Course Type	Course Code	Name of Course	L	T	P	Credit
DC	**NECC512**	Digital IC Design	3	1	0	4

Course Objective
The course is designed to give the student an understanding of the different design steps required to carry out digital VLSI (Very-Large-Scale Integration) design in silicon.
Learning Outcomes
This course covers basic theories and techniques of digital VLSI design in CMOS technology. In this course, we will study the fundamental concepts and structures of designing digital VLSI systems including CMOS devices and circuits, CMOS design rules, static and dynamic logic structures, and VLSI architecture

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	The Transistor: Basic MOS structure, I-V Characteristics, threshold voltage, MOS as a switch, latch-up in CMOS inverter, short channel effects, design rules and layout, MOSFET scaling - constant-voltage and constant-field scaling	9	Acquire an understanding of the basic knowledge of MOS transistors covering few essential device related details, serving as a background knowledge for its applicability in Digital ICs.
2	Inverter Properties: static nMOS, CMOS and BiCMOS inverters, design aspect, switching threshold and noise margin concepts and their evaluation, dynamic behavior, power consumption.	9	Develop an understanding about the analog aspects of MOS-based digital circuits.
3	CMOS Combinational Logic: static CMOS design, pass transistor logic, dynamic logic, speed, power and noise in dynamic logic, cascading dynamic gates, domino logic.	8	To gain an understanding of various MOS and CMOS based combinational circuits
4	Sheet resistance of layers, area capacitance of layers, driving large capacitive loads, propagation delay models of cascaded pass transistors, wiring capacitances.	5	This will help in understanding the process of estimating delay through the concept of sheet resistance.
5	CMOS Sequential Logic: static latches and registers, MUX based latches, S-R FF, dynamic latches and registers	4	Develop an understanding of MOS-based sequential circuits.
6	Clocking of Circuits: Classification of clocking schemes, clock distribution techniques, problems in single phase and two-phase clocking.	2	To understand on-chip clocks and their distribution.
7	Semiconductor Memories: static RAM; dynamic RAM; ROM, flash memory. Subsystem Design: design of ALU building blocks such as adder and multiplier, area-time trade-off, power consumption	5	To gain an understanding of semiconductor memories and few building blocks of digital system design.
	Total	42	

Textbook:

1. Sung-Mo Kang & Yusuf Lablebici, "CMOS Digital Integrated Circuits, Analysis & Design", TMH Edition.
2. Douglas A. Pucknell & Kamran Eshraghian, "Basic VLSI Design", PHI, 3rd Ed. 2005.

References:

1. John P. Uyemura, "Introduction to VLSI Circuits and Systems", Wiley-India Edition.
2. David A. Hodges, Horace G. Jackson and Resve A. Saleh, "Analysis and Design of Digital Integrated Circuits *in deep submicron technology*", TMH Edition.
3. J. M. Rabaey, A. Chandrakasan and B. Nikolic, Digital Integrated Circuits: A Design Perspective, Second Edition, Prentice Hall, 2003.