INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

DIGITAL LOGIC DESIGN								
III Semester: ECE / EEE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AECE03	**Core**	3	-	-	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite:								

I. COURSE OVERVIEW:
The course will make them learn the basic theory of switching circuits and their applications in detail. Starting from a problem statement they will earn to design circuits of logic gates that have a specified relationship between signals at the input and output terminals. They will be able to design combinational and sequential circuits. They will learn to design counters, adders, sequence detectors. This course provides a platform for advanced courses like Computer architecture, Microprocessors & Microcontrollers and VLSI design.

II. COURSES OBJECTIVES:
The students will try to learn

I. Simplification of the logic functions using Boolean algebraic theorems and techniques.
II. Implementation of conventional combinational and sequential circuits including conversions of flip-flops.
III. The exploration of the logic families and semiconductor memories.
IV. The realization of the micro and macro circuits using VHDL programming.

III. COURSE OUTCOMES:
At the end of the course students should be able to:

CO1 Outline binary arithmetic operations and optimize Boolean functions using Karnaugh and tabulation method
CO2 Make use of basic logic gates to realize the combinational logic circuits used in conventional electronic circuits.
CO3 Interpret the knowledge of flip-flops and latches in synchronous and asynchronous modules for memory storing applications.
CO4 Develop Mealy/Moore models and state diagrams for the complex sequential circuit applications.
CO5 Identify the different logic families, memories and programmable logic devices for understanding the architectural blocks of FPGA.
CO6 Demonstrate the different modelling styles and data types in VHDL for implementing combinational and sequential circuits.

IV. COURSE CONTENT:

MODULE - I: NUMBER SYSTEM AND BOOLEAN ALGEBRA (10)
Number system and base conversions, Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 5 variables, Binary codes, Code Conversion, Quine- McCluskey Method, Multilevel NAND/NOR realizations

MODULE –II: COMBINATIONAL CIRCUITS (10)
MSI devices like Comparators, Multiplexers, Demultiplexer, Encoder, Decoder, Half and Full Adders, Subtractors, Full adder using Half adders, Full subtractor using Half subtractors, Binary Multiplier, Serial and Parallel Adders, BCD Adder, Carry look ahead adder, Code Converters, Barrel shifter and ALU.

MODULE –III: SEQUENTIAL LOGIC DESIGN (10)
Latches, Flip-Flops, S-R, T FF, D FF, JK and Master-Slave JK FF, Characteristic Tables and equations, Conversion from one type of Flip-Flop to another.

Ripple and Synchronous counters, Design of Counters, Ring Counter, Johnson counter, Shift registers, Pseudo Random Sequence generator, Finite state machines, Design of synchronous FSM, Sequence detector, Algorithmic State Machines chart.

MODULE –IV: LOGIC FAMILIES AND SEMICONDUCTOR MEMORIES (09)
Digital IC Terminology, Specifications, Noise margin, Propagation delay, fan-in, fan-out, TTL NAND gate, Tristate TTL, ECL, CMOS families, Memory elements, RAM, ROM, EPROM, EEPROM, Concept of Programmable logic devices, Implementation of Combinational Logic circuits using PLD.

MODULE –V: VLSI DESIGN FLOW (09)
Introduction to Hardware Description Languages (HDL), VHDL constructs, Data types and objects, operators, different modeling styles in VHDL-Dataflow, Behavioral and Structural Modeling, delay models, Synthesis and Simulation, codes for combinational and sequential circuits.

V. TEXT BOOKS:

1. R.P.Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009.
2. Douglas Perry, "VHDL", Tata McGraw Hill, 4th edition, 2002.
3. Digital Design- Morris Mano, PHI, 3rd Edition.
4. Switching Theory and Logic Design-A. Anand Kumar, PHI, 2nd Edition.

VI. REFERENCE BOOKS:

1. D.V.Hall, "Digital Circuits and Systems", Tata McGraw Hill,1989.
2. Charles Roth, "Digital System Design using VHDL", Tata McGraw Hill, 2nd edition, 2012.

VII. ELECTRONICS RESOURCES:

1. NPTEL : Electrical , Electronics and Communication: Digital System Design
2. NPTEL : Computer science and Engineering: Switching theory and logic design
3. NPTEL : Electrical , Electronics and Communication: Synthesis of Digital Systems.
4. NPTEL: Electronics and Communication – Hardware Modeling using VHDL/Verilog

VIII. MATERIALS ONLINE

1. Course Outline Description
2. Lecture notes
3. PowerPoint presentation
4. Definitions and Terminology
5. Tutorial Question Bank
6. Case Studies
7. Real life Examples
8. Complex Engineering Problems
9. Tech Talk Topics
10. Concept Video Topics
11. Open-ended Exercises

12. Assignments
13. Model Question Paper – I
14. Model Question Paper – II
15. GATE Question Bank
16. Previous Question Papers and Solutions