EC-402	VLSI DESIGN	L	T	P	C
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COURSE OBJECTIVES:

1. To understand the basic CMOS circuit process and its theory.
2. To understand the CMOS processing technologies and typical geometric design rules.
3. To understand the depth of various alternatives available CMOS circuit design.
4. To understand the combinational logic design with CMOS technology.
5. To understand the various memories and floor planning in CMOS technology.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. demonstrate knowledge in: Fabrication process, Implementation of digital circuits using CMOS, Design of high speed digital circuits and Designing memories.
2. analyze: Various CMOS circuit implementation interms of delays, Performance of IC at system level physical design.
3. design of various combinational circuits using CMOS.
4. apply the concepts of CMOS to real time applications.
5. exhibit Programming skills, choose suitable hardware and program the devices to solve engineering problems.

UNIT I **(13)**

Fabrication of CMOS Integrated Circuits : Overview of Silicon Processing, Material Growth and Deposition, Lithography, The CMOS Process Flow, Design Rules.

Logic Design with MOSFETs : Ideal Switches and Boolean Operations, MOSFET as Switches, Basic Logic Gates in CMOS, Complex Logic Gates in CMOS, Transmission Gate Circuits, Physical Structure of CMOS ICs: Integrated Circuit Layers, MOSFETs, CMOS Layers, Designing FET arrays.

UNIT II **(13)**

Elements of CMOS Integrated Circuits : Basic Concepts, Layout of Basic Structures, Cell Concepts, FET Sizing and the Unit Transistor, Physical Design of Logic Gates.

Electronic Analysis of CMOS Logic Gates : DC Characteristics of CMOS Inverter, Inverter Switching Characteristics, Power Dissipation, DC characteristics: NAND and NOR gates, NAND and NOR Transient Response, Transmission Gates and Pass Transistors.

UNIT III **(13)**

Designing High-Speed CMOS Logic Networks : Gate Delays, Driving Large Capacitive Loads, Logical Effort, BiCMOS Drivers.

Advanced Techniques in CMOS Logic Circuits : Mirror Circuits, Pseudo-nMOS, Tri-State Circuits, Clocked CMOS, Dynamic CMOS Logic Circuits, DualRail Logic Networks.

UNIT IV **(13)**

General VLSI System Components : Multiplexers, Binary Decoders, Equality Detectors and Comparators, Parity Encoder, Latches, D-flip flop, Registers.

Arithmetic Circuits in CMOS VLSI : Ripple Carry Adders, Carry Look-Ahead Adders, Multipliers.

UNIT V **(13)**

Memories and Programmable Logic : The Static RAM, SRAM arrays, Dynamic RAMs, ROM Arrays, and Logic Arrays.

System Level Physical Design : Large Scale Physical Design, Interconnect Delay Modeling, Crosstalk, Interconnect Scaling, Floor Planning and Routing.

LEARNING RESOURCES:

TEXT BOOK(s):

John P.Uyemura - Introduction to VLSI Circuits and Systems, 1st Edition. Wiley, 2009

REFERENCE BOOK(s):

1. Neil H.E. Weste & Kamran Eshraghian - Principles of CMOS VLSI Design, A system perspective, 2nd Edition, Pearson Education, 2002.
2. Wayne Wolf - Modern VLSI Design: IP Based Design, 4th Edition, Pearson Education, 2009.

WEB RESOURCES:

1. http://nptel.iitm.ac.in/courses/
2. http://nptel.ac.in/courses/117101058/
3. http://www.ee.ncu.edu.tw/~jfli/vlsi1/
4. http://cc.ee.ntu.edu.tw/~ywchang/Courses/PD/EDA_Chapter1.pdf