Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Structure and Syllabus of

B.Tech.

Electronics and Telecommunication Engineering

Effective from Academic Year 2025-26

Prepared by: - Board of Studies in Electronics and Telecommunication

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

Chairman – BOS

Chairman – Academic Board

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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 Graduate will be able to

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and the cultural, societal,and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Contents

Title: Course Structure-B25, Module: III

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FF No. 653

Branch: E&TC **Year:** S.Y. **A.Y.:** 2025-26 **Module: III**, Sem1

Subject Head	Course Code	Course Name	Theory	Lab	Tut	Credit	Theory (W)ESE	Theory(O)	CVV(oral)	Course Project (CP)	Lab	Home Assignment	MSE	Test1 (w)	Test 1(online)	Test2(W)	Test2(Online)	ESE	Pract +CVV (Oral)
S1	ET2301	Data Structures	3	2	0	4				30	10								40+20
S2	ET2302	Digital Electronics	2	2	0	3	40		20	30	10								
S3	ET2303:	Solid State Devices And Circuits	2	2	0	3	40		20	30	10								
S4	ET2304	Signals and Systems	2	0	0	2			30					35		35			

S5	ETM001	IoT for Smart Applications	2	0	1	3						30			35		35		
S5	ETM002	Microcontroller and Applications																	
S6	HS2002	From Campus To Corporate - 1	2	0	0	2													
S7	HS2001	Reasoning And Aptitude Development - 3	1	0	0	1												**100**	
S8	ET2306	Engineering Design And Innovation - 1	0	0	0	2							30					**70**	
S9	ET2305	Design Thinking - 1	0	0	1	1												**100**	
						21													

Title: Course Structure-B25, Module: IV

Issue 1 : Rev No. 01: Dt. 01/08/25

Title : Course Structure **FF No. 653**

Branch :	Year:	Academic Year-	Semester:	Module:	Pattern:
E&TC	SY	2025-26	II	4	B25

Subject No.	Subject Code	Subject Name	Teaching Scheme(Hrs/Week))			Examination scheme										Total	Credits
			Theory	Lab	Tut	CVV	CP	LAB CA	GD/ PPT/HA	MSE (W/O)	T1 (W/O)	T2 (W/O)	ESE	ESE (W/O)	PRACT /CVV		
s1	ET2307	Communication Engineering	2	2	0	20	30	10						40(W)		100	3
s2	ET2308	Control Systems	2	2	0		30	10	GD/PPT (20)					40(O)		100	3
s3	ET2309	Operating Systems	2	2	0		30	10							40+20	100	3
s4	ET2310	Statistics, Probability and Optimization	2	0	1	30			GD/PPT (30)					40(W)		100	3
s5	MM1002	Object-Oriented Programming	2	0	1				30		35(O)	35(O)				100	3
s6	HS2003	From Campus To Corporate – 2	2							50(O)				50(O)		100	2

s7	HS2004	Reasoning And Aptitude Development – 4	1										100			100	1
s8	ET2311	Design Thinking - 2			1								100			100	1
s9	ET2312	Engineering Design And Innovation - 2		8						30			70			100	2
																	21

Abbreviations Used	
PPT	Powerpoint Presentation
GD	Group Discussion
CVV	Comprehensive Viva Voce
LAB	Laboratory
CP	Course Project
CA	Continuous Assessment
PR	Practical
T1	Test 1
T2	Test 2
HA	Home Assignment
MSE	Mid Semester Examination
ESE	End Semester Examination

FF No. : 654

ET2301: Data Structures

Credits: 4

Teaching Scheme:

Theory: 03 Hours / Week

Lab: 02 Hours / Week

Section 1: Topics/Contents

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.

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.

Linked Lists: Dynamic memory allocation, Singly Linked Lists, Doubly Linked Lists, Circular Linked Lists.

Stack: Representation and implementation using Arrays and Linked Lists. Applications include expression conversion and evaluation.

Queues: Representation and implementation using Arrays and Linked Lists. Types of Queues.

Applications of Stack, Queue, and Linked List:

Stack: Balancing parentheses in an expression, reversing a string, and evaluating postfix expressions.

Queue: Implementing a ticketing system, printing job scheduling, and simulating a queue at a service center.

Linked List: Managing a to-do list, implementing a simple phone directory, and designing a basic memory allocator.

Section2: Topics/Contents

Trees: This section covers the basic terminology and representation of trees using arrays and linked lists. It includes tree traversals, both recursive and non-recursive methods, and operations on binary trees and binary search trees (BST). Applications of trees are explored through the construction and analysis of Huffman Trees. Advanced trees such as AVL trees, Red-Black trees, B-trees, and B+ trees are introduced along with their analysis.

Graphs: Graphs are discussed in terms of terminology and representation using adjacency matrices and adjacency lists. Graph traversals, including BFS and DFS, are covered, along with applications like connected graphs, bipartite graphs, and cycle detection. Algorithms for finding minimum spanning trees, such as Prim's and Kruskal's, and shortest path algorithms are explained. Union-Find operations are also included, and the applications of graphs are illustrated through the analysis of the Traveling Salesman Problem.

Hashing: This topic introduces hashing techniques, hash tables, and hash functions. It covers collision handling and resolution techniques, including dynamic hashing. Applications of hashing are discussed with examples such as password encryption and integrity checks.

List of Practicals:

1. Assignment based on Object-Oriented Programming (OOP).
2. Assignment based on Basic Concepts of Arrays.
3. Assignment based on Sorting and Searching.
4. Assignment based on Stack Application (Expression conversion, etc.).
5. Assignment based on Queue Application (Job scheduling, resource allocation, etc.).
6. Assignment based on Linked List.
7. Assignment based on Advanced Linked List (Circular or Doubly Linked List).
8. Assignment based on Trees (binary trees, traversals, Huffman tree).
9. Assignment based on Advanced Trees (AVL, Red-Black trees).
10. Assignment based on Graphs (representation, BFS, DFS, cycle detection, bipartite check).
11. Assignment based on Minimum Spanning Tree and Shortest Path Algorithms (Prim's, Kruskal's, Dijkstra's).
12. Assignment based on Union-Find operations (disjoint sets, cycle detection).
13. Assignment based on Hashing (hash tables, collision handling, dynamic hashing, password encryption).

List of Project areas:

1. Simple Contact Manager using Arrays and Linked Lists
2. Basic Calendar App with Event Reminders
3. Maze Solver using BFS and DFS Traversals
4. Auto-complete Feature using Trie Data Structure
5. Simple Spell Checker using Hashing Techniques
6. Library or Inventory Management System
7. Job Scheduling Simulator using Queue and Priority Queue
8. Shortest Path Finder in a City Map using Dijkstra's Algorithm
9. Student Record Storage and Search System using Hash Tables
10. Classic Snake Game using Stack and Queue for Movement Handling

Text Books:

1. Yashavant Kanetkar, Data Structures through C++, BPB Publication, 2nd Edition

2. Data structures, Algorithms and Applications in C++, 2nd Edition, Sartaj Sahni, Universities Pree

Reference Books:

1. Yedidyah Langsam, Moshe J Augenstein, Aaron M Tenenbaum – Data structures using C and C++ - PHI Publications (2nd Edition).
2. Ellis Horowitz, Sartaj Sahni- Fundamentals of Data Structures – Computer Science Press.

Course Outcomes:

The student will be able to –

1. Understand and apply fundamental Object-Oriented Programming concepts, including classes, inheritance, and polymorphism.
2. Implement and analyze basic data structures such as arrays, linked lists, stacks, and queues.
3. Implement and analyze efficient sorting and searching algorithms with complexity evaluation.
4. Perform operations and traversals on trees and apply them to practical problem solving.
5. Represent graphs, execute traversal algorithms, and solve problems using graph algorithms.
6. Implement hashing techniques and collision resolution methods for secure and efficient data storage.

FF No. : 654

ET2302: Digital Electronics

Credits: 03

Teaching Scheme:
Theory: 02 Hours / Week
Lab: 02 Hours / Week

Prerequisites: Digital Logic Design and Testing (Course Code: ET1017)

Section 1:

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.

Section 2:

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.

List of Practical:

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. Desing 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:

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

Text Books:

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*

Course Outcomes:

The 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.

FF No. : 654

ET2303: Solid State Devices and Circuits

Credits: 3

Teaching Scheme:
Theory: 02 Hours / Week
Lab: 02 Hours / Week

Section 1:

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:

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. Introduction to Power Amplifiers.

List of Practical:

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

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

1. Floyd, “Electronic Devices and Circuits”, Pearson Education.
2. Donald Neamen, “Electronic Circuits Analysis and Design”, 3rdEdition, TMH*tion*
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.

Course Outcomes:

The 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. Analyse MOSFET based amplifiers.
6. Differentiate between MOSFET based oscillators.

FF No. : 654

ET2304: Signals and Systems

Credits: 02 **Teaching Scheme: 02 Hours / Week**

Section 1:

Unit I: Introduction to Signals and Systems 6L

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.
Systems: Definition, Classification: linear and nonl inear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.

Unit II: System Analysis 5L

System modeling: 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: System Analysis in Frequency Domain using Fourier Transform 5L

Definition and necessity of CT Fourier series and Fourier transforms. CT Fourier series, 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.

Unit IV: 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.

Unit V: Correlation and Spectral Density 4L

Definition of Correlation and Spectral Density, correlogram, analogy between correlation, convolution, conceptual basis, auto-correlation, cross correlation, energy/power spectral density, properties of correlation and spectral density, inter relation between correlation and spectral density.

Unit VI: Sampling Theorem and its Applications 3L

Sampling process, Nyquist criteria, ADC Blocks, Sampling theorem in time and frequency domain, Aliasing effect, Applications of sampling .

Text Books:

1. Ramesh Babu, “Signals and Systems”, 4th Ed., Scitech Publications
2. A. Nagoor Kani, “Signals and Systems”, Tata McGraw Hill

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 Projects:

1. ECG Signal Analysis for Arrythmia
2. Musical Instrument Identification.
3. Speech Signal preprocessing and Analysis
4. Analyze the overlapping and Aliasing effects in a Discrete time Signal

5. Extraction of Time and frequency domain features of a discrete time signal
6. Playing of Melodious music
7. Analysis of various Biomedical signals like ECG, EEG, EMG
8. Brain-Controlled Robotics via EEG
9. Gravitational Wave Detection
10. DNA Sequence Compression
11. Neuromorphic Signal Processing
12. Automotive & Transportation
13. Earthquake Early Warning System
14. Flood Prediction via River Sound Analysis
15. Steganography Detection in Images
16. Steganography Detection in Images
17. Motor Fault Detection via Vibration Analysis
18. Lung Sound Classification (COVID-19 Screening)

Course Outcomes:

The 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
6. Understand the aliasing effects in both time and frequency domains

FF No. : 654

ET2307: Communication Engineering

Credits: 3 **Teaching Scheme: Theory 2 Hrs./ Week**

Lab:2 Hrs./week

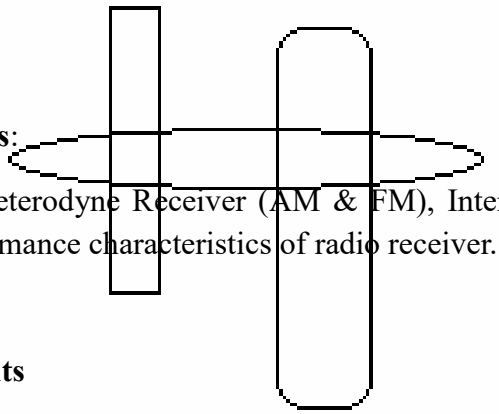
Section 1: Topics/Contents

Unit 1: Amplitude Modulation systems

Analog & Digital Communication System Overview, Types of Electronic Communication, Sources of Information, Communication Channels, Need of modulation, Mathematical treatment for an AM signal, Modulation and Demodulation , Modulation Index, Efficiency, Power calculations, DSB- SC and SSB-SC(1 method), VSB(5 Hrs)

Unit 2: Frequency Modulation and Demodulation

Mathematical equation FM signal, Transmission Bandwidth of FM Wave,Generation of FM(Direct Method and Indirect Method),Demodulation of FM(Slope detection and balanced Slope Detection),PLL based demodulation,Comparision of AM and FM systems.(5 Hrs)



Unit 3: Radio Receivers:

TRF Receiver, Super Heterodyne Receiver (AM & FM), Intermediate Frequency and Image Frequency, Performance characteristics of radio receiver. (4 Hrs)

Section2: Topics/Contents

Unit 4: Sampling and Waveform Coding:

Sampling, ideal sampling, Flat top & Natural Sampling, Aliasing, Pulse amplitude modulation, Quantization, Pulse code modulation reconstruction, Delta modulation, Line Coding, ISI and eye diagram. (5 Hrs)

Unit 5: Digital Modulation and Demodulation Techniques:

Digital modulation techniques - Amplitude Shift Keying, Binary Phase Shift Keying, Quadrature Phase Shift Keying, Binary Frequency Shift Keying, Quadrature amplitude modulation,Signal Space representations(BPSK,QPSK, QAM)(5 Hrs)

Unit 6: **Spread Spectrum Techniques**:

PN Sequences and its properties, Direct Sequence spread spectrum Techniques, Processing Gain, Jamming Margin, FHSS basics and types. (4 Hrs)

List of Practical: (Any Six)

1. AM - Modulation and Demodulation
2. FM - Modulation and Demodulation
3. Study of Sampling theorem
4. Pulse Code modulation (PCM)
5. Delta modulation (DM)
6. Binary phase shift keying (BPSK)
7. Quadrature phase shift keying (QPSK)
8. Direct Sequence Spread Spectrum Techniques

List of Project areas:

1. Simple AM Transmitter
2. Double Side Band –Suppressed Carrier modulator and demodulator
3. Pre-emphasis and De-emphasis for FM
4. Anti-Aliasing filter
5. Transistor/IC based Amplitude modulator
6. PLL IC 565 based on FM demodulation

7. Discrete PAM signal
8. Analog to Digital Conversion
9. Simulation - Design and Analysis of Communication System

Text Books:

1. *Louis E Frenzel; Principles of Electronic Communication Systems; Third Edition., McGraw Hill Publications.*

2. *Kennedy & Davis; Electronic Communication; Tata McGraw Hill Publications.*

3. *Taub Schilling; Principles of Communication Systems; Fourth Edition., Tata McGraw Hill Publications.*

Reference Books:

1. *Dennis Roddy & Coolen; Electronic Communication; Tata McGraw Hill Publications.*
2. *Wayne Tomasi; Electronic Communication Systems; Fourth Edition.*

3. *Simon Haykin; Digital Communications; Fourth Edition, Wiley Publications*

4. *Carlson; Communication Systems;Fourth Edition, McGrawHill.*

5. *Simon Haykin; Analog & Digital Communications; Wiley Publications.*

6.*B.Sklar; Digital Communication; Second Edition, Pearson*.

Course Outcomes:

The student will be able to –

1. **Analyze** the characteristics and performance of Amplitude Modulation systems.
2. **Evaluate** Frequency Modulation techniques for bandwidth and noise performance.
3. **Assess** the operation and performance metrics of radio receivers.
4. **Design** sampling and PCM-based waveform coding systems.
5. **Analyze** passband digital modulation techniques using signal-space concepts.

6. **Evaluate** spread spectrum techniques for secure communication.

FF No.: 654

ET2308 Control Systems

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

Prerequisites:	
•	Signals, Laplace transform
Course Objectives:	
•	Introduce the fundamentals of automatic control systems and feedback engineering.
•	Develop the ability to model simple electrical, mechanical, and electromechanical systems.
•	Familiarize students with time-domain performance and steady-state error concepts.
•	Provide an introduction to root locus and frequency-domain analysis including Bode, Nyquist, GM & PM.
•	Explain the effect of pole-zero locations on system stability, time response, and frequency response.
•	Provide a foundational understanding of basic controllers, compensators, introductory state-variable and digital control concepts, and their applications in real-life systems
Course Outcomes:	
	After completion of the course, student will be able to
1.	Explain the concepts of open-loop and closed-loop control systems and identify components of practical feedback systems.
2.	Model simple electrical and mechanical systems and reduce block diagrams and signal flow graphs.
3.	*Analyze first- and second-order systems in the time domain, interpret transient and steady-state behaviours, and determine steady-state errors using error constants.*
4.	Apply Routh–Hurwitz and root locus techniques to determine system stability and understand the effect of pole-zero locations.
5.	Sketch and interpret frequency responses using Bode plots and Nyquist plots and evaluate system stability using gain margin and phase margin.
6.	*Understand and interpret the behaviour of basic controllers (P, PI, PD, PID) and their influence on system performance.*

Section1:	**Topics/Contents**
Introduction to Control Systems	

Definition and classification of systems: open-loop, closed-loop ,Feedback concept – advantages and applications, Basic components: sensing element, controller, final control element, actuator Transfer function concept, Motivating applications: motor speed control, temperature control, automatic gain control (AGC)

System Modelling & Block Diagram Techniques
Modelling of simple electrical systems (RC, RL, RLC), Mechanical system modelling (mass–spring–damper), Electromechanical systems (qualitative DC motor model), Block diagram reduction techniques, Signal Flow Graphs – introduction and Mason's Gain Formula

Time Domain Analysis & Steady-State Error
Standard Test Signals, Time-domain specifications, *Transient Analysis,* Steady-State Error Analysis, Effect of Poles and Zeros on Time Response

Section2:	**Topics/Contents**

Stability & Root Locus Analysis
Stability Concept, Routh–Hurwitz stability criterion , Root Locus – Construction and analysis, Effect of Pole-Zero Locations, Stability from Root Locus

Frequency Domain Analysis
Frequency Response Basics, Parameters, Bode Plot construction and analysis, Nyquist plot introduction, construction and analysis, Gain Margin and Phase Margin

Controllers & Introduction to Modern Control Systems
Basic controller actions: P, PI, PD, PID, Simple tuning intuition, Lead and Lag compensators (effects only), State variable concept (intro only), Digital control basics: sampling, discrete-time stability idea, Real-life systems: drones, robotics, audio AGC, simple servo loops

Text Books:	
1	I.J. Nagrath & M. Gopal, 'Control Systems Engineering', New Age International
2	Norman S. Nise, 'Control Systems Engineering', Wiley India
3	Katsuhiko Ogata, 'Modern Control Engineering', Pearson
4	B. C. Kuo & Farid Golnaraghi, 'Automatic Control Systems', Wiley
Reference Books:	
1	Franklin, Powell & Emami-Naeini, 'Feedback Control of Dynamic Systems', Pearson Education c 2019
2	Curtis D Johnson, 'Process Control Instrumentation Technology', Eighth Edition, PHI Private Limited, New Delhi
3	R. Anadanatrajan, Ramesh Babu, 'Control Systems Engineering', Scitech Publication Pvt. Ltd.

List of Practical's:

1. To study Scilab/MATLAB – Basics and Control Systems toolbox
2. Time Response of First-Order Systems
3. Time Response of Second-Order Systems

4. Steady-State Error and Error Constants
5. Routh Stability and Root Locus Visualization
6. Bode Plot, Gain Margin & Phase Margin

List of Course Project areas:

1. Fundamental automation (Traffic Lights, Water Level, Conveyors)
2. Advanced AI/ML (Robotics, Autonomous Vehicles, Smart Grids)
3. Specific industry applications (Energy, Healthcare, Automotive, Aerospace, Defense)

FF No.: 654

ET2309: Operating Systems

Teaching Scheme	Examination Scheme
Credits : 3	CP: Marks
Lectures : 2 Hrs/week	GD/PPT/HA: Marks
Practical : 2 Hrs/week	MSE (W/O): Marks
Tutorial : -	ESE (W/O): Marks

Prerequisites:	Basics of computer system, data structures and any programming language.
Course Objectives:	
1.	To understand the basic concepts and functions of Operating System.
2.	To gain knowledge of process synchronization and its mechanism.
3.	To be familiar with CPU scheduling algorithms.
4.	To discuss different deadlock handling mechanisms.
5.	To learn memory management techniques and virtual memory.
6.	To discuss I/O management and file management.
Course Outcomes:	
	After completion of the course, student will be able to
1.	Understand the concepts and functions of Operating System
2.	Demonstrate knowledge in applying process management
3.	Apply various CPU scheduling algorithms with real world problems.
4.	Identify the mechanisms to deal with Deadlock.
5.	Illustrate the memory structure and memory management techniques
6.	Analyze I/O and disk management techniques for better utilization of secondary memory

Section1:	Topics/Contents

Introduction: Introduction to OS, Interaction of OS and hardware, Basic functions of OS, OS Services, Types of OS: Batch, Multiprogramming, Time Sharing, Parallel, Distributed & Real-time OS, System Calls, Types of System calls, Introduction to Linux, Basic Linux Commands

Process Management: Concept of Process, Process States: 3, 5 and 7 Process State Models, Process Description, Process Control Block (PCB), Context Switching, Inter Process Communication (IPC), Introduction to Threads, Comparison of Process and Threads, Multithreading models, Thread implementations – user level and kernel level threads, Concurrency: Issues with concurrency, Principles of Concurrency, Critical Section Problem, Race Condition, Mutual Exclusion: Semaphores and Mutex, Classical Process Synchronization Problems.

CPU Scheduling: Uniprocessor Scheduling, Preemptive and Non Premptive Scheduling CPU Scheduling Algorithms: First Come First Serve (FCFS), Shortest Job First (SJF), Round Robin (RR) and Priority Scheduling.

Section2:	Topics/Contents

Deadlock: Principles of deadlock, Deadlock Detection, Deadlock Prevention, Deadlock Avoidance, Deadlock Recovery, Banker's Algorithm.

Memory Management: Memory Management Requirements, Logical and Physical Address Space, Memory Partitioning, Memory Fragmentation, Placement Strategies: First Fit, Best Fit, Next Fit and Worst Fit. Paging, Page Table Structure, Translation Lookaside Buffer, Page Replacement Algorithms: First In First Out (FIFO), Least Recently Used (LRU) and Optimal algotithm, Segmentation, Concept of Virtual Memory (VM), VM with paging and Segmentation,

I/O Management: I/O Devices - Types, Characteristics of Devices, I/O Buffering. Secondary Storage: Disk Structure, Disk Scheduling Algorithms: FCFS, Shortest Seek Time First (SSTF), SCAN, C-SCAN, LOOK and C-LOOK.

Text Books:	
1	*Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Concepts*
2	*Stallings W., Operating Systems, Prentice Hall*
Reference Books:	
1	*Andrew Tanenbaum, Modern Operating Systems, Prentice Hall.*
2	*Harvey M. Deitel, an introduction to operating systems. Addison-Wesley.*
3	*Embedded Multicore: An Introduction, Freescale Semiconductor*

List of Practicals:

1. Execution of Linux Commands.
2. Demonstration of System Calls.
3. Shell Scripting Program.
4. Implementation of Classical Process Synchronization Problem
5. Implementation of CPU Scheduling Algorithms

Syllabus Template **FF No.: 654**

MM1002:Object Oriented Programming

Teaching Scheme	Examination Scheme
Credits : 3	CP: NA
Lectures : 2 Hrs/week	CVV: 30
Practical : NA	MSE (O): 35
Tutorial : -1 Hrs/week	ESE (O): 35

Prerequisites:	Basics of computer system, data structures and any programming language.
Course Objectives:	
1.	To introduce students to the fundamental concepts, syntax, and structure of Java programming.
2.	To develop the ability to apply object-oriented principles such as encapsulation, inheritance, and polymorphism in Java applications.
3.	To enable students to organize and manage code effectively using Java packages, access modifiers, and library imports.
4.	To train students in identifying, handling, and generating exceptions to develop robust and error-free Java programs.
Course Outcomes:	
1.	Explain the basic syntax, structure, and key features of Java programming.
2.	Analyze and solve problems using Java data types, variables, control flow, and looping constructs.
3.	Apply object-oriented concepts such as classes, objects, encapsulation, inheritance, and polymorphism to program design.
4.	Organize Java programs using packages, package hierarchy, and appropriate access modifiers.
5.	Identify and handle runtime errors using Java exception-handling mechanisms, including custom exceptions.
6.	Develop logical solutions to moderate-level problems by integrating OOP concepts, packages, and exception handling through tutorials.
Section1:	**Topics/Contents**
Fundamental Concepts in JAVA Programming:	

Introduction to Java: What is Java? History and evolution of Java. Features and advantages of Java. Java Development Environment: Setting up Java Development Kit (JDK). Installing and configuring Integrated Development Environments (IDEs) like Eclipse or IntelliJ IDEA. Basic Syntax: Java program structure. Writing and running a simple Java program. Data types and variables. Comments and conventions. Control Flow: Conditional statements (if, else if, else). Switch statements. Looping constructs (for, while, do-while). Break and continue statements. **Object-Oriented Programming Fundamentals:** Functions and Methods: Defining methods. Method parameters and return values. Function overloading. Recursion. Object-Oriented Programming (OOP): Introduction to OOP. Classes and objects. Encapsulation, inheritance, and polymorphism. Constructors and destructors.

Section2:	**Topics/Contents**
Packages and Libraries: Introduction to Packages: What are packages in Java? Why use packages? Benefits of organizing code into packages. Package Structure: How packages are structured in Java. The concept of a package hierarchy. Creating and Using Packages: How to create your own packages? Importing Java standard library packages. Importing user-defined packages. Package Naming Conventions: Naming conventions for packages. Choosing meaningful package names. Package Visibility: Access modifiers in Java (e.g., public, private, protected, default). Controlling visibility within and outside packages. **Exception Handling:** Introduction to Exceptions: What are exceptions? Why use exceptions? Types of exceptions (checked and unchecked). Exception Hierarchy: Understanding the Java exception class hierarchy. Throwable, Exception, and Error classes. Handling Exceptions: Using try-catch blocks. Catching specific exceptions. Multiple catch blocks. The finally block and its purpose. Throwing Exceptions: Throwing exceptions explicitly using the throw keyword. Creating custom exceptions.	
Text Books:	
1	Java: The Complete Reference" by Herbert Schildt
2	Head First Java" by Kathy Sierra and Bert Bates
3	Balagurusamy E, Object Oriented Programming Using C++ and JAVA
Reference Books:	
1	T. Budd, Understanding OOP with Java, Pearson Education.
2	E Balagurusamy, Programming with Java A Primer, Tata McGraw Hill, 3rd Edition.
3	Yashavant Kanetkar ,Object Oriented Programming with C++

List of Tutorials:

1. Introduction to Java and Java Development Environment
2. Java Program Structure, Data Types, and Variables
3. Decision Making Statements in Java
4. Looping Constructs and Control Statements
5. Methods, Parameters, and Method Overloading
6. Recursion and Problem Solving
7. Classes, Objects, and Encapsulation

8. Constructors and Inheritance
9. Polymorphism in Java
10. Packages and Access Modifiers
11. Exception Handling – Basics
12. Comprehensive Application of Object-Oriented Programming Concepts

CO-PO Mapping

CO	Program Outcomes (PO)											PSO		
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1										1		
CO2	3	3												
CO3	3	2	2										1	2
CO4	2	2			2									2
CO5	2	3			1									2
CO6	3	3	2		2				1	1		2	1	2
Average	**2.67**	**2.33**	**0.67**	**0**	**0.83**	**0**	**0**	**0**	**0.17**	**0.17**	**0**	**0.5**	**0.33**	**1.33**

FF No.: 654

ET2310: Statistics, Probability and Optimization

Section 1

Unit 1. Sampling Basics

Introduction to Data, Random sampling, Stratified, systematic, cluster sampling, Convenience & snowball sampling Sample size determination (basic idea)

Unit 2: Descriptive Statistics

Measures of central tendency: mean, median, mode, Measures of dispersion: range, variance, standard deviation, IQR, Shape of data: skewness, kurtosis, Percentiles & quartiles, Z-Score, Binomial Distribution, Histogram, bar chart, box plot, pie chart, Scatter plot, Interpretation of visual patterns

Unit 3: Inferential Statistics

Central Limit Theorem, Statement & intuition, Importance in data science & ML, Application for mean & proportion, Confidence intervals for mean, Margin of error, Fundamentals of Hypothesis Testing, Null & alternative hypothesis, Test statistic, p-value and critical value, One-tailed vs two-tailed tests, Properties of t-distribution, Degrees of freedom, Difference between Z and t

Section2

Unit 4. Optimization Basics and Distance Metrics

Optimization Basics, Objective functions, Constraints, Global vs local minima, Convex vs non-convex functions

Distance Metrics, Euclidean distance, Manhattan distance, Minkowski distance, Use of distance metrics in ML (KNN, clustering)

Unit 5: Probability Basics

Foundations of Probability, Random experiments, sample space, events, Mutually exclusive & exhaustive events Rules of Probability

Unit 6: Conditional Probability and Bayes' Theorem

Conditional Probability, Definition & intuition, Bayes' Theorem, Statement & formula Prior, likelihood, posterior, Step-by-step interpretation, Applications of Bayes Theorem

List of Tutorial

Tutorial 1: Sampling Concepts & Types of Data

Topics:

- Population vs sample
- Types of data (nominal/ordinal/interval/ratio)
- Random, stratified, systematic, cluster sampling

Outcome: Students identify correct sampling methods and differentiate data types.

Tutorial 2: Advanced Sampling Methods & Sample Size

Topics:

- Convenience & snowball sampling
- Sampling bias
- Basic idea of sample size determination

Outcome: Students select appropriate sampling strategies for different scenarios.

Tutorial 3: Descriptive Statistics – Central Tendency

Topics:

- Mean, median, mode
- When to use which measure
- Numerical examples & interpretation

Outcome: Students compute and interpret central tendency measures.

Tutorial 4: Descriptive Statistics – Dispersion & Shape

Topics:

- Range, variance, standard deviation, IQR
- Skewness & kurtosis
- Z-score calculations

Outcome: Students analyze spread and shape of data distributions.

Tutorial 5: Data Visualization Techniques

Topics:

- Histogram, bar chart, pie chart, box plot
- Scatter plot interpretation
- Visual pattern analysis

Outcome: Students create and interpret graphs using sample datasets.

Tutorial 6: Probability Fundamentals

Topics:

- Sample space & events
- Mutually exclusive vs independent events
- Addition & multiplication rules

Outcome: Students solve probability problems using real-life examples.

Tutorial 7: Binomial Distribution & Counting Concepts

Topics:

- Bernoulli vs binomial experiments
- nCr and counting principle
- Mean & variance of binomial distribution

Outcome: Students model binary events and compute probabilities.

Tutorial 8: Central Limit Theorem & Sampling Distribution

Topics:

- CLT intuition
- Standard error
- Distribution of sample mean

Outcome: Students understand why CLT supports inference in statistics.

Tutorial 9: Confidence Intervals & Margin of Error

Topics:

- CI for mean (σ known / unknown)
- CI for proportion
- Margin of error interpretation

Outcome: Students compute confidence intervals for different datasets.

Tutorial 10: Hypothesis Testing & t-Distribution

Topics:

- Null vs alternative hypotheses
- One-tailed vs two-tailed tests
- t-test (one-sample, independent, paired)
- t vs Z difference

Outcome: Students perform hypothesis tests and interpret p-values.

Tutorial 11: Optimization Basics & Distance Metrics

Topics:

- Objective function, constraints
- Gradient intuition
- Euclidean, Manhattan, Minkowski, Cosine, Hamming distances

- Applications in ML (KNN, clustering)

Outcome: Students compute distances and understand basic optimization.

Tutorial 12: Conditional Probability & Bayes' Theorem

Topics:

- Conditional probability
- Bayes rule: prior, likelihood, posterior
- Applications: medical tests, email spam example

Outcome: Students compute posterior probabilities and analyze real-world problems.

Course Outcome

CO No.	Course Outcome	Academic Challenge level (5 : Most Challenging)
1	Understand statistical terminologies associated with experimental design	1
2	Compute and interpret descriptive statistics and create visualizations to summarize data.	3
3	Construct confidence intervals and perform hypothesis testing using Z and t tests.	5
4	Apply optimization fundamentals and compute distance metrics for analytical tasks.	3
5	Solve problems on foundational probability concepts and rules of probability.	2
6	Apply conditional probability and Bayes' theorem to compute posterior probabilities in real-world applications.	4

Text Books:

1. 'Probability and Statistics for Engineers and Scientists', Sheldon Ross, Academic Press, 4th edition
2. 'Applied Statistics and Probability for Engineers', Montgomery and Runger, Wiley Publishing,3rd edition

Reference Book:'Introduction to Probability and Statistics', Milton and Arnold, McGraw Hill Publishing,4th edition

ETM001: IOT for Smart Applications

Total Credits: 3

Teaching Scheme:
Theory: 2 Hours / Week ;
Tutorial: 1 Hours / Week

SECTION I:

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. (4)

IoT Design Methodology Steps and IoT System Design Cycle.

Hardware Platforms - Arduino, Raspberry Pi, NodeMCU, ESP32. Sensors, actuators selection criteria for specific applications and interfacing basics.

UNIT III: IOT Protocols and Standards (6)

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

SECTION II:

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.

List of Tutorials

1. Smart Agriculture System
2. Weather Reporting System
3. Home Automation System
4. Air Pollution Monitoring System
5. Smart Parking System
6. Smart Traffic Management System
7. Smart Cradle System
8. Smart Gas Leakage Detector Bot
9. Streetlight Monitoring System
10. Smart Anti-Theft System
11. Liquid Level Monitoring System
12. Night Patrol Robot
13. Health Monitoring System
14. Smart Irrigation System
15. Flood Detection System
16. Mining Worker Safety Helmet
17. Smart Energy Grid

Suggested Sensors for project to respective domain:

Domain	Suggested Sensors
Civil	Ultrasonic, MQ135, Soil Moisture, Vibration
Mechanical	Load Cell, Thermocouple, Accelerometer
Electrical	Voltage/Current Sensors, LDR, Relay
Biomedical	Pulse Sensor, MLX90614, MAX30100
Agriculture	Soil Moisture, DHT11, UV Sensor, pH Sensor
Transport	GPS, IR, Hall Sensor, Accelerometer

List of Project areas:

1. Smart Home & Building Automation.
2. Smart Agriculture.
3. Smart Healthcare & Biomedical
4. Smart Transportation & Mobility
5. Industrial IoT & Predictive Maintenance
6. Civil and Infrastructure Monitoring
7. Electrical & Energy Systems
8. Environmental Monitoring

Course Outcomes

The student will be able to –

1. CO1: Demonstrate fundamental concepts of Internet of Things (L3 – Apply)
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)

Books and E-Resources

For Reference Print Book -

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

Text Books:

1. Arsheep Bahga and Vijay Madisetti, Internet of Things: A Hands-On Approach, 1st ed., Universities Press, 2014.
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.

For MOOCs and other learning Resources

1. https://www.coursera.org/specializations/iot, **An Introduction to Programming the Internet of Things (IOT) Specialization.** Create Your Own Internet of Things (IoT) Device. Design and create a simple IoT device in just six courses. Instructor: Ian Harris
2. https://www.coursera.org/learn/raspberry-pi-interface Interfacing with the Raspberry Pi, This course is part of An Introduction to Programming the Internet of Things (IOT) Specialization. Instructor: Ian Harris

FF 654

ETM002: Microcontroller and Applications

Total Credits: 3

Teaching Scheme:

Theory: 2 Hours / Week

Tutorial: 1 Hours / Week

SECTION I:

UNIT 1: Introduction to Microcontrollers and Architecture (5)

Microprocessor & Microcontroller comparison, Harvard & Von Neumann architecture, RISC & CISC comparison, Evolution of microcontrollers, Microcontroller selection criteria for particular application, MCS-51 architecture, family devices & its derivatives. Pin configuration,

UNIT 2: Internal modules of 8051 microcontroller (4)

Internal Port architecture, memory organization, external memory interfacing. Timers and its modes. Interrupt structure, Serial communication and its modes.

UNIT 3: 8051 Instruction Set, Programming and development tools (5)

Addressing modes, 8051 Instruction set, Programming environment: Study of software development tool chain (IDE), debugging tools, Programs: Assembly language programs.

SECTION II:

UNIT 4: 8051 Microcontroller based Real World Interfacing and programming I (5)

Interfacing peripheral devices using GPIO: LEDs 7 segment LED, generating various delays using timer, counter, switches, relay, stepper motor, LCD interfacing, keyboard interfacing, (Programming in C).

UNIT 5: 8051 Microcontroller based real world interfacing and programming II (4)

Basics of serial communication protocol: Synchronous and asynchronous communication, RS232, RS485, SPI, I2C. Interfacing of devices using protocols: Interfacing of peripherals using UART, interfacing RTC DS1307 using I2C protocol, Programs in C.

UNIT 6: AVR RISC Microcontroller and programming (5)

Overview of AVR family, AVR Microcontroller architecture, ROM space and other hardware modules, **interfacing peripheral devices with AVR:** DC motor control using PWM programming, ADC and temperature sensor LM35 interfacing, **Application areas:** home automation, smart health, smart agriculture. Design of simple real-life applications using microcontroller platforms

List of Tutorials :

1. Setting up the Microcontroller Development Environment (IDE and Toolchains)
2. Simple programs to explore 8051 IDE (Addition, subtraction, multiplication etc)
3. Writing and uploading program (Blinking an LED)
4. Interfacing of LED's, switches, buzzer, relay with 8051 Microcontroller.
5. Interfacing of 16x2 LCD in 8 bit/4-bit mode with 8051 Microcontroller and display message on it.
6. Interface 4x4 matrix keyboard with 8051 Microcontroller. Display value of pressed switch on LCD.
7. Interface Computer with 8051 Microcontroller using UART communication.
8. Interface stepper Motor with 8051Microcontroller and write program to rotate it in clockwise and anticlockwise direction using different drives (Full step drive, Half step drive and wave drive).
9. Interfacing of ADC PCF8591 with 8051 Microcontroller using IIC protocol read the analog voltage from ADC and display its equivalent digital value on LCD.
10. Writing and uploading AVR Program (LED Blink)
11. AVR based Temperature indicator using sensor LM35
12. Servo Motor interfacing with AVR ATMega32 Microcontroller
13. DC Motor interfacing with AVR ATMega32 Microcontroller

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

1. *Mazidi Muhammad Ali; Mazidi Janice Gillispie; McKinlay Rolin D, "The 8051 Microcontroller and Embedded Systems Using Assembly and C", 2nd Edition, Dorling Kindersley.*
2. *The AVR Microcontroller and Embedded Systems Using Assembly and C, By Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi, Pearson Education.*
3.

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

1. *Dhananjay Gadre, Programming and Customizing the AVR Microcontroller, McGraw Hill edu.*
2. *Richard Barnett, Sarah Cox, Larry O'Cull, "Embedded C Programming and the AVR Microcontrollers", 2nd edition Thomson publication.*
3. *Ayala Kenneth J, Gadre Dhananjay V, "8051 Microcontroller and Embedded Systems", Cengage Learning.*

Datasheets (from websites):

1. ATMEL 8051/52 data sheet 2. AVR ATmega32 data sheet

Online Resources:

1. *https://archive.nptel.ac.in/courses/108/105/108105102/ (From Lecture 23 onwards)*
2. *https://nptel.ac.in/courses/117104072*
3. *https://www.coursera.org/learn/microcontroller-and-industrial-applications*

Course Outcomes:

The student will be able to –

1. Explain the architecture of 8051 CISC and RISC microcontroller. (Level 2 Understand)
2. Understand the internal peripheral modules in 8051 microcontroller. (Level 2 Understand)
3. Write and debug assembly language programs using appropriate instruction sets, addressing modes, and debugging tools. (Level 3 Apply)
4. Interface peripheral devices with the 8051 microcontroller. (Level 3 Apply)
5. Demonstrate bus standards used in industrial environment. (Level 3 Apply)
6. Develop system using different microcontroller based for embedded applications. (Level 6 Create)

FF No.: 654

MM1002: Object Oriented Programming

Teaching Scheme	Examination Scheme
Credits : 3	CP: NA
Lectures : 2 Hrs/week	CVV: 30
Practical : NA	MSE (O): 35
Tutorial : -1 Hrs/week	ESE (O): 35

Prerequisites:	Basics of computer system, data structures and any programming language.
Course Objectives:	
1.	To introduce students to the fundamental concepts, syntax, and structure of Java programming.
2.	To develop the ability to apply object-oriented principles such as encapsulation, inheritance, and polymorphism in Java applications.
3.	To enable students to organize and manage code effectively using Java packages, access modifiers, and library imports.
4.	To train students in identifying, handling, and generating exceptions to develop robust and error-free Java programs.
Course Outcomes:	
1.	Explain the basic syntax, structure, and key features of Java programming.
2.	Analyze and solve problems using Java data types, variables, control flow, and looping constructs.
3.	Apply object-oriented concepts such as classes, objects, encapsulation, inheritance, and polymorphism to program design.
4.	Organize Java programs using packages, package hierarchy, and appropriate access modifiers.
5.	Identify and handle runtime errors using Java exception-handling mechanisms, including custom exceptions.
6.	Develop logical solutions to moderate-level problems by integrating OOP concepts, packages, and exception handling through tutorials.

Section1:	Topics/Contents
Fundamental Concepts in JAVA Programming: Introduction to Java: What is Java? History and evolution of Java. Features and advantages of Java. Java Development Environment: Setting up Java Development Kit (JDK). Installing and configuring Integrated Development Environments (IDEs) like Eclipse or IntelliJ IDEA. Basic Syntax: Java program structure. Writing and running a simple Java program. Data types and variables. Comments and conventions. Control Flow: Conditional statements (if, else if, else). Switch statements. Looping constructs (for, while, do-while). Break and continue statements. **Object-Oriented Programming Fundamentals:** Functions and Methods: Defining methods. Method parameters and return values. Function overloading. Recursion. Object-Oriented Programming (OOP): Introduction to OOP. Classes and objects. Encapsulation, inheritance, and polymorphism. Constructors and destructors.	

Section2:	Topics/Contents
Packages and Libraries: Introduction to Packages: What are packages in Java? Why use packages? Benefits of organizing code into packages. Package Structure: How packages are structured in Java. The concept of a package hierarchy. Creating and Using Packages: How to create your own packages? Importing Java standard library packages. Importing user-defined packages. Package Naming Conventions: Naming conventions for packages. Choosing meaningful package names. Package Visibility: Access modifiers in Java (e.g., public, private, protected, default). Controlling visibility within and outside packages. **Exception Handling:** Introduction to Exceptions: What are exceptions? Why use exceptions? Types of exceptions (checked and unchecked). Exception Hierarchy: Understanding the Java exception class hierarchy. Throwable, Exception, and Error classes. Handling Exceptions: Using try-catch blocks. Catching specific exceptions. Multiple catch blocks. The finally block and its purpose. Throwing Exceptions: Throwing exceptions explicitly using the throw keyword. Creating custom exceptions.	
Text Books:	
1	Java: The Complete Reference" by Herbert Schildt
2	Head First Java" by Kathy Sierra and Bert Bates
3	Balagurusamy E, Object Oriented Programming Using C++ and JAVA
Reference Books:	
1	T. Budd, Understanding OOP with Java, Pearson Education.
2	E Balagurusamy, Programming with Java A Primer, Tata McGraw Hill, 3rd Edition.
3	Yashavant Kanetkar ,Object Oriented Programming with C++

List of Tutorials:

1. Introduction to Java and Java Development Environment
2. Java Program Structure, Data Types, and Variables
3. Decision Making Statements in Java
4. Looping Constructs and Control Statements

5. Methods, Parameters, and Method Overloading
6. Recursion and Problem Solving
7. Classes, Objects, and Encapsulation
8. Constructors and Inheritance
9. Polymorphism in Java
10. Packages and Access Modifiers
11. Exception Handling – Basics
12. Comprehensive Application of Object-Oriented Programming Concepts

CO-PO Mapping

CO	Program Outcomes (PO)											PSO		
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1										1		
CO2	3	3												
CO3	3	2	2										1	2
CO4	2	2			2									2
CO5	2	3			1									2
CO6	3	3	2		2				1	1		2	1	2
Average	**2.67**	**2.33**	**0.67**	**0**	**0.83**	**0**	**0**	**0**	**0.17**	**0.17**	**0**	**0.5**	**0.33**	**1.33**

ET2306: Engineering Design and Innovations-1

ET2312: Engineering Design and Innovations-2*

Course Prerequisites:

Basic Electronics, Physics, Engineering Mathematics, Statistics, Programming Languages

Course Objectives:

1. To develop critical thinking and problem-solving ability by exploring and proposing solutions to realistic/social problems.
2. To Evaluate alternative approaches, and justify the use of selected tools and methods,
3. To emphasize learning activities those are long-term, inter-disciplinary and student centric.
4. To engage students in rich and authentic learning experiences.
5. To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.

Credits: 6 **Teaching Scheme:** Lab 2 Hours/Week

Course Relevance:

Project Centric Learning (PCL) is a powerful tool for students to work in areas of their choice and strengths. 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. Students can be evaluated for higher order skills of Blooms taxonomy like 'analyze, design and apply'. This course is capable of imparting hands on experience and self-learning to the students which will help them throughout their career. This is a step ahead in line with national policy of Atmanirbhar Bharat.

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. This course is designed to encourage and ensure application of technology for solving real world problems using an interdisciplinary approach.

Students need to plan their work in following steps:

1. Formation of project group comprising of 4-5 students. Multidisciplinary groups are allowed
2. A supervisor/mentor teacher assigned to individual groups.
3. Carrying out literature survey
4. Finalization of problem statement
5. Planning the project execution
6. Execution of project and testing
7. Writing a report
8. Publication in the form of research paper/patent/copyright as found suitable by supervisor/mentor

Teacher's Role in PCL:

1. Teacher is not the source of solutions rather he will they act as the facilitator and mentor.
2. To utilize the principles of problems solving, critical thinking and metacognitive skills of the students.
3. To aware the group about time management.
4. Commitment to devote the time to solve student's technical problems and interested in helping students to empower them better.

Student's Role in PCL:

1. Students must have ability to initiate the task/idea they should not be mere imitators.
2. They must learn to think.
3. Students working in PCL must be responsible for their own learning.
4. Students must quickly learn how to manage their own learning, Instead of passively receiving instruction.
5. Students in PCL are actively constructing their knowledge and understanding of the situation in groups.
6. Students in PCL are expected to work in groups.
7. They must develop interpersonal and group process skills, such as effective listening or coping creatively with conflicts.

Core Technology domains identified for E&TC Engg are as below. However, this list can be extended as per the need of project and multidisciplinary approach

1. VLSI Design
2. Embedded Systems
3. Signal Processing
4. Communication
5. Machine learning

Assessment Scheme:

Mid Semester Examination - 30
Marks End Semester Examination -
70 Marks

MOOCs Links and additional reading material:

www.nptelvideos.in
https://worldwide.espacenet.com/

Course Outcomes:

1. Review the literature to formulate problem statement to solve real world problems.
2. Apply knowledge of technology and modern tools to design solution considering sustainability and environmental issues.
3. Manage project ethically as team member/ lead.
4. Demonstrate effectively technical report/ research paper/ prototype/patent.

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	3	1	0	0	3	3	3	1	2	2	2
2	3	3	3	3	3	3	3	3	3	2	1	2	3	3
3	1	1	1	1	1	2	0	3	3	3	3	2	1	1
4	3	1	1	1	0	0	0	3	1	3	3	2	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels:

CO1: - Level 3

CO2: - Level 4

CO3: - Level 3

CO4: - Level 4

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ET2305: Design Thinking-1

ET2311: Design Thinking-2*

Credits: 1 Teaching Scheme Tut: 1 Hour/Week

Course Objectives:

To provide ecosystem for students and faculty for paper publication and patent filing

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

Suggest an assessment Scheme:

Publication of paper or patent

Course Outcomes:

On completion of the course, learner will be able to–

CO1: Understand the importance of doing Research
CO2: Interpret and distinguish different fundamental terms related to Research
CO3: Apply the methodology of doing research and mode of its publication
CO4: Write a Research Paper based on project work
CO5: Understand Intellectual property rights
CO6: Use the concepts of Ethics in Research
CO7: Understand the Entrepreneurship and Business Planning

CO- PO Mapping

	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	1	1	1	1	1	0	0	0	0	0	0	1	2	2
CO2	1	1	1	1	1	0	0	0	0	0	0	1	0	1
CO3	2	2	3	3	2	2	1	2	2	3	0	1	2	1
CO4	3	3	3	3	3	2	1	2	2	3	1	1	0	0
CO5	1	1	1	1	1	0	0	0	0	0	0	1	0	1
CO6	2	2	2	2	2	2	1	3	2	3	3	1	0	1
CO 7	1	1	1	1	1	0	0	0	0	0	0	1	0	2

CO Attainment levels

CO1	CO2	CO3	CO4	CO5	CO6	CO7
2	2	3	5	2	3	2

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SH2001: Reasoning And Aptitude Development

HS2004: Reasoning And Aptitude Development*

Unit 1: English Language

Familiarity with English Language, Ability to understand written text, spoken word and effective communication through written documents; Coverage of vocabulary to cope up with general and specific terminology, syntax and sentence structure, prevention of incorrect use leading to distortion in communication; synonyms, antonyms and contextual vocabulary, Grammar – Error identification, sentence improvement and construction, Reading Comprehension

Unit 2: Logical Ability

Objective interpretation of things, ability to perceive and interpret trends to make generalizations; ability to analyze assumptions behind an argument or statement; Deductive reasoning: Assessment of ability to synthesize information and derive conclusions - Coding deduction logic, Data Sufficiency, Directional Sense, Logical word sequence, Objective reasoning, Selection and decision tables, puzzles; Inductive reasoning: Assessment of ability to learn by example, imitation or by trial – Analogy pattern recognition, Classification pattern recognition, Coding pattern recognition, Number series pattern recognition; Abductive reasoning: Critical thinking ability of seeing through logical weak links or loopholes in an argument or a group of statements; Critical reasoning: assessment of ability to think through and analyze logical arguments, assessment of ability to use logical constructs to offer reasoning in unfamiliar situations; Information Gathering and synthesis: Ability of locating information, information ordering, rule based selection and data interpretation, order and classify data, interpret graphs, charts, tables and make rule based deductions. Application of these approaches for using visual, numerical and textual data from single or multiple sources

Unit 3: Quantitative Ability

Basic numbers – decimals and fractions, factorization, divisibility: HCF, LCM, Odd, even, prime and rational numbers. Application of algebra to real world, direct and inverse proportion, common applications – Speed-time -distance, Profit-loss, percentage, age relations, mixtures, other miscellaneous quantitative combination, exponentials and logarithms, permutations and combinations, probability. Spatial reasoning: Inductive – Missing portions, Sequence and series; Deductive analysis.

Reference Books –

1: "English Grammar in Use" by Raymond Murphy, Cambridge University Press. 2: "Word Power Made Easy" by Norman Lewis, Goyal Publishers & Distributors. 3: "Objective General English" by S.P. Bakshi, Arihant Publications.

4: "English for Competitive Examinations" by K. Sinha, S. Chand Publishing. 5: "Essential English Grammar" by Philip Gucker, Wiley.
6: "English Idioms and Phrasal Verbs" by M.A. Yadav, Vikas Publishing House.
7: "The Oxford English Grammar" by Sidney Greenbaum, Oxford University Press.
8: "A Modern Approach to Verbal & Non-Verbal Reasoning" by R.S. Aggarwal, S. Chand Publishing, ISBN: 978-8121903409.
9: "Logical Reasoning and Data Interpretation for the CAT" by Nishit K. Sinha, Pearson India, ISBN: 978-8131709117.
10: "Logical Reasoning and Data Interpretation for the CAT" by Arun Sharma, McGraw Hill Education, ISBN: 978-0070709642.
11: "A New Approach to Reasoning Verbal and Non-Verbal" by B.S. Sijwali & Indu Sijwali, Arihant Publications, ISBN: 978-9311124692.
12: "Quantitative Aptitude for Competitive Examinations" by R.S. Aggarwal, S. Chand Publishing, ISBN: 978-8121900637.
13: "How to Prepare for Quantitative Aptitude for the CAT" by Arun Sharma, McGraw Hill Education, ISBN: 978-0070709642.
14: "The Pearson Guide to Quantitative Aptitude for Competitive Examination" by Pearson, Pearson India, ISBN: 978-8131709117.
15: "Quantitative Aptitude for Competitive Examinations" by Abhijit Guha, Tata McGraw Hill Education, ISBN: 978-0070666653.
16: "Data Interpretation & Data Sufficiency" by R.S. Aggarwal, S. Chand Publishing ISBN: 978- 8121903515.
17: "Quantitative Aptitude for Competitive Examinations" by S. Chand, S. Chand Publishing, ISBN: 978-8121903423.

Course Outcomes –

Upon completion of the course, the student will be able to –

1. Improve the reading, writing and verbal skills, and enhance comprehension and articulation abilities
2. Develop logical reasoning abilities, enabling them to make sound decisions in problem-solving scenarios
3. Develop mathematical aptitude as well as data interpretation abilities and use them in test cases and real world problems
4. Learn to apply approaches for optimum time-management, prioritization maximizing the accuracy
5. Learn data interpretation, apply mathematical skills to draw accurate conclusions
6. Apply their knowledge of English, reasoning and quantitative skills for planning, critical thinking and real world problems