

VLSI Circuits & Systems  
EC 604

**Credits : 4**

### **Digital VLSI Circuits**

1. Introduction to ASIC Design
  - a. Design Strategies: Hierarchy, Regularity, Modularity & Locality
  - b. Chip Design Options: Gate Array, Field Programmable Gate Array, PLA, PLD, Standard Cell, Full Custom Design
  
2. Fabrication & Layout of CMOS
  - a. Fabrication Process Flow: Basic steps
  - b. CMOS n-Well Process
  - c. Layout & Design Rules
  - d. CMOS inverter Layout Design
  
3. MOS Inverter Characteristics
  - a. Transfer Characteristics: MOS with resistive load, n-MOSFET Load (Enhancement & Depletion), CMOS inverter
  - b. Transient Analysis of CMOS Inverter and Delay analysis
  
4. CMOS Logic Circuits
  - a. NAND & NOR Gates
  - b. Complex Logic Circuits
  - c. Pseudo n-MOS logic
  - d. CMOS Full adder circuit
  - e. CMOS Transmission Gate (Pass transistor Logic)
  
5. Advanced CMOS Logic circuits (3)
  - a. Dynamic CMOS Logic
  - b. Domino CMOS Logic
  - c. Differential Cascade voltage switch logic
  - d. NORA Logic
  
6. Sequential CMOS logic circuits
  - a. Behaviour of Bi-stable elements
  - b. SR Latch Circuit
  - c. Clocked JK Latch/Master-Slave JK
  - d. CMOS D-latch and edge triggered Flip-flop
  
7. Subsystem Design
  - a. Adders: Carry ahead adder, carry save adder, Manchester carry chain.
  - b. Multipliers: Serial-parallel Multiplier, array multiplier
  - c. High Density Memory: ROM, Static RAM, Dynamic RAM, SD RAM, Flash Memory
  
8. Physical Design
  - a. Floor Planning Methods: Block Placement & Channel Definition, Global and Channel Routing

### **Analog VLSI Circuits**

9. Introduction
  - a. Analog Signal Processing
  - b. Analog VLSI Mixed Signal Circuits
  - c. Basic Building Blocks in Analog Circuits
  
10. Basic Building Blocks
  - a. MOS Switches

- b. Resistor realization using Switched Capacitor
- c. Voltage level shifter
- d. CMOS Current Sources and sinks
- e. CMOS Voltage and Current references
- f. CMOS Differential Amplifier
- g. Output Amplifier

#### 11. Analog Circuits

- a. CMOS Operational Amplifier
- b. Comparator
- c. Switched Capacitor Filter
- d. ADC & DAC (FLASH ADC, Delta-Sigma Modulator)
- e. Phase locked Loop
- f. FPAA