

Microelectronics & VLSI Design

IT705D

Contracts: 3L

Credits- 3

Module 1 [6]

Introduction to VLSI Design: 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), Design principles (Digital VLSI - Concept of Regularity, Granularity etc), Design Domains (Behavioral, Structural, Physical), Y-Chart, Digital VLSI Design Steps.

Module 2 [10]

MOS structure: E-MOS & D-MOS, Charge inversion in E-MOS, Threshold voltage, Flat-band voltage, Potential balance & Charge balance, Inversion, MOS capacitances.

Three Terminal MOS Structure: Body effect.

Four Terminal MOS Transistor: Drain current, I-V characteristics. Current-voltage equations (simple derivation).

Scaling in MOSFET: Short Channel Effects, General scaling, Constant Voltage & Field scaling.

CMOS: CMOS inverter, Simple Combinational Gates - NAND gate and NOR Gate using CMOS.

Module 3 [10]

Micro-electronic Processes for VLSI Fabrication: Silicon Semiconductor Technology- An Overview, Wafer processing, Oxidation, Epitaxial deposition, Ion-implantation & Diffusion, Cleaning, Etching, Photolithography - Positive & Negative photo-resist

Basic CMOS Technology - (Steps in fabricating CMOS), Basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator

Layout Design Rule: Stick diagram with examples, Layout rules.

Module 4 [10]

Hardware Description Language - VHDL or Verilog Combinational & Sequential Logic circuit Design.

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 Eshraghian, PHI
4. CMOS Circuit Design, Layout & Simulation, R.J.Baker, H.W.Lee, D.E. Boyee, PHI