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

COURSE CONTENT

HIGH SPEED SYSTEM DESIGN								
VII Semester: ECE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AECD55	**Elective**	3	-	-	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Digital System Design								

I. COURSE OVERVIEW:
This course will teach teams of students how to design and fabricate PCB for prototyping as well as in Industrial Production environment. This will help students to innovate faster with electronics technology. Specific topics include: CMOS logic, MOSFET theory, selection of technology and logic, design process, design rules and layout procedure, design aidfor layout, rule checking, logic and circuit simulation, timing and testability are the main aspects of this course. The course further gives information on data path subsystems, several PLD's performance parameters and testing approaches for the circuits.

II. COURSES OBJECTIVES:
The students will try to learn

I The aspects of hierarchical VLSI design from the metal oxide semiconductor transistor up to the system level, fabrication and testing.
II The subsystem design incorporating into a VLSI chip with contemporary techniques for achieving high speed, low-power and low area overhead.
III Advanced modern tools such as Vivado and Cadence for front end and back end for chip design through a practical approach.

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

CO1: Summarize the MOSFET fabrication process, electrical properties and scaling for understanding latest developments in VLSI.
CO2: Make use of stick diagrams and layout designs to convey layer information in MOSFET circuits.
CO3: Analyze inverters, complex gates and dynamic CMOS circuits to calculate power consumption, distortion and speed of operation
CO4: Illustrate data path subsystems and array subsystems using stick diagrams and layouts.
CO5: Outline the role of Programmable logic devices for realization of complex boolean functions.
CO6: Examine the test strategies, implementation approach on full custom and semi-custom design for optimizing speed, cost, reconfiguration and reliability parameters.

IV. COURSE CONTENT:

MODULE - I: MOS TRANSISTOR (09)

The Metal Oxide Semiconductor (MOS) Structure, The MOS System under External Bias, Structure and Operation of MOS Transistor, MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects. MOS Inverters-Static Characteristics: Introduction, Resistive-Load Inverter, Inverters with n_Type MOSFET Load.

MODULE –II: MOS INVERTERS-STATIC CHARACTERISTICS (09)

CMOS Inverter. MOS Inverters: Switching Characteristics and Interconnect Effects: Introduction, Delay-Time Definition, Calculation of Delay Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters.

MODULE –III: SEMICONDUCTOR MEMORIES (10)

Introduction, Dynamic Random Access Memory (DRAM), Static Random Access Memory (SRAM), Nonvolatile Memory, Flash Memory, Ferroelectric Random Access Memory (FRAM).

MODULE –IV: DYNAMIC LOGIC CIRCUITS (10)

Introduction, Basic Principles of Pass Transistor Circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques, High Performance Dynamic CMOS circuits.

BICMOS LOGIC CIRCUITS: Introduction, Bipolar Junction Transistor (BJT): Structure and Operation, Dynamic Behavior of BJTs, Basic BiCMOS Circuits: Static Behavior, Switching Delay in BiCMOS Logic Circuits, BiCMOS Applications.

MODULE –V: VLSI DESIGN FLOW (10)

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. Sung Mo Kang & Yosuf Leblebici, "CMOS Digital Integrated Circuits: Analysis and Design", Tata McGraw-Hill, Third Edition.

VI. REFERENCE BOOKS:

1. Neil Weste and K. Eshragian, "Principles of CMOS VLSI Design: A System Perspective", Second Edition, Pearson Education (Asia) Pvt. Ltd. 2000.
2. Wayne, Wolf, "Modern VLSI Design: System on Silicon" Prentice Hall PTR/Pearson Education, Second Edition, 1998.
3. Douglas A Pucknell & Kamran Eshragian, "Basic VLSI Design" PHI 3rd Edition (original Edition – 1994).

VII. ELECTRONICS RESOURCES:

1. NPTEL :: Electronics and Communication: Digital System Design
2. NPTEL :: Electronics and Communication: Fundamental of Digital Devices

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