



SILVER OAK UNIVERSITY

College of Technology
Master of Technology
Electronics and Communication
Course Name: Digital VLSI Design
Course Code: 1010097236
Semester: 3rd

Prerequisite: Knowledge of Basic and Digital Electronics

Course Objective:

1. This course will provide an opportunity to the students to learn about various topics of Digital VLSI such as basic concepts of MOSFET, its physics, and analysis as well as design of digital circuits using MOSFET devices.
2. In the laboratory part of this course, students will be given exposure to hardware description language such as Verilog for automated design of digital circuits.
3. This subject is very important for the students who would like to pursue their career in the VLSI domain.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
3	0	2	5	4

Content:

Unit No.	Course Contents	Teaching Hours	Weightage %
1	Basics of MOS Transistor: Threshold voltage- characteristics of MOS transistor-channel length modulation- short channel effects- Design of Logic gates using NMOS, PMOS and CMOS, Stick diagrams, Transfer characteristics of CMOS inverter, Power dissipation – Delay and sizing of inverters.	6	15
2	CMOS Combinational Circuits: Static CMOS design-complementary CMOS - static properties complementary CMOS design Power consumption in CMOS logic gates-dynamic or glitching transitions, Design techniques to reduce switching activity, pass transistor logic, Differential pass transistor logic, Sizing of level restorer, Sizing in pass transistor, Dynamic CMOS design-Basic principles - Domino logic-optimization of Domino logic.	8	20

3	CMOS Sequential Circuits: Timing metrics for sequential circuit - latches Vs registers - static latches and registers, Bistability principle - multiplexer based latches-master slave edge triggered registers, non- ideal clock signals-low voltage static latches-static SR flip flop, Dynamic latches and MOS register.	10	25
4	Basic Concepts- Verilog: Operators, Basic concepts, Identifiers, System task and functions, Value set, Data types, Parameters, Operands, Operators, Modules and ports, Gate-level Modeling, Dataflow Modeling, Behavioral Modeling, Switch level modeling, Tri state gates, MOS Switches, Bidirectional switches, User defined primitives, Introduction to synthesis, Verilog HDL.	10	25
5	Sub-System Design/ System Verilog :Addition/Subtraction - Comparators- Zero/One Detectors Binary Counters- ALUs Multiplication- Shifters- Memory elements- control: Finite-State Machines. Advanced Technologies : Short channel effects, High-k, Metal Gate Technology, FinFET, TFET – Overview, Structure.	8	15

Course Outcome:

Sr. No.	CO statement	Unit No
CO-1	Describe working of MOSFET and develop its mathematical model	1
CO-2	The student will able to get the basic concept of CMOS circuit, characteristics and performance.	2
CO-3	The student will learn the designing of combinational and sequential circuits in CMOS	3
CO-4	The student will learn the different abstract levels in Verilog for modeling digital circuits.	4
CO-5	Write programs in Verilog for digital circuits and realize them on FPGA/CPLD	5

Teaching & Learning Methodology: -

1. Flipped Classroom
2. Adaptive Teaching
3. Direct Instruction Methodology
4. Context based learning.
5. Kinesthetic Learning

List of Experiments/Tutorials:

Total Hours : 28

Sr No.	Practical Name
1	Simulation of basic building blocks of digital circuits in Verilog using Xilinx simulator.
2	Write the Verilog code for a Full Adder, that takes in three 1-bit inputs, a, b and carry-in, and gives sum and carryout 1-bit outputs.
3	Write the Verilog code for Simple Combinational Logic.
4	Write the Verilog code for Multi-Function Gate
5	Write the Verilog code for Three-Bit Binary Adder.
6	Write the Verilog code for Decoder and Demultiplexer.
7	Simulate the code for the D flipflop.
8	Write the verilog code for a JK Flipflop, and its testbench.
9	Write the hardware description of a 4-bit down counter and test it.
10	Write the verilog code for Sequential Circuit Design: Counter with Inputs

Major Equipment:

Circuit simulator, FPGA/CPLD programming tool, Multimeter, Power supply, function generator, oscilloscope

Books Recommended: -

1. CMOS Digital Integrated circuits – Analysis and Design by Sung – Mo Kang, Yusuf Leblebici, TATA McGraw-Hill Pub. Company Ltd.
2. Samir Palnitkar, "Verilog HDL", Pearson education, Second Edition, 2003.
3. J. Bhasker, "A Verilog HDL Primer", Second Edition, Star Galaxy, 2005.
4. J. Bhasker, "A Verilog Synthesis: A Practical Primer", Star Galaxy, 1998.
5. Jan.M. Rabaey., Anitha Chandrakasan Borivoje Nikolic, "Digital Integrated Circuits", Second Edition.

List of Open Source Software/learning website:

Open source simulator for Verilog

- www.nptel.ac.in
- www.intel.com
- www.cpu-world.com

CO-PO Matrix:

