

Course Code	Course Title	L	T	P	C
1151EC115	VLSI DESIGN	3	0	0	3

a) Course Category

Program Core

b) Preamble

This course introduces the fundamentals of the VLSI and implementation of digital circuit through the CMOS Transistors.

c) Prerequisite

Digital Electronics

d) Related Courses

Low power VLSI

e) Course Outcomes

Upon the successful completion of the course, students will be able to

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Describe the design hierarchy and CMOS fabrication techniques	K2
CO2	Describe the physical design of CMOS transistors	K2
CO3	Explain the various characteristics and processing technology of CMOS transistors	K2
CO4	Construct the sequential circuits using CMOS transistors	K2
CO5	Illustrate the arithmetic building blocks and memories using CMOS circuits.	K2

f) Correlation of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M	L	L	L	-	-	-	-	-	-	H	-	-

CO2	M	L	M	M	L	-	L	-	-	-	-	L	-	-
CO3	M	L	L	M	L	M	-	-	L	-	-	L	-	-
CO4	H	M	M	H	M	L	-	-	-	-	-	L	L	L
CO5	H	M	H	H	M	L	-	L	L	L	-	H	L	L

g) Course Content

UNIT I CMOS FABRICATION AND DESIGN 9

Review of MOS Transistors: nMOS, pMOS CMOS Fabrication and Layout: Inverter and Cross Section - Fabrication process - Layout Design Rules - Gate Layout - Stick Diagrams. VLSI Design Flow: Design specifications, Design Entry, Functional Simulation, PPR, Timing Simulation, Fusing/Fabrication into the Chip. Logic gates: CMOS Inverter- CMOS NAND Gate- CMOS Combinational Logic- CMOS OR Gate- Pass Transistor and Transition Gates- Multiplexers -Latches and Flip-Flops.

UNIT II CMOS LOGIC, CIRCUIT AND PHYSICAL DESIGN 9

CMOS Logic Design: Top Level Interface, Block Diagrams, Hierarchy, Hardware Description Language - Circuit Design. Physical Design:Floor Planning, Standard Cells, Pitch Matching, Slice Plans, Arrays, Area Estimation.

UNIT III CMOS THEORY AND PROCESSING TECHNOLOGY 9

Theory: Ideal I-V Characteristics - C-V Characteristics -Non ideal I-V Effects - DC Transfer Characteristics of CMOS Transistor CMOS Processing Technology: Background, Wafer Formation, Photolithography, Well and Channel Formation, SiO₂, Isolation, Gate Oxide, Gate and Source/Drain Formation, Contacts and Metallization, Passivation, Metrology.

UNIT IV SEQUENTIAL CIRCUITS 9

Sequencing Static Circuits- Circuit Design for Latches and Flip-Flops - Static Sequencing Element Methodology- Sequencing Dynamic Circuits- Synchronizer.

UNIT V ARITHMETIC BUILDING BLOCKS AND MEMORY ARCHITECTURES 9

Design of arithmetic building blocks: Adders, Multipliers, Shifters – Comparator– Counters - Memories: SRAM, DRAM.

Total 45 Hrs

h) Learning Resources

Text Books

1. Neil H.E. Weste and David Money Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Pearson Education, 2015.
2. Douglas A. Pucknell and Kamran Eshraghian, "Basic VLSI Design", 3rd Edition, PHI, 2017.

Reference Books

1. Jan M. Rabaey, A. Chandrakasan, B. Nikolic, Digital Integrated Circuits: A Design Perspective", 2nd Edition, Pearson, 2016.

Online Resources

1. www.nptelvideos.in/2012/12/digital-vlsi-system-design.html
2. <http://www.cmosvlsi.com/coursematerials.html>
3. <http://freevideolectures.com/Subject/VLSI-and-ASIC-Design>