VLSI Design | EC 1503 | 4 Credits

Faculty: Dr. Lokesh Garg | Class: Core Course

Course Outcomes: At the end of the course, students will be able to

[EC1503.1] Illustrate MOS fabrication and its working for research skills in device fabrication domain.
[EC1503.2] Design and discuss CMOS circuits for delays and noise margin which is useful in employability.
[EC1503.3] Design and analyze different combinational logic circuits and systems using CMOS and other logic families for research skills.
[EC1503.4] Implement sequential circuits using CMOS and other logic families.

A.   SYLLABUS

Introduction: VLSI technology trends, performance measures and Moore's law; **MOS devices and circuits**: MOS transistors, Study of depletion and enhancement mode operations, Threshold Voltage. Second order effects in MOSFETs, Analysis of NMOS and CMOS inverter circuits;**Fabrication of ICs**: Lithographic process of MOS and CMOS fabrication. N-well, P-well and twin tub processes, Latch-up in CMOS, SOI process, VLSI Yield and economics;**MOS Circuit design & layouts**: Pass transistors and transmission gates, Implementation of Boolean functions and combinational circuits using switch logic & gate logic, Pseudo NMOS inverter, Dynamic and clocked CMOS inverters, Clocking strategies, Flip flops and sequential circuits, Static and dynamic memory cells, RAM, ROM and PLAs. Stick diagrams, Design rules and layouts, Scaling of MOS circuits;**Basic circuit concepts and performance estimation**: Sheet resistance, Standard unit of capacitance, Estimation of delay in NMOS and CMOS inverters, Driving of large capacitive loads, Super buffers, Power dissipation in CMOS;**Sub system design**: Design strategies, Design issues and structured approach. Design examples such as Adders, ALUs and Shifters, Design of sequential circuits;**current trends**: BiCMOS and GaAs devices and circuits, Low power VLSI circuit techniques, analog and mixed signal design.

B.   TEXT BOOKS

   i. J. M Rabaey, "*Digital Integrated Circuits*", Prentice Hall India, 2003
  ii. S. M. Kang &Y. Leblebici, "*CMOS digital Integrated circuits design and analysis*", Tata McGraw Hill, 3rd edition.
 iii. W. N.&K. Eshraghian, "*Principles of CMOS VLSI Design*", Addison Wesley Publication, 2nd Edition.
  iv. S. M. Kang &Y. Leblebici, "*CMOS digital Integrated circuits design and analysis*", Tata McGraw Hill, 3rd edition.
   v. A.Mukherjee, "*Introduction to NMOS & CMOS VLSI systems Design*", Prentice Hall, 1986.