in R^3**(2 hours)**, Practice problems on Kernel of a Linear Transformation and its basis **(1 hour)**, Practice problems on rank and nullity of a linear transformation **(1 hour)**, Practice problems on matrices for linear transformations **(1 hour)**, **Team Work -** Solve mathematically and write a Python program to explore and visualize linear transformations in two-dimensional space. Given a transformation matrix A, your program defines a triangle using a given set of points and apply the transformation A to all points of the shape. Also Plot the original shape and the transformed shape on the same axes for comparison **(2 hours)**.	**9**

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,	**L**	**CO1**	**A**			**1**
	Tutorial Problems	**T**	**CO1**	**U**		**Rs**	**1**
	Row echelon form and rank of a matrix	**L**	**CO1**	**A**			**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**
	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**

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 $M_{2\times2}$	**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 sets	**L**	**CO3**	**U**			**1**
	Orthogonal and orthonormal basis	**L**	**CO3**	**A**			**1**
	Gram-Schmidt orthonormalization 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**

			Total Pages: …….
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

(Answer all questions. Each question carries 3 marks)

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 $A = \begin{bmatrix} 0 & 1 \\ * & * \end{bmatrix}$ 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 $< p, q > = a_0b_0 + a_1b_1 + a_2b_2$. 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 $T: R^2 \to R^3$ given by $T(x, y) = (x^2, xy, y^2)$ is a linear transformation or not.	CO4	(3)
8	Let $T: R^2 \to R^2$be a linear transformation defined by $T(x, y) = (x - y, x + 3y)$. Find the standard matrix for T.	CO4	(3)

PART B

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

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 Tdepends 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				
11	a)	Determine whether the given subsets of $R^3$are vector subspaces; 1. the plane of vectors (x,y,z) that satisfy $y-x+z=0$. 2. the plane of vectors whose third component is -1.	CO2	(5)
	b)	Let W be the subspace of all symmetric $2x2$ matrices over 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 $R^2$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 R^3into an orthonormal basis.	CO3	(6)
	b)	Find $(u+v).(2u-v)$ when $u.u=4, u.v=-5$ and $v.v=10$.	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 R^2.	CO3	(3)
MODULE IV				
15	a)	Find the Kernel of the linear transformation $T: R^2 \to R^2$ defined by $T(X)=AX$ where $A=\begin{bmatrix}1 & -1 & -2\\ -1 & 2 & 3\end{bmatrix}$.	CO4	(5)
	b)	Let $T: R^3 \to R^3$ 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 $T: R^3 \to R^2$ 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 $T: R^3 \to R^3$ defined by the matrix A = $\begin{bmatrix}1 & 0 & 1\\ 0 & 1 & 0\\ 1 & 0 & 1\end{bmatrix}$.	CO4	(4)

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

Course Code	Course Name	Course Category
B250904/PH910B	**Physics for Information Science**	**BSE**
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)
CO 1	Apply free electron theory and BCS theory to find electrical conductivity in metals and superconductors.	CC1	A		
CO 2	Apply the Schrodinger equation to a one-dimensional quantum mechanical system for finding energy levels in such systems	CC2	A		
CO 3	Apply the theory of semiconductors in a p-n junction under forward and reverse biased conditions	CC2	A	M	Rs
CO 4	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			

TEACHING AND ASSESSMENT SCHEME

Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme						
							Theory			Practical			Total
L	T	J	P	S	C		CIA	ESE	Total	CIA	ESE	Total	
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**	Uncertainity 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) - Uncertainity 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 Arun Murthy	S. Chand 11th Edition, 2018
2	Engineering Physics	H K Malik, A.K. Singh,	McGraw2nd Edition, 2017 Hill Education,

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 Level			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			
		Uncertainity principle, conjugate observables	L	CO2	A	M	Rs	1

		Application of uncertainity 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
		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
3	**Semiconductor Physics**	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,	S	CO3	A			

		Self-Learning 9						
		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			
4	**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
		Zener diode- VI characteristics, Tunnel diode, VI characteristics	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

Module	**Topic**	**Objective**	**CO**	**Learning Domain Level**			**Hrs**
				C	P	A	
1	Diffraction grating	To determine the wavelength of laser using grating	CO4	A	M	Rs	2
2	Diode characteristics	To determine the characteristics of a diode	CO3	A	M	Rs	2
3	Cathode Ray Oscilloscope	To determine voltage and frequency of an electronic signal from function generator	CO3	A	M	Rs	2
4	LED characteristics	To determine the characteristics of an LED	CO4	A	M	Rs	2
4	Solar cell	To determine the characteristics of a solar cell	CO4	A	M	Rs	2

4	Numerical aperture	To determine numerical aperture of an optical fiber	CO4	A	M	Rs	2
4	Zener diode characteristics	To determine the characteristics of a zener diode	CO4	A	M	Rs	2
4	Half wave rectifier	To determine input and output waveforms through a half wave rectifier	CO4	A	M	Rs	2
4	Full wave rectifier	To determine input and output waveforms through a half wave rectifier	CO4	A	M	Rs	2
4	Photo diode characteristics	To determine the characteristics of a photo diode	CO4	A	M	Rs	2

Module	Module Title	Distribution of Marks (Revised Bloom's Level)						Total Marks
		R	U	A	An	E	C	
1	Electrical conductivity	√	√	√				15
2	Quantum Mechanics	√	√	√				15
3	Semiconductor Physics	√	√	√				15
4	Semiconductor Devices	√	√	√				15

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

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

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			
(Answer all questions. Each question carries 3 marks)			
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				
(Answer any one full question from each module, each question carries 9 marks)				
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 1.54×10^{-8} Ωm 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 8×10^5 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 Å 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 Å 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 μA at room temperature when a large 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	CO4	(6)

		with the help of a circuit diagram. What is your inference about white light produced from an LED?		
	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)

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

Course Code	**Course Name**	**Course Category**
B250008/CY200C	**Foundations of Cyber Security**	**EST**
Pre-requisite		
NIL		

COURSE OBJECTIVES	
1	To introduce students to foundational cybersecurity principles, threats, and mitigation strategies.
2	To equip students with hands-on skills using basic security tools and techniques.
3	To introduce emerging research areas in cybersecurity.
4	To promote awareness of legal and ethical dimensions of cyber activity.

COMPETENCY STATEMENT (CC)	
CC1	Demonstrate a foundational understanding of cybersecurity by distinguishing between information security and cybersecurity, explaining the CIA triad, and identifying common threats, vulnerabilities, and attackers.
CC2	Apply fundamental security mechanisms such as authentication, authorization, encryption, and access control, and perform basic security practices including safe browsing, cyber hygiene, and the use of basic security tools to protect digital assets and networks.
CC3	Demonstrate awareness of cybersecurity ethics, legal frameworks, and evaluate the impact of emerging technologies such as AI, blockchain, IoT, cloud security, and quantum cryptography on future cyber defence systems.

COURSE OUTCOMES (CO)

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

CO	CO Statement	CC Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	Understand the fundamental concepts of cybersecurity, threat types, and the motivation behind cyberattacks through real-world examples.	CC-1	U		RS
CO2	Apply basic security mechanisms and cryptographic techniques to protect data and systems.	CC-2	A		RS
CO3	Understand security configurations and identify potential network/system vulnerabilities while understanding applicable cyber laws and ethical practices.	CC-2, CC-3	U	I	RS
CO4	Understand and illustrate the role of emerging technologies like AI, blockchain, IoT, and quantum cryptography in cybersecurity research.	CC-3	U		RS

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

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

2	2	2	2	-	2	2	2	1	1	-	2	1	1	
3	2	2	2	-	2	2	2	1	1	-	2	1	1	
4	2	2	2	-	-	2	2	-	1	-	1	1	1	
Correlation [3 – High, 2 -Medium, 1 – Low]														

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					**Credit**	**Hours / Semester**	**Examination Scheme**		
							Theory		
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**
2	1	0	0	3	3	90	40	60	100

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

SYLLABUS (Major Topics)			
Module	**Title**	**Major Topics**	**Hrs**
1	Introduction to Cybersecurity and Threat Landscape	Fundamentals of Information and Network Systems, Security Concepts, Information Security vs Cybersecurity – Need and Scope, CIA Triad, Threat Landscape- Malware, Phishing, Social Engineering Attacks, Attackers-Hackers, Hacktivists, State Actors, Insider Threats, Case Study- NotPetya, SolarWinds, AIIMS ransomware attack.	10
2	Security Mechanisms and Cryptography	Authentication, Authorization, Access Control Models, System Hardening, Firewalls, IDS/IPS, Cryptography - Symmetric & Asymmetric Encryption, Hashing, Digital Signatures, PKI, Cryptographic Applications in Secure Communication.	10
3	Secure Systems, Networks & Cyber Law	Secure OS Concepts, Network Security Basics -IP, Ports, Packet Sniffing, Port Scanning, DoS, Man-in-the-Middle, SQL Injection, Safe Browsing Practices, Cyber Hygiene, Digital Footprint, Indian Cyber Law - IT Act 2000, Amendments, Ethics in Hacking.	10
4	Emerging Research Areas in Cybersecurity	Artificial Intelligence in Cybersecurity- Anomaly detection, Behaviour analysis, Blockchain Security Applications- Tamper-resistance, Decentralized Identity, IoT Security- Device authentication, Data Privacy Challenges, Cloud Security Challenges- Multi-tenancy, Secure VM isolation, Quantum Cryptography- Concept and Potential Impact.	10

SELF-LEARNING / TEAM WORK		
Sl. No	**Self-learning / Team Work Description**	**Hrs**
1	Explore NIST guidelines, CERT-IN reports, IT Act 2000, or OWASP Top 10 vulnerabilities (Reading).	8
2	Study reports on NotPetya, AIIMS Ransomware, and SolarWinds; answer guided questions.	6
3	Learn about tools like Wireshark, Nmap, and Hashing demos via videos or manuals.	6
4	Select 2–3 expert talks from YouTube or Coursera (e.g., on Zero Trust, Quantum Crypto).	6
5	Maintain weekly logs of personal digital hygiene, password policies, VPN usage, etc.	6
6	Write brief reflections (100–150 words) on Cyber Ethics or AI in Security.	5
7	Research and submit summaries on AI in anomaly detection, Blockchain Identity, Quantum Cryptography.	8

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	**Title of Book**	**Author**	**Publication**

1	Principles of Information Security.	Michael E. Whitman, Herbert J. Mattord	Cengage Learning (7th Ed.)
2	Computer Security: Principles and Practice.	William Stallings, Lawrie Brown	Pearson (4th Ed.)
3	Cryptography and Network Security: Principles and Practice.	William Stallings	Pearson Education (8th Ed.)
4	Data Communications and Networking.	Behrouz A. Forouzan	McGraw-Hill Education (5th Ed.)

Reference			
Sl. No.	**Title of Book**	**Author**	**Publication**
1	Network Security Essentials: Applications and Standards.	William Stallings	Pearson (6th Ed.)
3	Cybersecurity Essentials.	Charles J. Brooks et al.	Wiley
4	Applied Cryptography.	Bruce Schneier	Wiley
5	Artificial Intelligence for Cybersecurity: Develop AI Approaches to Solve Cybersecurity Problems in Your Organization.	Apostolis Zarras, Peng Xu, Bojan Kolosnjaji, Huang Xiao	Packt Publishing
6	Introduction to Quantum Cryptography.	Thomas Vidick and Stephanie Wehner	Cambridge University Press
7	IoT Security: Advances in Authentication.	Madhusanka Liyanage, An Braeken, Pardeep Kumar, Mika Ylianttila	Wiley
8	Cloud Computing: Concepts, Technology & Architecture.	Thomas Erl, Zaigham Mahmood, Ricardo Puttini	Prentice Hall
9	Applying Artificial Intelligence in Cybersecurity Analytics and Cyber Threat Detection.	Shilpa Mahajan, Mehak Khurana, Vania Vieira Estrela	Wiley
10	Computer Networks.	Andrew S. Tanenbaum	Prentice Hall

Web Resource	
1	https://onlinecourses.nptel.ac.in/noc25_ee54/preview
2	https://nptel.ac.in/courses/106106129

DETAILED SYLLABUS *(Self-learning if any to be marked)*							
Module	**Topic**	**Mode of Delivery**	**CO**	**Learning Domain**			**Hrs**
				C	**P**	**A**	
1	Fundamentals of Information and Network Systems: Introduction to Digital Systems, Basics of Computer Networks: LAN, WAN, Internet, IP Address, Client–Server Model	L	CO1	U	-	-	1
	Communication Concepts: Data Transmission, Protocols, and Internet Services (Email, Web, Cloud)	L	CO1	U	-	-	1
	Data Flow and Security Points: Where and how security is needed	L	CO1	U	-	-	1
	Security Concepts: Key Terminology: Asset, Threat, Vulnerability, Risk, Attack, Exploit, Incident, Countermeasure	L	CO1	U	-	-	1
	Need and Scope of Cybersecurity, CIA Triad (Confidentiality, Integrity, Availability)	L	CO1	U	-	-	1
	Threat Landscape: Malware – Viruses, Trojans, Ransomware, Phishing Attacks, Social Engineering	L	CO1	U	-	-	1

	Attacks						
	Attackers – Hackers, Hacktivists, State Actors, Insider Threats	T	CO1	U	-	RS	1
	Case Study: NotPetya, Case Study: SolarWinds	T	CO1	U	-	RS	2
	Case Study: AIIMS Ransomware Attack (India)	T	CO1	U	-	RS	1
2	Authentication (Passwords, OTP, Biometrics),	L	CO2	U	-	-	1
	Authorization	L	CO2	U	-	-	1
	Access Control Models	L	CO2	U	-	-	1
	System Hardening	L	CO2	U	-	-	1
	Firewalls, IDS/IPS(Conceptual)	T	CO2	U	I	RS	1
	Cryptography: Symmetric & Asymmetric Encryption (AES, RSA)	L	CO2	A	I	-	1
	Hashing (MD5)	L	CO2	A	I	-	1
	Hashing (SHA)	T	CO2	A	I	RS	1
	Digital Signatures, PKI (Conceptual level)	L	CO2	U	-	-	1
	Cryptographic Applications in Secure Communication	T	CO2	U	-	RS	1
3	Secure OS Concepts (Linux/Windows hardening basics)	L	CO3	U	-	-	1
	Network Security Basics: IP, Ports, Packet Sniffing (Wireshark)	T	CO3	A	I	-	2
	Port Scanning (Nmap)	T	CO3	U	I	-	1
	DoS, Man-in-the-Middle	L	CO3	U	-	RS	1
	SQL Injection	T	CO3	A	I	-	1
	Safe Browsing Practices, Cyber Hygiene	L	CO3	U	I	RS	1
	Digital Footprint	L	CO3	U	-	-	1
	Indian Cyber Law: IT Act 2000, Amendments	L	CO3	U	-	RS	1
	Ethics in Hacking	L	CO3	U	-	RS	1
4	Artificial Intelligence in Cybersecurity- anomaly detection, behaviour analysis	L,T	CO4	U	-	RS	2
	Blockchain Security Applications: tamper-resistance, decentralized identity	L	CO4	U	-	RS	2
	IoT Security: device authentication, data privacy challenges	L	CO4	U	-	RS	2
	Cloud Security Challenges: multi-tenancy	L	CO4	U	-	RS	1
	Cloud Security Challenges: secure VM isolation,	L	CO4	U	-	RS	1
	Quantum Cryptography: concept and potential impact	L	CO4	U	-	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	Introduction to Cybersecurity and Threat Landscape.	√	√					15
2	Security Mechanisms and Cryptography.	√	√	√				15
3	Secure Systems, Networks & Cyber Law.	√	√					15
4	Emerging Research Areas in Cybersecurity.	√	√					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 Activities	**15**
3. Regularity	**5**

End Semester Examination	**60**
Total	**100**

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

SECOND SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, DECEMBER 2025 (2025 SCHEME)			
Course Code:	B250008/CY200C		
Course Name:	Foundations of Cyber Security		
Max. Marks	**60**	**Duration**:	2 hours 30 minutes
CY			

PART A			
(Answer all questions. Each question carries 3 marks)			
No.	***Question***	***CO***	***Marks***
1	Differentiate between Information Security and Cybersecurity with suitable examples.	CO1	(3)
2	Illustrate the CIA Triad in cybersecurity with suitable examples for each component.	CO1	(3)
3	A fintech startup wants to enhance the security of its user login system. Apply your understanding of authentication mechanisms to design a method that ensures secure and convenient access for users, minimizing reliance on static credentials.	CO2	(3)
4	A digital certificate used by an online portal has expired, disrupting user logins. Apply your knowledge of PKI to explain how certificate management practices could prevent such incidents.	CO2	(3)
5	Illustrate how OS hardening practices improve the security posture of Linux or Windows systems with an example.	CO3	(3)
6	Illustrate the concept of a Man-in-the-Middle (MITM) attack and outline methods to detect or prevent it.	CO3	(3)
7	Justify how blockchain technology ensures tamper-resistance in data storage.	CO4	(3)
8	Evaluate the implications of quantum cryptography for traditional encryption systems.	CO4	(3)

PART B				
(Answer any one full question from each module, each question carries 9 marks)				
No.		***Question***	***CO***	***Marks***
MODULE I				
9	a)	Enumerate and exemplify the major types of malwares—viruses, trojans, and ransomware.	CO1	(5)
	b)	Investigate the methods used by the NotPetya attack to spread and summarize its key effects.	CO1	(4)
OR				
10	a)	Evaluate the significance and threat level posed by hackers, hacktivists, state actors, and insider threats.	CO1	(5)
	b)	Evaluate the AIIMS ransomware attack in terms of its causes, impact, and lessons learned.	CO1	(4)
MODULE II				
11	a)	A cybersecurity analyst is asked to secure communication between IoT devices in a smart home ecosystem. Apply lightweight encryption and hashing algorithms suitable for low-power devices to maintain security without performance degradation.	CO2	(5)
	b)	Suppose an IoT gateway detects unusual traffic patterns. Explain how IDS/IPS mechanisms can be applied to detect and respond to potential intrusion attempts.	CO2	(4)
OR				
12	a)	A government e-voting system requires end-to-end confidentiality, integrity, and authenticity of votes. Apply asymmetric encryption, hashing, and digital signatures to design a secure architecture for the voting process.	CO2	(5)

	b)	To ensure transparency and secure voter verification, propose how a PKI (Public Key Infrastructure) can be integrated into the above system to manage digital certificates, voter authentication, and secure result validation.	CO2	(4)
MODULE III				
13	a)	Assess how common network attacks including Denial of Service, Man-in-the-Middle, and SQL Injection impact data confidentiality and availability in connected systems.	CO3	(5)
	b)	Analyze how cyber hygiene and digital footprint management support safe browsing and responsible online behaviour.	CO3	(4)
OR				
14	a)	Assess the role of ethical hacking in maintaining organizational security and preventing malicious cyber activities.	CO3	(5)
	b)	Analyze the significance of the IT Act 2000 and its amendments in promoting ethical and secure use of cyberspace.	CO3	(4)
MODULE IV				
15	a)	Propose any two strategies to ensure secure isolation between virtual machines (VMs) in a shared infrastructure.	CO4	(2)
	b)	Device authentication is critical in securing Internet of Things (IoT) environments. Justify this statement with valid reasons.	CO4	(2)
	c)	Evaluate how quantum cryptography could transform data security by addressing the limitations of traditional encryption methods.	CO4	(2)
	d)	Match the following security mechanisms with their corresponding purposes and for each correct pair, write one relevant application area or example.	CO4	(3)

Column A (Security Mechanisms)	**Column B (Purpose)**
A. Anomaly Detection	1. Analyses deviations from normal user or system activity
B. Behaviour Analysis	2. Protects data integrity using cryptographic blocks
C. Blockchain Applications	3. Identifies abnormal network traffic or insider threats
D. IoT Security	4. Verifies device legitimacy and safeguards privacy
	5. Focuses on tamper-resistance and decentralized identity

OR				
16	a)	Examine how multi-tenancy and virtualization introduce unique security concerns in cloud computing.	CO4	(2)
	b)	Illustrate the major data privacy challenges that arise due to the large-scale interconnection of IoT devices.	CO4	(2)
	c)	Assess how decentralized identity systems based on Blockchain enhance security and privacy in digital ecosystems.	CO4	(2)

	d)	Match the security domains given in column a with their corresponding major challenges or features in column b, and also identify one related tool or technology from column c. **Column A (Security Domain)** / **Column B (Major Challenge / Feature)** / **Column C (Associated Tool / Technology)** A. Cloud Security / 1. Provides decentralized identity management / i. Quantum Key Distribution (QKD) Systems B. IoT Security / 2. Ensures VMs remain isolated from each other securely / ii. VMware vSphere / OpenStack C. Quantum Cryptography / 3. Deals with data privacy challenges in connected devices / iii. AWS IoT Device Defender / Azure IoT Hub D. Blockchain Security / 4. Risk due to shared computing environment (multi-tenancy) / iv. Firewalls / Intrusion Detection Systems E. Network Security / 5. Uses quantum principles to achieve unbreakable encryption / v. Hyperledger Fabric / Ethereum	CO4	(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						
							Theory			Practical			Total
L	T	J	P	S	C		CIA	ESE	Total	CIA	ESE	Total	
2	0	0	2	4	4	120	25	40	65	15	20	35	100

***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 variablesautomatic,static, external and register;Built-in functions; String functions	10
4	Pointers and Files	Pointer to pointer; Pointer to function;Dynamic Memory Allocation;Self-referential structures; Linked Structures like path, cycles, set of paths, staretc;Different types of files in C; Opening & Closing a file; Writing to and Reading from a file; Processing files;Library functions related to file – fseek(), ftell(), fread(), fwrite();Problem Solving using C(Translate algorithm to C program);	10

SELF-LEARNING / TEAM WORK		
Sl. No	Self-learning / Team Work Description	Hrs/Semester

1	Problems from The C Programming Language ,Brian W. Kernighan and Dennis Ritchie	20
2	C: A Reference Manual by Samuel P. Harbison, Guy Steele Jr.	20
3	Heap implementation as an array and use indexing to access parent/child	10
4	Code Reading (Data Structure or Operating Systems projects) (Sample https://github.com/attractivechaos/klib/blob/master/kalloc.c)	10

SUGGESTED LEARNING RESOURCES

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			Teaching Hours
				C	P	A	
1	Structure of a C program; Simple programs (Hello	Lecture	CO1	U	M	Rs	10

	world); Steps of compilation; Introduction to Popular compilers - Clang and LLVM; Introduction to gcc, C language specification	Practical					
	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	CO 3	A	M	Rs	10
	Multidimensional arrays						
	Structure; Defining a Structure variable; Accessing members; Array of structures						
	Pointer; Declaration; Operations on pointers; Pointer arithmetic						
	Accessing array elements using pointers						
	Accessing structure elements using pointers						
	Functions; Function definition; Function call; Function prototype						
	Parameter passing						

3	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						
	Different types of files in C; Opening & Closing a file; Writing to and Reading from a file; Processing files	Lecture Practical	CO7	U	I	Rs	
	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	CO 1	U	M	Rs	5

		data types, operators, and control structures to develop simple and efficient C programs.					
2	Mutidimensional ,Arrays,Structure,	To learn how to declare, initialize, and manipulate multidimensional arrays, and to understand the use of structures for organizing and managing related data efficiently in C programs.	CO 3	A	M	Rs	5
3	Functions;User defined functions;Built in Functions;	To understand the concept of functions in C and to develop the ability to create user-defined functions and effectively use built-in functions to design modular and reusable programs.	CO5,CO6	A	M	Rs	5
4	Pointers	To understand the concept of pointers and learn how to use them for efficient memory management, array manipulation, and function argument passing in C programs.	CO4	U	I	Re	5

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**

			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:	**B250903/CN210D**		
Course Name:	**PROGRAMMING IN C**		
Max. Marks	**60**	**Duration**:	**2 hours 30 minutes**
Common to CS, CY, ECE			

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***
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));`
			CO1	(3)

		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;* *}*		
	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)	Given an integer *n*, implement a C program to repeatedly **add all its digits** until the result has only one digit. Example Input: *n* = 38 Output: 2 Explanation: The process is 38 --> 3 + 8 --> 11 11 --> 1 + 1 --> 2	CO1	(4)
		What will be the **output** of the following program? *#include <stdio.h>* *int main()* *{ int i = 1 ;* *while(i<=10);* *{* *printf ("%d",i);* *i++;* *}* *}*	CO1	(3)
	b)	**Evaluate** the following **expressions** and show their hierarchy. i. g = big / 2 + big * 4 / big - big + abc / 3 ; (abc = 2.5, big = 2, assume g to be a float) ii. on = ink * act / 2 + 3 / 2 * act + 2 + tig ; (ink = 4, act = 1, tig = 3.2, assume on to be an int)	CO1	(2)
		MODULE II		
11	a)	Define a function with the following specification to check whether an integer array contains three consecutive odd numbers. 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 Example Input: *arr* = [2,6,4,1] Output: false Explanation: There are no three consecutive odds. Example 2: Input: arr = [1,2,34,3,4,5,7,23,12] Output: true Explanation: [5,7,23] are three consecutive odds.	CO3	(5)
	b	Write functions with the following specifications to initialize a 3×3 matrix	CO3	(4)

	)	and display its diagonal elements using functions. 1. Function Name :**displayMatrix()** Parameters:2D array (matrix) containing integer elements 2. Function Name :**displayDiagonals()** Parameters:2D array (matrix) containing integer elements		
		OR		
12	a)	You are given an m x n integer grid accounts where accounts[i][j] is the amount of money the i^{th} customer has in the j^{th} bank. Return the wealth that the richest customer has. 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. 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). 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	CO3	(5)
	b)	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. (a) Write a function to print names of all students who joined in a particular year. Function Name : **printStudentsByYear()** Parameters:Array of student structures,Number of students,Year to be searched (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	CO3	(4)
		MODULE III		
13	a)	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. 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	CO5	(5)

.		Algorithm for **PUSH** Operation 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" Algorithm for **POP** Operation 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 Algorithm for **DISPLAY** Operation 1. If top == -1, print "Stack is Empty" 2. Else, print all elements from stack[top] down to stack[0] Translate the above given **algorithm to C Program**		
	b)	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.	CO5	(4)
		OR		
14	a)	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.	CO5	(5)

	b)	List the four **storage classes** in C and mention one feature of each.
		What will be the **output?**
		*#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;
		}*
			CO5	(4)

		MODULE IV		
15	a)	In a scientific calculator application, a programmer needs to develop a	CO4	(5)

		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.		
	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**	**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**
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		
							Theory		
L	T	J	P	S	C		CIA	ESE	Total
4	0	0	0	4	4	120	40	60	100

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

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	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 Contraposition), 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.	11

		(Reference Text 1 - Relevant topics from sections 11.4-11.10, 14.5-14.11)	

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, counterexample	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	25
2	Learning Activity	10
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 $(p \to q) \wedge (q \to r) \Rightarrow (p \to r)$. Comment on its validity.	CO1	(4)
	e)	Use mathematical induction to prove that $1 + 3 + 5 + \cdots + (2n - 1) = n^2$.	CO1	(2)
		OR		
2	a)	Define *tautology* and *contradiction* with an example.	CO1	(2)
	b)	Fill in the Blanks: 1. The negation of $p \to q$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 $p \vee (p \to q)$and $q \vee (p \to q)$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 (a) $\forall a, b \in A, (a, b) \in R \Rightarrow (b, a) \in R$ 2. Symmetric relation (b) $\forall a \in A, (a, a) \in R$	CO2 CO3	(3)

		3. Transitive relation (c) $\forall a,b,c \in A,(a,b),(b,c) \in R \Rightarrow (a,c) \in R$ 4. Universal relation (d) $A \times A$		
	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 $f: R \to R$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 $f: A \to B$and $g: B \to C$, then $g \circ f: A \to C$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: **Column A** **Column B** 1. Eulerian Graph (a) Contains all vertices connected 2. Hamiltonian Graph (b) Traverses each edge exactly once 3. Spanning Tree (c) Traverses each vertex exactly once 4. Complete Graph (d) $n(n-1)/2$ edges	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: 1. In a simple connected planar graph, v - e + f = _____. 2. A connected graph without cycles is called a _____. 3. The number of edges in a complete graph with $n$vertices is _____.	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: 1. In a group, every element has a unique _____. 2. The identity element in Boolean algebra satisfies A + 0 = _____. 3. The complement law in Boolean algebra states that A + A' = _____.	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: **Column A** **Column B** 1. Idempotent Law (a) $A + 0 = A$ 2. Identity Law (b) $A + A = A$ 3. Involution Law (c) $(A')' = A$ 4. Absorption Law (d) $A + AB = A$	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 IPR**						**ESB**
Pre-requisite							
Course Code	**Course Name**						
Nil	Nil						
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Teamwork)							

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

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

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

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

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

COURSE ARTICULATION MATRIX																							
CO	**Knowledge Attitude Profile**									**Program Outcomes & Program Specific Outcomes**													
	WK									**PO**											**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1										3					1		1	1		2			
2										3			2	1	2	1	2	2	2	3			
3										2			1	2	2	2	1	1	2	3			
4										3			2	2	2	2	2	1	2	3			
5										3			2	3	3	2	2	3	3	3			
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"																							

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

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

SYLLABUS (Major Topics)			
Module	**Title**	**Major Topics**	**Contact Hours**
1	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., Ilaiyaraaja 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		

Module	Major Topic & Sub Topic	Mode of Delivery	Relevant COs	Learning Domain Level			Teaching Hours
				C	P	A	
1	Introduction to Innovation and Entrepreneurship – Meaning, need, and importance	L	CO1	U		Re	1
	Entrepreneurial mindset – Characteristics and motivation of entrepreneurs	L	CO1	U		Re	1
	Types of entrepreneurs – Intrapreneurs, social, tech-based, women entrepreneurs	L	CO1	U		Re	1
	Idea generation techniques – Creativity, brainstorming, problem identification	L	CO1	U		Re	1
	Design thinking – Empathy, define, ideate, prototype, and testing	L	CO1	U		Re	1
	Startup ecosystem – Incubators, accelerators, funding agencies	L	CO1	U		Re	1
	Government initiatives for startups – Startup India, Make in India, MSME schemes	L	CO1	U		Re	1
	Self-Learning 1	S	CO1	U		Re	
	Self-Learning 2	S	CO1	U		Re	

	Case study / activity – Successful Indian startups and their founders	L	CO1	U		Re	1
2	Market research and validation – Identifying customer needs	L	CO2	An		V	1
	Business model canvas – Key partners, activities, value proposition	L	CO2	An		V	1
	Revenue and pricing strategies – Cost-based and value-based pricing	L	CO2	An		V	1
	Business plan preparation – Structure and key components	L	CO2	An		V	1
	Self-Learning 3	S	CO2	An		V	
	Prototype and MVP development – Concept and significance	L	CO2	An		V	1
	Self-Learning 4	S	CO2	An		V	
	Risk management – Types of risks and mitigation plans	L	CO2	An		V	1
	Startup funding sources – Angel investors, venture capital, crowdfunding	L	CO2	An		V	1
	Self-Learning 5	S	CO2	An		V	
	Case study / activity – Analyze a startup's business model canvas	L	CO2	An		V	1
3	Introduction to IPR – Need, importance, and categories	L	CO3	U		Re	1
	Patents – Concepts, requirements, and types	L	CO3	U		Re	1
	Trademarks and Copyrights – Differences, examples, and protection	L	CO3	U		Re	1
	Industrial Designs and Geographical Indications – Overview	L	CO3	U		Re	1

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

TABLE OF SPECIFICATIONS (ToS) FOR QUESTION PAPER DESIGN

Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	U	A	An	E	C	
1	Entrepreneurship Fundamentals	8		√	√				10
2	Business Planning and Startup Management	8			√	√			10
3	Fundamentals of IPR	8		√	√				10
4	IPR Management and Commercialization	8			√	√			10
This ToS shall be treated as a general guideline for students and teachers for distribution of marks.									

ASSESSMENT PATTERN	
Assessment	**Marks**
Continuous Internal Assessment	**60**
Learning Activity	5
Attendance	5
Internal Examination	20
Course Project	30
End Semester Examination	**40**
Total	**100**

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

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

PART - A

(Answer all questions. Each question carries 2 marks)

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

PART - B

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

No.		***Question***	***CO***	***Marks***
		MODULE I		
9		Kerala has witnessed a steady rise in youth-led entrepreneurship through initiatives like **Kerala Startup Mission (KSUM),** which provides incubation, mentorship, and seed funding support. Programs such as **Young Innovators Programme (YIP)** encourage school and college students to identify real-world problems and propose innovative solutions. Many student startups—ranging from agritech to renewable energy—have evolved from these programs and are now scaling globally		
	a)	Analyse how Kerala's startup ecosystem supports the development of an entrepreneurial mindset among students.	CO1	(2)

	b)	Explain how design thinking principles can be applied to initiatives like YIP to improve innovation outcomes		(2)
	c)	Evaluate the challenges faced by youth entrepreneurs in Kerala in accessing funding and markets.		(1)
	d)	Suggest one policy-level improvement that could further strengthen Kerala's entrepreneurial ecosystem.		(1)
		OR		
10	In Kerala, there has been a growing presence of social and women entrepreneurs who are redefining business with a focus on sustainability and inclusivity. Initiatives like **Kudumbashree** and **WE Mission** (Women Entrepreneurship Mission) have empowered thousands of women to start micro and small-scale ventures across sectors like food processing, handicrafts, and local tourism. Meanwhile, social entrepreneurs such as *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 inclusive growth in Kerala.		(1)
	d)	Suggest one initiative the state government can introduce to strengthen the social entrepreneurship ecosystem.		(1)
		MODULE II		
11	A group of engineering graduates from Kochi developed an **IoT-based smart irrigation system** that optimizes water usage for farmers in Palakkad. With the support of KSUM's incubation center and an angel investor from Thrissur, the team built a Minimum Viable Product (MVP). However, scaling the product across India required a clear business model, pricing strategy, and risk assessment plan**.**			
	a)	Construct the key components of a Business Model Canvas for this smart irrigation startup.	CO2	(3)
	b)	Suggest an appropriate pricing strategy and justify your choice.		(2)
	c)	Analyse two major risks this startup may face during national expansion and suggest mitigation strategies		(1)
		OR		
12	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 *"Kanmani Anbodu Kaadhalan"* 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	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. In 2024, the Indian Ministry of Electronics and Information Technology initiated discussions on a framework for AI-generated content ownership and data protection, emphasising transparency and responsible innovation. 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. 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.			
	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	Over the past decade, India has witnessed explosive growth in digital entertainment and online media platforms such as **Netflix, Hotstar, Zee5** and **SonyLIV**. However, this growth has been accompanied by a surge in digital piracy, which severely affects the creative economy. According to a 2024 report by the **Motion Picture Association** (MPA), India ranks among the top five countries in illegal film downloads and streaming site traffic. The Cinematograph (Amendment) Act 2023 introduced strict penalties — including imprisonment — for individuals or groups involved in unauthorised recording or exhibition of films. Despite these legal measures, piracy persists through mirror sites, Telegram channels, and illegal OTT apps. This issue raises broader ethical and social questions: while piracy deprives creators and investors of revenue, it also exposes the affordability gap in India's digital ecosystem. Many argue that reducing piracy requires not only enforcement but also accessible pricing models and awareness among youth about IP ethics.			
	a)	Explain how licensing and distribution rights contribute to fair commercialisation of digital content in India.	CO4	(2)
	b)	Analyse the effectiveness of India's new anti-piracy laws in addressing the social and economic impacts of film piracy.		(2)
	c)	Evaluate the ethical dilemma between access and ownership in the context of digital piracy.		(1)
	d)	Suggest one initiative that could reduce piracy while ensuring affordable access to digital content.		(1)

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

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

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

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

COURSE OUTCOMES (CO)

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

CO	CO Statement	CC Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO 1	Evaluate self awareness to set effective goals and plans	CC 1	A		V
CO 2	Evaluate the ability to focus on strengthening the fundamentals of emotional quotient.	CC 1	A		V
CO 3	Apply techniques to enhance Critical Thinking, Problem-solving and Decision-making skills	CC 1	A		V
CO 4	Apply strategies to improve comprehension and communication skills	CC 1	A		Rs
CO 5	Present ideas using modern technological platforms	CC 1	A		V
CO 6	Establish a professional network using networking platforms	CC 1	An		O

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

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

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

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

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

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

SUGGESTED LEARNING RESOURCES

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

5	Effective Technical Communication	Ashraf Rizvi	McGraw Hill Education

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

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

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

Sl.No	Activity	Mode of Delivery	Group/ Individual (G/I)	Mark	COs	Learning Domain			Hrs
						C	P	A	
1.1	Group formation and self introduction among the group members	L	G			R		Re	2
1.2	Familiarizing the activities and preparation of the time plan for the activities	L	G			R		Re	
1.3	Preparation of Gantt chart based on the time plan	L, T	G	5	CO1	A		Re	
2.1	Take an online personality development test	L, T	I	2	CO1	U		V	3
2.2	Role-storming exercise 1: Students assume 2 different roles given below and write about their; ●Strengths ●Areas for improvement ●Concerns ●Areas in which he/she hesitates to take advice ●Goals/Expectations from the point of view of the following assumed roles: i) parent/guardian/mentor ii) friend/sibling/cousin	L, T	I	2	CO1	U		Rs	
2.3	Role-storming exercise 2: Students assume the role of their teacher and write about	L, T	I	2	CO1	U		Rs	

	●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								
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	
4.2	Interact with them to understand their workplace details including ●workplace skills required ●their work experience ●activities they have done to enhance their employability during their B.Tech years ●suggestions on the different activities to be done during B.Tech years Prepare a documentation of this	L, T	I	4	CO2	U		Rs	4
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	3
5.2	Listen to TED talks & video lectures from renowned Universities related to the problem and prepare a one-page summary (Each group member should select a different resource)	L, T	I	2	CO4	U			
5.3	Use any online tech forum to gather ideas for solving the problem chosen	L, T	G	2	CO5	A		Rs	
5.4	Arrive at a possible solution using six thinking hat exercise	L, T	G	5	CO3	An		V	
5.5	Prepare a report based on the problem- solving experience	L,T	G	2	CO4	A			
6.1	LinkedIn profile creation	L, T	I	2	CO6	U			2
6.2	Resume preparation	L, T	I	5	CO6	A			
6.3	Self-introduction video	L,T	I	3	CO6	A		V	
7	Prepare a presentation on instances of demonstration of emotional intelligence	L, T	I	2	CO2	A		V	3
8	Prepare a short video presentation on diversity aspects observed in our society (3 to 5 minutes)	L, T	G	5	CO2 CO5	A		V	3
9	Take online Interview skills development sessions like robotic interviews; self-reflect and report	L, T	I	2	CO6	U		V	1
10	Take an online listening test, self reflect and report	L, T	I	2	CO6	U		Rs	1
11.1	Activities to improve English vocabulary of students	L, T	I/G	4	CO4	U		Re	4
11.2	Activities to help students identify errors in English language usage	L, T	I/G	2	CO4	U		Re	
11.3	Activity to help students identify commonly	L, T	I/G	2	CO4	U		Re	

	misspelled words, commonly mispronounced words and confusing words								
11.4	Write a self-reflection report on the improvement in English language communication through this course	L, T	I	2	CO4	A		V	
11.5	Presentation by groups on the experience of using online collaboration tools in various group activities and time management experience as per the Gantt chart prepared	L, T	G	5	CO4 CO5	A		V	
12.1	Each group prepares video content for podcasts on innovative technological interventions/research work tried out in Kerala context by academicians/professionals/Govt. agencies/research institutions/private agencies/NGOs/other agencies	L, T	G	10	CO2 CO4 CO5	A		V	1
12.2	Upload the video content to podcasting platforms or YouTube	T	G	2	CO5	U			
12.3	Add the link of the podcast in their LinkedIn profile	T	G	2	CO5	U			

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

COURSE DESCRIPTION							
Regulation	**2025**	**L-T-J-P-S**	**0-0-0-2-0**	**Version**	**25/1**	**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**	**ESL**
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	Familiarise 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)**
CO 1	Identify the key components of computer system and networking hardware used in modern computing environments.	CC1	U	I	Re
CO 2	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
CO 3	Demonstrate file sharing and communication between computer systems.	CC2	A	P	V
CO 4	Deploy simple web pages using HTML, CSS, and JavaScript, by incorporating features such as form validation and image sliders on a local web server.	CC3	A	Ar	O
CO 5	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	CC4	A	Ar	O

	to write, compile and debug C programs.				

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		
							Practical		
L	T	J	P	S	C		CIA	ESE	Total
			2		1		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	Computer Systems & Linux Environment	Computer Hardware and Peripherals, Boot Process & OS Installation, Working with Text editors (Vim/ emac/ 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 defence 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 Narębski	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/ emac/ 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 visualisation	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**