Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Structure and Syllabus of

Pattern "A25"

S Y B.Tech.

Electronics and Telecommunication Engineering

Effective from Academic Year 2026-27

Prepared by: - Board of Studies in Electronics and Telecommunication Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune

Approved by: Academic Board, Vishwakarma Institute of Technology, Pune

Chairman – BOS | Dean Academics | Chairman – Academic Board

Head,
Department of E&TC
VIT, Pune - 48

Department of Electronics & Telecommunication Engg. V.I.T. PUNE - 48

Institute Vision

"To be a globally acclaimed institute in technical education and research for holistic socio-economic development."

Institute Mission

- To ensure that 100% students are employable and employed in Industry, Higher Studies, become Entrepreneurs, Civil / Defense Services / Govt. Jobs and other areas like Sports and Theatre.
- To strengthen Academic Practices in terms of Curriculum, Pedagogy, Assessment and Faculty Competence.
- Promote Research Culture among Students and Faculty through Projects and Consultancy.
- To make students Socially Responsible Citizen.

Department Vision

"To be a centre of academic excellence in Electronics, Telecommunication and related domains through continuous learning and innovation."

Department Mission

- To provide state of art education in Electronics and Telecommunication Engineering to meet current and future needs of society, industry, and academia.
- To strengthen collaborations with industries and institutes of repute to foster research culture among faculty members and students.
- To promote ethically conscious engineers demonstrating sustainable entrepreneurship and professional maturity in a social context.

Program Educational Objectives (PEOs)

Graduates of the program will

1. Have a comprehensive knowledge of Electronics engineering fundamentals to face the challenges of real-life complex problems.
2. Be professionals imbibed with a spirit of leadership, ethical behavior, and societal commitment.
3. Be compliant to constantly evolving technology through lifelong learning.

Program Specific Objectives (PSOs)

E&TC Graduates will have the ability to:

1. Design, develop and analyze complex Electronic Systems for communication, Signal Processing, Embedded Systems, and VLSI applications.
2. Identify and apply domain-specific hardware and software tools to solve real-world problems in Electronics and Communication.

Program Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

3. **Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5).

4. **Conduct Investigations of Complex Problems**: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

5. **Engineering Tool Usage**: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

6. **The Engineer and The World**: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

7. **Ethics**: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

8. **Individual and Collaborative Team work**: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

9. **Communication**: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

10. **Project Management and Finance**: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

11. **Life-Long Learning**: Recognize the need for , and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Second Year Structure, Semester 1, AY 2026-27

Sr. No.	Course Code	SY (Sem1)	Teaching Scheme(Hrs/Week)			Credits
			Theory	Lab	Tut	
CORE	ET2301	DATA STRUCTURES	3	2	0	4
CORE	ET2302	DIGITAL ELECTRONICS	2	2	0	3
CORE	ET2303:	SOLID STATE DEVICES AND CIRCUITS	2	2	0	3
CORE	ET2304	SIGNALS AND SYSTEMS	2	2	0	3
Multidisciplinary		MULTIDISCIPLINARY MINOR	2	0	1	3
HS	HS2002	FROM CAMPUS TO CORPORATE - 1	2	0	0	2
CORE	HS2001	REASONING AND APTITUDE DEVELOPMENT - 3	1	0	0	1
CORE	ET2306	ENGINEERING DESIGN AND INNOVATION - III	0	0	0	2
CORE	ET2305	DESIGN THINKING – 3	0	0	1	1
						22

MDM
MM1003:IOT FOR SMART APPLICATIONS

Chairman – BOS

Dean Academic

Chairman – Academic Board

Head,
Department of E&TC
VIT, Pune - 48

Department of Electronics & Telecommunication Engg. V.I.T. PUNE - 48.

Vishwakarma Institute of Technology

Structure

FF No. 653_A

Branch : E & TC **Year:** SY **Academic Year :** 2026-27 **Semester:** I **Module:** 3 **Pattern:** A24

Level 5																							
Course Code	NEP Course Category	Course Name	Teaching Scheme (Hrs./week)			Examination Scheme and Marks														Credits			
			Theory	Tutorial	Practical	CVV	CP	LAB/TUT	GD/PPT	HA	MSE(W)	MSE(R)	MSE(O)	ESE(R)	ESE (W)	ESE (O)	PRACT+CVV	ESE-Direct Evaluation		Theory	Tutorial	Practical	Total
Semester I																							
ET2301	CORE	Data Structures	3	0	2		20								40		40			3	0	1	4
ET2302	CORE	Signals and Systems	2	0	2	20	30	10			40									2	0	1	3
ET2303:	CORE	Digital Electronics	2	0	2	20	30	10							40					2	0	1	3
ET2304	CORE	Solid State Devices And Circuits	2	0	2	20	30	10							40					2	0	1	3
	Multidisciplinary	MDM	2	1	0	20	20			20	40									2	1	0	3
HS2002	HS	HSSM-FCTC	2	0	0							50		50						2	0	0	2
ET2305	CORE	VSEC-DT	0	1	0														100	0	1	0	1
HS2001	CORE	AEC-RAD	1	0	0														100	1	0	0	1
ET2306	CORE	FP-EDI	0	0	0							30		70						0	0	0	2
Total																				**14**	**2**	**4**	**22**

Abbreviations Used	
PPT	Powerpoint Presentation
GD	Group Discussion
CVV	Comprehensive Viva Voce
LAB	Laboratory
TUT	Tutorial
CP	Course Project
PR	Practical
HA	Home Assignment
MSE	Mid Semester Examination
ESE	End Semester Examination
R /W/O	Review /Written/Online

BOS Chairman

Head,
Department of E&TC
VIT, Pune - 48

Dean Academics

Department of Electronics & Telecommunication Engg. V.I.T. PUNE - 48.

CONTENTS

FF No.: 654A

ET2301: DATA STRUCTURE

Teaching Scheme	**Examination Scheme**
Credits : 04	CP: 20 Marks
Lectures : 3 Hrs/week	Lab Exam: 40 Matks
Practical : 2 Hrs/week	ESE : 40 Mark

Prerequisites:	
●	C++ Programming, Data Structures
Course Objectives:	
1.	Understand the principles of Object-Oriented Programming (OOP).
2	Develop efficient algorithms for sorting and searching by analyzing their time and space complexities and selecting appropriate techniques for different problem scenarios.
3	Design and implement linear data structures, including linked lists, stacks, and queues, using arrays and linked lists, and apply them to solve computational problems.
4	Understand and implement hierarchical data structures, including binary trees, binary search trees, balanced trees, B-trees, and Huffman trees, along with their traversal and analysis techniques.
5	Apply graph data structures and algorithms such as graph traversals, minimum spanning trees, shortest path algorithms, Union-Find operations, and graph-based problem-solving techniques.
6	Develop analytical and programming skills to select, implement, and evaluate appropriate data structures and algorithms for solving real-world computing problems efficiently.
Course Outcomes:	
1	Explain the fundamental concepts of arrays, stacks, queues, linked lists, trees, graphs, and object oriented programming principles such as classes, inheritance, and encapsulation.
2.	Apply arrays, linked lists, stacks, queues, and trees to solve basic problems involving data manipulation, traversal, and expression evaluation.
3	Analyze and compare the time and space efficiency of searching, sorting, and traversal algorithms for various data structures.
4	Evaluate multiple data structure choices and justify the most suitable option based on performance and scalability for use-cases like routing, job scheduling, or data compression.
5	Design and implement modular, reusable programs using abstract data types for trees, graphs, and hash tables.
6	Develop end-to-end applications like maze solvers, job schedulers, auto-complete systems, or shortest path finder's using graph algorithms, trees, and hashing.

Section1:	**Topics/Contents**
UNIT: I. Introduction to Object-Oriented Programming (OOP): Fundamental concepts of OOP, including classes, objects, inheritance, polymorphism, and encapsulation. Basic Concepts of Arrays: Definition, representation, and operations such as	

arithmetic traversal, insertion and deletion. **UNIT: II Sorting Techniques:** Bubble Sort, Insertion Sort, Quick Sort, and Heap Sort with time and space complexity analysis. Searching Techniques: Linear Search and Binary Search with time complexity analysis. **UNIT: III Linked Lists:** Dynamic memory allocation, Singly Linked Lists, Doubly Linked Lists, Circular Linked Lists.
Section2: Topics/Contents
Unit IV: Stack: Representation and implementation using Arrays and Linked Lists. Applications include expression conversion and evaluation. Balancing parentheses in an expression, reversing a string, and evaluating postfix expressions. Queues: Representation and implementation using Arrays and Linked Lists. Types of Queues. **UNIT: V Trees:** Basic terminology and representation of trees using arrays and linked lists. Tree traversals, both recursive and non-recursive methods, and operations on binary trees and binary search trees (BST). Applications of trees, explored through the construction and analysis of Huffman Trees. Advanced trees: AVL trees. **UNIT: VI Graphs:** Introduction to Graphs: Basic terminology, types of graphs, and graph representations (Adjacency Matrix and Adjacency List). Graph traversals, including BFS and DFS, are covered, along with applications like connected graphs. Algorithms for finding minimum spanning trees, such as Prims and Kruskals. Hashing(Only concept)

Text Books:	
1	Horowitz and Sahani, "Fundamentals of Computer Algorithms", 2nd Edition. University Press
2	Gilles Brassard, Paul Bratley, "Fundamentals of Algorithmics", PHI, ISBN 978-81-203-1131-2
Reference Books:	
1	Thomas H Cormen, Charles E Lieserson, "Introduction to Algorithms", 4TH Edition,
2	Michael T Goodrich and Roberto Tamassia," Algorithm Design: Foundations, Analysis, and Internet Examples" 2nd Edition, Wiley.

List of Practical's:

Sr No	Experiment Title
1	Implement a Menu Driven User Interactive Code for Searching Methods Namely, i) Linear Search and ii) Binary Search. Accept the Size and Elements of an Array from the User.
2	Implement a Menu Driven User Interactive Code for Sorting Methods Namely, i) Bubble Sort, ii) Insertion Sort, and iii) Quick Sort. Accept the Size and Elements of an Array from the User.
3	Implement a Menu Driven User Interactive Code for Linked List Operations Namely, i) Creation of a Linked List having at least 7 Nodes, ii) Find the Size of Created Linked List, iii) Print the Kth Node in the Linked List, iv) Search if Node with Value x Present in the Linked List, v) Print the Linked List in Reverse Order by Using Recursion, vi) Insert a Node with Value x in the Beginning of the Linked List, vii) Insert a Node with Value x in the Middle of Linked List, viii)

	Insert a Node with Value x and Position p in the Linked List, ix) Insert a Node with Value v in the End of the Linked List, x) Delete a Node in the Beginning of the Linked List, xi) Delete a Node in the Middle of the Linked List, xii) Delete a Node with Value x in the Linked List, xiii) Delete a Node at Position p in the Linked List, and xiv) Delete the Last Node in the Linked List. Print the Linked List After Performing Each of above Operations.
4	Implement a Menu Driven User Interactive Code for Stack Operations Operations Namely, i) Creation of Stack by Using Linked List, ii) Creation of Stack by Using Array, and iii) Evaluation of a Postfix Expression. Following Stack Methods Should be Implemented for Statements mentioned in i) and ii): a. Push(int x), b. Pop(), c. Peek(), d. Size(), e. isEmpty(). Users may use Terminal to Provide an Infix Expression for Statement mentioned in iii). You Need to Convert User-Entered Infix Expression to Postfix Expression to Evaluate it by Using Stack. Print the Stack After Performing Each of above Operations.
5	Implement a Menu Driven User Interactive Code for Queue Operations Namely, i) Creation of Queue by Using Linked List, ii) Creation of Queue by Using Array, iii) Creation of Queue by Using Stack, and iv) Given an integer, N. Find and Return first positive N integers in ascending order containing only digits 1, 2, and 3. a. Enqueue(int x), b. Dequeue(), c. Front(), d. Rear(), e. isEmpty(), f. Size(). Users may use Terminal to Provide a Command. Print the Queue After Performing Each of above Operations.
6	Implement a Menu Driven User Interactive Code for Binary Tree Operations Namely, i) Creation of a Binary Tree, ii) Find Size of the Binary Tree, iii) Check if a given Node Value present in the Binary Tree, iv) Return the Preorder Traversal of its Nodes' Values, v) Return the Inorder Traversal of its Nodes' Values, vi) Return the Postorder Traversal of its Nodes' Values, vii) Return the Level order Traversal of its Nodes' Values, viii) Return an integer denoting the Height of the Tree, ix) Return the Sum of all the Nodes of the Binary Tree, x) Return an integer denoting the Sum of Node Value of all Left Leaves in the Tree, xi) Return an integer denoting the Sum of Node Value of all Right Leaves in the Tree.
7	Implement a Menu Driven User Interactive Code for Binary Search Tree Operations Namely, i) Creation of a Binary Search Tree, ii) Check if it is a Binary Search Tree or Not. iii) Check if a given Node Value present in the Binary Search Tree, iv) Given Preorder Traversal of a Binary Tree { 4, 10, 5, 8 }, Check if it is possible that it is also a Preorder Traversal of a Binary Search Tree, where each internal node (non-leaf nodes) have exactly one child., v) Write a function to find the Kth Smallest Element in the Binary Search Tree
8	Implement a Menu Driven User Interactive Code for Operations Namely, i) Creation of Undirected Graph using Adjacency Matrix, ii) Creation of Directed Graph using Adjacency Matrix, iii) Creation of Directed Weighted Graph using Adjacency Matrix, iv) Creation of Undirected Graph using Adjacency List (Array of ArrayList), v) Creation of Directed Graph using Adjacency List (Array of ArrayList), vi) Creation of Directed Weighted Graph using Adjacency List (Array of ArrayList), vii) Creation of Undirected Graph using Adjacency List (ArrayList of ArrayList), viii) Creation of Directed Graph using Adjacency List (ArrayList of ArrayList), ix) Creation of Directed Weighted Graph using Adjacency List (ArrayList of ArrayList), and x) Breadth First Search Graph Traversal Algorithm. There should be at least 7 Nodes in the Graph.
9	Implement a Menu Driven User Interactive Code for Operations Namely, i) Depth First Search Graph Traversal Algorithm and ii) Find Number of Connected Components in a Disconnected Graph
10	Given an Array A. You have some integers given in the Array Q. For the ith Number, Find the Frequency of Q[i] in Array A and Return an ArrayList containing all the Frequencies. Use Hashmap.

List of Project areas:

Sr No	List of Sample Course Projects
1	Develop a stock market trading simulator that allows users to practice trading strategies using data structures like queues or stacks
2	Build a library management system that efficiently manages books, patrons, and transactions using appropriate data structures,
3	Implement a GPS navigation system that provides optimal routes and real-time traffic information using data structures like graphs and Dijkstra's algorithm.
4	Create a calendar application that efficiently manages events and appointments using data structures like binary search trees or hash tables.
5	Design an inventory management system for a retail store that tracks and optimizes inventory using data structures like linked lists or hash tables
6	Develop a flight booking system that efficiently manages flight schedules and bookings using data structures like priority queues or AVL trees.
7	Build a scheduling system for a conference or event that sorts and assigns time slots to sessions and speakers based on their availability and preferences.
8	Create a plagiarism detection system that efficiently compares and analyzes documents using data structures like hash tables
9	Build a social media analytics tool that analyzes user interactions and trends using data structures like graphs and breadth-first search (BFS) or depth-first search (DFS)
10	Implement a data compression tool for images that uses data structures like Huffman coding or run-length encoding to reduce file sizes.
11	Design a job search portal that matches job seekers with suitable job listings using data structures like binary search trees or hash tables.
12	Implement a text-based search engine that indexes and retrieves documents efficiently using data structures like trie structures
13	Design a student grading system that efficiently manages and analyzes student grades using data structures like hash tables or balanced search trees
14	Design an auction platform that efficiently manages bidding and auction processes using data structures like priority queues or AVL trees.
15	Implement a hotel reservation system that efficiently manages room bookings and availability using data structures like priority queues.
16	Create a chat application that supports real-time messaging and notifications using data structures like queues or linked lists
17	Design a route planning system for public transportation that provides optimal routes and schedules using data structures like graphs and Dijkstra's algorithm.
18	Build a social network analysis tool that analyzes relationships and connections among users using graph data structures and algorithms
19	Design a student course registration system that efficiently manages course enrollment and prerequisites using data structures like graphs or linked lists.
20	Build a smart parking system that efficiently manages parking spaces and provides real-time availability information using data structures like balanced search trees or hash tables.
21	Design a maze solving algorithm that uses a stack-based approach to navigate through the maze and find the shortest path.

22	Implement a printer spooler system that manages print jobs in a queue and ensures fair and efficient printing
23	Create a train scheduling system that uses a linked list to represent train routes and track train movements between stations
24	Build a restaurant waitlist management system that uses a queue to handle customer reservations and seating arrangements
25	Design a voting system that uses hash functions and hash tables to securely record and verify votes in an election
26	Implement a hospital resource allocation system that uses Prim's algorithm to optimize the allocation of medical resources, such as beds and equipment, to different departments or ward.
27	Design a road repair prioritization system that uses Kruskal's algorithm to prioritize road repair projects based on their impact on overall connectivity and transportation efficiency.

CO-PO Mapping

CO	Program Outcomes (PO)												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	0	0	0	0	0	0	0	0	2	0
CO2	3	3	2	0	2	0	0	0	0	0	0	2	2
CO3	3	3	0	2	0	0	0	0	0	0	0	2	1
CO4	3	3	3	0	2	1	0	0	0	0	0	3	2
CO5	3	3	2	2	3	0	0	0	2	2	2	3	3
CO6	3	3	3	3	3	0	0	1	3	3	3	3	3
Average	**3.00**	**2.83**	**1.33**	**0.50**	**1.67**	**0.00**	**0.00**	**0.00**	**0.33**	**0.33**	**0.33**	**2.17**	**1.83**

CO- WK Mapping :

CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	-	✓	✓	-	-	-	-	-	-
CO2	-	✓	✓	-	-	-	-	-	-
CO3	-	✓	✓	-	-	✓	-	-	-
CO4	-	✓	✓	-	-	✓	✓	-	-
CO5	-	✓	✓	-	-	✓	✓	-	-

CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO6	-	✓	✓	-	-	✓	✓	-	-

CO – WP Mapping (Complex Engineering Problems) Sample Table

CO	WP1	WP2	WP3	WP4	WP5	WP6	WP7
CO1	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-
CO6	-	✓	-	✓	-	✓	✓

CO – EA Mapping (Complex Engineering Activities)

CO – SDG Mapping (Sustainable Development Goals) Sample Table

CO	SDG(s) Addressed	Justification / Linkage
CO1	SDG 4	Develops fundamental knowledge of data structures and object-oriented programming, enhancing computational thinking, analytical skills, and lifelong learning capabilities
CO2	SDG 8	Enhances students' technical competency and software development skills, improving employ ability and readiness for the IT industry.
CO3	SDG 9	Promotes the development of efficient and scalable software systems through the analysis and selection of optimal algorithms and data structures.
CO4	SDG 7,	Industry, Innovation & Infrastructure: Establishes the core structural signal-processing blocks (RF/Audio amplification and feedback stabilizers) required for worldwide telecommunication systems.
CO5	SDG 9,	Promotes the development of efficient and scalable software systems through the analysis and selection of optimal algorithms and data structures.

CO	SDG(s) Addressed	Justification / Linkage
CO6	SDG 4	Quality Education: Empowers students with underlying technical and scientific semiconductor frameworks essential to fundamental electrical engineering literacy.

FF No.: 654-A

ET2302: DIGITAL ELECTRONICS

Teaching Scheme	**Examination Scheme**
Credits : 3	CP: 30 Marks
Lectures : 2 Hrs/week	CVV:20 Marks
Practical : 2 Hrs/week	LAB: 10Marks
Tutorial : Hrs/week	ESE (W/O):40Marks

Prerequisites:	
●	Digital Logic Design and Testing (Course Code: (ET1017)
Course Objectives:	
●	To design Combinational Logic Circuits
●	To design sequential logic circuits.
●	To design finite state machines.
●	To study different logic families.
●	To know various programmable logic devices
●	To compare various ADC and DAC circuits
Course Outcomes:	
	After completion of the course, student will be able to
1.	Design and implement combinational logic circuits.
2.	Design and implement sequential logic circuits.
3.	Design finite state machines.
4.	Describe digital circuit design using different logic families.
5.	Describe various programmable logic devices and its applications using HDL
6.	Compare various ADC and DAC circuits with respect to schematic,

	working, advantages and disadvantages.

Section1:	**Topics/Contents**

Unit-I: Combinational Logic Design:

Logic simplification using K-map (up to 4 variables), Quine-McCluskey minimization technique, multiplexers and demultiplexers as function generators (Few examples on each topic).

Unit-II: Sequential Logic Design:

Latches and Flip-flops, Conversion of flip-flops, Shift Registers, Types of shift registers, Counters: Asynchronous Counters, Synchronous Counters, Up/Down Synchronous Counters, Design of Synchronous Counters, modulo-N counters.

Unit-III: FSM:

State transition diagram, State table, Moore and Mealy Machines, Design examples of FSM.

Section2:	**Topics/Contents**

Unit-IV: Digital Logic Families:

Characteristics of Digital ICs: Speed of Operation, Power Dissipation, Figure of Merit, Fan in, Fan out, Current and Voltage Parameters, Noise Immunity, Types of logic families: TTL, Operation of TTL NAND gate, CMOS, Operation of CMOS Inverter, NAND and NOR gates, Introduction to Low-Voltage CMOS (LVCMOS) and Bi-CMOS logic families.

Unit-V: Programmable Logic Devices:

Simple Programmable Logic Devices (SPLDs): PROM, PAL and PLA. CPLDs and FPGAs, Introduction to HDL.

Unit-VI: A/D and D/A Converters:

Basics of analog to digital conversion: Sampling, Holding, Quantizing and Encoding.Digital-to-Analog Converters (DACs): Specifications, Binary-Weighted DAC, R/2R, ladder DAC. Analog-to-Digital Converters (ADCs): Specifications, Flash ADC, Dual-Slope ADC and Successive-Approximation ADC.

Text Books:	
1	1. Thomas L. Floyd, "Digital Fundamentals," 11th Edition, Pearson Education
2	R.P. Jain, "Modern Digital Electronics," 4th Edition, Tata McGraw Hill
3	Douglas L. Perry, "VHDL: Programming by Example," 4th Edition, McGraw-Hill
Reference Books:	
1	M. Morris Mano, "Digital Design," 4th Edition, Pearson Education
2	Donald P. Leach, Albert Paul Malvino and Goutam Saha, "Digital Principles and Applications," 8th Edition, McGraw Hill
3	A. Anand Kumar, "Fundamentals of Digital Circuits,'' 4th Edition, PHI
4	J. Bhasker, "VHDL Primer," 3rd Edition, Person

List of Practicals:

1. Design and implement combinational logic circuit using multiplexer & demultiplexer (Trainer kit or EDA tool)
2. Design and implement BCD (Decade) counter (Trainer kit or EDA tool)
3. Design and implement 4-bit up-down ripple counter (Trainer kit or EDA tool)
4. Design and implement Mod-N counters (Trainer kit or EDA tool)
5. Design and implement 4-bit bidirectional shift register (Trainer kit or EDA tool)
6. Design and implement pulse train generator (Trainer kit or EDA tool)
7. Design and simulation of 2-input TTL NAND gate using IRSIM.
8. Design and simulation of 2-input CMOS NAND gate using IRSIM.
9. Design N-bit Full Adder using VHDL and implement it on FPGA (Xilinx Vivado)
10. Design N-bit counter using VHDL and implement it on FPGA (Xilinx Vivado)
11. Design and implement Digital-to-Analog converter (Trainer kit or EDA tool)
12. Design and implement Analog-to-Digital converter (Trainer kit or EDA tool)

List of Project areas:

Course projects using digital ICs (Software simulation and hardware implementation)

Design of moderate to complex digital building blocks such as different types of adders (excluding ripple adder), Adder cum Subtractor, different types ofmultipliers, ALU, simple controllers using FSMs, Barrel shifter, basic controller/processor architectures using VHDL and its implementation on FPGAs.

CO – PO / PSO Articulation Matrix

Correlation: 1 = Low (Slight), 2 = Medium (Moderate), 3 = High (Substantial), '-' = no correlation.

CO	Program Outcome (PO)											PSO		
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	2	1	1	0	0	0	0	0	1	1	0	1	1	1
CO2	2	1	3	0	1	1	0	0	1	1	0	1	3	1
CO3	2	1	1	0	1	1	0	0	1	1	0	1	1	1
CO4	2	1	3	0	1	1	0	0	1	1	0	1	3	1
CO5	2	1	3	0	1	1	0	0	1	1	0	1	3	1
CO6	2	1	1	0	0	0	0	0	1	1	0	1	1	1
Avg	2	1	1	0	0	0	0	0	1	1	0	1	1	1

CO – WK Mapping (Knowledge & Attitude Profiles) Sample Table

'✓' indicates the knowledge profile drawn upon by the CO.

CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1		✓		✓	✓			✓	
CO2		✓		✓	✓	✓			
CO3		✓		✓	✓	✓		✓	
CO4		✓		✓		✓			
CO5			✓	✓		✓		✓	
CO6				✓	✓	✓		✓	

CO – WP Mapping (Complex Engineering Problems)

CO	WP1	WP2	WP3	WP4	WP5	WP6	WP7
CO1	✓		✓				
CO2	✓		✓				
CO3	✓		✓				
CO4	✓	✓	✓				
CO5	✓		✓				
CO6	✓		✓				

CO – EA Mapping (Complex Engineering Activities)

'✓' indicates the activity attribute addressed by the CO

CO	EA1	EA2	EA3	EA4	EA5
CO1	✓				
CO2	✓		✓		
CO3	✓		✓		
CO4	✓		✓		
CO5	✓		✓		
CO6	✓		✓	✓	✓

CO – SDG Mapping (Sustainable Development Goals)

CO	SDG(s) Addressed	Justification / Linkage
CO1	4, 9	Builds the foundation (SDG 4) that drives application based innovation (SDG 9).
CO2	9	Sequential design provide base for innovative applications (SDG 9).
CO3	9	Finite StateMachines supports broader innovation (SDG 9).
CO4	4	Depth in logic family for understanding logic circuits (SDG 4).
CO5	4, 9	Fundamentals of PLDs lead to solutions of industry problems (SDG 9).
CO6	4,9	Knowledge of data converters (4) leading to diversified applications (SDG 9).

Syllabus Template **FF No.: 654-A**

Course Code: Solid State Devices and Circuits (ET 2303)

Teaching Scheme	Examination Scheme
Credits : 03	CP: 30 Marks
Lectures : 02 Hrs/week	Lab : 10 Marks
Practical : 02 Hrs/week	CVV: 20 Marks
	ESE (W): 40 Marks

Prerequisites:	
●	Basic Electronics,
Course Objectives:	
●	To introduce the fundamentals of semiconductors and provide foundational understanding of JFET operation.
●	To explain the construction, working principles, and characteristics of MOSFET devices.
●	To enable students to perform DC biasing and analysis of MOSFET circuits.
●	To develop the ability to perform small-signal (AC) analysis of MOSFET-based circuits.
●	To impart analytical skills necessary for designing and evaluating MOSFET-based amplifier circuits.
●	To familiarize students with different types of MOSFET-based oscillators and their distinguishing features
Course Outcomes:	
	After completion of the course, student will be able to
1.	Understand the Semiconductor Fundamentals.

2.	Understand construction, working, and characteristics of MOSFET.
3.	Perform the DC analysis of MOSFET.
4.	Perform the AC analysis of MOSFET.
5.	Analyze MOSFET based amplifiers.
6.	Differentiate between MOSFET based oscillators.

Section1:	**Topics/Contents**

UNIT 1: **Semiconductor Fundamentals**:

Energy band and Bond Models in solids: conductors, semiconductors, insulators, Types of semiconductors, Intrinsic and extrinsic semiconductors, PN junction formation, energy band diagrams, Transition and diffusion capacitance. JFET: construction, operation, characteristics, Pinch of voltage, Comparison of FET with BJT.

UNIT 2: **MOSFET:**

Introduction to MOSFET, Types of MOSFET: Enhancement and Depletion type MOSFET, EMOSFET: Threshold voltage, operation regions, V-I characteristics: Transfer characteristics and output characteristics, MOSFET as a switch, non-ideal effects in MOSFET viz. Finite output resistance, channel length modulation, body effect, subthreshold conduction, breakdown effects and temperature effects. Numericals on characteristic equations of MOSFET. Introduction to CMOS technology: nMOS, pMOS, CMOS, HBTs FinFETs, TFETs, etc.

UNIT 3: **MOSFET DC analysis**:

DC Load Line, operating point(Q point), Types of biasing: Voltage divider bias and drain feedback bias, MOSFET Configurations: Common source circuit, Common Drain circuit and common Gate circuit.

Section2:	**Topics/Contents**

UNIT 4: **MOSFET AC analysis:**

MOSFET Low frequency and high frequency small signal equivalent circuits. Introduction to CS, CG, and CD amplifiers. AC analysis of a common-source amplifier with and without a bypass capacitor, Numerical analysis based on AC analysis of a common-source amplifier.

UNIT 5: **Feedback Amplifiers**

Concept of Feedback, Feedback topologies: Voltage series, Voltage Shunt, Current series, Current shunt. Effect of feedback on performance parameters of amplifiers. Applications of feedback amplifiers.

UNIT 6: **Oscillators**

Concept of positive feedback, Barkhausen criterion, Types of oscillators, RC phase shift oscillator, Hartley and Colpitts oscillators.

Text Books: ***(As per IEEE format)***

1	Floyd, "Electronic Devices and Circuits", Pearson Education.
2	Donald Neamen, "Electronic Circuits Analysis and Design", 3rdEdition, TMH
3	David A. Bell, "Electronic Devices and Circuits", 5th Edition, Oxford press.

Reference Books: ***(As per IEEE format)***

1	Millman, Halkias, "Integrated Electronics- Analog and Digital Circuits and Systems", 2nd TMH.
2	Boylstad, Nashlesky, "Electronic Devices and Circuits Theory", 9th Edition, PHI, 2006.

List of Practicals:

1. Study of VI characteristics of JFET.
2. Study of VI characteristics of MOSFET.
3. Build and test MOSFET as a switch to drive the LED and calculate the Q point.
4. Build a voltage divider biasing circuit for the MOSFET. Calculate the operating point parameter theoretically and practically.
5. Design and build single stage CS amplifier using MOSFET with bypass capacitor. Calculate Av, Ri, Ro theoretically.

6. Simulate an LC oscillator using MOSFET.
7. Design and build single stage Common Source self-biasing circuit for MOSFET. Calculate operating point parameter theoretically and practically.
8. Simulate Voltage-Series feedback amplifier and calculate Rif, Rof, Avf and Bandwidth.
9. Simulate Current-Series feedback amplifier and calculate Rif, Rof, Avf and Bandwidth.
10. Simulate transient, AC, and DC response of MOSFET single stage CD amplifier.
11. Simulate transient, AC, and DC response of MOSFET single stage CG amplifier.
12. Simulate RC oscillator using MOSFET.

List of Project areas:

1. JFET based Applications
2. MOSFET based Applications
3. Power amplifier circuits
4. Oscillators

CO – PO / PSO Articulation Matrix

Correlation: 1 = Low (Slight), 2 = Medium (Moderate), 3 = High (Substantial), '-' = no correlation.

CO	Program Outcome (PO)											PSO	
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	0	0	1	0	0	1	1	0	1	1	1
CO2	3	2	1	0	2	0	0	2	2	0	1	2	2
CO3	3	3	2	0	2	0	0	2	2	0	1	2	2
CO4	3	3	2	0	2	0	0	2	2	0	1	2	2
CO5	3	3	2	0	2	0	0	2	2	0	1	3	3
CO6	3	2	2	0	2	0	0	2	2	0	1	3	3
Avg	3.00	2.33	1.50	0.00	1.83	0.00	0.00	1.83	1.83	0.00	1.00	2.16	2.16

CO – WK Mapping (Knowledge & Attitude Profiles) Sample Table

'✓' indicates the knowledge profile drawn upon by the CO.

CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	✓	✓	-	-	-	-	-	-	-
CO2	-	-	✓	-	-	-	-	-	-
CO3	-	-	-	✓	-	-	-	-	-
CO4	-	-	-	✓	-	-	-	-	-
CO5	-	-	-	-	✓	-	-	-	-
CO6	-	-	-	-	✓	-	-	✓	-

CO – WP Mapping (Complex Engineering Problems) Sample Table

CO	WP1	WP2	WP3	WP4	WP5	WP6	WP7
CO1	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-
CO3	✓	-	✓	-	-	-	-
CO4	✓	-	-	-	-	-	-
CO5	-	-	-	-	✓	-	-
CO6	-	✓	-	✓	-	✓	✓

CO – EA Mapping (Complex Engineering Activities)

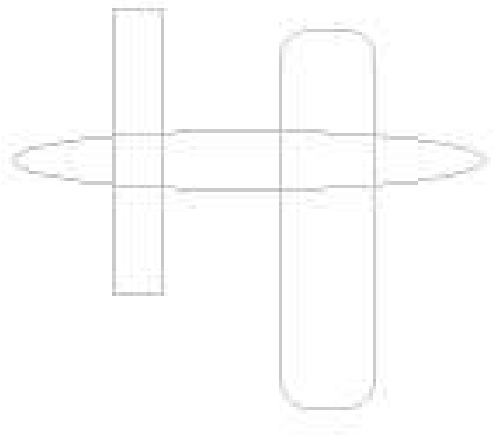
'✓' indicates the activity attribute addressed by the CO

CO	EA1	EA2	EA3	EA4	EA5
CO1					
CO2					
CO3	✓		✓		
CO4	✓		✓		
CO5		✓	✓		
CO6		✓	✓	✓	✓

CO – SDG Mapping (Sustainable Development Goals) Sample Table

CO	SDG(s) Addressed	Justification / Linkage
CO1	SDG 4	Quality Education: Empowers students with underlying technical and scientific semiconductor frameworks essential to fundamental electrical engineering literacy.
CO2	SDG 9	Industry, Innovation & Infrastructure: Examines advanced industrial integrated topologies (CMOS, TFETs, FinFETs) that directly foster global computing innovation and device scaling infrastructure.
CO3	SDG 7	Affordable & Clean Energy: Optimizing Q-point biasing setups enables high-efficiency operational switching inside active consumer electronics, lowering active power dissipation.
CO4	SDG 9	Industry, Innovation & Infrastructure: Establishes the core structural signal-processing blocks (RF/Audio amplification and feedback stabilizers) required for worldwide telecommunication systems.
CO5	SDG 7, SDG 9, SDG 12	Clean Energy, Innovation, and Responsible Production: Projects like Buck Converters (Project 23) and Single-phase power systems (Project 24) optimize green solar regulators and efficient

CO	SDG(s) Addressed	Justification / Linkage
		conversion arrays (SDG 7). Building timing loops and logic switches expands physical industrial automation frameworks (SDG 9). Selecting durable component thresholds minimizes hardware degradation, reducing e-waste footprints (SDG 12).
CO6	SDG 4	Quality Education: Empowers students with underlying technical and scientific semiconductor frameworks essential to fundamental electrical engineering literacy.



FF No.: 654

ET2304: Signals and systems

Teaching Scheme	Examination Scheme
Credits : 03	CP: 30 Marks
Lectures : 2 Hrs/week	Lab: 10 Marks
Practical : 2 Hrs/week	CVV: 20 Marks
Tutorial : Nil	MSE (W): 40 Marks

Prerequisites:	
•	Mathematics
Course Objectives:	
•	To introduce students to the fundamentals of signals.
•	To develop analytical skills for system characterization
•	To familiarize students with correlation functions and its applications
•	To enable understanding of frequency-domain analysis using Fourier Series
•	To enable understanding of frequency-domain analysis using Fourier Transform
•	To equip students with the ability to analyse linear time-invariant (LTI) systems using Laplace transforms**.**
Course Outcomes:	
	After completion of the course, student will be able to
1.	Understand the basic signals and operations and transformation on the signal.
2.	Illustrate the concept of impulse response of a system and system characterization
3.	Interpret frequency domain analysis of signals and systems
4.	Analyze systems with Laplace transform
5.	Apply the concept of autocorrelation, cross correlation, ESD and PSD

Section1:	Topics/Contents

Unit I: Introduction to Signals **8L**

Definition of signals and systems, communication and control systems as examples, Classification of signals: Continuous time and discrete time, even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power.

Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration (accumulator for DT), time scaling, time shifting and folding, precedence rule.

Elementary signals: exponential, sine, step, impulse and its properties, ramp, rectangular, triangular, signum, sinc.

Unit II: System Analysis **6L**

Systems: Definition, Classification: linear and nonlinear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible. System modelling: Input output relation, Definition of impulse response, convolution integral, convolution sum, computation of convolution integral using graphical method for unit step to unit step, unit step to exponential, exponential to exponential and unit step to rectangular, rectangular to rectangular only. Computation of convolution sum. Properties of convolution, system interconnection, system properties in terms of impulse response

Unit III: Correlation **2L**

Definition of Correlation, auto-correlation, cross correlation, properties of auto-correlation, cross correlation, analogy between correlation and convolution,

Application of correlation to radar signals.

Section2:	**Topics/Contents**

Unit IV: Fourier Series **2L**

Definition and necessity of CT Fourier series. CT Fourier series, properties, problem solving using properties,

Unit V: Fourier Transform **5L**

Definition and necessity of CT Fourier transform, CT Fourier transform and its properties, problem solving using properties, amplitude spectrum, phase spectrum of the signal and system. Interplay between time and frequency domain using sinc and rectangular signals. Limitations of FT and need of LT and ZT.

Unit VI: System Analysis in Frequency Domain using Laplace Transform 5L

Definition and its properties, ROC and pole zero concept. Application of Laplace transforms to the LTI system analysis. Inversion using duality, numerical based on properties. Signal analysis using LT.

Text Books:	
1	Ramesh Babu, "Signals and Systems", 4th Ed., Scitech Publications
2	A. Nagoor Kani, "Signals and Systems", Tata McGraw Hill
Reference Books:	
1	Simon Haykin, "Signals and Systems", John Wiley and Sons.
2	B. P. Lathi, "Signal Processing and Linear Systems".
3	Oppenheim, Willsky and Hamid, "Signals and Systems", Prentice Hall.

List of Practical's:

1 Write a program to plot the following continuous time and discrete time signals.
i. Step Function ii. Impulse Function iii. Exponential Function iv. Ramp Function v. Sine Function

2. Write a program to perform amplitude-scaling, time-scaling and time shifting operation on a given signal.

3. Write a program to obtain linear convolution of the given sequences.

4. a. Write a program to compute autocorrelation of a sequence x(n).
b. Write a program to compute cross-correlation of sequences x(n) and y(n).

5. Write a program to plot square wave using Fourier Series Coefficients.

6. Write a program to plot frequency spectrum of a given signal.
7. Write a program to determine impulse response of a system.
8. Write a program to plot pole zero plot of a system.
9. Write a program to plot power spectral density of a signal.
10. Write a program to plot a sampled signal and show aliasing.

CO-PO Mapping

CO	Program Outcomes (PO)											PSO	
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	1	1	2							1	
CO2	3	3	1	1	2							1	
CO3	3	3	1	1	2							1	
CO4	3	3	1	1	2							1	
CO5	3	3	1	1	2							1	
CO6	3	3	1	1	2							1	
Average	**3**	**3**	**1**	**1**	**2**							**1**	

CO – WK Mapping (Knowledge & Attitude Profiles) Table

'✓' indicates the knowledge profile drawn upon by the CO.

CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	✓	✓	✓	✓					✓
CO2	✓	✓	✓	✓					✓
CO3	✓	✓	✓	✓					✓
CO4	✓	✓	✓	✓					✓
CO5	✓	✓	✓	✓					✓

CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO6	✓	✓	✓	✓					✓

CO – WP Mapping (Complex Engineering Problems) Table

CO	WP1	WP2	WP3	WP4	WP5	WP6	WP7
CO1	✓						
CO2	✓						
CO3	✓						
CO4	✓						
CO5	✓						
CO6	✓						

CO – EA Mapping (Complex Engineering Activities)

'✓' indicates the activity attribute addressed by the CO

CO	EA1	EA2	EA3	EA4	EA5
CO1					
CO2					
CO3					
CO4					
CO5					
CO6					

CO – SDG Mapping (Sustainable Development Goals)

CO	SDG(s) Addressed	Justification / Linkage
CO1	4	Develops knowledge about signals essential for quality engineering education.
CO2	4	Enables students to understand systems essential for quality engineering education.
CO3	4	Familiarize students with concept of correlation required for quality engineering education
CO4	4	Enables students to analyze signals required for quality education
CO5	4	
CO6	4	Enables students to understand analysis of systems required for quality education

Syllabus Template **FF No.: 654-A**

MM1003: IOT for Smart Applications

Teaching Scheme	**Examination Scheme**
Credits : 3	CP: 20 Marks
Lectures : 2 Hrs/week	CVV: 20 Marks
~~Practical : Hrs/week~~	HA: 20 Marks
Tutorial : 1 Hrs/week	MSE (W): 40 Marks

Prerequisites:	
●	Electronics Circuit, Digital electronics, Electronics hardware workshop, C programming
Course Objectives:	
●	To understand IoT fundamentals, architecture, and applications across domains.
●	To learn IoT design steps and explore key hardware platforms and sensors.
●	To study IoT communication protocols and standards for data exchange.
●	To understand wireless sensor networks and their role in IoT.
●	To implement cloud integration, data visualization, and IoT security basics.
●	To analyze domain-specific IoT case studies and develop a mini project.
Course Outcomes:	
	After completion of the course, student will be able to
1.	CO1: Understand fundamental concepts of Internet of Things (L2- Understand)
2.	CO2: Recognize IoT Design Methodology Steps (L2-Understand)
3.	CO3: Apply basic Protocols in IoT (L3 – Apply)

4.	CO4: Analyze fundamentals of networking (L4-Analyze)
5.	CO5: Apply of cloud platforms to visualize real-time sensor data (L3 – Apply)
6.	CO6: Provide IoT solutions practically with the help of case study (L6 – Create)

Section1:	**Topics/Contents**

UNIT I: Introduction to IoT **(4)**

Introduction, Definitions Characteristics of IoT, IoT Architectures, Physical and Logical Design of IoT, Enabling Technologies in IoT, IoT frameworks, Applications of IOT in various domains.

UNIT II: IOT Design Methodology and Platform. **(6)**

IoT Design Methodology Steps and IoT System Design Cycle.

Hardware Platforms - CISC/RISC Based microcontrollers and programming (8051/AVR), Arduino, Raspberry Pi, NodeMCU, ESP32. Sensors, actuators selection criteria for specific applications and interfacing basics.

UNIT III: IOT Protocols and Standards **(4)**

RFID, IEEE 802.15.4, Zigbee, NFC, Z-Wave, BLE, Bacnet, Modbus. IPv6, 6LowPAN, MQTT. Authorization and Access Control in IOT.

Section2:	**Topics/Contents**

UNIT IV: Wireless Sensor Networks for IOT **(4)**

Types of Wireless Sensors, Examples and Working, Wireless Sensor Networks: History and Context of the node, Connecting nodes, Networking Nodes, WSN and IoT. Types of Network and network topologies for IOT.

UNIT V: Cloud Integration and Data Visualization **(5)**

Cloud platforms for IoT: Thing Speak, Blynk, Firebase. Real-time data logging, charting, and alerts. Security and privacy fundamentals: Security Challenges in IoT Systems, Authentication, Authorization, and Access Control.

UNIT VI: Domain-Specific Smart Systems: Case Studies (5) Smart agriculture, Smart health, Smart cities, Smart transportation, Industrial IoT. System integration and real-world challenges.	
Text Books: ***(As per IEEE format)***	
1	Arsheep Bahga and Vijay Madisetti, Internet of Things: A Hands-On Approach, 1st ed., Universities Press, 2015.
2	Adrian Mcewen and Hakim Cassimally, Designing the Internet of Things, 1st ed., Wiley, 2013.
3	Daniel Lion, Introduction to Internet of Things (IoT), 1st ed., Independently Published, 2023.
4	S. Verma, R. Verma, O. Farhaoui, and J. Lyu, Eds., Emerging Real-World Applications of Internet of Things, 1st ed., CRC Press, 2024.
5	Mazidi Muhammad Ali; Mazidi Janice Gillispie; McKinlay Rolin D, "The 8051 Microcontroller and Embedded Systems Using Assembly and C", 2nd Edition, Dorling Kindersley.
6	Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi The AVR Microcontroller and Embedded Systems Using Assembly and C, Pearson Education.
Reference Books: ***(As per IEEE format)***	
1	R. Kamal, Internet of Things: Architecture and Design Principles, 1st ed., McGraw Hill Education, 2021.
2	Olivier Hersent, D. Boswarthick, and O. Elloumi, The Internet of Things: Key Applications and Protocols, 2nd ed., Wiley, 2021.
3	Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press

List of Practical's/Tutorials:

I. RISC and CISC Architecture based Microcontrollers

1. 8051 Microcontroller Architecture and Interfacing
2. Programming Basics of 8051 Microcontroller (GPIO, Timers, in Assembly language)
3. Introduction to AVR Microcontroller Architecture (ATmega Series)
4. AVR Programming: Digital I/O, Timers, and Interrupts (Embedded C)

II. IoT for Smart Applications

1. Smart Home Automation: Design and Case Study
2. Smart Healthcare Monitoring System: Design and Analysis
3. Smart Agriculture using IoT: Precision Farming Applications
4. Smart Transportation and Intelligent Traffic Management
5. Smart Energy Management and Smart Grid Applications
6. Smart City Solutions: Parking, Waste Management, and Street Lighting

List of Project areas:

Course Project Domains – IoT for Smart Applications

The following domains are suitable for **Second Year B.Tech (Electronics & Telecommunication Engineering)** students. They focus on practical IoT applications using sensors, microcontrollers (ESP32/ESP8266/Arduino/AVR/Raspberry Pi), wireless communication, and cloud platforms.

Domain	Sample Project Ideas
Smart Home	Smart Home Automation, Smart Door Lock, Gas Leakage Detection, Fire & Smoke Alarm, Smart Lighting Control
Smart Healthcare	Remote Patient Monitoring, Heart Rate & SpO_2 Monitoring, Fall Detection System, Smart Medicine Reminder
Smart Agriculture	Smart Irrigation System, Soil Moisture Monitoring, Greenhouse Automation, Crop Health Monitoring
Smart City	Smart Parking System, Smart Street Lighting, Smart Waste Bin, Air Quality Monitoring, Noise Monitoring
Industrial IoT (IIoT)	Machine Health Monitoring, Predictive Maintenance, Temperature & Humidity Monitoring, Asset Tracking
Energy Management	Smart Energy Meter, Power Consumption Monitoring, Solar Energy Monitoring, Smart Load Control
Environmental Monitoring	Weather Monitoring Station, Water Quality Monitoring, Flood Detection, Forest Fire Detection
Transportation & Logistics	Vehicle Tracking System, Smart Traffic Management, Driver Fatigue Detection, Fleet Monitoring

Safety & Security	Smart Helmet, Intruder Detection, Smart Surveillance System, LPG Leakage Alert
Retail & Smart Commerce	Smart Shopping Cart, Inventory Monitoring, Smart Billing System, Cold Storage Monitoring
Campus & Office Automation	Smart Classroom, Smart Attendance System, Smart Laboratory Monitoring, Occupancy Detection
Wearable IoT	Fitness Tracker, Smart Health Band, Emergency SOS Device, Smart Walking Stick
Animal & Livestock Monitoring	Smart Pet Feeder, Livestock Health Monitoring, GPS-Based Animal Tracking
Disaster Management	Earthquake Alert System, Landslide Monitoring, Emergency Rescue Monitoring, Flood Warning System

CO – PO / PSO Articulation Matrix

Correlation: 1 = Low (Slight), 2 = Medium (Moderate), 3 = High (Substantial), '-' = no correlation.

CO	Program Outcome (PO)											PSO	
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO_1	**3**	1	-	-	1	-	-	-	-	-	-	2	1
CO_2	2	**2**	1	-	2	-	-	-	-	-	-	2	2
CO_3	2	2	**3**	1	**2**	-	-	-	-	-	-	3	3
CO_4	2	**3**	1	**2**	2	-	-	-	-	-	-	3	2
CO_5	2	1	**2**	1	**3**	-	-	-	-	-	1	2	3
CO_6	2	**3**	**3**	**2**	**3**	2	2	1	**2**	**2**	**2**	3	3
Avg	**2.2**	**2.0**	**2.0**	**1.5**	**2.2**	**2.0**	**2.0**	**1.0**	**2.0**	**2.0**	**1.5**	**2.5**	**2.3**

Justification for CO–PO/PSO Mapping

CO	Justification for CO-PO/PSO Mapping
CO1: Understand fundamental concepts of Internet of Things (L2)	Strongly mapped to PO1 (3) as it develops engineering knowledge of IoT concepts. Moderately mapped to PSO1 (2) by introducing E&TC fundamentals in IoT. Low correlation with PO2 (1) and PO5 (1) as students gain basic understanding of IoT technologies and tools. Low correlation with PSO2 (1) through introductory exposure to IoT applications.
CO2: Recognize IoT Design Methodology Steps (L2)	Moderately mapped to PO1 (2) and PO2 (2) since students understand and analyze IoT design methodology. Low correlation with PO3 (1) due to exposure to system design. Moderate mapping to PO5 (2) through the use of IoT development platforms. Strong relation with PSO1 (2) and PSO2 (2) by applying E&TC concepts in IoT system design.
CO3: Apply basic Protocols in IoT (L3)	Strongly mapped to PO3 (3) as students design communication-based IoT solutions. Moderately mapped to PO1 (2), PO2 (2), and PO5 (2) through application of networking concepts and IoT tools. Low mapping to PO4 (1) due to protocol experimentation. Strong mapping to PSO1 (3) and PSO2 (3) because communication protocols are core competencies of Electronics and Telecommunication engineering.
CO4: Analyze fundamentals of networking (L4)	Strongly mapped to PO2 (3) due to network analysis and problem-solving. Moderately mapped to PO1 (2), PO4 (2), and PO5 (2) through engineering knowledge, investigation, and simulation tools. Low mapping to PO3 (1) as networking contributes to system design. Strong mapping to PSO1 (3) and moderate mapping to PSO2 (2) owing to networking and communication expertise.
CO5: Apply cloud platforms to visualize real-time sensor data (L3)	Strongly mapped to PO5 (3) because students use modern engineering and cloud-based IoT tools. Moderately mapped to PO1 (2) and PO3 (2) through implementation of cloud-enabled IoT systems. Low mapping to PO2 (1), PO4 (1), and PO11 (1) due to data analysis, experimentation, and project management aspects. Moderate mapping to PSO1 (2) and strong mapping to PSO2 (3) as cloud integration is an advanced IoT application.
CO6: Provide IoT solutions practically with the help of case study (L6)	Strongly mapped to PO2 (3), PO3 (3), PO5 (3), PSO1 (3), and PSO2 (3) because students develop complete IoT solutions using engineering design, modern tools, and domain-specific knowledge. Moderately mapped to PO1, PO4, PO6, PO7, PO9, PO10, and PO11 (2) through engineering knowledge, investigations, societal impact, sustainability, teamwork, communication, and project management. Low mapping to PO8 (1) as students demonstrate professional ethics while implementing IoT solutions.

CO – WK Mapping (Knowledge & Attitude Profiles)

'✓' indicates the knowledge profile drawn upon by the CO.

CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	✓		✓	✓					
CO2			✓	✓		✓			

CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO3		✓	✓	✓		✓			
CO4		✓	✓	✓		✓		✓	
CO5		✓	✓	✓	✓	✓		✓	
CO6		✓	✓	✓	✓	✓	✓	✓	✓

Justification CO – WK Mapping

CO	Mapped WK	Reason
CO1: Understand fundamental concepts of IoT	WK1, WK3, WK4	Covers scientific principles, engineering fundamentals, and IoT domain knowledge.
CO2: Recognize IoT Design Methodology Steps	WK3, WK4, WK6	Involves engineering fundamentals, IoT system design, and engineering practice.
CO3: Apply basic Protocols in IoT	WK2, WK3, WK4, WK6	Requires networking concepts, mathematical/logical analysis, engineering knowledge, and practical implementation.
CO4: Analyze fundamentals of networking	WK2, WK3, WK4, WK6, WK8	Involves analytical skills, networking theory, engineering practice, and awareness of evolving networking technologies.
CO5: Apply cloud platforms to visualize real-time sensor data	WK2, WK3, WK4, WK5, WK6, WK8	Integrates data analysis, cloud computing, sustainable engineering, practical implementation, and current technologies.
CO6: Provide IoT solutions practically with the help of case study	WK2, WK3, WK4, WK5, WK6, WK7, WK8, WK9	Covers complete engineering design, sustainability, engineering practice, societal impact, emerging technologies, and professional ethics.

CO – WP Mapping (Complex Engineering Problems)

CO	WP1	WP2	WP3	WP4	WP5	WP6	WP7
CO1	✓						
CO2	✓		✓				
CO3	✓		✓	✓			
CO4	✓	✓	✓	✓			✓
CO5	✓	✓	✓	✓	✓	✓	✓

CO	WP1	WP2	WP3	WP4	WP5	WP6	WP7
CO6	✓	✓	✓	✓	✓	✓	✓

Justification CO – WP Mapping

Course Outcome	Mapped WP	Justification
CO1: Understand fundamental concepts of Internet of Things	WP1	Requires in-depth engineering knowledge of IoT fundamentals.
CO2: Recognize IoT Design Methodology Steps	WP1, WP3	Involves engineering knowledge and analytical understanding of IoT design methodology.
CO3: Apply basic Protocols in IoT	WP1, WP3, WP4	Requires protocol analysis, implementation, and solving unfamiliar networking problems.
CO4: Analyze fundamentals of networking	WP1, WP2, WP3, WP4, WP7	Involves complex networking analysis, system-level thinking, and interconnected subsystems.
CO5: Apply cloud platforms to visualize real-time sensor data	WP1, WP2, WP3, WP4, WP5, WP6, WP7	Integrates cloud technologies, IoT standards, stakeholder requirements, and complete system integration.
CO6: Provide IoT solutions practically with the help of case study	WP1, WP2, WP3, WP4, WP5, WP6, WP7	Requires designing complete IoT solutions considering technical, societal, sustainability, multidisciplinary, and system-level engineering aspects.

CO – EA Mapping (Complex Engineering Activities)

'✓' indicates the activity attribute addressed by the CO

CO	EA1	EA2	EA3	EA4	EA5
CO1	✓				
CO2	✓	✓			✓
CO3	✓	✓	✓		✓

CO	EA1	EA2	EA3	EA4	EA5
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓
CO6	✓	✓	✓	✓	✓

Justification of CO – EA Mapping

Course Outcome	Mapped EA	Justification
CO1: Understand fundamental concepts of Internet of Things	**EA1**	Requires understanding of diverse IoT resources such as sensors, devices, networks, and cloud platforms.
CO2: Recognize IoT Design Methodology Steps	**EA1, EA2, EA5**	Involves selecting appropriate resources, understanding interactions among system components, and applying established engineering design approaches.
CO3: Apply basic Protocols in IoT	**EA1, EA2, EA3, EA5**	Requires protocol implementation, interaction among communication layers, innovation in application development, and adaptation to new technologies.
CO4: Analyze fundamentals of networking	**EA1, EA2, EA3, EA4, EA5**	Involves network analysis, innovative solutions, consideration of societal impacts, and application of engineering principles.
CO5: Apply cloud platforms to visualize real-time sensor data	**EA1, EA2, EA3, EA4, EA5**	Integrates cloud services, IoT data management, innovative dashboards, societal applications, and practical engineering approaches.
CO6: Provide IoT solutions practically with the help of case study	**EA1, EA2, EA3, EA4, EA5**	Covers complete IoT solution development involving multidisciplinary resources, innovation, societal impact, sustainability, and engineering practice.

CO – SDG Mapping (Sustainable Development Goals) Sample Table

CO	SDG(s) Addressed	Justification / Linkage
CO1: Understand fundamental concepts of Internet of Things	**SDG 4 - Quality Education**, **SDG 9 - Industry, Innovation and Infrastructure**	Provides fundamental knowledge of IoT technologies that supports quality technical education and promotes innovation in engineering.
CO2: Recognize IoT Design Methodology Steps	**SDG 9 - Industry, Innovation and Infrastructure**, **SDG 11 - Sustainable Cities and Communities**	Develops systematic IoT design skills for building innovative and sustainable smart systems and infrastructure.
CO3: Apply basic Protocols in IoT	**SDG 9 - Industry, Innovation and Infrastructure**, **SDG 17 - Partnerships for the Goals**	Enables reliable communication among IoT devices and promotes interoperability required for collaborative smart systems.
CO4: Analyze fundamentals of networking	**SDG 9 - Industry, Innovation and Infrastructure**, **SDG 11 - Sustainable Cities and Communities**	Strengthens networking knowledge essential for smart city infrastructure, intelligent transportation, and connected environments.
CO5: Apply cloud platforms to visualize real-time sensor data	**SDG 7 - Affordable and Clean Energy**, **SDG 9 - Industry, Innovation and Infrastructure**, **SDG 12 - Responsible Consumption and Production**	Facilitates cloud-based monitoring and analytics for energy optimization, efficient resource utilization, and sustainable industrial practices.
CO6: Provide IoT solutions practically with the help of case study	**SDG 3 - Good Health and Well-being**, **SDG 7 - Affordable and Clean Energy**, **SDG 9 - Industry, Innovation and Infrastructure**, **SDG 11 - Sustainable Cities and Communities**, **SDG 13 - Climate Action**	Develops practical IoT solutions for healthcare, energy management, environmental monitoring, smart cities, and climate-resilient applications that contribute directly to sustainable development.

Summary of SDG Coverage

SDG No.	Description	Mapped COs
SDG 3	Good Health and Well-being	CO6
SDG 4	Quality Education	CO1
SDG 7	Affordable and Clean Energy	CO5, CO6
SDG 9	Industry, Innovation and Infrastructure	CO1, CO2, CO3, CO4, CO5, CO6
SDG 11	Sustainable Cities and Communities	CO2, CO4, CO6

SDG 12	Responsible Consumption and Production	CO5
SDG 13	Climate Action	CO6
SDG 17	Partnerships for the Goals	CO3

- **SDG 9** is the primary SDG addressed by this course because IoT is a key enabling technology for innovation, digital transformation, and intelligent infrastructure.
- **SDGs 7, 11, and 13** are addressed through smart energy systems, smart city applications, and environmental monitoring.
- **SDG 3** is supported through IoT-enabled healthcare applications.
- **SDG 4** is achieved by equipping students with modern IoT knowledge and skills.
- **SDG 17** is addressed through interoperable IoT systems and collaborative technology ecosystems.

FF No.: 654

HS2002: FROM CAMPUS TO CORPORATE (FCTC-1)

Teaching Scheme

Credits : 02

Lectures : 2 Hrs/week

Examination Scheme

MSE: 50 Marks

ESE: 50 Marks

Course Objectives:	
•	Understand the organizational structure, business domains, financial concepts, and functioning of companies in the corporate environment.
•	Develop knowledge of product management, user experience, quality assurance, customer success, security, and emerging technologies used in modern industries.
•	Apply analytical thinking, problem-solving, and decision-making techniques to address industry-oriented challenges through case studies and practical scenarios.
•	Enhance professional competencies including communication, presentation, teamwork, leadership, and interpersonal skills required in multidisciplinary work environments.
•	Develop project management, planning, prioritization, and execution skills for effective management of professional tasks and projects.
•	Cultivate professional ethics, adaptability, critical thinking, and lifelong learning to achieve continuous personal and professional growth.
Course Outcomes:	
	After completion of the course, student will be able to

1.	Explain the organizational structure, business processes, financial concepts, and product development lifecycle in the corporate ecosystem.
2.	Analyse workplace problems and recommend suitable solutions using concepts of product management, quality, customer success, security, and emerging technologies.
3.	Apply critical thinking, problem-solving techniques, AI awareness, and project management principles to solve industry-oriented case studies.
4.	Demonstrate effective communication, teamwork, leadership, and presentation skills while working in professional and multidisciplinary environments.
5.	Apply project planning, prioritization, and management techniques for successful execution of professional assignments and collaborative projects.
6.	Demonstrate professional ethics, social responsibility, adaptability, and lifelong learning necessary for continuous professional development in a dynamic corporate environment.

Vertical 1: COMPANIES & INDUSTRY

Topic 1: Understanding Companies

- Understand how to analyse a company-based domains, customers, offering and strategy
- Understand how to use this knowledge to contribute earlier and faster.

Topic 2: Understanding Company Financials (and AOP Budgeting)

- Understand components of company P&L and Balance Sheet
- Be able to assess financial health of a company
- How do companies build AOP. Top down and bottom up
- Understand the funding avenues

Vertical 2: Application Of Knowledge

Topic 1: Product Management

- Understand product roadmap creation

- Understand product growth strategies
- Understand product discovery techniques
- Understand backlog prioritization techniques
- Be able to write requirements in detail

Topic 2: Understanding UX And UI

- Understand what usability, user interaction design and consumer journeys mean
- Compare and contrast UX with user interface. Use several industry examples
- technique of building a good UX

Topic 3: Releasing A Product To The Market

- Understand what it takes to release a product to the market by product and engineering teams
- Understand what it takes for a product to be successful with the customer from external go-to market perspective.

Topic 4: Quality – Understanding Beyond The Theory

- Understand how to look at product quality
- Understand how to approach building a good quality product
- Understanding Testing and Test Automation
- Build a Test Plan
- Career options in Quality

Topic 5: Customer Success Management

- Concept of Customer Success
- What is CSAT , NPS , RATING, REVIEWs and how should one track Customer Value
- Understand what issues mean in the industry
- Understand how to identify and prioritize issues and ways to resolve them.

Topic 6: Security And Privacy

- Understand Security concepts (Threat, Vulnerability, Risk)
- Understand about Threat Modelling

- Understand about Security Engineering Approach
- Be able to prepare security test plan

Topic 7: Artificial Intelligence (AI) – The Evolution

- Introduction to AI. AI is pervasive today. Origins of AI and ML Potential and possibilities
- Machine Learning. How is it different from traditional programs? Extensive practical applications over the last decade or so
- Deep Learning. Computer Vision and Natural Language Processing

Vertical 3: PROFESSIONAL SKILLS

Topic 1: Curiosity And Inquisitiveness

- What is Curiosity and Understand the importance of asking questions
- Review Industry Examples
- Understand techniques of asking thought provoking questions
- Tips and tricks to ask effective questions

Topic 2: Articulation And Communication

- Understand different types of communications
- Understand barriers to communications
- Understand why articulation is important
- How do you make Impactful Introductions

Topic 3: Problem Breakdown and Resolution Using Mind Maps

- What are mind maps
- Tips on creating Mind Maps
- Real-life case of Problem Breakdown
- Prioritizing a long list. Concept and Technique
- Live workshop on understanding constraints and prioritizing and long to-do list

Topic 4: Effective Project And Program Management

- Understand the key concepts within project management
- Understand key aspects of planning
- Understand the link between planning and execution
- Case study based Proj and Prog Management hands on workshop

Topic 5: Developing Critical Thinking Using Mental Models

- Why Critical Thinking
- What are the barriers to Critical Thinking
- Technique and Steps in Critical Thinking
- Why Mental Models
- Using Mental Models for sharper decisions

CO-PO Mapping

CO	Program Outcomes (PO)											PSO		
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2	PSO 3
CO1	2	2	–	–	1	–	–	–	1	–	1			
CO2	2	3	2	1	2	2	1	1	–	–	1			
CO3	1	3	2	2	2	1	–	2	1	2	2			
CO4	–	1	–	–	–	–	2	3	3	2	1			
CO5	–	1	2	1	1	1	3	2	2	3	2			
CO6.	–	–	–	–	1	2	3	2	2	1	3			
Average														

CO – WK Mapping (Knowledge & Attitude Profiles) Table

'✓' indicates the knowledge profile drawn upon by the CO.

CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	✓	✓	-	-	-	-	-	-	-

CO2	-	✓	-	✓	-	✓	-	-	-
CO3	-	✓	-	✓	-	-	-	✓	-
CO4	-	-	-	-	-	-	-	-	✓
CO5	-	-	-	-	-	-	-	✓	✓
CO6	-	-	-	-	-	-	✓	✓	✓

CO – WP Mapping (Complex Engineering Problems) Table

CO	WP1	WP2	WP3	WP4	WP5	WP6	WP7
CO1	-	✓	-	-	-	-	✓
CO2	-	✓	-	✓	-	✓	-
CO3	-	-	✓	✓	-	-	-
CO4	-	-	-	-	-	-	-
CO5	-	✓	-	-	-	-	✓
CO6	-	✓	-	-	-	-	-

CO – EA Mapping (Complex Engineering Activities)

'✓' indicates the activity attribute addressed by the CO

CO	EA1	EA2	EA3	EA4	EA5
CO1	✓	-	-	-	-
CO2	-	-	-	-	-

CO3	-	✓	✓	-	-
CO4	✓	✓	-	-	✓
CO5	✓	✓	-	-	-
CO6	-	-	-	✓	✓

CO – SDG Mapping (Sustainable Development Goals) Table

CO	SDG(s) Addressed	Justification / Linkage
CO1	4, 8, 9	Builds foundational understanding of organizational, financial, and product-lifecycle knowledge that prepares students for productive employment and industry participation.
CO2	8, 9	Analyzing workplace problems via product management, quality, security, and emerging technology supports innovation-driven, industry-relevant solutions.
CO3	4, 9	Develops critical thinking, problem-solving, and AI awareness through case studies — building future-ready skills and innovation capability.
CO4	4, 5, 17	Builds communication, teamwork, and leadership for inclusive, multidisciplinary collaboration and stronger partnerships across diverse teams.
CO5	8, 17	Develops project planning and management skills for successful execution of collaborative professional work.
CO6	4, 8, 16	Cultivates professional ethics, social responsibility, and lifelong learning — reinforcing responsible conduct and good practice in the workplace.

Syllabus Template **FF No.: 654-A**

ET2305: Design Thinking 1

Teaching Scheme	**Examination Scheme**
Credits : 1	CP: Marks
Lectures : Hrs/week	GD/PPT/HA: Marks
Practical : Hrs/week	MSE (W/O):30 Marks
Tutorial : 1 Hrs/week	ESE (W/O):70 Marks

Prerequisites:	
●	Course Prerequisites: Problem Based Learning, Project Centric Learning Course Relevance:
Course Objectives:	
●	To provide ecosystem for students and faculty for paper publication and patent filing
Course Outcomes:	**[Publication of paper or patent]**
	After completion of the course, student will be able to
1.	Understand the importance of doing Research
2.	Interpret and distinguish different fundamental terms related to Research

3.	Apply the methodology of doing research and mode of its publication
4.	Write a Research Paper based on project work
5.	Understand Intellectual property rights
6.	Use the concepts of Ethics in Research , Understand Entrepreneurship and Business Planning
7.	

Section1:	**Topics/Contents**
What is research? Importance of Paper Publication and Patents Importance of Paper Publication and Patents Structure of Paper Journal Publication Publication in conference Literature Review Research Paper Writing Journal Ratings and Evaluation How to rate a Journal? Intellectual property (IP) Research Ethics Entrepreneurship	
Section2:	**Topics/Contents**
Structure of The paper Journal List (Top 50 Journals) Selection of the journal Use of various online journal selection tools Plagiarism checking Improving contents of the paper Patent drafting Patent search Filing of patent Writing answers to reviewer questions Modification in manuscript Checking of publication draft	

CO – PO / PSO Articulation Matrix

Correlation: 1 = Low (Slight), 2 = Medium (Moderate), 3 = High (Substantial), '-' = no correlation.

CO	Program Outcome (PO)	PSO

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	1	1	1	1							1	2
CO2	1	1	1	1	1							1	2
CO3	2	2	3	3	2	2	1	2	2	3		1	3
CO4	3	3	3	3	3	2	1	2	2	3	1	1	3
CO5	1	1	1	1	1							1	2
CO6	2	2	2	2	2	2	1	3	2	3		1	3
Avg	1.7	1.7	1.8	1.8	1.7	2.0	1.0	2.3	2.0	3.0	1.0	1.0	2.5

CO – WK Mapping (Knowledge & Attitude Profiles) Sample Table

'✓' indicates the knowledge profile drawn upon by the CO.

CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	✓	✓		✓					✓
CO2		✓	✓	✓	✓				
CO3		✓	✓	✓	✓	✓			
CO4			✓	✓	✓	✓	✓		
CO5				✓	✓	✓	✓	✓	
CO6	✓			✓		✓		✓	✓

CO – WP Mapping (Complex Engineering Problems) Sample Table

CO	WP1	WP2	WP3	WP4	WP5	WP6	WP7
CO1	✓	✓	✓		✓		✓

CO	WP1	WP2	WP3	WP4	WP5	WP6	WP7
CO2	✓	✓	✓	✓	✓		
CO3	✓	✓	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓
CO6			✓		✓	✓	✓

CO – EA Mapping (Complex Engineering Activities)

'✓' indicates the activity attribute addressed by the CO

CO	EA1	EA2	EA3	EA4	EA5
CO1	✓	✓			
CO2	✓	✓	✓		
CO3	✓	✓	✓	✓	
CO4		✓	✓	✓	✓
CO5			✓	✓	✓
CO6				✓	✓

CO – SDG Mapping (Sustainable Development Goals) Sample Table

CO	SDG(s) Addressed	Justification / Linkage
CO1	4, 9	Understanding the importance of research promotes quality education, scientific inquiry, innovation, and technological advancement for solving real-world problems.
CO2	4, 9	Knowledge of research terminology and concepts strengthens analytical thinking, research competency, and innovation capabilities.
CO3	9, 17	Applying research methodology and publishing research fosters innovation, knowledge dissemination, and collaboration among researchers and institutions.
CO4	4, 9, 17	Writing research papers develops scientific communication, promotes lifelong learning, and contributes to global knowledge sharing through collaborative research.
CO5	9,12	Understanding Intellectual Property Rights encourages innovation, protection of inventions, responsible use of knowledge, and sustainable technological development.
CO6	4, 16	Applying research ethics promotes academic integrity, responsible conduct of research, transparency, fairness, and ethical decision-making.
	8, 9	Entrepreneurship and business planning encourage innovation, job creation, sustainable economic growth, and technology-based enterprises.

FF No.: 654-A

HS2001: REASONING & APTITUDE DEVELOPMENT-3

Teaching Scheme	**Examination Scheme**
Credits : 1	CP: -- Marks
Lectures : 1 Hrs/week	GD/PPT/HA: -- Marks
Practical : -- Hrs/week	MSE (W/O): -- Marks
Tutorial : -- Hrs/week	ESE (W/O): 100 Marks

Prerequisites:	
●	Basic knowledge of English grammar and vocabulary.
●	Fundamental understanding of sentence construction and communication skills.
●	Basic arithmetic and mathematical concepts (Class XII level).
●	Elementary logical and analytical reasoning skills.
●	Familiarity with problem-solving techniques.
●	Basic computer literacy and programming concepts.
●	Exposure to at least one programming language (C/C++/Java/Python) is desirable.
Course Objectives:	
●	Develop proficiency in English grammar, vocabulary, reading comprehension, and effective written communication.
●	Strengthen logical, analytical, critical, and reasoning abilities to solve diverse aptitude-based problems.
●	Apply quantitative and mathematical concepts to solve real-world numerical and analytical problems efficiently.
●	Interpret, analyze, and synthesize information from textual, graphical, tabular, and numerical data for informed decision-making.
●	Develop computational thinking and programming aptitude through logic building, pseudocode, algorithmic problem solving, and debugging techniques.

●	Enhance coding proficiency, optimization skills, and problem-solving abilities to perform effectively in programming assessments, campus recruitment tests, and technical interviews.
Course Outcomes:	
	After completion of the course, student will be able to
1.	**Apply** appropriate English language skills, including grammar, vocabulary, reading comprehension, and effective communication techniques to improve verbal and written proficiency.
2.	**Analyze** logical reasoning problems, critical thinking scenarios, and data interpretation tasks to arrive at accurate and evidence-based conclusions.
3.	**Solve** quantitative aptitude problems using mathematical concepts, algebraic reasoning, probability, geometry, and analytical techniques in real-life contexts.
4.	**Develop** efficient algorithmic solutions by applying computational thinking, programming fundamentals, debugging, optimization techniques, and time complexity analysis to solve coding problems.

Section1:	**Topics/Contents**

English Language and Communication Skills: English tenses (Present, Past, Future), active and passive voice, sentence correction, parts of speech, syntax, sentence structure, subject − verb agreement, reading comprehension, skimming and scanning, inference, tone, theme, intent identification, contextual vocabulary.

Logical Reasoning and Analytical Thinking: Deductive reasoning (syllogisms, coding − decoding, statement − conclusion, data sufficiency, directional sense, logical sequencing), inductive reasoning (analogies, classification, number series, sequence completion, trend identification), abductive and critical reasoning (assumptions, arguments, cause − effect, logical evaluation, decision making), information gathering, interpretation and synthesis using graphs, charts, tables and multi-source data.

Section2:	**Topics/Contents**

Quantitative Aptitude and Mathematical Reasoning: Number systems, integers, fractions, decimals, divisibility, HCF and LCM, prime and rational numbers, algebraic expressions, linear equations and inequalities, proportional reasoning, speed − time − distance, profit and loss, percentages, averages, ages, mixtures, permutations and combinations, probability, geometry, spatial reasoning, pattern recognition and quantitative problem solving.

Programming Aptitude and Automata Skills: Logic building, pseudocode, programming fundamentals, basic coding problems, program correctness, execution efficiency, intermediate coding challenges, data structures, algorithms, debugging, optimization techniques, time complexity analysis, industry best coding practices, Automata Pro IT, Automata Pro Max and comprehensive mock assessments.

Text Books: ***(As per IEEE format)***

1	R. S. Aggarwal, *Quantitative Aptitude for Competitive Examinations*, Revised and Enlarged Edition. New Delhi, India: S. Chand and Company Ltd., 2017.
2	R. S. Aggarwal, *A Modern Approach to Verbal & Non-Verbal Reasoning*. New Delhi, India: S. Chand Publishing.
3	Dr. M. B. Lal and A. Gupta, *CSAT Logical Reasoning & Analytical Ability*. Agra, India: Upkar Prakashan.
4	G. Laakmann McDowell, *Cracking the Coding Interview: 189 Programming Questions and Solutions*, 6th ed. Palo Alto, CA, USA: CareerCup, 2015.

Reference Books: ***(As per IEEE format)***

1	B. H. Dowden, *Logical Reasoning*. California State University, Sacramento, CA, USA, 2011.
2	*501 Challenging Logic and Reasoning Problems*, 2nd ed. New York, NY, USA: LearningExpress, LLC, 2005.
3	*Logic and Reasoning Problems*. LearningExpress Practice Series.

Link:
https://drive.google.com/drive/folders/1fXLzuofNhMFq7skonrC0TpCdaCoT7_i0?usp=sharing

CO – PO / PSO Articulation Matrix

Correlation: 1 = Low (Slight), 2 = Medium (Moderate), 3 = High (Substantial), '-' = no correlation.

CO	Program Outcome (PO)											PSO		
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	–	–	–	–	–	–	–	–	3	–	2			
CO2	2	2	–	–	–	–	–	–	1	–	2			
CO3	2	2	–	–	–	–	–	–	1	1	2			
CO4	2	2	3	3	3	–	1	–	1	1	3			
Avg	**2**	**2**	**3**	**3**	**3**	**–**	**1**	**–**	**1.5**	**1**	**2.25**			

CO – WK Mapping (Knowledge & Attitude Profiles)

'✓' indicates the knowledge profile drawn upon by the CO.

CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	–	✓	–	–	–	–	–	✓	✓
CO2	–	✓	–	–	–	–	–	✓	✓
CO3	–	✓	–	–	–	–	–	✓	✓
CO4	–	✓	–	–	–	–	–	✓	✓

CO – WP Mapping (Complex Engineering Problems)

CO	WP1	WP2	WP3	WP4	WP5	WP6	WP7
CO1	–	–	–	–	–	–	–
CO2	✓	–	✓	✓	–	–	–
CO3	✓	–	✓	✓	–	–	–
CO4	✓	–	✓	✓	–	–	✓

CO – EA Mapping (Complex Engineering Activities)

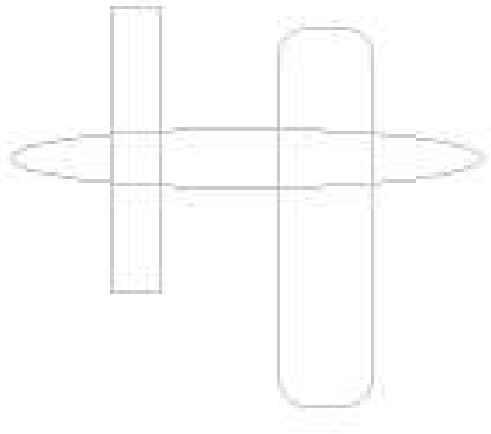
'✓' indicates the activity attribute addressed by the CO

CO	EA1	EA2	EA3	EA4	EA5
CO1	–	–	–	–	–
CO2	–	–	✓	–	✓
CO3	–	–	✓	–	✓
CO4	✓	–	✓	–	✓

CO – SDG Mapping (Sustainable Development Goals)

CO	SDG(s) Addressed	Justification / Linkage
CO1	**SDG 4**	Develops proficiency in English communication, reading comprehension, and language skills, promoting inclusive and quality education and lifelong learning.
CO2	**SDG 4**	Enhances logical reasoning, critical thinking, and analytical decision-making skills, enabling responsible problem-solving and informed decision-making.
CO3	**SDG 4, 8**	Strengthens quantitative aptitude and analytical skills essential for employability, professional competence, and workplace productivity.
CO4	**SDG 4, 8, 9**	Develops computational thinking, programming, and algorithmic problem-solving skills required for innovation, digital transformation, and industry-ready engineering professionals.

- **SDG 4:** Quality Education
- **SDG 8:** Decent Work and Economic Growth
- **SDG 9:** Industry, Innovation and Infrastructure



Syllabus Template **FF No.: 654-A**

ET2306: Engineering Design & Innovation

Teaching Scheme	**Examination Scheme**
Credits : 2	CP: Marks
Lectures : Hrs/week	GD/PPT/HA: Marks
Practical : 2 Hrs/week	MSE (W/O):30 Marks
Tutorial : Hrs/week	ESE (W/O):70 Marks

Prerequisites:	
●	Course Prerequisites: Problem Based Learning Course Relevance: Project Centric Learning (PCL) is a powerful tool for students to work in areas of their choice and strengths. Along with course-based projects, curriculum can be enriched with semester long Engineering Design and Development courses, in which students can solve socially relevant problems using various technologies from relevant disciplines. The various socially relevant domains can be like Health care, Agriculture, Defense, Education, Smart City, Smart Energy and Swaccha Bharat Abhiyan. To gain the necessary skills to tackle such projects, students can select relevant online courses and acquire skills from numerous sources under guidance of facultyand enrich their knowledge in the project domain, thereby achieving project centric learning. Modern world sustained and advanced through the successful completion of projects. In short, if students are prepared for success in life, we need to prepare them for a project-based world. It is a style of active learning and inquiry-based learning. Project centric learning will also redefine the role of teacher as mentor in the learning process. The PCL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It brings students not only to know, understand and remember rather it takes them to analyse, design and apply categories of Bloom ’ s Taxonomy.
Course Objectives:	
●	To develop critical thinking and problem-solving ability by exploring and proposing solutions to realistic/social problems.
●	To Evaluate alternative approaches, and justify the use of selected tools and methods,

●	To emphasize learning activities those are long-term, inter-disciplinary and student-centric.
●	To engage students in rich and authentic learning experiences.
●	To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.
●	To develop an ecosystem to promote entrepreneurship and research culture among the students

Course Outcomes:	
	After completion of the course, student will be able to
1.	Identify the real life problem from societal need point of view
2.	Choose and compare alternative approaches to select most feasible one
3.	Analyze and synthesize the identified problem from technological perspective.
4.	Design the reliable and scalable solution to meet challenges.
5.	Evaluate the solution based on the criteria specified
6.	Inculcate long life learning attitude towards the societal problems

Section1:	**Topics/Contents**

Preamble - The content and process mentioned below is the guideline document for the faculties and students to start with. It is not to limit the flexibility of faculty and students; rather they are free to explore their creativity beyond the guideline mentioned herewith. For all courses of ED, laboratory course contents of "Engineering Design" are designed as a ladder to extend connectivity of software technologies to solve real word problem using interdisciplinary approach. The ladder in the form of gradual steps can be seen as below:

Industry Communication Standards, Single Board Computers and IoT, Computational Biology (Biomedical and Bioinformatics), Robotics and Drone, Industry 4.0 (Artificial Intelligence, Human Computer Interfacing, 5G and IoT, Cloud Computing, Big Data and Cyber Security etc).

Group Structure:

There should be a team/group of 4-5 students. A supervisor/mentor teacher assigned to individual groups. It is useful to group students of different abilities and nationalities together.

Selection of Project/Problem:

● Students must focus on initiating the task/idea. The idea of inception and consideration shall be from following areas as a real-world problem:

-Health Care, Agriculture, Defense, Education, Smart City, Smart Energy, Swaccha Bharat Abhiyan, Environment, Women Safety.

● This is the sample list to start with. Faculty and students are free to include other areas which meet society's requirements at large.

● The model begins with the identifying of a problem, often growing out of a question or "wondering". This formulated problem then stands as the starting point for learning. Students design and analyse the problem/project within an articulated disciplinary subject frame/domain.

● A problem can be theoretical, practical, social, technical, symbolic, cultural, and/or scientific and grows out of students' wondering within different disciplines and professional environments. A chosen problem has to be exemplary. The problem may involve an interdisciplinary approach in both the analysis and solving phases.

● By exemplarity, a problem needs to refer to a particular practical, scientific, social and/or technical domain. The problem should stand as one specific example or manifestation of more general learning outcomes related to knowledge and/or modes of inquiry.

Teacher's Role in PCL:

● Teacher is not the source of solutions rather he will act as the facilitator and mentor.

● To utilize the principles of problem solving, critical thinking and metacognitive skills of the students.

● To make the group aware about time management.

● Commitment to devote the time to solving student's technical problems and interested in helping students to empower them better.

Student's Role in PCL:

● Students must have ability to initiate the task/idea, they should not be mere imitators.

● They must learn to think.

- Students working in PCL must be responsible for their own learning.
- Students must quickly learn how to manage their own learning, instead of passively receiving instruction.
- Students in PCL are actively constructing their knowledge and understanding of the situation in groups.
- Students in PCL are expected to work in groups.
- They have to develop interpersonal and group process skills, such as effective listening or coping creatively with conflicts.

Developing Inquiry Skills:

- Students in PCL are expected to develop critical thinking abilities by constantly relating: What they read to do? What do they want to do with that information?
- They need to analyse information presented within the context of finding answers.
- Modelling is required so that the students can observe and build a conceptual model of the required processes.
- Use the following mechanism to maintain the track of moving towards the solution.

  How effective is …….?

  How strong is the evidence for ……?

  How clear is …….?

- What are the justifications for thinking? Why is the method chosen?
- What is the evidence given to justify the solution?

Literature Survey – To avoid reinvention of wheel:

- It is an integral part of self- directed learning
- Identify the information needed to solve a given problem or issue
- Be able to locate the needed information
- Use the information to solve the given problem effectively.
- Skills required by students in information literacy include:

- • How to prepare for the search? How to carry out research
- Sorting and assessing of information in general

Use of Research Methodology: - investigation, collaboration, comprehension, application, analysis, synthesize and evaluation

Focus on the following skills while working in a team to reach to solution:

- Collaborative learning
- Interpersonal Skills
- Resources Evaluation
- Metacognitive Skills
- Reflection Skills

Section2:	Topics/Contents

EDD Sample Case Studies: -

With the adaptation of industry communication standards, Raspberry Pi and Sensors, the following projects can be taken up:

1) Design a deployable product for soil moisture detection

2) Design a deployable product for temperature detection

3) Design a deployable product for pressure detection

4) Design a deployable product smoke detection

5) Design a deployable product for motion detection

6) Design a deployable product for collision detection

7) Design a deployable product for sound detection

...**not limited to.... Faculty and students are free to include other areas which meet**

society's requirements at large.	
Text Books: ***(As per IEEE format)***	
1	*A new model of problem-based learning. By Terry Barrett. All Ireland Society for higher education (AISHE). ISBN:978-0-9935254-6-9; 2017*
2	*Problem Based Learning. By Mahnazmoallem, woei hung and Nada Dabbagh, Wiley Publishers. 2019.*
3	*Stem Project based learning and integrated science, Technology, Engineering and mathematics approach. By Robert Robart Capraro, Mary Margaret Capraro*
4	*A new model of problem-based learning. By Terry Barrett. All Ireland Society for higher education (AISHE). ISBN:978-0-9935254-6-9; 2017*
Reference Books: ***(As per IEEE format)***	
1	De Graaff E, Kolmos A., red.: Management of change: Implementation of problembased and project-based learning in engineering. Rotterdam: Sense Publishers. 2007.
2	Project management core textbook, second edition, Indian Edition , by Gopalan.
3	The Art of Agile Development. By James Shore & Shane Warden

CO – PO / PSO Articulation Matrix

Correlation: 1 = Low (Slight), 2 = Medium (Moderate), 3 = High (Substantial), '-' = no correlation.

CO	Program Outcome (PO)											PSO	
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	2					3		2	3	3
CO2	2	2	3	2	2		2		3		2	3	3
CO3	2	2	3	2	3		2		3		2	3	3
CO4	2	2	3	2	3	3		2	3		2	3	3
CO5	2	2	3	2	3	2			3		2	3	3
CO6	2	2	3	3	2				3		3	3	3
Avg	2.0	2.0	2.83	2.83	2.6	2.5	2.0	2.0	3.0	1.0	2.16	3.0	3.0

CO – WK Mapping (Knowledge & Attitude Profiles) Sample Table

'✓' indicates the knowledge profile drawn upon by the CO.

CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1		✓	✓	✓	✓			✓	
CO2		✓	✓	✓	✓	✓		✓	
CO3		✓	✓	✓	✓	✓		✓	
CO4		✓	✓	✓	✓	✓	✓	✓	✓
CO5		✓	✓	✓	✓	✓	✓	✓	
CO6		✓	✓	✓	✓	✓		✓	

CO – WP Mapping (Complex Engineering Problems) Sample Table

CO	WP1	WP2	WP3	WP4	WP5	WP6	WP7
CO1	✓			✓		✓	✓
CO2	✓	✓				✓	
CO3	✓		✓		✓		
CO4	✓				✓	✓	
CO5	✓	✓	✓				
CO6	✓					✓	✓

CO – EA Mapping (Complex Engineering Activities)

'✓' indicates the activity attribute addressed by the CO

CO	EA1	EA2	EA3	EA4	EA5
CO1	✓	✓			
CO2	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓
CO6	✓	✓	✓		✓

CO – SDG Mapping (Sustainable Development Goals) Sample Table

CO	SDG(s) Addressed	Justification / Linkage
CO1	4,9	Identifies real-life societal problem and develops engineering knowledge for innovative solutions
CO2	4,9,12	Evaluates and compares alternative solutions to select sustainable and resource efficient approaches
CO3	4,9,11	Analyze engineering problems and synthesizes technological solutions for societal needs
CO4	4,9,11,13	Designs reliable,scalable and sustainable engineering solutions addressing environmental and societal challenges
CO5	4,9,16	Evaluates engineering solutions based on defined technical, ethical,and quality criteria to ensure reliability and accountability
CO6	4,17	Promotes lifelong learning,professional development,collaboration and commitment to solving societal problems