DIGITAL SYSTEM DESIGN

(Elective Subject)

Course Code:	12B1WEC732	**Semester:**	7th Semester, B. Tech (ECE)
Credits:	3	**Contact Hours:**	L-3, T-0, P-0

Course Objectives

The objectives are to study

1. To design digital circuits based on the required application
2. It offers a profound understanding of the design of complex digital circuits and their implementation for real time applications.

Course Outcomes

After studying this course the students would gain enough knowledge

1. To use state machine diagrams to design finite state machines using various types of flip-flops and combinational circuits with prescribed functionality.
2. Design state machines to control complex systems.
3. Define and describe digital design flows for system design and recognize the trade-offs.
4. Understand and design System controllers.
5. The ability to identify and prevent various races and hazards and timing problems in a digital design.
6. Write synthesizable VHDL program.

Course Contents

Unit	**Topics**	**References (chapter number, page no. etc)**	**Lectures**
1.	Introduction to Digital Design Concepts, Review of digital design fundamentals, minimization and design of combinational circuits, sequential machine fundamentals: the need, concept of memory, Flip flops, sequential machine operations, classifications.	Text Book 1: Chapter 1-5	4
2.	Design of Synchronous Sequential Circuits-Sequential circuits, Finite state model – Basic definition, capabilities and limitation of finite state machines, state equivalence & machine minimization, simplification of incompletely specified machines, Extraction of maximal compatibles, synthesis & analysis of synchronous sequential circuits. Introduction to Multi-Input System controller design: system controllers, frequency and time consideration, MDS diagram generation, CPLD and FPGA	Text Book 1: Chapter 6	12

	level custom design.		
3	Design of Asynchronous Sequential Circuits - Introduction to asynchronous circuits, timing diagram, state diagram & flow tables, types of asynchronous circuits, fundamental mode circuits, pulse mode circuits, state assignment in asynchronous sequential circuits, Synthesis and analysis, ASM charts: Representation of sequential circuits using ASM charts, synthesis of output and next state functions, Data path control path partition-based design	Text Book 1: Chapter8	12
4	Hazards and Races - Introduction, gate delays, generation of spikes, production of static hazards in combinational networks, elimination of static hazards, design of hazard free combinational networks, hazard free asynchronous circuit design, dynamic hazards, essential hazards, Races and Cycles.	Text Book 3: Chapter 10	8
5	VHDL/ Verilog HDL - Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Functional Verification, System Tasks, Programming Language Interface (PLI), Module, Simulation and Synthesis Tools, Test Benches. Language constructs and conventions: Introduction, Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Memory, Operators, System Tasks, Exercises.	Text Book 4: Chapter 1-3	6
		Total Number of Lectures	42

Evaluation Scheme

1. Test 1 :15 marks
2. Test 2 : 25 marks
3. Test 3 : 35 marks
4. **Internal Assessment** : 25 marks
    - 10 Marks : Class performance, Tutorials & Assignments
    - 10 Marks : Quizzes
    - 5 marks : Attendance

Text Books

1. John M Yarbrough : Digital Logic Applications and Design, 2nd Edition, Thomson Educaion

2. W. I. Fletcher :An Engineering approach to Digital Design , PHI
3. M.Morris Mano : Digital Design, 3rd edition, Pearson Education, 2007.
4. Michael D. Ciletti: Advanced Digital Design with Verilog HDL, PHI, 2005.

Reference Books

1. Digital Systems Design using VHDL – Charles H Roth, CENGAGE Learning.
2. Switching and Finite Automata Theory by ZVI Kohavi, TMH