CS 2300 Switching Theory and Digital Design

L-T-P-C: 3 - 0 - 0 - 3

Representation of Data: Number systems and codes, Representation of unsigned and signed integers, Fixed-point representation of real numbers, Floating-point representation of real numbers, Representation of character data, Representation of signals.

Switching Theory: Laws of Boolean algebra, Theorems of Boolean algebra, Switching functions, Methods for specification of switching functions – Truth tables and Algebraic forms, Realization of functions using logic gates.

Digital Logic Elements: Electronic logic gates, Positive and negative logic, Logic families –TTL, ECL and CMOS, Realization of logic gates.

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.

Design of Combinational Logic Circuits: Gate level design of Small Scale Integration (SSI) circuits, Modular combinational logic elements – Decoders, Encoders, Priority encoders, Multiplexers and Demultiplexers.

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 recoding, Carry save addition and Wallace tree multiplier, Signed integer division circuits – Combinational array circuits, Complexity and propagation delay analysis of circuits.

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

Sequential Circuit Elements: Latches –RS latch and JK latch, Flip-flops-RS, JK, T and D flip flops, Master-slave flip flops, Edge-triggered flip-flops

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)

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.

Sequence detection and state reduction methods: Moore and Mealy state graphs for sequence detection, Methods for reduction of state tables, Methods for state assignment

VLSI Realization of Digital Systems: Field-Programmable Logic Arrays (FPLAs) and Logic Cell Arrays (LCAs),

Reference:

1. C. H. Roth, Fundamental s 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 Logical Design with Emphasis on VLSI, John Wiley & Sons, 1993
5. C. Hamacher, Z. Vranesic and S. Zaky, Computer Organization, McGraw-Hill, 2002.
6. J.P. Hayes, Computer Architecture and Organization, McGraw-Hill, 1998.