



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Electronics And Communication (VLSI Design)

Subject Code: ME01096031

Subject Name: CMOS Digital Circuits Design

WEF Academic Year	: 2025-26
Semester	: 01
Category of the Course	: PEC

Prerequisite:	Basic Digital Electronics and CMOS based circuits
Rationale:	This course will provide an opportunity to the students to learn about various topics of VLSI such as design of digital circuits using MOSFET device as well as using hardware description language (HDL). In the laboratory part of this course, students will be given exposure to HDL for automated design of digital circuits. This subject is very important for the students who would like to pursue their career in VLSI domain.

Course Scheme:

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Practical		
				ESE (E)	PA(M)	ESE (V)	PA (I)	
03	00	02	04	70	30	30	20	150

Course Content:

U. No	Course Content	No of Hours	% of Weightage
1	MOS Inverter – Switching Characteristics and Interconnect Effects: Introduction, delay-time definitions, calculation of delay times, inverter design with delay constraints, estimation of interconnect parasitic, calculations of interconnect delay, switching power	8	20



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	dissipation of CMOS inverters.		
2	Combinational MOS Logic Circuits: Introduction, MOS logic circuits with depletion nMOS loads, CMOS logic circuits, complex logic circuits, CMOS transmission gates.	6	15
3	Sequential MOS Logic Circuits: Introduction, behavior of bistable elements, the SR latch circuit, clocked latch and flip-flop circuits, CMOS D-latch and edge-triggered flip-flop,	8	20
4	Semiconductor Memories: Introduction, read-only memory circuits, static read-write memory circuits, dynamic read-write memory circuits,	6	15
5	Arithmetic Building Blocks: Architectures of Adders, Subtractors, and Multipliers.	7	15
6	Low-Power CMOS Logic Circuits: Introduction, overview of power consumptions, low-power design through voltage scaling, estimation and optimization of switching activity, reduction of switched capacitance, adiabatic logic circuits.	7	15
		42	100

Reference Book:

- CMOS Digital Integrated circuits – Analysis and Design by Sung – Mo Kang, Yusuf Leblebici, and TATA McGraw- Hill Pub. Company Ltd.
- Basic VLSI Design by Pucknell and Eshraghian, PHI, 3rd Ed.
- Introduction to VLSI Systems by Mead C and Conway, Addison Wesley
- Introduction to VLSI Circuits & Systems – John P. Uyemura
- Fundamentals of Digital Logic Design with VHDL, Brown and Vranesic
- Fundamentals of Digital Logic Design with Verilog, Brown and Vranesic, TATA McGraw
- FPGA Based System Design, Wyane Wolf, Pearson
- Verilog HDL, Sameer Palnitkar, Pearson

Course Outcome:

After completion of the Course, Students will be able to:

No	Course Outcomes	RBT Level*
01	Understand operations of various MOS circuits.	UN



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02	Analyze different MOS combinational circuits.	AN
03	Analyze different MOS sequential circuits.	AN
04	Simulate and measure performance parameters of various MOS circuits.	AP
05	Design MOS circuits.	AP

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

List of Laboratory/Learning Resources Required:

- List of Hardware: FPGA/CPLD programming tool, Multimeter, Power supply, function generator, oscilloscope
- List of Software: EDA Tools – Cadence, Synopsis, Siemens
- List of Useful websites MOOCs:---
 - Course-related online MOOCs on NPTEL/SWAYAM platform
 - Recent publications in reputed journal/conferences
