



MANIPAL UNIVERSITY JAIPUR

School of Electrical, Electronics & Communication Engineering (SEEC)

Department of Electronics & Communication Engineering
Course Hand-out

Advance Digital VLSI Design | EC 2111 | 4 Credits

Session: July 14 – Dec. 14 | Faculty: Prof B P Singh | Class: Core Course

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

- [EC2111.1] Illustrate MOS technology, working and its fabrication for research skills required in device fabrication domain.
- [EC2111.2] Design and discuss CMOS circuits for delays and noise margin which is useful in employability.
- [EC2111.3] Design and analyze different combinational and sequential logic circuits systems using CMOS and other logic families for research skills.
- [EC2111.4] Understand semiconductor memories, their working and the design issues in deep sub-micron level.

A. SYLLABUS

VLSI design methodologies: VLSI design flow, design hierarchy, Concepts of Regularity, Modularity and Locality, VLSI design styles, Design Quality and Computer Aided Design. MOS Transistor theory: Operation and characteristics, Threshold voltage, Body effect, Sub threshold conduction, Channel length modulation, mobility variation, Tunnelling, Drain punch through and Hot electron effect; MOS models, small signal AC characteristics; CMOS inverter, β_n/β_p ratio, noise margin, static load MOS inverters, tristate inverter; Advantages of CMOS over NMOS, CMOS/SOI technology, CMOS/Bulk technology, latch up in bulk CMOS and its prevention. Principles of Digital VLSI Design using CMOS: Principles of circuit design using pass transistors and transmission gates; Combinational Logic circuit design using CMOS logic; Sequential logic Circuit design using CMOS, Flip Flops, synchronous sequential circuits and clocked storage elements. Basic circuit concepts and performance estimation: Introduction, Resistance Estimation Capacitance Estimation and switching characteristics of CMOS gates; Transistor Sizing, Power dissipation, Sizing Routing Conductors, Design Margins and Reliability. Dynamic CMOS logic and clocking: Introduction, static CMOS design, Pseudo NMOS circuits, Domino CMOS structure and design, Charge sharing, clocking, clock generation and distribution. Semiconductor memories & I/O circuits. Various types of memories and their working.

B. TEXT BOOKS

- J. M Rabaey, "Digital Integrated Circuits", Prentice Hall India, 3rd ed., 2003.
- W. N. & K. Eshraghian, "Principles of CMOS VLSI Design", (2e), Addison Wesley, 2nd ed., 1993.
- S. M. Kang & Y. Leblebici, "CMOS digital Integrated circuits design and analysis", Tata McGraw Hill, 3rd ed., 1996.

