

EC 703 VLSI Design

Module I

Introduction to Microelectronics - Monolithic and hybrid integrated circuits - Bipolar and MOS technology- Fabrication of active and passive components, bonding, packaging. Concept of SSI, LSI, VLSI. Introduction to thick film and thin film technology - resistors, capacitors - VLSI process integration - fundamental considerations in IC processing - NMOS IC technology - CMOS IC technology- BiCMOS IC technology. - GaAs technology. Ion implantation in IC fabrication

Module II

The MOS device - (n - channel & p- channel) - capacitance of MOS structure - accumulation, depletion and inversion, threshold voltage, current equations - characteristics, channel pinch-off. Second order MOS device effects : short-channel effect, narrow width effect, sub-threshold current, device saturation characteristics. The basic inverter using MOS-circuit - current equations - pull up_ pull down ratios- Alternate forms of pull up

Module III

Basic circuit concepts- sheet resistance, area capacitance, inverter delays - effect of loading - basic NAND, NOR circuit - super buffers - pull up and pull down characteristics. The CMOS inverter characteristics - NAND, NOR circuits using CMOS. Layout design of static MOS circuits - Layout rules - general principles & steps of lay-out design - use of stick diagrams - design rules - effects of scaling down.

Module IV

General considerations in subsystem design - Layout examples of NAND, NOR, registers -pass_transistors in implementing a circuit. Logic design of MOS networks - combinational circuits -clocked sequential circuit - drivers for bus lines - dynamic RAM - Forming arrays of RAM. Implementation approaches-custom circuit design, cell based design, array based design.

Module V

Timing issues in VLSI system design: timing classification- synchronous timing basics - skew and jitter- latch based clocking- self timed circuit design - self timed logic, completion signal generation, self timed signaling-synchronizers and arbiters, clock generation and synchronization-synchronous versus asynchronous design.

References

- 1) Douglas A Pucknell, Kamran Eshraghian , "Basic VLSI Design", P H
- 2) Millman and Grabel "Microelectronics" TMH.
- 3) Jan M. Rabaey, A. Chandrakasan, B. Nikolic"Digital Integrated Circuits- A Design perspective " 2/e, PHI.
- 4) Thomas E. Dillinger , "VLSI Engineering ", PH International editions.
- 5) S M Sze, " VLSI Technology"
- 6) W este and Eshraghian,"Principles of CMOS VLSI Design,A Systems Perspective",2/e, Pearson Education.
- 7) Mead & Conway , "Introduction to VLSI System Design"-
- 8) Fabricius, " Introduction to VLSI Design".
- 9) Charles H Roth Jr - "Fundamentals of Logic Design" 4 Ed, Jaico Publishers, 2002 704/