

EE 010 606 L02 VLSI Systems

Teaching scheme

2 hours lecture and 2 hours tutorial per week

Credits:4

Objective:

- *To cater the needs of students who want a comprehensive study of the principle and techniques of modern VLSI Design and Systems.*

Module I (10 hours)

Process steps in IC fabrication: Silicon wafer preparation- Czochralski process- Diffusion of impurities- physical mechanism- Ion implantation- Annealing process- Oxidation process- Lithography- Chemical Vapour Deposition (CVD)- epitaxial growth- reactors- metallization- patterning- wire bonding and packaging.

Module II (12 hours)

Monolithic components: Isolation of components- junction isolation and dielectric isolation. Monolithic diodes- schottky diodes and transistors- buried layer- FET structures- JFET- MOSFET- PMOS and NMOS, control of threshold voltage (V_{th})- silicon gate technology- Monolithic resistors- resistors in diffused regions- MOS resistors- monolithic capacitors- junction and MOS structures- IC crossovers and vias.

Module III (13 hours)

CMOS technology: CMOS structures- Latch up in CMOS. CMOS circuits: combinational logic circuits:- Inverter-NAND, NOR gates, complex logic circuits, Full adder circuit. CMOS Transmission Gates (TG)- realization of Boolean functions using TGs. Complementary Pass Transistor Logic (CPL)- CPL circuits: NAND, NOR gates, 4bit shifter.

Module IV (13 hours)

CMOS sequential logic circuits: SR flip-flop, JK flip-Flop, D latch circuits. BiCMOS technology- Structure- BiCMOS circuits: Inverter, NAND gate, NOR gate. CMOS Logic systems- Scaling of MOS structures- scaling factors- effects of miniaturization.

Module V (12 hours)

Gallium Arsenide Technology:- Crystal structure- Doping process- Channeling effect- MESFET. Comparison between Silicon and GaAS technologies. Introduction to Programmable Logic Arrays (PLA) and Field Programmable Gate Arrays (FPGA).

Text Books

1. N Weste and K Eshragian, “*Principles of CMOS VLSI Design: A systems perspective*”, Pearson Education.
2. Jan M Rabaey, Anantha Chandrakasan and Borivoje Nikolic, “*Digital Integrated Circuits – A Design Perspective*”, Prentice Hall

Reference Books

1. S M Sze, *VLSI technology*, Me Graw Hill.
2. Douglas Pucknell, *Basic VLSI design*, PHI.
3. S.M.Kang & Y.Lebibici, *CMOS digital integrated circuits*, Mcgraw Hill.
4. K R Botkar, *Integrated Circuits* , Khanna Pub.