

NIRMA UNIVERSITY
SCHOOL OF TECHNOLOGY, INSTITUTE OF TECHNOLOGY
B.Tech. Electronics & Communication Engineering
Semester - V

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Course Code	2EC501
Course Title	VLSI Design

Course Outcomes (COs):

At the end of the course, the students will be able to

1. Analyze the digital VLSI circuits working with resistive load, NMOS, PMOS and CMOS load conditions under linear and saturation region.
2. Evaluate digital VLSI circuits for speed, area, power, cost and output voltage requirements.
3. Design combinational, sequential and dynamic logic circuits using CMOS for given specifications.
4. Simulate and optimize digital VLSI circuits and layouts using EDA Tools.

Syllabus:

Teaching Hours: 45

UNIT I : Introduction of VLSI	02
Historical perspective, Objective and organization, Overview of VLSI Design Methodologies, VLSI design flow, Design Hierarchy, Concept of Regularity, Modularity and Locality, VLSI design Styles, Design Quality, Packaging Technology, CAD Technology.	
UNIT II: MOS Basics Scaling and Effects of Scaling on MOS	07
MOSFET Basics, V-I Characteristics, MOSFET scaling, Small-geometry effects, MOSFET capacitances	
UNIT III: MOS Inverter Static Characteristics	08
Introduction, Resistive load Inverter, Inverter with n-type MOSFET load (Enhancement & Depletion type MOSFET load), CMOS Inverter.	
UNIT IV: MOS Inverters Switching Characteristics and Interconnect Effects	07
Introduction, Delay-time definitions, Calculation of Delay times, Inverter design with delay constraints, Estimation of Interconnect Parasitic, Calculation of interconnect delay, Switching Power Dissipation of CMOS Inverters.	
UNIT V: Combinational MOS Logic Circuits	08
Introduction, MOS logic circuits with Depletion NMOS Loads, CMOS logic circuits, Complex logic circuits, CMOS Transmission Gates (TGs).	
UNIT VI: Sequential MOS Logic Circuits	03
Introduction, Behaviour of Bistable elements, SR latch circuit, Clocked latch & Flip-flop circuits, CMOS D-latch & Edge-triggered flip-flop.	
UNIT VII: Dynamic Logic Circuits	07
Introduction, Basic Principles of pass transistor circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, CMOS Dynamic Circuit Techniques.	
UNIT VIII: Advances in VLSI Design	03
Challenges with MOS, MOS Alternate Technologies, Low Power Technology	

Self-Study:

The self-study content will be declared at the commencement of the semester. Around 10% of the question will be asked from self-study content.

Laboratory Work:

Laboratory work will be based on the above syllabus with a minimum of 10 experiments to be incorporated.

Suggested Readings:

1. Sung-Mo Kang, Yusuf Leblebici, CMOS Digital Integrated Circuits – Analysis and Design, TATA McGraw-Hill
2. Pucknell and Eshraghian, Basic VLSI Design, PHI
3. Amar Mukerji, Introduction to nMOS and CMOS VLSI System Design, Prentice Hall
4. Neil H. E. Weste, David Money Harris, CMOS VLSI Design: A Circuits and Systems Perspective, Addison Wesley