Microelectronics & VLSI Designs
EC702
Contacts: 3L
Credits: 3

Pre-requisite: Knowledge about MOS, MOS-Characteristics, MOS Capacitors, Short Channel MOS, CMOS inverters, MOS Gates etc done in ES201 (Basic Electronics of second semester), EC302 (solid state devices of third semester), Analog Circuit Theory and Digital Circuits done in semesters 3 & 4 respectively.

Module 1: Introduction to VLSI Design: [6L]
VLSI Design Concepts, Moor's Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI – basic idea only), Types of VLSI Chips (Analog & Digital VLSI chips, General purpose, ASIC, PLA, FPGA)   (2L),
Design principles (Digital VLSI – Concept of Regularity, Granularity etc), Design Domains (Behavioral, Structural) (12L)

Module 2: Micro-electronic Processes for VLSI Fabrication: **[10]**
Silicon Semiconductor Technology- An Overview, Wafer processsig   (1L),
Oxidation, Epitaxial deposition, Ion-implantation & Diffusion   (1L),
Cleaning, Etching   (1L),
Photo-lithography – Positive & Negative photo-resist   (1L);
Basic CMOS Technology – (Steps in fabricating CMOS)   (1L),
Basic n-well CMOS process, p-well CMOS process, Twin tub process   (1L),
Silicon on insulator   (1L);
Layout Design Rule: Stick diagram with examples   (2L),
Layout rules   (1L).

Module – 3: CMOS for Digital VLSI Circuits: [10]
Recapitulation of MOS   (2L);
CMOS, CMOS inverter characteristics   (1L);
CMOS logic circuits, NAND & NOR Gates   (1L),
Complex logic circuits   (1L),
CMOS Full Adder   (1L),
CMOS Transmission GATE   (1L),
Advanced CMOS Logic circuits; Sequential CMOS logic circuits   (1L);
SR Latch circuit, clocked JK Latch/ Master-Slave JK   (1L),
CMOS D-latch & Edge triggered flip-flop   (1L);

Module – 4: Analog VLSI Circuits: [8L]
Analog VLSI design steps   (1L);
Basic building blocks of Analog VLSI chips   (1L);
MOS switch   (1L);
Active load / resistors; Voltage dividers   (1L);
CMOS Current source & sink; CMOS Voltage references/voltage dividers [Basic circuits only]   (1L);
CMOS Differential amplifier; Output amplifiers [Basic circuits only]   (1L);
CMOS OPAMP   (1L);
Switched capacitor filter   (1L)

Text Books:
1. Digital Integrated Circuit, J.M.Rabaey, Chandrasan, Nicolic, Pearson Education.
2. CMOS Digital Integrated Circuit, S.M.Kang & Y.Leblebici, TMH.
3. Modern VLSI Design, Wayne Wolf, Pearson Education.
4. VHDL, Bhaskar, PHI.
5. Advance Digital Design Using Verilog , Michel D. Celliti, PHI

References:
1. Digital Integrated Circuits, Demassa & Ciccone, John Willey & Sons .
2. Modern VLSI Design: system on silicon, Wayne Wolf; Addison Wesley Longman Publisher
3. Basic VLSI Design, Douglas A. Pucknell & Kamran Eshranghian, PHI
4. CMOS Circuit Design, Layout & Simulation, R.J.Baker, H.W.Lee, D.E. Boyee, PHI
5. CMOS Analog Circuit Design by P.E. Allen & D.R. Holberg; OUP