



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

## COURSE CONTENT

DIGITAL SYSTEM DESIGN								
III Semester: ECE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P		C	CIA	SEE
AECD03	Core	3	-	-	3	40	60	100
		Contact Classes: 48		Tutorial Classes: Nil		Practical Classes: Nil		Total Classes: 48
Prerequisite: Matrices and calculus								

### 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 learn 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. Greater emphasis is placed on the use of programmable logic devices and State machines.

### 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 Apply combinational circuits for realization of basic building blocks of conventional electronic circuits
- CO3 Design dynamic system operations using simulation results.
- CO4 Extend the logic design techniques for ECL, TTL and CMOS methodologies for designing the fundamental gate level modelling.
- CO5 Extend the characteristics of logic families and PLDs to enhance the design skills in digital integrated Circuits
- CO6 Evaluate synthesis and simulation of VHDL modules for implementing combinational and sequential circuits.

### IV. COURSE CONTENT:

#### MODULE - I: LOGIC SIMPLIFICATION AND COMBINATIONAL LOGIC DESIGN(10)

Review of decimal, binary, octal and hexadecimal number system and conversions, Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Binary codes, Code Conversion

#### MODULE -II: MSI DEVICES(10)

MSI devices like Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Full adder using Half adders, Full subtractor using Half subtractors, Serial and Parallel Adders, BCD Adder, Barrelshifter and ALU.

### **MODULE –III: SEQUENTIAL LOGIC DESIGN (10)**

Building blocks like S-R, T FF, D FF, JK and Master-Slave JK FF, Edge triggered FF, Characteristics and Excitation of SR, JK, T, D FF, Ripple and Synchronous counters, Shift registers.

Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation

### **MODULE –IV: LOGIC FAMILIES AND SEMICONDUCTOR MEMORIES (09)**

Properties of random numbers, Generation of pseudo-random numbers, Techniques for generating random numbers, Tests for random numbers, Inverse-transform technique, Acceptance-rejection technique, Special properties.

### **MODULE –V: VLSI DESIGN FLOW (09)**

Design entry: Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation VHDL constructs and codes for combinational and sequential circuits.

#### **V. TEXT BOOKS:**

1. R.P.Jain, “Modern digital Electronics”, Tata McGraw Hill, 4<sup>th</sup> edition, 2009.
2. Douglas Perry, “VHDL”, Tata McGraw Hill, 4<sup>th</sup> edition, 2002.
3. W.H. Gothmann , “Digital Electronics-An introduction to theory and practice”, PHI, 2<sup>nd</sup> edition, 2006.

#### **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, 2<sup>nd</sup> 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.

#### **VIII. MATERIALS ONLINE**

1. Course template
2. Tutorial question bank
3. Definition and terminology
4. Tech-talk topics
5. Assignments
6. Model question paper - I
7. Model question paper - II
8. Lecture notes
9. Early learning readiness videos (ELRV)
10. Power point presentations