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VL5101 CMOS DIGITAL VLSI DESIGN

DETAILED SYLLABUS

OBJECTIVES:

- This course deals comprehensively with all aspects of transistor level design of all the digital building blocks common to all CMOS microprocessors, DPSs, network processors, digital backend of all wireless systems etc.
- The focus will be on the transistor level design and will address all important issues related to size, speed and power consumption. The units are classified according to the important building and will introduce the principles and design methodology in terms of the dominant circuit choices, constraints and performance measures.

UNIT I MOS TRANSISTOR PRINCIPLES AND CMOS INVERTER

MOS(FET) Transistor Characteristic under Static and Dynamic Conditions, MOS Transistor Secondary Effects, Process Variations, Technology Scaling, Internet Parameter and electrical wise models CMOS Inverter - Static Characteristic, Dynamic Characteristic, Power, Energy, and Energy Delay parameters.

UNIT II COMBINATIONAL LOGIC CIRCUITS

Propagation Delays, Stick diagram, Layout diagrams, Examples of combinational logic design, Elmore's constant, Dynamic Logic Gates, Pass Transistor Logic, Power Dissipation, Low Power Design principles.

UNIT III SEQUENTIAL LOGIC CIRCUITS

Static Latches and Registers, Dynamic Latches and Registers, Timing Issues, Pipelines, Pulse and sense amplifier-based Registers, Nonbistable Sequential Circuits.

UNIT IV ARITHMETIC BUILDING BLOCKS AND MEMORY ARCHITECTURES

Data path circuits, Architectures for Adders, Accumulators, Multipliers, Barrel Shifters, Speed and Area Trade-offs, Memory Architectures, and Memory control circuits.

UNIT V INTERCONNECT AND CLOCKING STRATEGIES

Interconnect Parameters – Capacitance, Resistance, and Inductance, Electrical Wire Models, Timing classification of Digital Systems, Synchronous Design, Self-Timed Circuit Design.

REFERENCES:

1. Jan Rabaey, Anantha Chandrakasan, B Nikolic, "Digital Integrated Circuits: A Design Perspective". Second Edition, Feb 2003, Prentice Hall of India.

2. Jacob Baker "CMOS: Circuit Design, Layout, and Simulation, Third Edition", Wiley IEEE Press 2010 3rd Edition.

3. M J Smith, "Application Specific Integrated Circuits", Addisson Wesley, 1997

4. N.Weste, K. Eshraghian, " Principles of CMOS VLSI Design". Second Edition, 1993 Addision Wesley.