Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot		Total Marks	Contact Hr./week			Total Credits
			Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment Marks	Major Evaluation	Continuous Evaluation/Lab work & Sessional	Major Evaluation		L	T	P	
14242201	DC	Digital Signal Processing	25	25	20	30	-	-	100	2	1	-	3

Digital Signal Processing (14242201)

Course Objectives: Understanding of the fundamental concepts of digital signal processing, designing of digital filters, and brief knowledge about the DSP for next generation communication.

Unit I: Review of Transform Domain Techniques: Review of discrete time signals and systems, Properties and applications of discrete time Fourier transform, Review of Z transform, Analysis of minimum phase, maximum phase and inverse system.

Unit II: Discrete Fourier Transform (DFT): Introduction and properties of DFT, Computation of circular convolution using DFT, Decimation in time FFT algorithm, Decimation of frequency FFT algorithm with radix-2, and radix-4.

Unit III: Digital Filters (Part-I): Characteristics of practical frequency selective filters, Various signal flow graph structure of IIR filters. IIR Filter design: Overview of Butterworth, Chebyshev and Elliptic approximations, Design of discrete time IIR filters using Impulse invariant, and bilinear transformation methods, Spectral transformation of IIR filters.

Unit IV: Digital Filters Part-II: Introduction and Signal flow graph structure of FIR Filter. FIR Filter design: Symmetric, and Asymmetric FIR filters, Design of linear phase FIR filters using windows, and Frequency sampling method, Design of Optimum Equiripple linear phase FIR filters, Design of FIR differentiators.

Unit V: DSP for Next Generation Communication(Dynamic-Jan-June 2026): Qualcomm Hexagon DSP for 5G smart phones and modems, beamforming, channel estimation.

Text Books:

1. John. G. Proakis, “Digital Signal Processing”, 4th Edition, Pearson Education.
2. Oppenheim and Schafer, “Digital Signal Processing”, 2nd Edition, PHI Learning.

Reference Books:

1. Johnny R. Johnson, “Introduction to Digital Signal Processing”, 1st Edition, PHI Learning.
2. Rabiner and Gold, “Theory and Application of Digital Signal Processing”,3rd Edition, PHI Learning.
3. Ingle and Proakis, ”Digital Signal Processing- A MATLAB based Approach”, 3rd Edition, Thompson, Cengage Learning.

COURSE OUTCOME:-

Students will be able to:

CO1: Analyze the discrete-time signals, systems, DTFT and Z-transform concepts.
CO2: Apply DFT/FFT algorithms for efficient spectral analysis and convolution.
CO3: Design IIR filters using classical approximations and transformation methods.
CO4: Design FIR filters using window, frequency sampling, and equiripple techniques.
CO5: Apply DSP in beam forming and 5G communications.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	1	1	1	-	1	1	1	3	2	1
CO2	2	3	3	2	1	1	1	-	2	1	1	3	2	2
CO3	3	2	3	2	2	1	-	-	2	1	1	3	2	2
CO4	3	3	2	1	2	1	1	-	2	1	1	3	2	2
CO5	3	3	2	1	1	1	1	-	1	1	1	3	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot		Total Marks	Contact Hr./week			Total Credits
			Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment Marks	Major Evaluation	Continuous Evaluation/Lab work & Sessional	Major Evaluation		L	T	P	
14242202	DC	Microprocessor and Interfacing	25	25	20	30	-	-	100	2	1	-	3

Microprocessor and Interfacing (14242202)

Course objectives: To introduce the basic concepts of microprocessor and microcontroller and to develop assembly language programming skills along with their use in various applications.

Course Contents:

Unit I: Introduction to Microprocessor

Introduction to microprocessors and microcomputers, 8-bit/16-bit Microprocessor, Overview of Intel Pentium-I, Pentium i3, i5 and i7 Series Processor. Study of 8 bit Microprocessor, 8085 pin configuration, Internal Architecture and operations, Interrupts, Interrupts and interrupt service routine.

Unit II: 8085 Assembly language Programming and Timing diagram

8085 instruction set, Data transfer operations, Arithmetic operations, logic operations, Branch operations, 8085 assembly language programming, Debugging the program, Addressing modes of 8085. Counters and Time delays, Instruction cycle, Machine cycle, T-states, timing diagram for different 8085 arithmetic, logical and branch instructions.

Unit III: Peripheral ICs

Memory interfacing and various interfacings chips like: Programmable input/output ports 8155/8255(PPI), Programmable interval timer 8253/8254 (PIT), Programmable interrupt controller 8259 (PIC) and DMA controller 8257.

Unit IV: Architecture and Programming of 16-Bit Microprocessor

8086 Block diagram and Architecture, Pin configuration of 8086, Execution Unit (EU) and Bus Interface Unit(BIU), Minimum mode & Maximum mode operation, Memory segmentation, Instruction set and addressing modes of 8086, Introduction to 8086 assembly language programming.

Unit V: Advanced Microprocessor Architectures(Dynamic-Jan-June 2026):

Overview of ARM Architecture, ARM Processor Architecture, ARM Design, States, Registers, Modes, Conditional Execution, Pipelining, Vector Tables, Exception handling.

Text Books:

1. Ramesh. S. Gaonkar, "Microprocessor architecture Programming and Application with 8085" Penram International Publishing, 4th Edition.
2. B.Ram, "Fundamentals of microprocessors and microcomputer" Dhanpat Rai, 5th Edition.

Reference Books:

1. Douglas V Hall., "Microprocessor and Interfaing" Tata Mcgraw Hill
2. A.K. Ray and K. M. Bhurchandi , "Advance microprocessor and peripheral", Tata Mcgraw Hill

<u>Course Outcomes</u>

At the end of this course, students will be able to:

CO1: Analyze 8085 microprocessor architecture and operational principles.
CO2: Develop assembly language programs for problem-solving.
CO3: Integrate peripheral ICs into microprocessor-based systems.
CO4: Analyze x86 microprocessor architecture and operational principles.
CO5: Analyze the architecture and programming of advanced microprocessors.

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Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	1	1	-	1	1	1	3	2	1
CO2	3	3	3	2	1	1	-	-	2	1	1	3	2	2
CO3	3	3	3	2	2	1	-	-	2	1	1	3	2	2
CO4	3	3	2	1	2	1	1	-	2	1	1	3	2	2
CO5	3	3	2	1	1	1	1	-	1	1	1	3	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot		Total Marks	Contact Hr./week			Total Credits
			Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment Marks	Major Evaluation	Continuous Evaluation/Lab work & Sessional	Major Evaluation		L	T	P	
14242203	DC	Wireless Communication	25	25	20	30	-	-	100	2	1	-	3

Wireless Communication (14242203)

Course Objective:

This course aims to build a strong foundation in random processes, noise modeling, and digital modulation techniques essential for wireless communication. It equips learners with the skills to analyze,and evaluate baseband and band-pass transmission schemes, assess system performance under noise, and fading channels.

Unit 1: Random Process and Spectral Density Functions: Probability and Random Variables, Gaussian Random Variables, Central Limit Theorem, Rayleigh distribution, Random Process: mean, correlation and covariance; non stationary, stationary, and ergodic processes; power spectral density; Gaussian Process, White Noise.

Unit 2: Digital Baseband Data Transmission for Wireless Communication: Baseband Transmission of Digital Data, Line Coding, Inter-symbol Interference Problem, Pulse Shaping: Nyquist Channel, Raised-Cosine Pulse Spectrum, Gaussian Pulse Shaping Filter, Baseband Transmission of M-Ary Data.

Unit 3: Digital Band-Pass Modulation Techniques for Wireless Communication: Basic digital modulations schemes, MSK, GMSK, and Digital QAM; coherent demodulation and detection; ***M***-ary Digital Modulation Schemes, PSD of Digital Carrier Modulation.

Unit 4: Performance Analysis of Digital Modulation : Bit Error Rate, Detection of a Single Pulse in Noise, Optimum Detection of Binary PAM, BPSK, BFSK, QPSK and QAM in Noise, Summary of Digital Performance.

Unit 5: Emerging Wireless Technologies (Dynamic-Jan-June 2026): 6G visions and System Design Considerations and Implications, orthogonal and non-orthogonal multiple access and massive MIMO.

Text Books:

1. A. Papoulis, and Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes", Fourth Edition, McGraw Hill, 2002.
2. Rappaport T.S., Wireless communications", Second Edition, Pearson Education, 2010.
3. B. P. Lathi&Zhi Ding: Modern Digital & Analog Communication Systems, 4^{th} Edition, Oxford University Press
4. S. Haykin and Michael Moher: An Introduction to Analog & Digital Communications, 2^{nd} Edition, Wiley India.

Reference Books:
1. Andreas. F. Molisch, Wireless Communications, John Wiley – India, 2006.
2. David Tse and PramodViswanath, Fundamentals of Wireless Communication, Cambridge University Press, 2005.
3. B. Sklar, "Digital Communication Fundamentals and Applications", 2^{nd} Edition, Pearson Education, 2009.
4. Leon W. Couch, Digital and Analog Communication Systems, 6^{th} Edition, Pearson Education, 2001

After completion of this course students will be able to:

CO1: Analyze random processes, noise models, and spectral density functions used in wireless communication.

CO2: Apply appropriate line coding, pulse-shaping, and ISI-mitigation methods to achieve efficient baseband transmission.

CO3: Apply digital band-pass modulation techniques and constellation mapping for wireless signal transmission.

CO4: Evaluate digital modulation performance through BER analysis and optimal detection methods in noisy environments.

CO5: Explore advanced wireless technologies including 6G, orthogonal and non orthogonal multiple access, MIMO, and cognitive radio.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	1	1	1	1	1	2	2	3	2
CO2	3	3	3	3	3	1	1	1	1	1	2	2	3	3
CO3	3	2	3	3	3	1	1	1	1	1	2	2	3	3
CO4	3	3	2	3	3	1	1	1	1	1	2	2	3	3
CO5	3	2	2	3	3	1	1	1	1	1	2	3	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot		Total Marks	Contact Hr./week			Total Credits
			Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment Marks	Major Evaluation	Continuous Evaluation/Lab work & Sessional	Major Evaluation		L	T	P	
14242204	DC	Electromagnetic Theory	25	25	20	30	-	-	100	2	1	-	3

Electromagnetic Theory (14242204)

Course objectives: To develop an understanding of fundamental concepts of electromagnetic fields with an emphasis on wave propagation and to create ability to relate basic electromagnetic concepts to the performance of devices, circuits, and systems.

Unit I: Electrostatics: Coulomb's Law, Electric field intensity, Electric flux and flux density, Gauss law, Boundary relations, Electric potential, Divergence, Curl, Divergence and Stokes theorem, Electric field in dielectric and conductor, Continuity equation, Poisson's and Laplace's equations.

Unit II: Magnetostatics and Electrodynamics: Biot-Savart's Law, Magnetic Field intensity due to a finite and infinite wire carrying current; Magnetic field intensity on the axis of a circular loop carrying current; Magnetic flux Density; Magnetic Vector Potential; Magnetic force, force between current carrying wires, Ampere's circuital law; Boundary conditions for magnetic fields; Conduction current and displacement current densities; Faraday's Law, Maxwell's equations (differential and integral form) –for steady, time varying and time harmonic fields.

Unit III : Electromagnetic Wave Equation: General wave equation, Uniform plane wave in free space, Perfect dielectric, Lossy dielectric and conducting medium, Skin depth, Poynting vector and Poynting theorem. Wave Polarization- linear-elliptic-circular, Reflection of uniform plane waves, Normal incidence and Oblique incidence, Brewster angle, Total internal reflection.

Unit IV: **Transmission Line**: Transmission lines parameters, Equations of Voltage and Current on TX line, Propagation Constant and Characteristic Impedance, Input Impedance, and Reflection Coefficient and VSWR, Power Transfer, Lossless and Distortion less Transmission Lines, Smith Chart, Applications of Transmission Lines, Impedance Matching: Single and Double Stub Lines.

Unit V: Antenna for Next-Generation Systems (Dynamic, Jan-June 2026): Basics of Antenna, Microstrip Patch Antenna, Design of Embedded Chip Antennas.

Text Books:

1. Elements of Engineering Electromagnetic Third Edition- N.N. Rao- Prentice Hall, India.
2. Elements of Electromagnetics: Mathew N. O.Sadiku, 3rd Edition, Oxford Publication Press.
3. Electromagnetic - J.D. Kraus-McGraw Hill.

Reference Books:

1. Fields & Waves in Communication Electronics - S.Ramo, J.R. Whinnery& T. Van Duzer- John Wiley & Sons.
2. Electromagnetic Waves & Radiating Systems - E.C. Jordan & K.G. Balmain- Prentice
3. Networks, Lines, &Fields: J.D. Ryder, 2nd Edition, Prentice Hall of India.

Course Outcomes

After successful completion of the course, students will be able to:

CO1. Analyze the concepts of electrostatic fields in practical applications.
CO2. Apply Magnetic Field concepts and the maxwell equations to solve problems of time varying fields.
CO3. Analyze propagation, polarization and reflection of electromagnetic waves in a practical field. in different media.
CO4. Analyze the characteristics of transmission lines.

CO5. Design suitable antennas for next-generation systems such as IoT, 5G/6G, and smart devices.
CO6. Apply the concepts of Advanced Electromagnetics in various practical applications.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1	-	2	1	-	1	-	3	3	1
CO2	3	3	3	3	2	-	2	1	-	1	-	1	3	1
CO3	3	3	3	3	3	-	1	-	-	1	-	2	3	1
CO4	3	3	3	2	3	-	1	-	-	1	-	1	3	1
CO5	3	3	3	3	3	-	1	-	-	1	2	3	3	

1 - Slightly; 2 - Moderately; 3 Substantially

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot		Total Marks	Contact Hr./week			Total Credits
			Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment Marks	Major Evaluation	Continuous Evaluation/Lab work & Sessional	Major Evaluation		L	T	P	
14242205	DC	System Design using Verilog	25	25	20	30	-	-	100	2	1	-	3

System Design using Verilog (14242205)

Course Objective: To develop students' ability to model, design, simulate, and verify digital systems using Verilog enabling them to apply modern HDL-based design and verification methodologies for efficient and reliable electronic system development.

Unit 1:Introduction to Verilog HDL: Verilog as HDL, Levels of Design Description, Concurrency, Program structure, Top-down and Bottom up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block, Verilog Data types and Operators, system tasks, compiler directives. Modules and Ports: Modules, Ports, Hierarchical names. Gate-Level Modeling: Gate types, Gate delays.

Unit 2: Data flow Modelling: Continuous assignments, Delays, Expressions, Operators and Operands. Operator types, Examples. Behavioural Modelling: Structured procedures, Procedural assignments, Timing controls, Conditional statements, Multiway branching, Loops, Sequential and parallel Blocks, Generate blocks, Examples.

Unit 3: Task and Functions: Differences between tasks and functions, Tasks, Functions. Useful Modelling Techniques: Procedural continuous assignments, Overriding parameters, Conditional compilation and execution, Time scales, Useful system tasks. Timing and Delays: Types of delay models, Path delay modelling, Timing checks, Delay back annotation.

Unit 4: Test Benches: Basic test benches, Test bench structure, Constrained random stimulus generation, Object-oriented programming and Assertion-based verification.

Unit 5: System Verilog (Dynamic-Jan-June 2026): Adoption for Advanced Verification, UVM (Universal Verification Methodology), Verilog designs integrated with C/C++/System C-based HLS tools.

Text Books:

1. Verilog HDL: Samir Palnitkar, 2nd Edition, Pearson Education.
2. Digital System Design with System Verilog: Mark Zwolinski, 1st Edition, Pearson Education.

Reference Books,

1. Fundamentals of Digital Logic with Verilog Design: Stephen Brown and ZvonkoVranesic, 3rd Edition, McGraw-Hill.
2. Verilog HDL Synthesis-A practical Prime: J. Bhasker, 1st Edition, Star galaxy Press.

Course Outcomes
After the completion of this course students will be able to:

CO1: Explain the structure, syntax, and design methodologies of Verilog HDL along with gate-level and module-level modeling techniques.
CO2: Develop digital circuits using dataflow and behavioural modeling constructs including timing controls, conditional statements, loops, and generate blocks.
CO3: **Evaluate** digital system designs using tasks, functions, advanced modeling techniques, path delay modeling, timing checks, and delay back-annotation.
CO4: **Design** verification environments using structured test benches, and constrained-random stimulus.
CO5: **Construct** advanced verification frameworks using System Verilog features.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	2	2	1	2	3	1	_	1	2	2
CO2	3	3	2	2	2	2	1	2	3	2	_	2	3	3
CO3	3	3	2	3	2	2	1	2	3	1	1	2	3	2
CO4	3	2	3	3	2	2	1	1	3	2	1	2	3	3
CO5	3	2	3	3	2	2	1	2	3	2	1	3	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot		Total Marks	Contact Hr./week			Total Credits
			Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment Marks	Major Evaluation	Continuous Evaluation/Lab work & Sessional	Major Evaluation		L	T	P	
14242206	DLC	Microprocessor and Interfacing Lab					70	30	100	-	-	2	1

Microprocessor and Interfacing Lab (14242206)

Course Objectives

This course gives the ability to the students to learn the assembly language programming of 8085 and 8086 microprocessor and their interfacing with different peripherals.

List of Experiments

1. Write an assembly language program to perform addition operation on two immediately given 8 bit numbers using 8085 microprocessor.
2. Write an assembly language program to perform addition operation on two numbers 8 bit numbers stored in memory using 8085 microprocessor.
3. Write an assembly language program to find whether the number is even or odd using 8085 microprocessor.
4. Write an assembly language program to obtain 2’s complement of a given number using 8085 microprocessor.
5. Write an assembly language program to perform arithmetic operations of two BCD numbers using 8085 microprocessor.
6. Interface a Stepper Motor to the 8085 microprocessor system and write an 8085 assembly language program to control the Stepper Motor.
7. Write an assembly language program to generate standard waveforms using DAC and display waveforms on CRO with 8085 microprocessor.
8. Write an assembly language program to Multiply Two 16-Bit Numbers with 8086 microprocessor.
9. Write an assembly language program to find the square of a given number with 8086 microprocessor.
10. Write an assembly language program to Move a Block of Data from one memory location to another with 8086 microprocessor.

Course Outcomes:

After successful completion of the course, students will be able to:

1. **Execute** the assembly language programs for arithmetic and logical operations with 8085 and 8086 microprocessor.
2. **Design** an interfacing circuits using peripheral ICs with 8085 microprocessors.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	1	1	-	1	1	1	3	2	1
CO2	3	3	3	2	1	1	-	-	2	1	1	3	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot		Total Marks	Contact Hr./week			Total Credits
			Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment Marks	Major Evaluation	Continuous Evaluation/Lab work & Sessional	Major Evaluation		L	T	P	
14242207	DLC	Wireless Communication Lab					70	30	100	-	-	2	1

Wireless Communication Lab (14242207)

Course Objective: This lab aims to develop hands-on skills in analyzing the error performance of digital modulation schemes and wireless communication systems. Students will simulate BER and SER characteristics for various modulation formats under AWGN, Rayleigh fading, ISI, OFDM, and MIMO channels, and gain practical experience in configuring 5G systems

List of Experiments

1. Determine the BER performance of BPSK in an AWGN channel.
2. Calculate the Symbol Error Rate (SER) for QPSK modulation.
3. Compute the Bit Error Rate (BER) for DPSK modulation.
4. Compute the Bit Error Rate for FSK modulation.
5. Evaluate the error rate for 16-QAM modulation with Gray mapping.
6. Calculate the Symbol Error Rate (SER) analysis for 16-QAM, 64-QAM, and 256-QAM modulation schemes in an OFDM system over an AWGN channel.
7. Configure and bring up the 5G Core, IMS, and gNodeB.
8. Compute the BER performance of BPSK using OFDM transmission.
9. Calculate the Bit Error Rate (BER) for BPSK modulation in a flat Rayleigh fading channel, both with and without beam forming.
10. Compute the BER for BPSK in a 2×2 MIMO Rayleigh fading channel.

Course Outcome:

CO1: Compute error rate for various modulation techniques across different channel models.

CO2: Demonstrate the setup of 5G Core and gNodeB.

CO3: Implement OFDM, MIMO, and beamforming for performance optimization.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	2	1	1	1	1	2	1	2	3	2
CO2	2	2	3	2	3	1	1	1	2	2	2	2	3	3
CO3	3	3	3	3	3	1	1	1	2	2	2	3	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot		Total Marks	Contact Hr./week			Total Credits
			Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment Marks	Major Evaluation	Continuous Evaluation/Lab work & Sessional	Major Evaluation		L	T	P	
14242208	DLC	System Design Lab using Verilog					70	30	100	-	-	2	1

System Design Lab using Verilog (14242208)

Course Objectives: To enhance practical skills in hierarchical design, modular coding, and reusable hardware components using Verilog constructs

List of Experiments

1. Design and simulation of half adder, and full adder circuit using gate and data level modelling.
2. Design and simulation of half adder, and full adder circuit using behavioural level modelling.
3. Design and simulation of Flip-flops and Latches (JK, D, T, SR) using behavioural level modelling.
4. Design and simulation of 4-bit comparator using behavioural modelling and parameter statement.
5. Design and simulation of 8-bit adder circuit using structural modelling and generic statement.
6. Design and simulation of 4-bit Carry-Look ahead Adder.
7. Design and simulation of 4-bit Universal Shift Register.
8. Design and simulation of MOD-n UP/DOWN Counter.
9. FPGA Implementation of full adder circuit.
10. FPGA Implementation of Ring and Johnson Counter.

Course Outcomes:

After successful completion of the course, students will be able to:
CO1: **Design** combinational and sequential digital circuits using gate-level, dataflow, behavioral, and structural modeling in Verilog HDL.
CO2: **Implement** arithmetic and sequential circuits such as adders, comparators, shift registers, and counters using parameterized and modular Verilog constructs.
CO3: **Demonstrate** FPGA-based realization of digital circuits including adders and counters using industry-relevant hardware tools.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	2	1	1	1	1	2	1	2	3	2
CO2	2	2	3	2	3	1	1	1	2	2	2	2	3	3
CO3	3	3	3	3	3	1	1	1	2	2	2	3	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot		Total Marks	Contact Hr./week			Total Credits
			Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment Marks	Major Evaluation	Continuous Evaluation/Lab work & Sessional	Major Evaluation		L	T	P	
14242210	PBL	Macro Project-II					70	30	100	-	-	2	1

Macro Project-II (14242210)

Course Objective: To design and develop an application-oriented mini project demonstrating practical implementation of core concepts.

1. Smart Waste Segregation System.
2. Smart Drone Landing System Using Ultrasonic.
3. Indoor Localization Using Bluetooth Low Energy.
4. FSM-Based Digital Stopwatch with Start–Stop–Reset Functionality.
5. Design and Simulation of a 4-Stage Pipelined ALU.
6. Design and Verification of Dual-Port RAM (32×8) with Independent Access Ports.
7. Development of a Minimal RISC-Lite CPU Supporting Eight Instructions.
8. Vehicle Accident Detection Using Accelerometer and GSM Alerts.
9. Smart Trolley with Automatic Billing Using RFID.
10. Smart Street Garbage Bin Level Indicator.
11. Design of a 32-Bit Priority Encoder with Timing Optimization.
12. Smart Inventory Shelf Using Weight Sensors.
13. Smart Gas Leakage Detector with Automatic Valve Control.
14. Smart Dustbin with Auto-Lid and Fill-Level Alert.
15. IoT-Based Smart Street Lighting with Motion Sensing.
16. Intelligent Weather Station with Simple Prediction .
17. Real-Time Traffic Sign Detection on Raspberry Pi.
18. Traffic Signal Controller Using Moore FSM with Pedestrian Mode
19. Fall Detection Using IMU.
20. Smart Agriculture Node.
21. Design of a 32-Bit ALU with Status Flags.
22. Development of a Full-Duplex UART Transmitter–Receiver Module
23. Smart Attendance System With Face Recognition using ESP32-CAM and small dataset.
24. IoT Smart Wheelchair with Gesture Control .
25. Smart Door Lock with Multi-Security using RFID and OTP.
26. Implementation of a Configurable PWM Generator Using Verilog HDL.
27. Intelligent Traffic Light System using basic camera and simple vehicle count.
28. Smart Inventory Management with RFID and Cloud.
29. IoT Air Pollution Monitoring with Basic AQI Prediction .
30. Smart Water Distribution Automation with Flow Sensors.
31. Gesture Controlled Robot.
32. Real-Time Drowsiness Alert System using IR Eye Blink Detector.
33. IoT-Based Cold Chain Monitoring with Graph Analytics.
34. Home Energy Usage Analyzer with Simple Load Forecast using Small Dataset.
35. Solar Panel Monitoring Using ESP32 and Cloud Dashboard.
36. Smart Parking System using Ultrasonic Sensors.
37. IoT-Based Water Leakage Detection in Buildings.
38. IoT-Enabled Cold Storage Temperature Monitoring.
39. IoT-Based Smoke Detection System.
40. Intelligent Mini Weather Station using Temp/Humidity/Pressure.
41. Smart Water Meter with Real-Time Billing.
42. IoT-Based Aquaponics Monitoring & Auto-Control.
43. Smart Helmet with Accident Detection & Alerts.

44. IoT-Based Water Quality Monitor.
45. Smart Mini Energy Meter using basic consumption logging.
46. IoT-Based Air Pollution Monitor.
47. Wireless Door Lock with RFID Authentication.
48. Traffic Light System with Vehicle Counting using IR Sensors.
49. Smart Garden Irrigation System.
50. IoT Weather Logging System with Cloud Storage.
51. Low cost Smart Doorbell with ESP32 Camera .
52. LPG/Smoke Alarm System with Mobile Notification.
53. IoT-Based Room Occupancy Detection.
54. Smart Fan Speed Controller (Temp based).
55. ESP32-Based Clock with Internet Time Sync.
56. Smart Bicycle Anti-Theft Alarm.
57. Attendance System using RFID/NFC.
58. Smart Dustbin with Auto-Lid and Fill-Level Alert.
59. IoT Water Tank Level Controller using Ultrasonic.
60. RFID-Based Library Book Tracking.
61. Smart Panic Button for Elderly Safety.
62. Portable ECG Display System .
63. IoT Fire Alert System for Home Safety.
64. Contactless Digital Thermometer Using IR Sensor.
65. Simple Home Security System with Motion Alerts.

Course Outcomes:

Students will be able to:

CO1: **Analyze** the electronic components, measuring instruments, and tools.
CO2: **Design** and simulate the schematic, layout using CAD software.
CO3: **Design** and fabricate PCBs for various electronic circuits individually and in a team.
CO4: **Troubleshoot** the program or circuit individually and in a team.
CO5: **Implement** mini project that benefits society.