Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati Autonomous

Course Structure & Credit Distribution for

T. Y. B. Sc. (Electronics) (Sem. V)

Course Structure

Semester	Title of Paper		No. of Credits
V	ELE351	Advanced Digital Design with Verilog HDL	3
	ELE352	8051 Microcontroller	3
	ELE353	Analog Circuit Design and Applications	3
	ELE354	Foundation of Semiconductor Devices	3
	ELE355	Programming in C	3
	ELE356	Fibre Optic Communication and Techniques	3
	ELE357	Practical Course I	2
	ELE358	Practical Course II	2
	ELE359	Project	2

Paper I : Semester V
ELE 351:Advanced Digital Design with Verilog HDL

Course Objectives:

1. To introduce VERILOG
2. To know the architectural features of programmable logic devices
3. To know the behavioral modeling of combinational and simple sequential circuits
4. To understand sequential and combinational logic design techniques
5. To learn various digital circuits using VERILOG
6. To know the behavioral modeling of algorithmic state machines
7. To learn VLSI devices

Course Outcomes:

By the end of the course, students will be able to:

CO1.To know the basic language features of Verilog HDL and the role of HDL in digital logic design
CO2. To know the various modeling of combinational and simple sequential circuits
CO3. To know the architectural features of programmable logic devices
CO4. Construct the combinational circuits, using discrete gates and programmable logic devices.
CO5.Describe Verilog model for sequential circuits and test pattern generation.
CO6. Understand the language constructs and programming fundamentals of Verilog HDL.
CO7. Analyze and verify the functionality of digital circuits/systems using test benches
CO8.Synthesize different types of processor and I/O controllers that are used in embedded system.

Unit 1: Programmable Logic Devices [10]

Introduction, fixed function IC's, ASICs, Introduction of Programmable Logic Devices (PLD), ROM as PLD, SPLD- PLA, PAL, CPLD, FPGA with examples.

Unit 2: Digital System Design [10]

Design flow for logic circuits, Mealy & Moore sequential machine models, state machine notation, state equivalence, state reduction, Equivalence classes, Implication charts, state reduction of incompletely specified state tables, Merger graphs, ASM symbols

Unit 3: Introduction to Verilog Hardware Description Language [10]

Importance of HDL's, features of Verilog HDL, Overview of Digital Design with Verilog HDL, Hierarchical modeling concepts, Basic concepts of Verilog- Operators, comments, Number specifications, strings, Identifiers& keywords, Data types, system tasks & Compiler Directives, Modules & ports.

Unit 4: Modeling of Digital systems [15]

Gate level Modeling- Gate types, Gate delays, Examples
Data flow modeling- Continuous Assignments, Delays expression, operators & operands, Examples
Behavioral Modeling- Structured Procedures, Assignments, Timing Controls, Conditional

statements, Multiway Branching, Loops, Examples

(Examples of Verilog Design- Multiplexer, Demultiplexer, Encoder, Decoder, Adder, Subtractor, Flip Flop, Counter, and Shift register, Traffic light controller, Stepper motor sequence generator)

Recommended Books:

1. Digital logic: Applications & design by John M. Yarbrough, cengage LearningIndia(Thompson)
2. Verilog HDL A guide to digital design & synthesis By Samir Palnitkar, Pearson SecondEdition
3. A VHDL Synthesis Primer J. Bhaskar BS Publications Hyderabad
4. Fundamental of digital logic with Verilog By Stephen Brown, ZvonkoVranesic, Tata McGrawHill
5. Digital fundamentals By Floyd, Thoms, Jain R.P.,Pearson

Mapping of Program Outcomes with Course Outcomes

Weightage: 1=Weak or low relation, 2=Moderate or partial relation, 3=Strong or direct relation

Course Outcome	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-
CO5	-	-	-		-	-	-	-	1
CO6	-	-	-	1	-	-	-	-	-
CO7	-	3	-	-	-	-	-	-	-

Justification for the mapping

PO1: Disciplinary Knowledge

CO1: Students focuses on the fundamental understanding of Verilog HDL, which is a key aspect of the discipline.

CO2: Students will involve in understanding and modeling circuits, a fundamental aspect of the discipline.

CO3: Students will involve in understanding the architecture of programmable logic devices, a critical aspect within the discipline.

PO2: Critical thinking and problem solving

CO7: Students will involve in the critical skills of analyzing and verifying the functionality of digital circuits/systems.

PO4: Research-related skills and scientific temper

CO4: Students will involve in the practical application of constructing circuits using both discrete gates and programmable logic devices.

CO6: Students will involve in understanding the language constructs and programming fundamentals, a key aspect of research-related skills.

PO5: Trans-disciplinary knowledge

CO8: Students will involve in synthesizing components used in embedded systems, demonstrating knowledge that spans multiple disciplines.

PO9: Self-directed and lifelong learning:

CO5: Students will involve in ability to describe Verilog models and generate test patterns, reflecting self-directed learning in a specific technological domain.

Paper II : Semester V
ELE352: 8051 Microcontroller

Course Objectives:

1. To study the basics of 8051 microcontroller.
2. To study the Programming of 8051 microcontroller.
3. To study the interfacing techniques of 8051 microcontroller.
4. To apply knowledge of 8051 to design different application circuits.
5. To introduce the basic concepts of advanced Microcontrollers.
6. To introduce advance microcontrollers.
7. To learn the Embedded C programming language.

Course Outcomes:

CO1. Get familiar with general microcontroller and their working.
CO2. Knowledge about architecture and programming syntaxes of microcontroller.
CO3. Run the programmes on the Compiler “Keil”.
CO4. Interfacing of input output peripherals to the 8051 microcontrollers.
CO5. Designing microcontroller based hobby projects.
CO6. Comparing the microcontrollers.
CO7. Comparing Assembly Language and Embedded C language.

Unit 1: Microcontroller architecture [16]

Introduction to microcontroller, 8051 microcontroller block diagram, 8051 Oscillator and clock, Program counter, Datapointer, A and B CPU registers, Flags and PSW, Internal RAM and ROM, Stack and stack pointer, SFRs, I/O ports, Clock and reset circuitry, External memory , Counters and timers , Serial Data I/O,Interrupts.

Unit 2: Instruction set [16]

Addressing modes, Different groups of instructions- Data transfer instructions, Logical instructions,Arithmetic instructions, Jump and call instructions.Programs based on data transfer, logical, arithmetic, Jump and call instructions.Delay generation and waveform generation using timer

Unit 3: Development tools and Integrated Development Environment [4]

Algorithms, Flow charts, Program Designing, Editors, Assemblers, Compilers, Cross compiler,Linkers,Simulator, Emulator and Debugger.

Unit 4: Interfacing memory and I/O devices [12]

Interfacing microcontroller with- LED, LCD, DAC, Seven segment display, Relay, Stepper motor, Switch.

External memory interfacing – RAM, ROM, EPROM

Recommended Books :

1. The 8051 Microcontroller Architecture, Programming and application [Second Edition] Kenneth J. Ayala, Penram International (1999)
2. The 8051 Microcontroller and Embedded Systems using Assembly and C M.A.Mazidi,J.G.Mazidi,R.D.Mckinlay. Pearson Education Second Edition 2009
3. The 8051 Microcontroller and Embedded Systems using Assembly and C, Kenneth J. Ayala, Dhananjay V. Gadre. Cengage Learning
4. Microcontrollers [Theory and Applications] Deshmukh Ajay V. TMH

Mapping of Program Outcomes with Course Outcomes

5. **Weightage: 1=Weak or low relation, 2=Moderate or partial relation, 3=Strong or direct relation**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	-	-	-	-	-	1	1
CO2	-	-	-	-	-	-	1
CO3	2	1	1	-	-	-	2
CO4	2	2	2	-	-	-	-
CO5	2	2	2	2	-	1	-
CO6	-	-	-	-	1	1	1
CO7	-	-	-	-	-	-	1

Justification for the mapping

PO1: Computer Knowledge

CO3: Students will be running programs on the Keil compiler is a specific skill that supports the broader application of computer fundamentals and programming knowledge.

CO4: Students will be able to interfacing input/output peripherals with microcontrollers requires the application of mathematics, statistics, and computer fundamentals.

CO5: Students will be capable of designing microcontroller-based hobby projects involves applying knowledge of microcontroller architecture and programming syntaxes.

PO2: Design/ Development of Solution

CO3: Students will be able to run programs on the Keil compiler is a specific skill that is not directly linked to designing solutions with the latest technologies.

CO4: Students will interface different peripherals with microcontrollers are a skill that contributes to solution design, but the focus is on microcontroller technology rather than the latest IT application technologies.

CO5: Students will be capable for designing microcontroller-based hobby projects involves skills that can contribute to solution design but may not necessarily involve the latest technologies.

PO3: Modern tool usage

CO3: Students will be able to running programs on the Keil compiler involves the direct use of a modern IT tool, aligning with the objective of modern tool usage in IT applications.

CO4: Students will be interfacing peripherals involves a skill set that contributes to modern tool usage, but the specific use of modern engineering and IT tools is not explicitly emphasized.

CO5: Students will design microcontroller-based hobby projects contributes to technical skills but may not explicitly involve the application of modern engineering and IT tools.

PO4: Environment and Sustainability

CO5: Students will be designing microcontroller-based hobby projects which involves technical skills, but the connection to societal and environmental impacts is not explicitly emphasized.

PO5: Ethics

CO6: Students will compare microcontrollers, which is more focused on technical aspects and less on explicit consideration of professional ethics.

PO6: individual and Team work

CO1: Students will be familiar with general microcontrollers contributes to individual effectiveness but may not explicitly address teamwork and leadership skills.

CO5: Students will be designing microcontroller-based hobby projects involves both individual and potentially team-based efforts, fostering teamwork and leadership skills.

CO6: Students will study as comparing microcontrollers involves technical analysis but may not directly address teamwork or leadership skills.

PO7: Innovation, employability and Entrepreneurial skills

CO1: Students will be in familiarity with general microcontrollers provides a foundation for innovation and entrepreneurial skills but may not explicitly address value creation and wealth generation.

CO2: Students will get knowledge of microcontroller architecture contributes to innovation and entrepreneurial skills but may not directly address wealth creation or employability.

CO3: Students will be running programs on the Keil compiler involves technical skills but may not explicitly contribute to entrepreneurial skills or employment transition.

CO6: Students will study as comparing microcontrollers involves technical analysis but may not directly address innovation, employability, or entrepreneurial skills.

CO7: Students will be comparing Assembly Language and Embedded C language is more focused on technical aspects and may not directly contribute to innovation, employability, or entrepreneurial skills.

Paper III : Semester V

ELE353: Analog Circuit Design and Applications

Course Objectives:

1. To study the practical design aspects while using Op- amps
2. To study the basic application circuits of Op -amps
3. To Learn the specifications and selection criterion for linear ICs
4. To obtain information about different special purpose ICs and their applications
5. To refer and understand data manuals.
6. To study the voltage regulators for power supply.
7. To understand the basics of PLL and its practical applications

Course Outcomes:

CO1: Learn about the basic concepts for the circuit configuration for the design of linear integrated circuits and develops skill to solve engineering problems
CO2 : Develop skills to design simple circuits using OP-AMP.
CO3 : Gain knowledge about various filters and rectifiers.
CO4 : Gain knowledge about PLL.
CO5: Learn about various techniques to develop multivibrators.
CO6 : Develop skills to develop simple filter circuits and various amplifiers and can solve problems related to it.
CO7 : Develop skills to design power supply

Unit 1: Practical Considerations for Op-amp Circuit Design [10]

Practical consideration with Op-amps: selecting Op-amps for dc, low frequency and high frequency applications, interference noise/shielding and guarding, offset compensation / balancing techniques, stability of op-amp circuits and technique for frequency compensation.

Unit 2: Basic Application Circuits using Op-amp [12]

Design of basic and practical integrator and differentiator circuits, Active filters: 2nd and higher order, Design of LP, HP and BP filters Log and antilog amplifiers: transdiode configuration and diode connected transistor configuration for log amplifier, Practical log and antilog amplifiers, Precision half wave rectifier, precise full wave rectifiers with equal resistor and one with high input impedance, peak detectors, sample and hold circuits.

Unit 3: Basic Application Circuits using Linear ICs [14]

Voltage comparators using op-amp as well as comparator IC (LM311), design of inverting and non- inverting Schmitt trigger, Astable and mono stable multivibrators using op-amp. Single power supply Op-amp. Timer IC555: Block diagram, astable and mono stable multivibrators Function generators: LM 566, ICL8038

Unit 4: Voltage Regulators and Phase Lock Loops [12]

Voltage references: band gap reference, LM385 Linear Regulators: Fixed three terminal regulators ICs-78XX, 79XX; Adjustable Three terminal regulators ICs LM317, LM337, PWM controller IC3524 Phase lock loop (PLL): Monolithic IC LM565, operating principle, block diagram, PLL characteristics.

Recommended Books:

1. George Clayton and Steve Winder, "Operational Amplifiers," 5th Edition Newnes An Imprint of Elsevier
2. Sergio Franco, "Design With operational Amplifiers and analog integrated circuits, "MH
3. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits," 4th Edition PHI
4. R.F. Coughlin, F.F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits," Prentice Hall.
5. James M Fiore, "Operational Amplifiers and Linear Integrated Circuits," Jaico Publishing house.

Mapping of Program Outcomes with Course Outcomes

Weightage: 1=Weak or low relation, 2=Moderate or partial relation, 3=Strong or direct relation

Course Outcome	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	-	1	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-
CO3	-	-	-	-	2	-	-	-	-
CO4	2	-	-	-	-	-	-	-	2
CO5	-	3	-	-	-	-	-	-	2
CO6	2	-	-	-	-	-	-	-	-
CO7	-	-	-	-	-	1	-	-	-

Justification For The Mapping

PO1: Disciplinary Knowledge:

CO2: It focuses on the development of skills in designing circuits using operational amplifiers (OP-AMP), a fundamental aspect of electrical engineering.

CO4: Learning about Phase-Locked Loops (PLL) contributes to disciplinary knowledge in electronics and also involves trans-disciplinary knowledge, as PLL is utilized in various engineering domains.

CO6: This CO involves disciplinary knowledge in the design of filter circuits and amplifiers, contributing to personal and professional competence in the field of electronics.

PO2: Critical thinking and problem-solving:

CO1: It involves understanding basic concepts and applying them to solve engineering problems related to linear integrated circuits.

CO5: Studying various techniques for developing multivibrators requires critical thinking skills and expands knowledge as multivibrators are used in different electronic systems.

PO5: Trans-disciplinary knowledge:

CO3: Understanding various filters and rectifiers involves gaining knowledge through research and applying scientific temper in the study and analysis of these components.

PO6: Personal and professional competence:

CO7: The design of power supplies requires a combination of technical expertise, creativity, and problem-solving skills. This process develops the students' personal and professional competence by enhancing their ability to analyze, design, and implement complex systems.

PO9: self-directed and life-long learning

CO4: Understanding Phase-Locked Loops (PLL) and various techniques for developing multivibrators requires students to delve into specialized knowledge within the field of electronics. These topics often extend beyond basic curriculum requirements, encouraging students to engage in self-directed learning to fully grasp these advanced concepts.

CO5: Students develop the ability to adapt to new technologies and continue their education independently for designing of various multivibrator techniques,. This aligns with the spirit of self-directed and life-long learning, preparing students for a dynamic and ever-evolving field like electronics.

Paper IV: Semester V

ELE354: Foundation of Semiconductor Devices

Course Objectives:

1. To introduce crystal structure with reference to semiconductors
2. To study Energy band diagram.
3. To understand concept of absorption
4. To study the theory of metal-semiconductor and p-n junctions
5. To understand Concept ohmic contact
6. To understand the characteristics of semiconductor devices
7. To introduce theoretical background of BJT and FETs

Course Outcomes:

CO1: Concept of crystal.
CO2: Student will be able to draw energy band diagram
CO3: Understand the concept of absorption.
CO4: Basic concept of pn junction
CO5: Working principle of ohmic contact.
CO6: characteristics of semiconductor devices
CO7: Concept of BJT and FET.

Unit 1 : Fundamentals of Semiconductors [14]

Crystal structure: Basic Lattice Types, Basic Crystal Structures, Miller Indices, bulk semiconductor growth and epitaxial growth,
Electronic levels in semiconductors bonding forces and energy bands in semiconductors, metal semiconductors and insulators, direct and indirect semiconductors, Fermi level and temperature dependence, carrier drift in electric and magnetic field Excess carriers in semiconductors: optical absorption, photo and electro-luminescence.

Unit 2 : Junctions [12]

Equilibrium conditions: contact potential, space charge at junction. Forward and reverse bias junctions: steady state
Reverse bias breakdown: Zener and avalanche breakdown mechanism
Metal Semiconductor Junction: Schottky barriers,rectifying contacts, Ohmic Contacts.

Unit 3 : Bipolar Junction Transistors [12]

BJT structure and operation, BJT Characteristics, Minority carrier distributions and terminal currents, current transfer ratio. Coupled diode model (Ebers-Moll Model).
Switching: cutoff, saturation, switching cycle.
Effects: Drift in the Base region, Avalanche Breakdown.

Unit 4 : Field Effect Transistors (FETs) [10]

Junction FETs (JFETs) and Metal Semiconductor FETs (MESFETs): The Ohmic Region,Pinch-off and saturation, GaAs MESFET, Current-Voltage Characteristics.

Text / Reference Books:

1. Solid State Electronics Devices, Ben G. Streetman and Sanjay Kumar Banerjee, PHI,

6th Edition.
2. Semiconductor Physics and Devices Basic Principles, Donald A. Neamen, TMH, 3rd Edition.
3. Semiconductor Device Physics and Design, Umesh K. Mishra and Jasprit Singh, Springer.
4. Semiconductor Device fundamentals, Robert F. Pierret, Pearson Education.

Mapping of Program Outcomes with Course Outcomes

Weightage: 1=Weak or low relation, 2=Moderate or partial relation, 3=Strong or direct relation

Justification For The Mapping

PO1 (Disciplinary Knowledge)
CO1: Understanding the concept of crystals is foundational to the discipline, contributing to the overall knowledge base in the field.
CO2: Drawing energy band diagrams requires a deep understanding of the discipline, contributing to the overall knowledge base
CO5: Understanding the working principle of ohmic contacts is essential to the discipline.
CO7: Understanding the concepts of BJT and FET is fundamental to the discipline.
PO2: Critical Thinking and Problem solving:
CO1: Grasping the concept of crystals involves critical thinking and problem-solving skills.
CO2: Drawing energy band diagrams involves critical thinking and problem-solving skills.
CO3: Understanding the concept involves critical thinking.
CO5: Grasping the working principle involves critical thinking.
CO7: Analyzing the behavior and operation of BJT and FET involves critical thinking.
PO3: Social competence
CO1: Grasping the concept of crystals involves social competence.
CO2: The ability to communicate and share diagrams with others.
PO4: Research-related skills and Scientific temper
CO1 to CO6: All co matched with research related skill and scientific temper.

Course Outcome	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	3	3	2	1	2	1	1
CO2	2	1	1	1	3	-	1	-	-
CO3	-	3	-	2	-	1	-	-	-
CO4	-	-	-	2	-	-	2	-	-
CO5	1	1	-	3	-	-	-	-	-
CO6	-	-	-	1	2	-	-	-	-
CO7	2	1	-	-	-	-	-	-	-

PO5: Trans-disciplinary knowledge:
CO1: The understanding of crystals may have applications in various disciplines.
CO2; Drawing energy band diagrams involves trans disciplinary knowledge.

CO6: Understanding characteristics enhances trans disciplinary knowledge.
PO6: Personal and professional competence
CO1: Grasping the concept of crystals involves personal and professional competence.
CO3: The understanding of absorption is often related to personal and professional competence.
PO7: Effective Citizenship and Ethics
CO1:The understanding of crystals may have effective citizenship.
CO2: This skill is often used in effective citizenship.
CO4: Grasping the basic concept involves effective citizenship and ethics.
PO8: Environment and Sustainability:
CO1: Understanding the concept of crystals contributes to the foundational sustainability.
PO9: Self-directed and Life-long learning:
CO1: Grasping the concept of crystals involves self directed and life long learning,

Paper V: SemesterV
ELE355: Programming in C

Course Objectives:

1. To understand fundamentals of C language.
2. To develop algorithm/flowcharts for problem solving.
3. To develop basic C programs.
4. To learn to user defined function, arrays and pointers.
5. To understand string and file handling operations.
6 To develop C programs using string, arrays, pointers and file.
7. To get the knowledge of basics of graphics and programs.

Course Outcomes:

By the end of the course, students will be able to:
CO1. Understand the concepts of character set , I/O functions , loops and derived data types
CO2. Develop basic C programs.
CO3. Know functions, arrays and pointers.
CO4. Develop the programs using function, arrays.
CO5. Understand the concept of strings and file in C.
CO6. Develop and analyze the programs based on strings and file.
CO7. Know basics of C graphics.

Unit 1: C- Fundamentals [16 L]
Introduction, structure of C, character set, constants and variables, Key words, Symbolic constant, statements, entering and executing C program, input and output functions, operators and expressions, control structures and loops, programming examples.
Unit 2: Arrays, Pointers and Functions [14 L]
Defining and processing of an array, passing array to a function, Pointer's declarations, passing pointers to a function, programming examples.
Defining a user defining function, accessing a function, function prototype, recursion and programs.
Unit 3: String and File handling [10 L]
Declaring and initializing string, Operations on string, string length, string size, string copy, string concatenation, string compare, programming examples.
Defining file in C, Operations on file, Opening and closing of data file, read and write data file, input and output functions on files - getc and putc ,fscanf and fprintf , processing data file and append data file, programming examples.
Unit 4: Introduction to C- Graphics [08 L]
Concept of graphics, Graphics initialization, graphics commands, getpixel, putpixel, line, Polyline, lineto, circle, arc, ellipse, rectangle, polygon, bar, getmax x, getmax y, setcolor, fillpattern etc. And programming examples.

Recommended Books:

1. J. Jayasri The C Language Trainer with C Graphics and C++ WILEY.
2. Byron. S. Gottfried Schaum's Outline of Programming with C TMH.
3. E Balaguruswamy Programming in ANSI C The McGraw Hill publications.
4. Stephens Cochan Programming in C Prentice hall of India Ltd.

5. V. Rajaraman Computer Programming in C Prentice hall of India Ltd.
6. Madhusudan Mothe C for Beginners.

Mapping of Program Outcomes with Course Outcomes

Weightage: 1=Weak or low relation, 2=Moderate or partial relation, 3=Strong or direct relation

Course Outcome	Program Outcome								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	2	2	-	1	-	-	3
CO2	3	3	3	3	-	1	-	-	3
CO3	3	3	2	2	-	3	-	-	3
CO4	3	3	3	3	-	3	-	-	3
CO5	3	3	2	2	-	3	-	-	3
CO6	3	3	3	3	-	3	-	-	3
CO7	3	3	2	2	-	1	-	-	3
CO8	3	3	3	3	-	3	-	-	3

Justification For The Mapping

PO1: Disciplinary Knowledge
CO1: Providing a foundational understanding essential for effective programming and problem-solving across various domains.
CO2: Developing a fundamental programming skill set essential for proficiency in diverse application domains.
CO3: Empowering individuals with essential programming skills crucial for effective problem-solving and code development across diverse applications.
CO4: Fostering practical programming skills essential for proficient problem-solving and code development across diverse applications.

CO5: Equipping individuals with fundamental skills necessary for effective programming, data manipulation, and file handling across various application domains.
CO6: Developing and analyzing programs based on strings and files enhancing practical programming proficiency and data manipulation skills essential for effective problem-solving and application development.
CO7: Acquiring the basics of C graphics, providing essential skills for understanding and implementing graphical elements in programming, contributing to a well-rounded proficiency in software development.
CO8: Promoting practical skills in graphical programming and contributing to a comprehensive understanding of software development principles.

PO2: Critical Thinking and Problem solving
CO1: Fostering analytical skills essential for effective programming and algorithmic development
CO2: Developing analytical reasoning to design efficient algorithms and solve programming challenges, contributing to the development of essential problem-solving skills.
CO3: It enables the application of diverse data structures and algorithms, fostering analytical skills essential for effective programming solutions.
CO4: Cultivating analytical reasoning for designing efficient algorithms and solving real-world programming challenges.

CO5: Fostering analytical skills essential for effective data manipulation and file handling in programming challenges
CO6: Enhancing analytical reasoning for effective data manipulation and file handling in software development.
CO7: It enables creative decision-making for visual representation and problem-solving skills in designing graphical elements within programming.
CO8: Developing analytical reasoning and creative solutions to design visually appealing and functional graphical applications
PO3: Social competence
CO1: It facilitating effective communication and collaborative problem-solving within programming contexts
CO2: Encouraging collaborative learning, effective communication, and shared problem-solving
experiences within programming contexts, fostering a supportive and inclusive learning environment.
CO3: Fostering collaborative problem-solving, effective communication, and shared understanding within programming contexts.
CO4: Encouraging collaborative coding, effective communication, and shared problem-solving experiences within programming contexts, fostering teamwork and a supportive learning environment.
CO5: Promoting collaborative coding practices, effective communication, and shared problem-solving experiences within programming contexts, contributing to a supportive learning environment.

CO6: It encouraging collaborative coding, effective communication, and shared problem-solving
experiences within programming contexts.
CO7: Fostering collaborative and creative problem-solving skills, promoting effective communication through visual representation in programming contexts.
CO8: Encouraging collaborative coding, effective communication, and shared creativity within programming.
PO4: Research-related skills and Scientific temper
CO1: Providing foundational knowledge essential for systematic exploration and inquiry within programming.
CO2: Raising systematic problem-solving, experimentation, and logical reasoning within programming, promoting a scientific approach to software development.
CO3: Providing essential tools for systematic inquiry, experimentation, and structured problem-solving within programming.
CO4: Developing systematic experimentation, structured problem-solving, and logical reasoning
within programming, encouraging a scientific approach to software development.
CO5:Providing a foundational understanding crucial for systematic exploration, experimentation,
and logical analysis within programming.
CO6:Enhancing systematic inquiry, structured problem-solving, and analytical reasoning within programming.
CO7: Fostering creativity, experimentation, and structured problem-solving in visual representation within programming.
CO8: Promoting experimentation, exploration, and creative problem-solving within programming contexts, fostering a mindset of inquiry and exploration.

PO6: Personal and professional competence
CO1: Providing foundational knowledge essential for efficient programming, algorithmic design,
and effective problem-solving
CO2: Cultivating foundational programming skills essential for effective problem-solving and proficiency in software development.
CO3: Enhances personal and professional competence, providing essential programming skills crucial for effective problem-solving and proficient software development.
CO4: Fostering advanced problem-solving skills and proficiency in software development through practical application of programming principles.
CO5: Providing essential skills for efficient data manipulation and file handling in software development.
CO6: Honing advanced programming skills, fostering effective problem-solving, and ensuring proficiency in software development.
CO7: Enhancing creative expression, visual communication skills, and proficiency in software development.
CO8: Cultivates advanced programming skills, fosters creative expression, and ensures proficiency in leveraging graphical elements for effective software development.

PO9: Self-directed and Life-long learning
CO1: Providing a solid foundation for continuous exploration, adaptation, and staying abreast of evolving programming concepts and techniques
CO2: Instilling a foundation for continuous exploration, experimentation, and adaptation to evolving programming challenges, fostering a proactive and adaptive approach to lifelong skill development.
CO3: Establishing a solid foundation for ongoing exploration and adaptation to evolving programming paradigms and advanced concepts.
CO4: Fostering continuous exploration, adaptation, and skill development in programming through hands-on application of advanced concepts.
CO5: Establishing a foundational knowledge base, enabling continuous exploration and adaptation to evolving programming practices and technologies.
CO6: Encouraging continuous exploration, critical analysis, and adaptation to evolving programming challenges throughout one's career..
CO7: Laying the foundation for continuous exploration, experimentation, and adaptation to evolving graphical programming techniques and advancements in the dynamic field of computer
graphics.
CO8: Encouraging continuous exploration, experimentation, and adaptation to evolving technologies in the dynamic field of graphics programming.

Paper VI : Semester V

ELE356: Fibre Optic Communication and Techniques

Course Objectives:

1. To learn optical characteristics.
2. To understand the principles of fiber optic communication system.
3. To learn different parameter of optical fibers.
4. To understand essential optical components of Fiber Optic Communication.
5. To study measuring equipments.
6. To get knowledge about optical sources and their working principles.
7. To calculate different optical parameters.

Course Outcomes:

CO1: Understand concepts of fiber optics, its types, different optical sources and detectors.

CO2:. Know the concepts of attenuation and losses in fiber used in optical communication.

CO3: Demonstrate an understanding of optical fiber communication link, structure, propagation and transmission properties of an optical fiber.

CO4:. Describe the principles of optical sources and power launching-coupling methods.

CO5:. To learn the various optical sources, materials and fiber splicing.

CO6: Learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.

CO7: Knowledge about optical fiber transmitter and receiver system.

Unit 1: Fibre Optic Communication [12]

The evolution of fibre optic systems, Block diagram of optical fibre communication , Repeaters, optical fibre amplifiers, advantages and applications of optical fibre communication, Ray theory transmission, total internal reflection, acceptance angle, numerical aperture and skew rays. Single mode and multimode fibers, linearly polarized modes. Types and specification of single mode, multimode, step index, graded index.

Unit 2: Optical Sources and Detectors [12]

Coherent and non-coherent sources, quantum efficiency, modulation capability of optical sources. LEDs: Working principle, structure and characteristics, Laser diodes: Working principle, structure and characteristics, PIN and APD: Working principle and characteristics of detectors, noise analysis in detectors. Comparison of photo diodes

Unit 3: Fiber Optic Losses [12]

Fiber splices, fibre connectors and fibre couplers. Dispersion, Intra model dispersion, Inter model dispersion. Attenuation in optical fibers, material or impurity losses, scattering losses, absorption losses, bending losses. Fiber optic link structure and link losses, connector and splicing losses.

Unit 4: Fiber Optic communication Techniques [12]

OPTICAL NETWORKS: Introduction, SONET. OTDR Working Principle and characteristics, Optical Multiplexing techniques (OFDM, OTDM, WDM)

Recommended Books:

1. G. Kaiser Optical fiber communication McGraw Hill
2. Subirkumar Sarkar Optical fibers and fiber optic communication systems S.Chand and Company
3. R. P. Khare Fiber optics and optoelectronics oxford University Press
4. John M. Senior Optical fiber communications Principles and Practice, (2nd edition) PHI
5. Ajoy Ghatak and K. Thyagarajan Introduction to fiber optics Cambridge University Press
6. D. C. Agarwal Fiber optic communication wheeler Publication

Mapping of Program Outcomes with Course Outcomes

Weightage: 1=Weak or low relation, 2=Moderate or partial relation, 3=Strong or direct relation

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	-	-	-	1	1	-	-	1
CO2	1	1	-	1	-	-	-	-	1
CO3	2	2	-	1	1	1	-	-	-
CO4	3	3	-	1	1	-	-	-	-
CO5	1	1	-	2	1	-	1	1	-
CO6	2	2	-	-	1	-	-	-	-
CO7	2	2	2	-	-	-	-	-	2

Justification For The Mapping:

PO1: Disciplinary Knowledge

CO1: Understanding concepts of fiber optics, its types, different optical sources, and detectors aligns directly with the objective of comprehensive knowledge in the graduate program.

CO2: Knowing the concepts of attenuation and losses in fiber used in optical communication directly contributes to a strong theoretical understanding in the area of work.

CO3: Demonstrating an understanding of optical fiber communication link, structure, propagation, and transmission properties of an optical fiber is crucial for executing practical knowledge in the graduate program.

CO4: Describing the principles of optical sources and power launching-coupling methods directly supports a comprehensive knowledge base in the discipline.

CO5: Learning various optical sources, materials, and fiber splicing moderately contributes to theoretical and practical understanding in the field.

CO6: Learning the basic elements of an optical fiber transmission link, fiber modes configurations, and structures moderately supports theoretical and practical knowledge in the discipline.

CO7: Knowledge about optical fiber transmitter and receiver system aligns directly with the goal of comprehensive knowledge in the graduate program.

PO2: Critical Thinking and Problem solving

CO2: Knowing the concepts of attenuation and losses in fiber used in optical communication contributes directly to critical thinking and problem-solving skills, involving the analysis of signal degradation in optical communication.

CO3: Demonstrating an understanding of optical fiber communication link, structure, propagation, and transmission properties of an optical fiber requires critical thinking and problem-solving to design and optimize communication links.

CO4: Describing the principles of optical sources and power launching-coupling methods involves critical thinking in designing efficient optical communication systems.

CO5: Learning various optical sources, materials, and fiber splicing moderately contributes to problem-solving skills, as it involves practical considerations in optical communication.

CO6: Learning the basic elements of an optical fiber transmission link, fiber modes configurations, and structures moderately supports critical thinking and problem-solving skills, as it involves designing and configuring optical transmission links.

CO7: Knowledge about optical fiber transmitter and receiver systems aligns with critical thinking and problem-solving, involving the design and optimization of these systems.

PO3: Social competence

CO7: Knowledge about optical fiber transmitter and receiver systems is not directly related to social competence or effective communication in groups.

PO4: Research-related skills and Scientific temper

CO2: Knowing the concepts of attenuation and losses in fiber used in optical communication is strongly related to research-related skills and scientific temper, as it provides essential knowledge for experimental analysis and research.

CO3: Demonstrating an understanding of optical fiber communication link, structure, propagation, and transmission properties is strongly related to research-related skills and scientific temper, as it involves knowledge applicable to experimental design and research.

CO4: Describing the principles of optical sources and power launching-coupling methods is strongly related to research-related skills and scientific temper, as it involves knowledge applicable to experimental design and research.

CO5: Learning various optical sources, materials, and fiber splicing moderately contributes to research-related skills, as it involves practical knowledge applicable to experimentation.

PO5: Trans-disciplinary knowledge

CO1: Understanding concepts of fiber optics, its types, different optical sources, and detectors contributes to trans-disciplinary knowledge by integrating knowledge from optics, materials science, and electronics.

CO3: Demonstrating an understanding of optical fiber communication link, structure, propagation, and transmission properties is strongly related to trans-disciplinary knowledge, as it integrates knowledge from optics, communication engineering, and material science.

CO4: Describing the principles of optical sources and power launching-coupling methods contributes to trans-disciplinary knowledge by integrating optics and electronics principles.

CO5: Learning various optical sources, materials, and fiber splicing is strongly related to trans-disciplinary knowledge, involving aspects of material science and communication engineering.

CO6: Learning the basic elements of an optical fiber transmission link, fiber modes configurations, and structures contributes to trans-disciplinary knowledge, integrating principles from optics, communication engineering, and material science.

PO6: Personal and professional competence

CO1: Understanding concepts of fiber optics, its types, different optical sources, and detectors moderately contributes to personal and professional competence by providing foundational knowledge applicable to interdisciplinary work.

CO3: Demonstrating an understanding of optical fiber communication link, structure, propagation, and transmission properties moderately supports personal and professional competence, as it provides knowledge applicable to collaborative work.

PO7: Effective Citizenship and Ethics

CO5: Learning various optical sources, materials, and fiber splicing is strongly related to effective citizenship and ethics, as it involves knowledge applicable to the development of communication technologies with societal considerations.

PO8: Environment and Sustainability

CO5: Learning various optical sources, materials, and fiber splicing is strongly related to environment and sustainability, as it involves knowledge applicable to the development of sustainable optical communication technologies.

PO9: **Self-directed and Life-long learning**

CO1: Understanding concepts of fiber optics is strongly related to self-directed and life-long learning, as it involves foundational knowledge applicable to ongoing learning in the field of optical communication.

CO2: Knowing the concepts of attenuation and losses in fiber used in optical communication is strongly related to self-directed and life-long learning, as it involves knowledge that is crucial for staying updated in the evolving field.

CO7: Knowledge about optical fiber transmitter and receiver systems is strongly related to self-directed and life-long learning, as it involves knowledge necessary for staying updated in the field.

T.Y. B.Sc. (Electronic Science)

Paper VII ELE 357: Practical Course- I

General Electronics

There are 10 Experiments in Paper VII ELE3507 : Practical Course- I

One activity as directed in practical course which will be equivalent to 2 experiments

Internal Practical Examination (Out of 40)

· 32 Marks to Experiments, 08 Marks to Activity

Semester Practical Examination (Out of 60)

· One experiment - 3 hours duration (60 Marks)

· 44 Marks to Experiment, 16 marks to activity

Course Objectives:

1. To refer the various datasheets of the electronic devices and integrated circuits
2. To learn how to select the devices, sensors, actuators and ICs for a particular application
3. To develop the basic skills required to handle the various instruments
4. To learn the designing aspects of circuits/ systems
5. To learn basic of semiconductor.
6. To understand concept of OFC
7. To design transmitter and Receiver for OFC.

Course Outcomes:

After completing the course, the students will be able to

CO1:- Design of integrated circuit

CO2: Concept of sensor

CO3:handleling different Sensor.

CO4: Basic of design circuit

CO5:Basic of semiconductor.

CO6: Working of OFC

CO7:Design of OFC circuit.

Total 8 Experiments

Group 1: Total 4 Experiments

Analog Circuit Design and Applications of Linear ICs

1. Wave shaping circuits (Integrator / differentiator circuit)
2. Op-amp based clipper and clampers
3. Log amplifier using opamp
4. Regulated power supply using IC 723 (Low and High Voltage,1A Current)
5. Function generator using 8038/2206 or any equivalent IC
6. Astable and monostable multivibrator using IC555.

Group 2: Total 2 Experiments

Principles of Semiconductor Devices

1. Measurement of Efficiency and fill factor of solar cell.
2. Energy band gap measurement
3. Reverse recovery time measurement of diodes (any two).
4. Transfer characteristic of phototransistor/ Photodiode

Group 3: Total 2 Experiments

Fiber Optics and fiber optic Communication

1. Design of fiber optic Transmitter
2. Design of fiber optic Receiver
3. Study of propagation loss in optical fibers

Mapping of Program Outcomes with Course Outcomes

Weightage: 1=Weak or low relation, 2=Moderate or partial relation, 3=Strong or direct relation

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	3	1	2	1	2	3	1
CO2	2	1	2	1	3	-	3	-	-
CO3	-	3	-	2	-	3	-	-	-
CO4	-	-	-	2	2	-	2	1	1
CO5	2	1	2	3	-	-	-	-	-
CO6	-	-	-	1	2	-	-	-	-
CO7	2	1	-	-	-	-	-	-	-

PO1:Disciplinary Knowledge

CO1: Designing integrated circuits requires a deep understanding of the discipline.

CO2: Understanding the concept of sensors is fundamental to the discipline.

CO5: Understanding the basics of semiconductors is fundamental to the discipline.

CO7: Designing OFC circuits requires a deep understanding of the discipline.

PO2: Critical Thinking and Problem solving

CO1: The design process involves critical thinking and problem-solving skills.

CO2: Grasping the concept involves critical thinking.

CO3: experience in handling sensors is essential for problem solving.

CO5: Grasping the basics involves critical thinking.

CO7: The design process involves critical thinking and problem-solving skills.

PO3: Social competence

CO1: The design process involves social competence.

CO2: Grasping the concept involves social competence.

CO5: Understanding the basics of semiconductors is social competence.

PO4: Research-related skills and Scientific temper

CO1 to CO6: All co matched with research related skill and scientific temper.

PO5: Trans-disciplinary knowledge:

CO1: The ability to design integrated circuits enhances trans-disciplinary knowledge.

CO2: Sensor concepts may have applications in various disciplines

CO4: The ability to design circuits enhances trans-disciplinary knowledge.

CO6: Understanding the working of OFC enhances.

PO6: Personal and professional competence

CO1: The ability to design integrated circuits enhances professional competence.

CO3: Handling sensors enhances professional competence.

PO7: Effective Citizenship and Ethics

CO1: Designing circuits involves Effective Citizenship and Ethics

CO2: Sensor technology evolves, and students must be prepared for Effective Citizenship and Ethics.

CO4: Circuit design involves Effective Citizenship and Ethics

PO8:Environment and Sustainability

CO1: Designing integrated circuits requires a deep understanding of the sustainability

CO4: The design process involves sustainability

PO9: Self-directed and Life-long learning:

CO1: Designing integrated circuits used for life long learning

CO4: The design process involves life long learning.

T.Y. B.Sc. (Electronic Science)

Paper VII : Semester V
ELE 358: Practical Course- II

Programming : Verilog and C language

There are 10 Experiments in Paper VII ELE358 : Practical Course- II

One activity as directed in practical course which will be equivalent to 2 experiments

Internal Practical Examination (Out of 40)

· 32 Marks to Experiments, 08 Marks to Activity

Semester Practical Examination (Out of 60)

· One experiment - 3 hours duration (60 Marks)

· 44 Marks to Experiment, 16 marks to activity

Course Objectives:

1. To learn the basic C-Programming.
2. To learn Verilog HDL to design basic combinational and sequential circuits
3. To get familiar with structural, data flow and behavioral modeling
4. To learn assembly level language of 8051 microcontroller
5. To Understand assembly language for programming
6. To develop AVR microcontroller based systems.

Course Outcomes:

After completing the course, the students will be able to

CO1: Develop and simulate design digital systems using Verilog.
CO2: Design and develop AVR microcontroller based systems.
CO3: Understand c language programming.
CO4: Increase problem-solving skills, creativity, algorithmic etc.
CO5: sequential and computational thinking skills.
CO6: Understand assembly language for programming
CO7: inculcate basic skills required for design and development of embedded Systems.

Total 8 Experiments

Group A: Total 4 Experiments

Digital System Design using Verilog HDL

1. Design logic gates using gate level/data flow/Structural/Behavioral style of modeling
2. Design 4 to 1 line MUX/ 1 to 4 DEMUX
   Use a) gate level b) data flow c) Structural d) Behavioral style of modeling
3. Arithmetic circuits: Half adder, Full adder (using gate level , Data flow modeling) and Parallel adder using structural modeling
4. Four bit ALU design.
5. Design of flip-flops : R-S, J-K, D and T using behavioral modeling
6. Code converters
7. Binary Adder
8. Counters. (Up counter/down counter, ring counter)
9. Shift Registers (SIPO/SISO/PISO/PIPO)
10. Sequence generator for stepper motor

Group B: Total 4 Experiments

C' Programming

Program to compute the following:

1. Series and Parallel equivalent resistance of n resistors.
2. Reactance of Inductor and Capacitor in Ω at given frequency.
3. To determine i) impedance of the series LR circuit.
   ii) Resonant frequency of series L(mH), C(μF)
4. Solve the given quadratic equation.
5. Find minimum and maximum of N numbers.
6. Calculate factorial of a given number.
7. Generate and print prime numbers up to an integer N
8. Sort given N numbers in ascending order.

Group C: ACTIVITY

Any one of the following activities will be considered as equivalent to 2 experiments

1. PCB Making using simulator
2. Internet browsing
3. Industrial /field Visit
4. Hands on training workshop
5. Do it Yourself Open ended Project

Mapping of Program Outcomes with Course Outcomes

Weightage: 1=Weak or low relation, 2=Moderate or partial relation, 3=Strong or direct relation

Course Outcome	Program Outcome								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	-	1	1	2	-	-	3
CO2	3	3	-	1	1	2	-	-	3
CO3	3	3	2	3	2	2	-	-	3
CO4	3	3	2	3	1	2	-	-	3
CO5	3	3	2	3	1	2	-	-	3
CO6	3	3	2	3	1	2	-	-	3
CO7	3	3	2	3	2	2	-	-	3

Justification For The Mapping

PO1: Disciplinary Knowledge

CO1,CO6,CO7: Providing essential foundations for effective programming within the C language.
CO2,CO4,CO5: Fostering basic skills for embedded systems align with disciplinary knowledge, laying the foundation for effective understanding and application within the field of embedded systems.
CO3: Providing essential skills for effective design and implementation within the field of digital systems

PO2: Critical Thinking and Problem solving

CO1,CO6,CO7: Fostering analytical reasoning and practical application in programming challenges.
CO2,CO4,CO5: Enhancing analytical reasoning and practical application in the field of embedded systems.
CO3:Developing analytical reasoning and practical application, enabling effective design and implementation within the realm of digital systems.

PO3: Social competence

CO3: Encouraging collaborative problem-solving and effective communication in the context of designing and implementing digital systems.
CO4,CO5: Encouraging collaboration, effective communication, and shared problem-solving experiences within the realm of embedded systems development.
CO6,CO7: Fostering collaborative learning, effective communication, and shared problem-solving experiences within the programming community.

PO4: Research-related skills and Scientific temper

CO1: Proficiency in C language software enhances research-related skills by providing a versatile programming tool for developing and analyzing algorithms in scientific investigations.
CO2: Mastery of microcontroller programming tools cultivates a scientific temper by enabling the exploration and development of advanced embedded systems, crucial for research and technological innovation.
CO3: Verilog skills contribute to research-related proficiency by empowering the design and simulation of digital systems, fostering a scientific approach in exploring complex hardware implementations.
CO4: Designing 8051 microcontroller-based systems develops a scientific temper through hands-on experience, allowing for practical application of theoretical knowledge in research-oriented embedded system projects.
CO5: Acquiring basic skills in embedded systems design promotes a research-oriented mindset, laying the foundation for exploring innovative solutions in scientific and technological domains.
CO6: Gaining basic programming skills in C language fosters research-related capabilities by providing a fundamental tool for implementing algorithms and conducting computational analyses in scientific research.
CO7: Developing and simulating C programs using Turbo C++ enhances research-related skills, as it equips individuals with the ability to efficiently implement and analyze algorithms in a research context.

PO5: Trans-disciplinary knowledge

CO1: Proficiency in C language software contributes to trans-disciplinary knowledge, offering a versatile programming tool applicable across various domains and facilitating interdisciplinary collaboration.

CO2:Understanding microcontroller programming software promotes trans-disciplinary knowledge by providing a foundation for diverse applications, from embedded systems in healthcare to automation in industrial sectors.
CO3: Verilog skills for digital system design and simulation transcend disciplinary boundaries, enabling the application of digital systems in fields such as communication, signal processing, and control systems.
CO4: Designing 8051 microcontroller-based systems imparts trans-disciplinary knowledge by offering a platform applicable in various domains, from consumer electronics to automotive and medical devices.
CO5: Basic skills in embedded systems design foster trans-disciplinary knowledge, as they are essential for creating innovative solutions that bridge the gap between hardware and software in diverse application domains.
CO6: Basic programming skills in C language contribute to trans-disciplinary knowledge, as C is widely used in fields ranging from data science to game development, facilitating communication and collaboration across disciplines.
CO7: Developing and simulating C programs using Turbo C++ enhances trans-disciplinary knowledge, providing a foundational skill applicable in diverse fields and facilitating collaboration through the use of a widely recognized programming environment.

PO6: Personal and professional competence
CO1: Proficiency in C language software contributes to personal and professional competence by equipping individuals with a fundamental programming skill widely used in the industry, enhancing their employability and adaptability.
CO2: Knowledge of microcontroller programming software enhances personal and professional competence, providing individuals with the skills needed to work on a variety of embedded systems projects, from IoT devices to robotics.
CO3: Developing and simulating digital systems using Verilog enhances personal and professional competence by imparting advanced skills crucial for working on complex projects in digital design and hardware development.
CO4: Designing and developing 8051 microcontroller-based systems contributes to personal and professional competence by providing hands-on experience in embedded systems, reinforcing practical skills essential for engineering professionals.
CO5: Inculcating basic skills in embedded systems design nurtures personal and professional competence, preparing individuals to contribute effectively to the development of innovative solutions in diverse industries.
CO6: Acquiring basic programming skills in C language is foundational for personal and professional competence, enabling individuals to comprehend and contribute to a wide range of software projects across various domains.
CO7: Developing and simulating C programs using Turbo C++ enhances personal and professional competence by providing skills that are applicable in legacy systems and fostering adaptability in diverse programming environments.

PO9: Self-directed and Life-long learning
CO1: Knowing the C language software fosters self-directed and life-long learning by providing a foundational programming skill that encourages continuous exploration and adaptation to evolving software development practices.
CO2: Knowledge of microcontroller programming software promotes self-directed and life-long learning, as it empowers individuals to stay current with advancements in embedded systems and microcontroller technologies through ongoing self-education.

CO3: Developing and simulating digital systems using Verilog encourages self-directed and life-long learning by exposing individuals to the complexities of hardware design, motivating ongoing exploration and improvement of digital system design skills.
CO4: Designing and developing 8051 microcontroller-based systems instills a self-directed and life-long learning mindset by requiring continuous skill enhancement to adapt to emerging challenges in the field of embedded systems and microcontroller applications.
CO5: Inculcating basic skills in embedded systems design supports self-directed and life-long learning by laying the groundwork for individuals to independently explore and advance their knowledge in this dynamic and evolving field.
CO6: Acquiring basic programming skills in C language promotes self-directed and life-long learning by providing a solid foundation for individuals to continuously enhance their programming abilities and adapt to new programming languages and paradigms.
CO7: Developing and simulating C programs using Turbo C++ encourages self-directed and life-long learning by exposing individuals to different programming environments, fostering adaptability and a proactive approach to staying current with diverse programming tools.

T.Y. B.Sc. (Electronic Science)
Paper IX : Semester V

ELE 359: Project

Course Objectives:

Application of the knowledge/concepts acquired in the lower semesters to create/design/implement project relevant to the field of Electronics.

Course Outcomes:

CO1: Create/Design the project.
CO2: Implement/Simulate/Test and deploy the project application.
CO3: Present and defend the project relevance/creation/design/implementation/simulation
CO4: Prepare project report in a standard format

Guideline to conduct Practical Course III

Practical Course III is a project work of 100 Marks.

- Internal project Examination (Out of 40)
- Semester project Examination (Out of 60)

The project work should be followed with following guidelines.

a) In CBCS Pattern, Student has to perform project in Semester V as well as Semester VI.

b) There should be internal continuous assessment of Project work in the form of Seminars/presentation and continuous monitoring of work.

c) After completion of project, student has to submit the Project Report in the following format.

i. Title of Project

ii. Aim and objectives of project.

iii. Literature or Reference work

iv. Block diagram and its explanation in brief and/or algorithm of software required if any

v. Design and development of Circuit/system and Simulation required if any

vi. Circuit Diagram and its working and Program explanation if any

vii. Experimental Work and PCB Design/fabrication required if any

viii. Results and Discussion
ix. Applications
x. Future Scope
xi. References

d. Further extension work may be suggested for better outcome of the project.
e. It is recommended to present the projects in competitions / project exhibitions organized by various authorities

Mapping of Program Outcomes with Course Outcomes

Weightage: 1=Weak or low relation, 2=Moderate or partial relation, 3=Strong or direct relation

Course Outcome	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	-	-	-	3	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-
CO4	-	-	-	1	-	3	-	-	-
CO5	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-
CO7	-	-	-	-	-	-	-	-	-

Justification For The Mapping

PO2: Critical Thinking and Problem Solving

CO3: "Present and defend the project relevance/creation/design/implementation/simulation." This involves critical thinking and problem-solving skills during the presentation and defense.

PO4: Research Related Skills and Scientific Temper

CO1: "Create/Design the project" and CO4: "Prepare project report in a standard format." Both involve applying research-related skills and adopting a scientific temper.

PO6 :Personal and professional competence

CO4: As preparing a project report in a standard format requires both personal and professional competence.