

B.E. ELECTRONICS ENGINEERING
FOURTH YEAR SEMESTER VII

SUBJECT: Basics of VLSI

Lectures: 4 Hrs per week
Practical: 2 Hrs per week

Theory: 100 Marks
Term Work: 25 Marks
Oral: 25Marks

Rationale: This subject shall foundation for understanding the intricacies of very large scale integrated circuits and analyzing these circuits. The knowledge gained shall be useful for further elective on designing with VLSI circuits

DETAILED SYLLABUS

Physics of FET

NMOS, PMOS, enhancement and depletion mode transistor, MOSFET, threshold voltage, flatband condition, threshold adjustment, linear and saturated operation, FET capacitance, mobility saturation, thermal variation, short channel and hot electron effect.

Silicon semiconductor technology

Wafer processing, mask generation, oxidation, epitaxy ion implantation, diffusion, metalization, basic NMOS and PMOS processes. Process simulation using CAD tools.

Scaling

Scaling of MOS circuits, type of scaling, functional limitations of scaling, scaling of wires and interconnects.

Design rules and layout

Purpose of design rules, NMOS and CMOS design rules and layout, Design of NMOS and CMOS inverters, NAND and NOR gates. Interlayer contacts, butting and buried contacts, stick diagrams, layout of integrated circuits, use of layout tools like MAGIC for integrated circuits.

MOS Inverters

MOSFET aspect and inverter ratio, Enhancement VS Depletion mode pull ups, standard CMOS inverter, transit time and switching speed of NMOS and CMOS inverters, NMOS and CMOS gates, transistor sizing and power dissipation, noise margin calculations, SPICE models and circuit simulation using PSPICE.

Design of basic VLSI circuits

Design of circuits like multiplexer, decoder, priority encoder, Flip flops, shift registers using MOS circuits.

Design Methodologies

Design analysis and simulation, design verification, design implementation, design synthesis, validation and testing of manufactured circuits.

Text Books:

E.D. Fabricus, Introduction to VLSI design, McGraw Hill Publications, first edition, 1990
Neil H.E. Weste, Kamran Eshraghian, Principles of CMOS VLSI Design: A Systems Perspective, second edition, Addison Wesley Publications, 1993
Rabaey Jan M., Chandrakasan Anantha, Nikolic Borivoje, Digital Integrated Circuits: A Design Perspective, second edition, Prentice Hall of India

TERM WORK
The Term work shall consist of at least four computer programs and atleast six assignments covering the whole syllabus, duly recorded and graded. This will carry a weightage of fifteen marks. A term work test shall be conducted with a weightage of 10 marks.
ORAL EXAMINATION
An oral examination is to be conducted based on the above syllabus.