1. ECE 571/575: VLSI System Design/Experiments in VLSI System Design I

2. 4 credits total: 2-75 minute lecture sessions/week, 1 credit weekly lab assigned

3. Sourajeet Roy; Steve Undy

4. CMOS VLSI Design: A Circuits and Systems Perspective. Weste, N. & Harris, D. 2010.

5. Course Information
    a. Design of integrated circuits at the system level including cell design, digital systems, parallel architecture, systolic arrays. Set of labs designed to enhance students' understanding of the materials in lecture
    b. Prerequisite: ECE 451; Concurrent registration in ECE 571 and ECE 575
    c. Selected Elective: Electrical Engineering; Computer Engineering

6. Goals for the Course
    a. Course Learning Objectives
        i. Describe basic cell design in VLSI
        ii. Describe the entire process of VLSI chip design
        iii. Design a D-FF in VLSI
        iv. Design a synchronous circuit and determine its timing characteristics
        v. Design a more complex logic circuit using the static, dynamic and pass transistor logic styles
        vi. Utilize various design stages from behavioral modeling using Verilog and their simulation environment, to logic and circuit design, and finally to layout and design verification.
        vii. Evaluate the performance and the power requirements of static logic, dynamic logic, and pass transistor logic circuits
        viii. Use HP workstations for all the design activities workstations
    b. Student Outcomes
        1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
        2. An ability to apply the engineering design process to produce solutions that meet specified needs with consideration for public health and safety, and welfare, as well as global, cultural, social, environmental, and economic factors
        3. An ability to communicate effectively with a range of audiences
        4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
        6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
        7. An ability acquire and apply new knowledge as needed, using appropriate learning strategies

7. Topics Covered
    - VLSI design methodology
    - Current trends in VLSI system design
    - MOS transistor theory and MOS VLSI processing technology
    - Performance characteristics and performance optimization of CMOS
    - Layout of MOS ICs
    - IC circuit design techniques: static, dynamic, and pass transistor logic (PTL)
    - Power and timing analysis of VLSI circuits
    - Clock skew and clock distribution
    - Floorplanning, placement, routing, DRC and ERC
    - Testing and design for testability
    - IC packaging technology