Digital System Design

Course Content:

1. **Representation of Data:** Number Systems and Codes, Representation of tin and signed integers, Floating Point representation of real numbers, Representation of character data, Representation of Signals
2. **Switching Theory:** Laws of Boolean Algebra, Theorems of Boolean Algebra, Switching Functions, Methods for specification of Switching Functions – Truth Table and Algebraic Forms, Realization of functions using logic gates
3. **Digital Logic Elements:** Electronic Logic Gates, Positive and Negative Logic, Families – TTL, ECL and CMOS, Realization of Logic Gates
4. **Simplification of Boolean Expressions and Functions:** Algebraic Methods, Canonical forms of Boolean Functions, Minimization of Functions using Karnaugh Maps, Minimization of Functions using Quine-McClusky Method
5. **Design of Combinational Logic Circuits:** Gate level deisgn of Small Scale Integration (SSI) circuits, Modular Combinational Logic Elements, Decoders, Encoders, Priority Encoders, Multiplexers and Demultiplexrs
6. **Design of Integer Arithmetic Circuits using Combinational Logic:** Integer adders – Ripple carry adder and Carry look ahead adder, Integer subtractors using adders, Unsigned integer multipliers – Combinational array circuits, Signed integer multipliers Booth's Coding, Bit – pair recording, Carry save addition and Wallace tree multiplier, Signed integer division circuits – Combinational array circuits, Complexity and propogation delay analysis of circuits
7. **Design of Combinational Circuits using Programmable Logic Devices(PLDs):** Programmable Read Only Memories (PROMs), Programmable Logic Arrays (PLAs), Programmable Array Logic (PAL) devices, Design of multiple output circuits using PLDs
8. **Sequential Circuit Elements:** Latches – RS Latch, JK Latch, Flip flops – RS, JK, T and D Flip flops, Master slave flip flops, Edge-triggered filp flops
9. **Analysis and Design of Synchronous Sequential Circuits:** Models of sequential circuits – Moore machine and Mealy machine, Flip-flops – Characteristic table, Characteristic equation and Excitation table, Analysis of sequential circuits – Flip flop input expressions, Next state equations, Next state maps, State table and state transition diagram, Design of sequential circuits – State transition diagram, State table, Next state maps, Output maps, Expressions for flip flop inputs and expressions for circuit outputs, Modular sequential logic circuits – Shift registers, Registers, Counters and Random access memories, Design using Programmable Logic Sequencers (PLSs)

10. **Design of Arithmetic Circuits using Sequential Logic:** Serial adder for integers, Unsigned integer multiplier, Unsigned integer division circuits, Signed integer division, Floating point adder / subtractor - Design of control circuit, Floating point multiplier,
11. **Sequence Detection and State Reduction Methods:** w:st="on" Moore and Mealy state graphs for sequence detection, Methods for reduction of state tables, Methods for state assignment
12. **VLSI Realization of Digital Systems:** Field Programmable Logic Arrays (FPLAs) and Logic Cell Arrays(LCAs)

Reference Books:

1. C. H. Roth, Fundamentals of Logic Design, Jaico Publishers, 1998
2. V. P. Nelson, H. T. Nagle, E. D. Caroll and J. D. Irwin, Digital Logic Circuit Analysis and Design, Prentice Hall International, 1995
3. S. Brown and Z Vranesic, Fundamentals of Logic Design with VHDL Design, Tata McGraw-Hill,2000
4. F. J. Hill and G. R. Peterson, Computer Aided Logic Design with Emphasis On
5. VLSI, John Wiley & Sons,1993
6. C. Hamacher, Z Vranesic and S. Zaky, Computer Organization, McGraw-Hill, 2002
7. J. P. Hyes, Computer Architecture and Organization, McGraw-Hill, 1998
8. Herbert Taub and Donald Schilling, Digital Integrated Circuits, McGraw Hill
9. Neil H. E. Weste and Kamran Eshraghian, Principles of CMOS VLSI Design
10. Richard F. Tinder, Engineering Design, Academic Press