

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

SYSTEM DESIGN AND MODELING								
IV Semester: ECE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AECD18	Core	L	Т	Р	С	CIA	SEE	Total
		1	0	2	2	-	-	-
Contact Classes: 16	Tutorial Classes: Nil	Practical Classes: 16				Total Classes: 32		
Prerequisite: Digital System Design								

I. COURSE OVERVIEW:

This course provides a comprehensive understanding of digital system design concepts, emphasizing both theoretical foundations and practical applications to equip students with the skills necessary to design, simulate, and implement digital systems. By progressing through structured modules, students will gain expertise in key areas such as combinational and sequential circuit design, HDL-based modelling, and real-world hardware solutions using tools like Verilog, VHDL, and FPGA platforms.

II. COURSES OBJECTIVES:

The students will try to learn

- I. The fundamentals of hardware description languages such as Verilog and VHDL.
- II. The concepts of combinational and sequential circuits in digital design.
- III. The syntax and semantics of HDL for modeling digital circuits.

III. COURSE OUTCOMES:

At the end of the course students should be able to:

- CO 1 Understand the fundamental concepts and importance of hardware description languages (HDLs) in digital system design.
- CO 2 Demonstrate proficiency in the syntax and semantics of Verilog/VHDL for designing digital circuits.
- CO 3 Design and optimize combinational circuits such as adders, subtractors, multiplexers, and decoders using Boolean expressions and truth tables.
- CO 4 Design sequential circuits, including flip-flops, counters, and registers, for use in complex digital systems.
- CO 5 Verify and debug the functionality of practical digital systems through simulation and testing on hardware platforms like FPGAs or simulators.
- CO 6 Analyze the trade-offs in terms of area, power, and performance for the implemented designs to meet real-world constraints.

IV.COURSE CONTENT:

MODULE-I: Hardware Description Languages (HDL)

Overview of Verilog/VHDL, Syntax and semantics of HDL, Modeling techniques: Behavioral modeling, Dataflow modeling, Structural modeling.

MODULE - II: Synthesize and verify

Overview of combinational and sequential circuits. Number systems and Boolean algebra. Importance of hardware implementation in digital design.

MODULE-III: Digital Circuit Design

Design of basic combinational circuits: Multiplexers, Decoders, Encoders. Adders (Half, Full, Ripple Carry, etc.) subtractors, Comparators.

MODULE – IV: Design of sequential circuits

Flip-flops and Latches. Registers and Counters. Finite State Machines (FSMs).

MODULE -V: Practical Assignments and Case Studies

Implement a BCD (Binary Coded Decimal) to Seven-Segment Display using code converters. Implement a simple traffic light controller using FSM. Design and implement a 4-bit ALU.

V. TEXT BOOKS:

- 1 M. Morris Mano and Michael D. "Digital Design", Ciletti Publisher: Pearson 5th Edition, 2019.
- 2 Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education, 2nd Edition, 2021.

VI. REFERENCE BOOKS:

- 1. Charles H. Roth Jr. and Lizy Kurian, "Digital Systems Design Using VHDL", John Publisher: Cengage Learning Edition: 3rd Edition, 2021.
- 2. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education, 2nd Edition, 2022.

VII. ELECTRONICS RESOURCES:

1. NPTEL: Digital system design