MUFFAKHAM JAH COLLEGE OF ENGINEERING AND TECHNOLOGY

ELECTRONICS AND COMMUNICATION ENGINEERING DEPARTMENT

Course Handout 2018-19

Course Title	: VLSI Design (EC 402)
Class	: BE. 4/4Year ECE Sec B I Semester
Contact hours per week	: 4
Course Coordinator	: AFSHAN KALEEM
Course Coordinator Phone	: 04023280344
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Resource Link	:

http://mjcollege.ac.in/studentresourceslist.php?resourceusername=afshan.kaleem

Course Coordinator Location	: ROOM No: (5714B)
Course Coordinator Availability	: **Friday 1:45 -3:45**
Pre-requisite Courses:	

- Electronic devices (EC203)
- Switching Theory and Logic Design(EC255)
- Linear Integrated Circuits and Application (EC301)
- Digital Integrated Circuits and Application (EC302)

Course Description:

In this course, the fundamentals of VLSI Design system will be explored which familiarizes the students with CMOS Technology, used for reducing size of the components .It introduces basic concepts of electrical properties of MOS devices and the relation between physical and electrical parameters of MOS device. It describes about the IC fabrication process Layout design, Memory Devices, Combinational Logic, Sequential Logic, Interconnects and small signal Amplifier. Practical application of VLSI can be found in Robotics, Nanotechnology, Communication and Medical electronics.

Course Outcome:

On Successful completion of the course the student will be able to:

1. Analyze the electrical properties of MOSFET and design of MOS inverters with different loads, Basic Logic Gates with CMOS.
2. Design layouts of a gate in CMOS VLSI technology and explain minimization of delay, and calculate sheet resistance and capacitance.
3. Design the Combinational Logic, Sequential Logic, Transmission gates, the memory devices.
4. Explain the Interconnect Design Coupling capacitance, coupling effects on Delay, Crosstalk, and Interconnect Inductance.
5. Explain the Analog VLSI Design, Small Signal Model of MOSFETs, Amplifiers and mirror concepts.

Overview of Learning Activities:

a. Lectures and class discussions
b. Assignments
c. Power Point Presentations (PPT)

Overview of Learning Resources:

1. David A Hodges, Horace G Jackson Resve A Saleg “Analysis and Design of Digital Integrated circuits”, McGraw Hill Companies 3rd edition, 2006.
2. Jan M Rabaey, A Chandrakasan, Borvioje N, “ Digital Integrated Circuits Design Perspective”, 2nd edition, PHI, 2005.
3. Wayne Wolf, “Modern VLSI Design”, 4th edition, Pearson Education, 2009.
4. Kamran Eshraghian, Douglas A. Pucknell, and Sholeh Eshraghian, “Essentials of VLSI circuits and systems”, PHI, 2011.
5. John P. Uyemura, “Introduction to VLSI Circuits and Systems”, Wiley India Pvt. Ltd., 2011.

6. David Johns, Ken Martin, "Analog Integrated Circuit Design", John Wiley & sons. 2004

Freely Accessible Internet Sites:

1.

SL.NO.	TITLE	RESOURCE LINK
1.	VLSI Circuits -- Prof. S. Srinivasan	http://nptel.ac.in/courses/117106092/
2.	VLSI Technology -- Dr. Nandita Dasgupta	http://nptel.ac.in/courses/117106093/

2. Additional Material provided in the class
   a. Lecture notes soft copy.
   b. Question bank.

Overview of Assessment

i. Class test
ii. University exam
iii. Assignment
iv. Quiz

UNIT-I-Introduction to MOS Technology, Basic MOS Transistor action: Enhancement and Depletion Modes. Basic electrical properties of MOS, Threshold voltage and Body Effect. Design of MOS inverters with different loads, Basic Logic Gates with CMOS: INVERTER, NAND, NOR, AOI and OAI gates. Transmission gate logic circuits, Bi-CMOS inverter.

UNIT-II-MOS and CMOS circuit Design Process: MOS Layers, Stick diagrams, Lambda based Design rules and Layout diagrams. Basic Circuit Concepts: Sheet Resistance, Area Capacitance and Delay calculation.

UNIT-III-Combinational Logic: Manchester, Carry select and Carry Skip adders, Crossbar and barrel shifters, Multiplexer.

Sequential Logic: Design of Dynamic Register Element, 3T, 1T Dynamic RAM Cell, 6T Static RAM Cell.
D flip flop using Transmission gates. NOR and NAND based ROM Memory Design.

UNIT-IV- Interconnect Design: Introduction, Interconnect RC Delays, Buffer Insertion for very long wires, Interconnect coupling capacitance: Components of Coupling capacitance, Coupling effects on Delay, Crosstalk, Interconnect Inductance.

UNIT-V-Analog VLSI Design: Small Signal Model of MOSFETs. Simple CMOS current mirror, common source amplifier, source follower, common gate amplifier, cascode amplifiers. Source degenerated current mirror, cascode current mirror, Wilson current mirror.

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