VLSI Design

Paper Code	**ECS-701**
Course Credits	4
Lectures/ Week	3
Tutorials/ Week	1

Course description

UNIT-I   MOSFET MODELS

Introduction, MOSFET modeling: accumulation, flat-band, depletion and inversion mode of operation,subthreshold conduction, Modeling Noise sources in MOSFET, Inverters, depletion load and enhancement mode MOSFET

UNIT-II   DIGITAL VLSI DESIGN

NMOS device sizing, Device sizing in NOR and NAND gates, CMOS device sizing. Symmetric devices: Advantages and limitations, Transmission gates, signal propagation delay modeling.

UNIT-III   CURRENT TRENDS IN VLSI DESIGN

Bulk Technology, Advantages and limitations, short channel effects: threshold voltage roll-off, channel length modulation, velocity saturation, DIBL, hot carrier effects, SOI Technology, Partially and fully depleted SOI, layout designing.

UNIT-IV   CMOS PROCESSING TECHNOLOGY

Device fabrication, crystal growth, CZ technique, FZ technique, Oxidation, dry and wet oxidation, Lithography, Etching, Diffusion, Ion Implantation and Metallization.

UNIT-V   PROGRAMMABLE DEVICES

Introduction to VHDL, design methodology, styles of modeling, designing basic building blocks and functional units as adder, multiplexer and decoder; programming the FPGA and CPLD.

Pre-requisite Course/Paper: Analog electronics –I & II, Digital circuits and Systems

Text Book:	1. Allen Strader, "VLSI Design technologies", McGraw Hill International Edition, 1990.
	2. May and Sze, "Semiconductor fabrication", John Wiley, 2004.
	3. Boris and Backer, "CMOS VLSI designing", John Wiley, 3rd edition, 2001
Reference Books:	1. Neil H. E. Waste, "CMOS VLSI Design", Pearson, 3rd edition, 2006.
	2. R.J. Baker, H.W. Li and D.E. Boyce, "CMOS: Circuit Design, Layout and Simulation", IEEE Press, PHI, Pvt. Ltd. New Delhi – 2000
	3. R.L. Geiger, P.A. Allen and N.R. Strader, "VLSI: Design Techniques for analog Digital Circuits", McGraw Hill International Edition, Electronic Engineering Series, 1990
	4. S.M. Szee, "VLSI", McGraw Hill International Editions, 2000
	5. Malcolm R. Haskard, "ASIC Designing", Printice Hall, New York, Edition, 1990
	6. Donald L. Schilling and Charles Belove, "Electronic Circuits: Discrete and Integrated", McGraw Hill Book Company, New Delhi
Course Outcomes	**CO1:** Understanding of basics of MOSFET modelling.
	CO2: Understanding of impact of device sizing on the performance of Nano-scaled NMOS and CMOS circuitry.
	CO3: Understanding of how to keep Moore's law valid in future using bulk technology and SOI technology and the trade-off thereof.
	CO4: Comprehensive knowledge of device fabrication, steps involved in integrated circuit fabrication, various challenges and the current solutions in IC fabrication
	CO5: To implement combinational & sequential circuits using Hardware Descriptive Language (VHDL). To understand concept of Programmable Devices, PLA, PAL, CPLD and FPGA.
Computer usage/ Software required:	VHDL & Logic synthesis