PCCMECE201
VLSI DESIGN

UNIT I

Issues in Digital Integrated Circuit Design, Review of MOS transistor models. –Static and Dynamic Behavior, Secondary effects. CMOS Inverter Static and Dynamic Behavior, Noise Margin, Power Consumption and Power Delay Product, Latch up, Technology Scaling.

UNIT II

Low power design, scaling effects, scaling versus power consumption, power reduction using Voltage scaling and multiple voltage supplies, Timing Issues in synchronous design. Interconnect Parasitics.

UNITIII

Circuit design style, Non-clocked logic families and clocked logic families, CMOS logic families including static, dynamic and dual rail logic, DCSL. Logic gates- Static CMOS Design: Complementary CMOS, Ratioed Logic, Pass Transistor Logic. Dynamic CMOS Design: basic principles, performance of dynamic logic, Noise consideration, Power consumption in CMOS gates – switching activity, Glitches. Logical effort in basic CMOS circuits, Predicting Delay, Logical area and logical efficiency.

UNITIV

Sequential Circuits: introduction Bi-stability, bi-stable elements, CMOS static flip-flop, Pseudostatic latch, Dynamic two-phase flip-flop, C2MOS latch, NORA (no race)-CMOS logic design style, CMOS D latch and edge triggered Flip Flop, Schmitt Trigger, Astable and monostable circuits.

UNITV

Arithmetic Building blocks: CMOS full Adder and Multiplier, organization of a static RAM, MOS static RAM cell, 4T SRAM

Recommended Books:

- Neil Weste and K. Eshragian, “Principles of CMOS VLSI Design: A System Perspective”, Pearson Education (Asia) Pvt. Ltd., 2nd Edition ,2000.
- Wayne Wolf, “Modern VLSI design: System on Silicon” Pearson Education, Second Edition, 1998
- Douglas A Pucknell& Kamran Eshragian , “Basic VLSI Design” PHI 3rd Edition (original Edition – 1994)
- Sung Mo Kang &Yosuf Leblebici, “CMOS Digital Integrated Circuits: Analysis and Design”, McGraw- Hill, 3rd Edition, 2003

PCCMECE201L
VLSI DESIGN LAB

Section I: Introduction about the CAD tool:

Setting the Cadence environment, Introduction to Cadence Based ASIC- Digital Design flow, Introduction to HDL Features.

Section II: List of Experiments:

1.HDL based Implementation of Logic Gates.

2.HDL based Implementation of Half Adder and Full Adder.

3.HDL based Implementation of Half Subtractor and Full Subtractor.

4.HDL based Implementation of Multi-bit Adder circuit.

5.HDL based Implementation of Multiplier circuit.

6.HDL based Implementation of Counter circuit.

7.HDL based test bench for verification of implemented designs.

8.Cadence based synthesis and layout generation of Digital circuits.

9.DRC, LVS and Antenna rule checks of Digital circuits.

10.ASIC design flow of NAND gate.

Required Tools: Vivado, Cadence Digital Design Tool Package, Mentor Graphics.

PCCMECE202
MODERN WIRELESS COMMUNICATION SYSTEMS

UNIT I

Large-scale Path loss: Propagation of EM signals in wireless channel, Reflection, Diffraction and scattering, Free-space propagation model, Two-ray ground reflection model, Log- distance path loss model, Log-normal shadowing, Outdoor propagation models, Longley-Rice model, Okumura model, Hata model, COST-231, Link power budget analysis

UNIT II

Small-scale Fading and Multipath: Factors influencing small-scale fading, Doppler shift, Impulse response model of multipath channel, Parameters of mobile multipath channels, Types of small-scale fading, Statistical models for multipath fading channels, Rayleigh and Rician distributions, Jakes Doppler spectrum.

UNIT III

Equalization: Introduction, Fundamentals of Equalization, training a generic adaptive equalizer, Equalizes in a communication receiver, Linear Equalizers, Non-Linear Equalization- Decision Feedback Equalization (DFF) and Maximum Likelihood Sequence Estimation (MLSE) Equalizer, Algorithms for adaptive equalization- Zero forcing Algorithm, Least mean square algorithm and recursive least squares algorithm.

UNIT IV

Diversity Techniques: Condition for deep-fading, Probability of error analysis under fading channel, Time diversity, Frequency diversity, Polarization diversity, Space diversity, Selective diversity combining, scanning diversity, Maximal ratio-combining and Equal gain combining, Performance analysis of Rayleigh fading channel, RAKE Receiver, Analysis of BER of Multi-Antenna system, Diversity order.

UNIT V

Spread Spectrum Techniques: Introduction to spread spectrum, Orthogonal spreading codes, Benefits of spreading, Multi-user CDMA, Performance Analysis of CDMA uplink and downlink with multiple users, Asynchronous CDMA, Near-far problem, Power control.

UNIT VI

OFDM: Introduction to Multi-carrier modulation, Importance of cyclic prefix, Adaptive modulation and coding techniques, OFDM issues,PAPR, Frequency and timing offset, ICI mitigation techniques. Overview of various evolutions of wireless communication technologies: GSM, GPRS, EDGE, CDMA, 3G, 4G and beyond 4G.

Recommended Books:

1. Aditya K. Jagannatham, Principles of Wireless Communication Systems, 2015, Ist Edition, McGraw-Hill India.
2. T. S. Rappaport, "Wireless Communications," Pearson Education, 2003.

Reference Books:

1. Simon Haykin, Micheal Moher, Modern Wireless Communications, 2011 Ist Edition, Pearson Education, India.
2. T L Singal, "Wireless Communications", Tata McGraw Hill, 2010.
3. Wireless Communication and Networking- William Stallings, 2003, PHI.

PCCMECE202L
MODERN WIRELESS COMMUNICATION SYSTEMS LAB

List of Experiments:

1.Simulation of Free-space propagation model using MATLAB.

2.Simulation of Hata and Okumura model using MATLAB.

3.Determination of path loss using Okumura Hata model for urban, suburban and rural areas.

4.Plot Path loss curve with respect to distance for different values of path loss exponent between 2 to 4.

5.Simulation of Adaptive Linear Equalizer using MATLAB.

6.Simulation of RAKE receiver for CDMA communication using MATLAB.

Tools Required: MATLAB, and supported SDR hardware

PCCMECE203
OPTIMIZATION TECHNIQUES

UNIT-I

Introduction &Concepts of Optimization Formulation of Linear Programming Problems, General Statement of LPP, Assumptions Underlying LP, Solution of Linear Programming Problems: Graphic Method. Some Special Cases of Graphic Method, Convex Set: Extreme points of Convex Set, Convex hull.

UNIT-II

Simplex Techniques LP Model in Equation Form, Transition From Graphical To Algebraic Solution, Simplex Algorithm, Artificial starting solution: Big M-Method, Two-phase Method, Special cases in Simplex Method: Degeneracy, Alternative Optima, Unbounded solution, infeasible solution.

UNIT-III

Transportation Models Mathematical Model of Transportation Problem, Methods of finding Initial basic feasible solution by NWC Rule, LCM,VAM, Test for optimality by Stepping Stone and MODI method, Balanced and Unbalanced Transportation Problems, Degeneracy. Assignment Model: Mathematical Model of Assignment Problem, The Hungarian Method, Simplex Explanation of the Hungarian Method.

UNIT-IV

Engineering Applications Network Models: Shortest route Algorithm, network Construction, Rules for network diagram, Techniques in project planning and Construction, CPM, Project Crashing. Sequencing Model: Advantages of Sequencing, Johnsons Algorithm of Sequencing problems, Type I: n jobs two machines, Type II: n jobs three machines, Type III: two jobs m machines. General Structure of Queuing System, Operating Characteristics of Queuing System, Queuing Models, Role of Poisson and Exponential Distributions, Pure Birth and Death Models, Generalized Poisson Queuing Model, Specialized Poisson Queues: Single, Multiple and Machine Serving Models.

Recommended Books:

1.Linear Programming by G. Hadlay, Addison Wasley.
2.Operations Research – An Introductory by Hamidi A. Taha, Macmillan.
3.Operations Research – Methods and problems by M. Sasieni, A. Yaspam and L. Friedman, John Wily and Sons Inc. London.

References:

1.Linear Programming by S.I. Gass, Mc-Graw Hill.
2.Introduction to Operations Research. John Wiley and Sons, New York.
3.Operations Research: An Introduction. Prentice Hall of India Private Limited, New Delhi Wagner.