

Course Name: Digital Signal Processing

Course Code: EC-501

Course Type: PC

(Semester – V)

Course Broad Category: Major

1. Course Prerequisite:

Class-XII level knowledge of Physics
Mathematics
Signals and Systems

2. Course Learning Objectives:

- i. To understand the fundamentals for the analysis and processing of digital signals.
- ii. To understand the fast computation of DFT and appreciate the FFT processing.
- iii. To study the designs and structures of digital (IIR and FIR) filters and analyze and synthesize for a given specifications
- iv. To acquaint in Multi-rate signal processing techniques and finite word length effects.

3. Teaching methodology and evaluation system for the course:

Teaching methodology– Lectures and Presentations, Interactive Discussions and Case Studies.

Evaluation System –

- A. Continuous Internal Assessment I (40 Marks)
- B. Continuous Internal Assessment II (40 Marks)
- C. End-Semester Exam (60 Marks)

4. Course Content:

Course Name: DIGITAL SIGNAL PROCESSING

Course Code: EC-501

Hours per Week: 3L: 0T: 0P

Credits: 3

Module	Topics	36L
1.	Discrete time signals: Sequences; representation of signals on orthogonal basis; Sampling and reconstruction of signals; Discrete systems attributes, Z-Transform and ROC, Analysis of LSI systems, frequency Analysis, Inverse Systems, Discrete Fourier Transform(DFT),Fast Fourier Transform Algorithm, Implementation of Discrete Time System.	12L
2.	Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low pass, Band pass, Band stop and high pass filters.	10L
3.	Effect of finite register length in FIR filter design, Parametric and non-parametric spectral estimation, Introduction to multirate signal processing. Application of DSP.	8L

Module	Topics	36L
4.	Origin of Wavelets, Classification(CWT & DWT), Filter Bank	6L

5. References:

Text Books:

- S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
- A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
- John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, Prentice Hall, 1997.

Reference Books:

- L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.
- J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
- D.J. De Fatta, J. G. Lucas and W. S. Hodgkiss, Digital Signal Processing, John Wiley & Sons,1988

6. Course Outcomes (CO):

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
EC-501.1	Illustrate digital Signals and Systems mathematically in time domain.	Illustrate	Level 2 Understanding
EC-501.2	Explain digital signals, systems and After going through this course the Students will be able to the significance.	Explain	Level 2 Understanding
EC-501.3	Estimate the response of an LTI system to different signals.	Estimate	Level 5 Evaluating
EC-501.4	Analyze the digital signals using various digital transforms DFT, FFT etc.	Analyze	Level 4 Analyzing
EC-501.5	Design of different types of digital filters for various applications.	Design	Level 4 Create
EC-501.6	Interpret the finite word length effects on functioning of digital filters.	Interpret	Level 2 Understanding

7. Mapping of Course Outcomes (CO) to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	-	-	2	-	-
2	-	3	-	2	-	-
3	-	-	3	2	-	-
4	-	-	-	2	3	-
5	-	-	-	2	-	3

8. Mapping of the Course Outcomes (CO) to Program Outcomes (PO)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	-	-	-	-	-	2	-	1
CO2	3	1	1	1	-	-	-	-	-	2	-	1
CO3	3	1	1	1	-	-	-	-	-	2	-	1
CO4	3	1	1	1	-	-	-	-	-	2	-	1
CO5	3	1	1	1	-	-	-	-	-	2	-	1
CO6	2	1	1	1	-	-	-	-	-	2	-	1

9. Mapping to Program Specific Outcome(PSO)

COs	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-
CO6	3	-	-

*** End of Syllabus***

Course Name: Digital Communication
Course Code: EC- 502
Course Type: PC
(Semester – V)
Course Broad Category: (Major)

1. Course Prerequisite:

Basics of Probability and Statistics,
 Signals and Systems, Fourier Transform and Linear Algebra.

2. Course Learning Objectives:

- i. Develop an understanding of the fundamental concepts of stochastic processes and their application in communication systems.
- ii. Analyze the characteristics of stationary and ergodic processes with respect to signal behavior.
- iii. Evaluate correlation, covariance, and auto-correlation functions in signal processing.
- iv. Explain and utilize digital data transmission techniques, including PAM, PCM, and associated encoding schemes.
- v. Differentiate among digital modulation techniques such as ASK, FSK, PSK, and QPSK.
- vi. Examine modern digital communication methods, including MIMO systems, OFDM, and SDR.

3. Teaching methodology and evaluation system for the course:

Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies, Guest Lectures and Field Visits.

Evaluation System –

- A. Continuous Internal Assessment I(40 Marks)
- B. Continuous Internal Assessment II (40 Marks)
- C. End-Semester Exam (60 Marks)

4. Course Content:

Course Name: DIGITAL COMMUNICATION

Course Code: EC-503

Hours per Week: 3L: 1T: 0P

Credits: 3

Module	Topics	25L
1.	Introduction to Stochastic Processes and Signal Space Representation: Definition and examples of stochastic processes, random variables in communication systems, classification of random processes, stationary and ergodic processes, correlation coefficient, covariance, auto-correlation functions, signal space concepts: orthogonality, basis functions, signal constellations, geometric interpretation of signals	3L
2.	Digital Data Transmission: Sampling techniques (Nyquist criteria, natural and flat-top sampling, aliasing), Pulse Amplitude Modulation (PAM): generation, detection, and noise impact, Multiplexing techniques: TDM and FDM, Pulse Code Modulation (PCM): encoding/decoding,	10L

Module	Topics	25L
	quantization, and noise analysis, Binary encoding (Gray and Huffman coding), Differential PCM (DPCM), Delta and Adaptive Delta Modulation, digital transmission components, pulse shaping and ISI mitigation	
3.	Digital Modulation Techniques: Fundamentals of digital modulation: amplitude, frequency, and phase modulation, Coherent and non-coherent binary modulation, Detailed study of ASK, FSK, PSK (including BPSK and QPSK), M-ary modulation, related error performance and spectral analysis, Introduction to Orthogonal Frequency Division Multiplexing (OFDM)	10L
4.	Modern Techniques in Digital Communication: Overview of advanced methods in digital communication, Principles and capacity improvements in MIMO systems, Advanced OFDM techniques, error correction/detection (Turbo codes, LDPC), Software-Defined Radio (SDR), Introduction to 5G technology and future trends	2L

5. References:

Text Book:

- Simon Haykin, Communication Systems; 5th Edition, John Wiley & Sons, 2009.

Reference Books:

- B.P. Lathi; Modern Digital and Analog Communication Systems; 4th Edition, Oxford University Press, 2010.
- John G. Proakis and Masoud Salehi, Digital Communications, 5th Edition, McGraw-Hill, 2007.
- Hwei P. Hsu, Schaum's Outline of Probability, Random Variables, and Random Processes, 3rd Edition, McGraw-Hill, 2014.

6. Course Outcomes (CO):

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
EC-502.1	To understand and apply the fundamental concepts of stochastic processes in communication systems.	Explain	Understand
EC-502.2	To analyze the characteristics and significance of stationary and ergodic processes.	Analyze	Understand
EC-502.3	To evaluate correlation, covariance, and auto-correlation functions in signal processing.	Evaluate	Understand
EC-502.4	To explain and utilize digital data transmission techniques including PAM, PCM, and encoding schemes.	Explain	Understand
EC-502.5	To differentiate among digital modulation techniques such as ASK, FSK, PSK, and QPSK.	Differentiate	Understand
EC-502.6	To explore and apply modern digital communication techniques, including MIMO, OFDM, and SDR.	Explore	Understand

7. Mapping of Course Outcomes (CO) to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	3	3	-	-	-
2	-	-	-	3	-	-
3	-	-	-	-	3	-
4	-	-	-	-	-	3

8. Mapping of the Course Outcomes (CO) to Program Outcomes (PO)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	-	-	-	-	-	-	2
CO2	2	3	1	2	-	-	-	-	-	-	-	2
CO3	2	2	2	2	-	-	-	-	-	-	-	1
CO4	1	1	3	3	2	-	-	-	-	-	-	1
CO5	1	1	1	2	3	-	-	-	-	-	-	1
CO6	1	1	1	1	2	3	-	-	-	-	-	2

9. Mapping to Program Specific Outcome (PSO)

COs	PSO1	PSO2	PSO3
CO1	3	2	-
CO2	3	3	-
CO3	3	3	2
CO4	3	3	2
CO5	2	3	3
CO6	-	3	3

***** End of Syllabus*****

Course Name: Microprocessors & Microcontrollers

Course Code: EC-503

Course Type: PC

(Semester – V)

Course Broad Category: (Major)

1. Course Prerequisite:

Digital System Design

2. Course Learning Objectives:

- i. This course introduces the concepts of Architecture of 8085, 8086 microprocessors
- ii. Students will also understand the design aspects of I/O and Memory Interfacing circuits
- iii. Familiarize the students with the programming and interfacing of microprocessors and microcontrollers
- iv. To provide strong foundation for designing real world applications using microprocessors and microcontrollers

3. Teaching methodology and evaluation system for the course:

Teaching methodology- Lectures and Presentations, Interactive Discussions and Case Studies.

Evaluation System –

- A. Continuous Internal Assessment I (40 Marks)
- B. Continuous Internal Assessment II(40 Marks)
- C. End-Semester Exam (60 Marks)

4. Course Content:

Course Name: MICROPROCESSORS & MICROCONTROLLERS

Course Code: EC-503

Hours per Week: 3L: 0T: 3P

Credits: 3

Module	Topics	27L
1.	Introduction to Microprocessor: Basic computer architecture, Stored program computer concept, Evolution of Microprocessors 8085 Architecture, Drawbacks and Instruction sets and programming with 8085.	5L
2.	8086 Microprocessor: Introduction to 8086: Microprocessor architecture, addressing modes, Instruction set and assembler directives, Assembly language programming, Modular Programming, Linking and Relocation Stacks: Procedures, Macros Interrupts and interrupt service routines, Byte and String Manipulation. 8086 signals Basic configurations, System bus timing, System design using 8086, IO programming; Introduction to Multiprogramming, System Bus Structure, Multiprocessor configurations; Coprocessor, closely coupled and loosely Coupled configurations Introduction to advanced processors.	10L
3.	I/O And Memory Interface: LCD, Keyboard, External Memory; RAM, ROM Interface, ADC, DAC Interface. Serial Communication and Bus Interface: Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External	5L

Module	Topics	27L
	Communication Interfaces-RS232, USB.	
4.	8051 architectures: Memory organization, Addressing modes & port structure, external memory access, Counters and timers, Interrupts, Serial communication, Microcontroller instructions; moving data, logical operations, arithmetic operations, Jump and call instructions; subroutines; Interrupts and returns. Microcontroller programming; Assembly Language Programming, timer and counter programming, Interrupt programming Interfacing examples.	5L
5.	PIC Microcontrollers: Introduction Architecture; ALU, Program memory, register, Instruction , Interrupts, Peripherals	2L

6. References:

Text Book:

- R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996.
- Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", 2nd Edition, Pearson Education, 2011.
- Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", 3rd Edition "Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.

Reference Books:

- Douglas V. Hall, "Microprocessors and Interfacing, Programming and Hardware", Tata McGraw-Hill, 2012.
- Jonathan W. Valvano, "Embedded Microcomputer Systems Real Time Interfacing", 3rd Edition, Cengage Learning, 2012.
- David. E. Simon, "An Embedded Software Primer", 1st Edition, Fifth Impression, Addison-Wesley Professional, 2007.

7. Course Outcomes (CO):

After going through this course, the students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
EC-503.1	Describe the fundamental operations and internal architectures of microprocessors and Microcontroller's as well as identify the peripherals to be used for the given microprocessor and Microcontroller based problems.	Describe	Understand
EC-503.2	Understand the performance of Microprocessor (8085 & 8086) and Microcontroller based systems and select appropriate platform to meet specified requirements.	Understand	Apply
EC-503.3	Apply the knowledge of Microprocessors, Microcontrollers and peripheral devices and demonstrate the programming proficiency	Demonstrate	Apply

	using the various instruction codes of the target microprocessor and microcontroller.		
EC-503.4	Analyze different problems on microprocessors and microcontrollers and write appropriate assembly language programs.	Analyze	Apply
EC-503.5	Evaluate the machine codes to provide solutions to the real-world problems.	Evaluate	Evaluate
EC-503.6	Design necessary I/O and Memory interfacing circuitry to communicate Microprocessor and Microcontroller with external devices.	Design	Create

8. Mapping of Course Outcomes (CO) to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	-	-	2	-	-
2	-	3	-	2	-	-
3	-	-	3	2	-	-
4	-	-	-	2	3	-
5	-	-	-	2	-	3

9. Mapping of the Course Outcomes (CO) to Program Outcomes (PO)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	2
CO3	3	2	3	-	-	-	-	-	-	-	-	2
CO4	3	2	3	3	-	-	-	-	-	-	-	-
CO5	3	2	-	-	3	-	-	-	-	-	-	-
CO6	3	2	3	3	-	3	-	-	-	-	-	2

10. Mapping to Program Specific Outcome (PSO)

COs	PSO1	PSO2	PSO3
CO1	3	2	-
CO2	2	3	-
CO3	3	3	2
CO4	3	3	2
CO5	2	3	-
CO6	3	3	2

*** End of Syllabus***

Course Name: CMOS VLSI Design

Course Code: EC-504

(Semester – V)

Category: PC

Course Broad Category: (Major)

1. Course Prerequisite:

Fundamental understanding on Basic Electronics Engineering, Digital Electronics and Digital System Design, Electronic Devices and Analog Electronics, Microprocessor & Microcontroller, DSP and Computer Architecture, Probability Theory & Stochastic Processes and Mathematics.

2. Course Learning Objectives:

- i. This course acquaint students on VLSI design flow along with MOS-electrical characteristics to optimize MOS-level VLSI circuits.
- ii. Students will also learn about different static and dynamic logic styles along with circuit analysis and advanced circuit strategies for ASIC applications

3. Teaching methodology and evaluation system for the course:

Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies.

Evaluation System –

- A. Continuous Internal Assessment I (40 Marks)
- B. Continuous Internal Assessment II (40 Marks)
- C. End-Semester Exam (60 Marks)

4. Course Content:

Course Name: CMOS VLSI Design

Course Code: EC 504

Hours per Week: 3L: 0T: 0P

Credits: 3

Module	Topics	36L
1.	VLSI Design Methodology: Introduction, Moore's law, VLSI Design style: Full-custom, standard-cell based, Gate-array and reconfigurable, VLSI Design flow: Full-Custom and FPGA, Top-down and Bottom-Up approach, Domain of representation, Different Abstraction Levels, Y-chart, Complexity-issue: design hierarchy, regularity, modularity and locality, Application Specific Integrated Circuit.	6L
2.	MOSFET Electrical Characteristics: Review on: Threshold potential, MOS Capacitance, Drain and Transfer Characteristics of MOSFET, operating regions, I-V relation (gradual channel approximation method), MOSFET Figure of Merit (FOM), Aspect Ratio, MOSFET Pass characteristics, small geometry effects and leakage current: sub-threshold conduction, body bias effect, channel length modulation, punch-through, velocity	9L

Module	Topics	36L
	saturation, junction leakage, DIBL, GIDL, Hot carrier effect, time-dependent dielectric breakdown etc., Temperature Effect, MOSFET scaling: constant field and constant voltage scaling, scaling effect on power density of MOSFET.	
3.	<p>CMOS Logic Circuit: Resistive load, enhancement and depletion nMOS load Inverter, static CMOS logic: Merit and demerit, CMOS Inverter: VTC, noise margin, Beta ratio effect, Switching characteristic: Rise, fall and propagation delay, power dissipation: static, dynamic and leakage, Tri-state inverter/buffer, Design of complex CMOS logic circuits, Sizing of MOSFET, sizing for driving large capacitive load, CMOS Transmission Gate and Pass Transistor Logic (PTL), PTL-Multiplexer, XOR etc. Ratioed Logic, DCVSL, Low-power techniques, Glitch Reduction, MTCMOS, Multi-Valued Logic (MVL).</p> <p>Dynamic CMOS logic circuits, charge leakage and charge sharing problem, dynamic gate cascading issue, Domino, NORA and Zipper CMOS logic, sequential CMOS logic circuits, D-Latch with CMOS TG, Layout and Layout design rules.</p>	15L
4.	<p>Semiconductor Memory: Static RAM, Dynamic RAM, Read Only Memory (ROM), Flash Memory, Content Addressable Memory (CAM): Architecture, Read/Write operation</p>	6L

5. References:

Text Book:

- N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4th Edition, Pearson Education India, 2011.
- Debaprasad Das, VLSI Design, 2nd Edition, Oxford University Press, 2015

Reference Books:

- Introduction to VLSI Circuits and Systems, John P. Uyemura, John Wiley & Sons
- Modern VLSI Design: System-on-Chip Design, Wayne Wolf, PHI
- CMOS Digital Integrated Circuits – S. Mo. Kang and Yusuf Leblebici, 3rd Ed, TMH
- Chip Design for submicron VLSI: CMOS Layout and Simulation, John P. Uyemura, Thomson India Edition.

6. Course Outcomes (CO):

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
EC-504.1	Understand and explain the fundamental VLSI Design process flow and various design styles	Explain	Understanding
EC-504.2	Explain and select MOSFET- Electrical Characteristics for VLSI Circuit design	Explain, select	Understand, Apply
EC-504.3	Explain various short-channel effects of MOSFET	Explain	Understand
EC-504.4	Construct and Analyze Static CMOS logic circuits	Construct, Analyze	Create, Analyze

EC-504.5	Construct and Analyze Dynamic CMOS logic circuits	Construct, Analyze	Create, Analyze
EC-504.6	Explain and Identify semiconductor Memory	Explain, Identify	Understand, Apply

7. Mapping of Course Outcomes (CO) to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	-	-	-	-	-
2	-	3	3	-	-	-
3	-	-	-	3	3	-
4	-	-	-	-	-	3

8. Mapping of the Course Outcomes (CO) to Program Outcomes (PO)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	1	-	-	1	-	-	1	-	1
CO2	3	-	-	1	-	-	1	-	-	1	-	1
CO3	3	-	-	1	-	-	1	-	-	1	-	1
CO4	3	-	-	1	-	-	1	-	-	1	-	1
CO5	3	-	-	1	-	-	1	-	-	1	-	1
CO6	3	-	-	1	-	-	1	-	-	1	-	1

9. Mapping to Program Specific Outcome (PSO)

COs	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-
CO6	3	-	-

***** End of Syllabus*****

Course Name: Object Oriented Programming

Course Code: EC-505

Course Type: PC

(Semester – V)

Course Broad Category: (Major)

1. Course Prerequisite:

Basics of a programming language, often a procedural one like C

Logic building skills

Basic knowledge of algorithms and data structures

2. Course Learning Objectives:

- i. Understand OOP principles: Grasp and apply fundamental OOP concepts like encapsulation, inheritance, polymorphism, and abstraction to design and implement software.
- ii. Problem-solving: Use object-oriented approaches to solve computational problems, including solving problems using object-oriented data types.
- iii. Program design and implementation: Design, implement, and evaluate programs using various control and iterative statements.
- iv. Develop robust solutions: Build robust, scalable, and maintainable software systems by applying OOP principles and best practices.
- v. Real-world application: Write efficient and reusable code, and understand how OOP concepts are used in practical applications.
- vi. Java programming: Learn to use Java to develop simple applications, understanding its syntax, data types, operators, and control structures.

3. Teaching methodology and evaluation system for the course:

Teaching methodology-This method recognizes that students have different learning styles, abilities, and backgrounds, and aims to create a learning environment that accommodates these differences.

Evaluation System-

- A. Continuous Internal Assessment I - (40 marks)
- B. Continuous Internal Assessment II - (40 marks)
- C. End-Semester Exam (60 Marks)

4. Course Content:

Course Name: OBJECT ORIENTED PROGRAMMING

Course Code: EC-505

Hours per Week: 3L: 0T: 0P

Credits: 3

Module	Topics	34L
1	Abstract data types and their specification. How to implement an ADT. Concrete state space, concrete invariant, abstraction function. Implementing operations, illustrated by the Text example	8L
2	Features of object-oriented programming. Encapsulation, object identity, polymorphism –but not inheritance.	8L
3	Inheritance in OO design. Design patterns. Introduction and classification. The iterator pattern	6L

Module	Topics	34L
4	Model-view-controller pattern. Commands as methods and as objects. Implementing OO language features. Memory management.	6L
5	Generic types and collections GUIs. Graphical programming with Scale and Swing, The software development process	6L

5. References:

Text Books:

- Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
- Ali Bahrami – "Object Oriented System Development" – Mc Graw Hill
- Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH
- R.K Das – "Core Java For Beginners" – VIKA

Reference Books:

- S PUBLISHING5. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson
- Ivor Horton's Beginning Java 2 SDK – Wrox
- E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH

6. Course Outcomes (CO):

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
EC505.1	Specify simple abstract data types and design implementations, using abstraction functions to document them	Explain	Understand
EC505.2	Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.	solve	Apply
EC505.3	Name and apply some common object-oriented design patterns and give examples of their use	Simplify	Analyze
EC505.4	Design applications with an event-driven graphical user interface.	solve	Apply

7. Mapping of Course Outcomes (CO) to module / course content:

Module	CO1	CO2	CO3	CO4
1	3	-	-	-
2	3	3	-	2

3	-	-	3	2
4	-	-	-	2

8. Mapping of the Course Outcomes (CO) to Program Outcomes (PO):

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

9. Mapping to Program Specific Outcome (PSO):

COs	PSO1	PSO2	PSO3
CO1	2	3	1
CO2	2	3	1
CO3	2	3	1
CO4	2	3	1

***** End of Syllabus*****

Course Name: Computer Organization & Architecture

Course Code: EC-506

Course Type: ES

(Semester – V)

Course Broad Category: Ability Enhancement

1. Course Prerequisite:

A basic understanding of digital logic Circuit
Microprocessors and microcontroller.

2. Course Learning Objectives:

- i. Learn computer architecture with an emphasis on system design, performance, and analysis.
- ii. Elevate thinking process to the level of performance improvement techniques for recent multi-core architectures
- iii. Enable exploration of future directions in computer architecture research.

3. Teaching methodology and evaluation system for the course:

Teaching methodology– Lectures and Presentations, Interactive Discussions and Case Studies.

Evaluation System –

- A. Continuous Internal Assessment I (40 Marks)
- B. Continuous Internal Assessment II (40 Marks)
- C. End-Semester Exam (60 Marks)

4. Course Content:

Course Name: COMPUTER ORGANIZATION & ARCHITECTURE

Course Code: EC-503

Hours per Week: 3L: 0T: 0P

Credits: 3

Module	Content	36L
1	Review of Basic Computer Organization, Performance Evaluation Methods, Introduction to RISC Instruction Pipeline, Instruction Pipeline and Performance.	6L
2	Pipeline Hazards and Analysis, Branch Prediction, MIPS Pipeline for Multi-Cycle Operations.	5L
3	Compiler Techniques to Explore Instruction Level Parallelism, Dynamic Scheduling with Tomasulo's Algorithm and Speculative Execution. Advanced Pipelining and Superscalar Processors, Exploiting Data Level Parallelism: Vector and GPU Architectures	7L
4	Introduction to Cache Memory, Block Replacement Techniques and Write Strategy, Design Concepts in Cache Memory, Basic and Advanced Optimization Techniques in Cache Memory,	6L
5	Introduction to DRAM Systems, DRAM Controllers and Address Mapping, Secondary Storage Systems, Design Concepts in DRAM and Hard Disk.	6L
6	Tiled Chip Multicore Processors (TCMP), Routing Techniques in Network on Chip (NoC), NoC Router Microarchitecture, TCMP and NoC: Design and Analysis, Future Trends in Computer Architecture Research.	6L

5. References:

Text Books:

- Computer System Architecture, Revised 3/e by M. Morris Mano.
- Computer Organization and Design: The Hardware/Software Interface" by David A. Patterson and John L. Hennessy.
- Computer Architecture: A Quantitative Approach" by John L. Hennessy and David A. Patterson.
- Modern Computer Architecture" by Rafiquzzaman Mohammed.
- Computer Systems: A Programmer's Perspective" by Randal E. Bryant and David R. O'Hallaron.

Reference Books:

- Structured Computer Organization" by Andrew S. Tanenbaum.
- Computer Architecture: Concepts and Evolution" by Gerritt A. Blaauw and Frederick P. Brooks Jr.
- Computer Organization and Architecture: Designing for Performance" by William Stallings.
- Computer Architecture: Pipelined and Parallel Processor Design" by Michael J. Flynn.

6. Course Outcomes (CO):

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
EC506.1	Describe the basics of computer architecture and its organization	Explain	Remember, Understand Apply
EC506.2	Recognize processor models based on their organization, addressing modes and instruction set	Identify	Understand, Analyze, Apply
EC506.3	Explain basics of ALU, control unit and computer organization such as memory & I/O	Identify, Design	Apply, Analyze, Evaluate
EC506.4	Differentiate between various architectures based on performance, cost and applicability	Design	Apply, Analyze, Evaluate
EC506.5	Summarize impact of modern techniques like pipelining, express buses processor performance	Implement	Understand, Apply, Analyze
EC506.6	Explain multicore processors, Network-on-Chip (NoC), and their relevance in modern systems.	Design	Analyze, Evaluate, Create

7. Mapping of Course Outcomes (CO) to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	-	-	2	-	-
2	-	3	-	2	-	-
3	-	-	3	2	-	-
4	-	-	-	2	3	-
5	-	-	-	2	-	3
6				2	3	

8. Mapping of the Course Outcomes (CO) to Program Outcomes (PO)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	1	1	1	1	2	2	2
CO2	3	3	3	3	3	1	1	1	1	2	2	2
CO3	3	3	3	3	3	1	1	1	1	2	2	2
CO4	3	3	3	2	3	1	1	1	1	2	2	2
CO5	3	3	3	2	3	1	1	1	1	2	2	2
CO6	3	3	3	3	3	2	2	2	2	3	3	3

9. Mapping to Program Specific Outcome (PSO)

COs	PSO1	PSO2	PSO3
CO1	3	3	1
CO2	3	3	1
CO3	3	3	1
CO4	3	3	1
CO5	3	3	1
CO6	3	3	3

***** End of Syllabus*****

Course Name: Digital Signal Processing Laboratory

Course Code: EC-591

Course Type: PC

(Semester – V)

Course Broad Category: (Major)

1. Course Prerequisite:

Class-XII level knowledge of Physics and Mathematics
Signals and Systems

2. Course Learning Objectives:

- i. To understand the fundamentals for the analysis and processing of digital signals.
- ii. To understand the fast computation of DFT and appreciate the FFT processing.
- iii. To study the designs and structures of digital (IIR and FIR) filters and analyze and synthesize for a given specifications
- iv. To acquaint in Multi-rate signal processing techniques and finite word length effects.

3. Teaching methodology and evaluation system for the course:

Teaching methodology- Lectures and Presentations, Interactive Discussions and Case Studies.

Evaluation System –

- A. **Internal Assessment** (60 Marks)- Formative Continuous Assessment [Continuous Assessment; Note Book (30 Marks), Viva Voce (20 Marks), Attendance (10 Marks)]
- B. **End-Semester Exam** (40 Marks)

4. Course Content:

Course Name: DIGITAL SIGNAL PROCESSING LAB

Course Code: EC-591

Hours per Week: 0L: 0T: 2P

Credits: 1

Module	Topics	
1.	Sampled sinusoidal signal, various sequences and different arithmetic operations. Convolution of two sequences using graphical methods and using commands	2P
2.	Z-transform of various sequences - verification of the properties of Z-transform.	2P
3.	Twiddle factors - verification of the properties. DFTs / IDFTs using matrix multiplication and also using commands. Circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions.	5P

Module	Topics	
	Verifications of the different algorithms associated with filtering of long data sequences and Overlap-add and Overlap-save methods.	
4.	Butterworth filter design with different set of parameters.	2P
5.	FIR filter design using rectangular, Hamming and Blackman windows	2P

5. References:

Text Books:

- S.K.Mitra, Digital Signal Processing: A computer based approach. TMH
- A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
- John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997.
- L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.

Reference Books:

- J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
- D.J.DeFatta, J. G. Lucas and W.S.Hodgkiss, Digital Signal Processing, John Wiley & Sons, 1988

6. Course Outcomes (CO):

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
EC 591.1	Illustrate digital Signals and Systems mathematically in time domain.	Illustrate	Level 2 Understanding
EC 591.2	Explain digital signals, systems.	Explain	Level 2 Understanding
EC 591.3	Estimate the response of an LTI system to different signals.	Estimate	Level 5 Evaluating
EC 591.4	Analyse the digital signals using various digital transforms DFT, FFT etc.	Analyse	Level 4 Analyzing
EC 591.5	Design of different types of digital filters for various applications.	Design	Level 4 Create
EC 591.6	Interpret the finite word length effects on functioning of digital filters.	Interpret	Level 2 Understanding

7. Mapping of Course Outcomes (CO) to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	-	-	-	-	-
2	-	2	3	2	-	-
3	-	3	-	-	-	-
4	-	-	-	-	3	-
5	-	-	-	-	-	3

8. Mapping of the Course Outcomes (CO) to Program Outcomes (PO)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	2	2	1	2	2	-	-	-	-	-	-	2
C02	3	3	1	2	2	-	-	-	-	-	-	2
C03	3	3	1	2	2	-	-	-	-	-	-	2
C04	3	3	1	2	2	-	-	-	-	-	-	2
C05	3	3	1	2	2	-	-	-	-	-	-	2
C06	3	3	1	2	2	-	-	-	-	-	-	2

9. Mapping to Program Specific Outcome (PSO)

COs	PSO1	PSO2	PSO3
C01	2	3	-
C02	2	3	-
C03	2	3	-
C04	2	3	-
C05	2	3	-
C06	2	3	-

*** End of Syllabus***

Course Name: Digital Communication Laboratory

Course Code: EC-592

Course Type: PC

(Semester – V)

Course Broad Category: (Major)

1. Course Prerequisite:

Digital Communication Theory
Communication Engineering Lab

2. Course Learning Objectives:

- i. Students will learn to study and analyze the basics of communication systems and various digital modulation techniques.
- ii. Students will gain hands-on experience in implementing and evaluating digital communication systems using both hardware and software tools.
- iii. Students will develop the ability to simulate, generate, and analyze digital modulation waveforms using MATLAB.

3. Teaching methodology and evaluation system for the course:

Teaching methodology: Instruction through laboratory experiments, demonstration, and simulation. Emphasis on practical implementation and MATLAB-based waveform generation.

Evaluation System –

- A. **Internal Assessment** (60 Marks)- Formative Continuous Assessment [Continuous Assessment; Note Book (30 Marks), Viva Voce (20 Marks), Attendance (10 Marks)]
- B. **End-Semester Exam** (40 Marks).

4. Course Content:

Course Name: DIGITAL COMMUNICATION LAB

Course Code: EC-592

Hours per Week: OL: OT: 2P

Credits: 1

Module	Topics	
1.	Time Division Multiplexing and Demultiplexing	1P
2.	Pulse Code Modulation & Demodulation	1P
3.	Differential Pulse Code Modulation & Demodulation	1P
4.	Amplitude Shift Keying Modulation & Demodulation	2P
5.	Frequency Shift Keying Modulation & Demodulation	2P
6.	Phase Shift Keying Modulation & Demodulation	2P
7.	Quadrature Phase Shift Keying Modulation & Demodulation	2P
8.	MATLAB-based waveform generation: ASK	1P
9.	MATLAB-based waveform generation: PSK	1P
10.	MATLAB-based waveform generation: FSK	1P
11.	MATLAB-based waveform generation: QPSK	1P

5. References:

Text books

- Digital Communications: Simon Haykin, Wiley India
- Communication Systems: B.P. Lathi, Oxford University Press

Reference Books

- Digital Signal Processing: Proakis and Manolakis, Pearson Education
- Modern Digital and Analog Communication Systems: B.P. Lathi and Zhi Ding, Oxford University Press

6. . Course Outcomes (CO):

After going through this course, the students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
EC-592.1	Study and understand the basics of communication systems and different digital modulation systems	Understand	Remember
EC-592.2	Analyze and apply the concept of pulse coding modulation techniques (PCM, DPCM)	Analyze	Apply
EC-592.3	Analyze and apply the concept of digital modulation techniques (ASK, FSK, PSK, QPSK)	Analyze	Apply
EC-592.4	Analyze and apply the concept of time division multiplexing	Analyze	Apply
EC-592.5	Evaluate the performance of digital communication systems using MATLAB	Evaluate	Analyze

7. Mapping of Course Outcomes (CO) to module / course content

Module	CO1	CO2	CO3	CO4	CO5
1	3	-	-	3	-
2	3	3	-	-	-
3	3	3	-	-	-
4	3	-	3	-	-
5	3	-	3	-	-
6	3	-	3	-	-
7	3	-	3	-	-
8	3	-	3	-	3
9	3	-	3	-	3
10	3	-	3	-	3
11	3	-	3	-	3

8. Mapping of the Course Outcomes (CO) to Program Outcomes (PO)

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

CO4	2	3	2	3	2	-	-	-	-	-	-	2
CO5	2	2	3	2	3	-	-	-	-	-	-	2

9. Mapping to Program Specific Outcome (PSO)

COs	PSO1	PSO2	PSO3
CO1	2	2	-
CO2	2	3	-
CO3	2	2	-
CO4	2	3	-
CO5	2	3	-

***** End of Syllabus*****

Course Name: Microprocessors & Microcontrollers Laboratory

Course Code: EC-593

Course Type: PC

(Semester – V)

Course Broad Category: (Major)

1. Course Prerequisite:

Digital System Design Lab

2. Course Learning Objectives:

- i. To expose students to the operation of typical microprocessor (8085) trainer kit.
- ii. To familiarize the students with the programming and interfacing of microprocessors and microcontrollers.
- iii. To provide strong foundation for designing real world applications using microprocessors and microcontrollers

3. Teaching methodology and evaluation system for the course:

Teaching methodology: Instruction: This method recognizes that students have different learning styles, abilities, and backgrounds, and aims to create a learning environment that accommodates these differences.

Evaluation System –

- A. **Internal Assessment (60 Marks)**- Formative Continuous Assessment [Continuous Assessment; Note Book (30 Marks), Viva Voce (20 Marks), Attendance (10 Marks)]
- B. **End-Semester Exam (40 Marks)**

4. Course Content:

Course Name: MICROPROCESSORS & MICROCONTROLLERS LAB

Course Code: EC-593

Hours per Week: 0L: 0T: 2P

Credits: 1

Module	Topics	
1.	Study of prewritten programs on trainer kit using the basic instruction set (data transfer, Load/Store, Arithmetic, Logical) Assignments based on above.	2P
2.	Familiarization with 8085 & 8051 simulator on PC. Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical) on the simulator. Assignments based on above	2P
3.	Programming using kit and simulator for: Table look up Copying a block of memory. Shifting a block of memory. Packing and unpacking of BCD numbers. Addition of BCD numbers. Binary to ASCII conversion. String Matching, Multiplication using shift and add method and Booth's Algorithm. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit e.g. subroutine for delay, reading switch state and glowing	6P

Module	Topics	
	LEDs accordingly.	
4.	Study of timing diagram of an instruction on oscilloscope.	2P
5.	Interfacing of 8255: Keyboard and Multi-digit Display with multiplexing using 8255. Study of 8051 Micro controller kit and writing programs as mentioned in S/L3. Write programs to interface of Keyboard, DAC and ADC using the kit. Serial communication between two trainer kits.	3P

References:

Text books

- A K Ray and K M Bhurchandi, "Advanced Microprocessors & Peripherals", 2nd ed., TMH, 2006.

Reference Books

- Kenneth. J. Ayala, "8051 Microcontroller Architecture, Programming and Applications".2nd edition, Thomson.

6. Course Outcomes (CO):

After going through this course, the students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
EC-593.1	Understand and execute prewritten programs on a trainer kit using basic instruction sets for data transfer, arithmetic, and logical operations.	Understand	Apply
EC-593.2	Demonstrate the ability to simulate and execute prewritten programs on 8085 and 8051 simulators using basic instruction sets for data transfer, load/store, arithmetic, and logical operations.	Execute	Apply
EC-593.3	Develop and implement assembly language programs on a trainer kit and simulator for memory operations, numerical conversions, and arithmetic operations.	Implement	Create
EC-593.4	Utilize subroutine calls and IN/OUT instructions with 8255 PPI to interface with external hardware for input/output operations.	Utilize	Apply
EC-593.5	Analyze and interpret the timing diagram of an instruction using an oscilloscope to understand its execution process.	Understand	Analyze
EC-593.6	Develop and implement programs for interfacing peripherals like a keyboard, multi-digit display, DAC, and ADC using 8255 and 8051, and establish serial communication between trainer kits.	Develop	Create

7. Mapping of Course Outcomes (CO) to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	-	-	-	-	-
2	-	3	-	-	-	-
3	-	-	3	3	-	-
4	-	-	-	-	3	-
5	-	-	-	-	-	3

8. Mapping of the Course Outcomes (CO) to Program Outcomes (PO)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	3	2	-	-	-	-	-	-	-	-	-	2
CO3	3	2	3	-	-	-	-	-	-	-	-	1
CO4	3	2	3	3	-	-	-	-	-	-	-	2
CO5	3	2	-	-	3	-	-	-	-	-	-	1
CO6	3	2	3	3	-	2	-	-	-	-	-	2

9. Mapping to Program Specific Outcome (PSO)

COs	PSO1	PSO2	PSO3
CO1	3	2	-
CO2	3	3	-
CO3	3	3	2
CO4	3	3	2
CO5	2	3	-
CO6	3	3	2

*** End of Syllabus***

Course Name: CMOS VLSI Design Laboratory

Course Code: EC- 594

(Semester – V)

Category: PC

Course Broad Category: (Major)

1. Course Prerequisite:

Fundamentals of Basic Electronics Engineering,
Digital Electronics, Digital System Design,
Electronic Devices, Analog Electronics,
Microprocessor & Microcontroller, Probability Theory,
Stochastic Processes and Mathematics

2. Course Learning Objectives:

- i. Expose students to experimental skills on CMOS logic circuit design and optimization through Full-custom EDA-tool
- ii. To gain practical knowledge by applying experimental methods to correlate with the VLSI Circuit theory.
- iii. To apply the analytical techniques and graphical analysis to the experimental data.

3. Teaching methodology and evaluation system for the course:

Teaching methodology: This method recognizes that students have different learning styles, abilities, and backgrounds, and aims to create a learning environment that accommodates these differences.

Evaluation System –

- A. **Internal Assessment** (60 Marks)- Formative Continuous Assessment [Continuous Assessment; Note Book (30 Marks), Viva Voce (20 Marks), Attendance (10 Marks)]
- B. **End-Semester Exam** (40 Marks)

4. Course Content:

Course Name: CMOS VLSI DESIGN LAB

Course Code: EC - 594

Hours per Week: 0L: 0T: 2P

Credits: 1

Module	Topics	
1.	<p>Introduction to EDA tool and MOSFET I-V Characteristics:</p> <p>Familiarization with EDA-tool for CMOS VLSI Design Find Drain and Transfer Characteristics of a given MOSFET using suitable EDA tool.</p>	2P
2.	<p>Experiment on Static CMOS Inverter:</p> <p>Design and Plot VTC of static-CMOS inverter with different β_p/β_n ratio using suitable EDA-tool. Find Noise-Margin and Logic Threshold in each case.</p> <p>Design a CMOS Inverter and perform transient analysis using suitable EDA-tool. Find propagation delay, rise/fall-time, static and average power of the</p>	2P

Module	Topics	
	circuit.	
3.	<p>Experiment on Complex CMOS logic:</p> <p>Design a CMOS Logic Circuit for a given Boolean Expression in AOI/OAI-form using suitable EDA-tool. Validate transient response and evaluate Power-Delay-Product with all possible test-patterns.</p> <p>Design a CMOS half-adder using suitable EDA-tool, validate the transient response, find delay and avg. power with $\pm 10\%$ supply variation at -45°C, 27°C and 85°C under SS, TT and FF design corner.</p> <p>Design a 4-bit Binary-to-Grey and Grey-to-Binary converter using PTL-based 2:1-multiplexer using suitable EDA-tool. Validate transient response; determine propagation delay and average power under nominal operating condition.</p> <p>Design a CMOS 4:1-multiplexer and validate transient response using suitable EDA-tool.</p>	4P
4.	<p>Experiment on Dynamic CMOS Logic Circuit:</p> <p>1. Design of dynamic-CMOS XOR logic using suitable EDA-tool and validate transient response.</p>	1P
5.	<p>Experiment on Sequential Logic Circuit:</p> <p>1. Design of SR and D-latch on CMOS logic using suitable EDA-tool. Validate state diagram through transient simulation.</p>	1P
6.	<p>Experiment on Physical Design:</p> <p>1. Make a layout of CMOS Inverter and perform post layout transient simulation.</p> <p>2. Make a layout of CMOS NAND/NOR logic and perform post layout transient simulation</p>	2P

5. References:

Text Books:

- N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4th Edition, Pearson Education India, 2011.
- Debaprasad Das, VLSI Design, Oxford University Press

Reference Books:

- Introduction to VLSI Circuits and Systems, John P. Uyemura, John Wiley & Sons
- Modern VLSI Design: System-on-Chip Design, Wayne Wolf, PHI
- CMOS Digital Integrated Circuits – S. Mo. Kang and Yusuf Leblebici, 3rd Ed, TMH
- Chip Design for submicron VLSI: CMOS Layout and Simulation, John P. Uyemura, Thomson India Edition.

6. Course Outcomes (CO):

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
EC594.1	Understand and Explain Full-Custom EDA-tool for VLSI Design	Explain	Understand
EC594.2	Experiment with MOSFET and apply for VLSI Circuit Design using EDA-tool	Experiment with	Apply
EC594.3	Design and Explain Static CMOS Combinational Logic Circuit using EDA-tool	Design, Explain	Create, Evaluate
EC594.4	Design and Analyze Dynamic CMOS Combinational Logic Circuits using EDA-tool	Design	Create, Analyze
EC594.5	Construct and Examine CMOS sequential logic circuit using EDA tool.	Construct, Examine	Create, Analyze
EC594.6	Construct layout of CMOS logic circuits and explain through post layout simulations	Construct, Explain	Create, Evaluate

7. Mapping of Course Outcomes (CO) to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	3	1	1	1	1
2	1	-	3	-	-	-
3	1	-	3	-	-	-
4	1	-	-	3	-	-
5	1	-	-	-	3	-
6	1	-	-	-	-	3

8. Mapping of the Course Outcomes (CO) to Program Outcomes (PO)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	2	3	3	-	-	-	-	-	1	1
CO2	2	3	2	3	3	-	2	-	-	-	1	1
CO3	2	3	2	3	3	-	2	-	-	-	1	1
CO4	2	3	2	3	3	-	2	-	-	-	1	1
CO5	2	3	2	3	3	-	2	-	-	-	1	1
CO6	2	3	2	3	3	-	2	-	-	-	1	1

9. Mapping to Program Specific Outcome (PSO)

COs	PSO1	PSO2	PSO3
CO1	3	3	-
CO2	3	3	-
CO3	3	3	-
CO4	3	3	-
CO5	3	3	-
CO6	3	3	-

***** End of Syllabus*****

Course Name: Object Oriented Programming Laboratory

Course Code: EC – 595

Course Type: ES

(Semester – V)

Course Broad Category: (Ability Enhancement)

1. Course Prerequisite:

Fundamentals of Programming
Control Structures
Algorithms and Logic
Basic Computation

2. Course Learning Objectives:

- i. Understand the core principles of object-oriented programming, including objects, classes, encapsulation, inheritance, and polymorphism.
- ii. Implement these concepts in practical programming exercises using an appropriate language (e.g., Java).
- iii. Develop applications using key OOP features such as:
- iv. Constructors and destructors
- v. Method overloading and overriding
- vi. Interfaces and packages (for modularity and multiple inheritance)
- vii. Exception handling mechanisms
- viii. Multithreaded programming
- ix. File handling methods
- x. Generic programming and templates
- xi. Design solutions for complex engineering problems by applying an object-oriented approach to provide flexibility and re-usability in programming.
- xii. Analyze and debug programs effectively using an integrated development environment

3. Teaching methodology and evaluation system for the course:

Teaching methodology- This method recognizes that students have different learning styles, abilities, and backgrounds, and aims to create a learning environment that accommodates these differences.

Evaluation System –

- A. Internal Assessment (60 Marks)- Formative Continuous Assessment [Continuous Assessment; Note Book (30 Marks), Viva Voce (20 Marks), Attendance (10 Marks)]
- B. End-Semester Exam (40 Marks)- Summative Assessment.

4. Course Content:

Course Name: OBJECT ORIENTED PROGRAMMING LABORATORY

Course Code: EC- 595

Hours per Week: 0L: 0T: 2P

Credits: 1

Module	Topics	
1	Assignments on class, constructor, overloading, inheritance, overriding	2P
2	Assignments on wrapper class, arrays	5P
3	Assignments on developing interfaces- multiple inheritance, extending interfaces	1P
4	Assignments on creating and accessing packages	2P
5	Assignments on multithreaded programming.	1P
6	Assignments on applet programming	1P

5. References:

Text Books:

For C++:

- The C++ Programming Language by Bjarne Stroustrup
- Object-Oriented Programming with C++ by Sourav Sahay

For Java:

- The complete reference-Java2 by Patrick Naughton and Herbert Schildt

Reference Books:

- Object Oriented System Development by Ali Bahrami
- Object Oriented Modeling and Design by Rumbaugh and Blaha

6. Course Outcomes (CO):

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
EC595.1	Define an object oriented programming language, and associated class libraries and learn how to develop object oriented programs.	Explain	Understand
EC595.2	Understand the concepts of class, constructor, data encapsulation, inheritance, overriding and polymorphism to describe large scale software	analyze	Apply
EC595.3	Develop and debug programs using object oriented principles with wrapper class, arrays.	Simplify	Analyze
EC595.4	Apply the concept of interfaces- multiple inheritance, extending interfaces.	solve	Apply
EC595.5	Analyze and use an integrated environment development by creating and accessing packages and multithreaded programming	implement	examine
EC595.6	Develop programs with Graphical User Interfaces capabilities and solve related problems	Examine	Analyze

7. Mapping of Course Outcomes (CO) to module / course content:

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	-	-	-	-	-
2	-	3	-	2	-	-
3	-	-	3	2	-	-
4	-	-	-	2	3	-
5	-	-	-	2	-	3

8. Mapping of the Course Outcomes (CO) to Program Outcomes (PO):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	2	2	-	-	-	-	-	-	2
CO2	3	3	1	2	2	-	-	-	-	-	-	2
CO3	3	3	1	2	2	-	-	-	-	-	-	2
CO4	3	3	1	2	2	-	-	-	-	-	-	2
CO5	3	3	1	2	2	-	-	-	-	-	-	2
CO6	3	3	1	2	2	-	-	-	-	-	-	2

9 Mapping to Program Specific Outcome (PSO):

COS	PSO1	PSO2	PSO3
CO1	2	3	-
CO2	2	3	-
CO3	2	3	-
CO4	2	3	-
CO5	2	3	-
CO6	2	3	-

***** End of Syllabus*****