Subject: Digital Electronic Circuits
Code : PC-EI304
Credit: 3
Total lectures: 45

Course Content:

Module-I

Number System and Codes [5L]

- Introduction to Digital system, Data and number systems, Decimal, binary, octal and hexadecimal number systems and their arithmetic operations; conversion of one number system to another.
- Binary codes, natural BCD codes ,weighted, non-weighted, sequential, self-complementing, cyclic, Excess-3, Alphanumeric, EBCDIC and Gray codes,
  Code conversion- from one code to another.
- Signed binary number representation with 1's and 2's complement methods, Binary arithmetic

Module-II

Logic Gates and Boolean algebra [7L]

- Logic Operation-NOT, AND, OR, NAND, NOR, XOR and XNOR –operations, truth tables and universal gates; commonly used 7400 series IC's, standard and IEEE symbols of logic gates.
- All Postulates and laws of Boolean algebra with proof, De Morgan's theorem. Minimization of Logic Expressions using Algebraic method.
- Canonical forms of expressions, minterms and maxterms, SOP and POS forms.
- Simplification and minimization of Logic Expressions using K-map method (up to 6 variables (focussing mainly up to 4 variables)). Concept of don't care and use of don't care terms in K-map method
- Limitation of K-map and Quine-McClausky (Q-M) method of minimization of logic functions and concept of PI, EPI, RPI, SPI.

Module-III

Combinational and arithmetic logic circuit [7L]

- Introduction to combinational circuits, Design procedure
- Adders: Half Adder, Full Adder, Binary parallel adder, Composite adder, Carry look ahead adder, BCD adder.
- Multiplexers and Demultiplexer: basic 2:1, 4:1, 8:1 multiplexer equation and circuit diagram. Implementation of higher order MUX using lower order MUX, function implementation using MUX, basic 1:2 and 1:4 DEMUX equation and circuit diagram. function implementation using DEMUX, application of MUX and DEMUX
- Decoders: basic 2:4, 3:8, 4:16 decoder equation and circuit diagram. Implementation of higher order DECODER using lower order DECODER, function implementation using DECODER. Application of Decoder
- 3bit and 4 bit EVEN and ODD Parity Generator and checkers, 1 bit,2 bit,4 bit Magnitude Comparators with equation and circuit diagram
- 4:2 Encoders and Priority Encoders equation with circuit diagram. Application of DECODER and ENCODER
- Code converter: Binary to Gray and Gray to Binary, BCD to XS-3 and XS-3 to BCD, BCD to Binary and Binary to BCD

Module-IV

Sequential Logic Circuits [12L]

- Concept of Sequential circuit, difference between combinational and sequential circuit, Introduction to latches (S-R Latch, NOR based S-R latch, NAND based S'-R' latch) with characteristic table, truth table, equation and circuit diagram.
- Introduction to different types of Flip-Flop(S-R, D, J-K, T) with characteristic table, truth table, Excitation table, equation and circuit diagram.
- Triggering of flip-flops, Asynchronous inputs in FF, race around condition, Master-slave configuration; Conversion of Flip-flop and application of FF.
- Registers: left, right, serial and parallel shift registers (SISO, SIPO, PIPO, PISO), Bi-directional and universal shift registers, Ring and Johnson (twisted ring) counters, application of register.
- Asynchronous counters - Full-sequence length counter, Binary up and down counter, Bidirectional counter, Modulo-N counter
- Synchronous counters - Full-sequence length counter, Binary up and down counter, Bidirectional counter, Modulo-N counter, Truncated Counter, Arbitrary sequence counter,

Module-V

Analog - Digital Conversion [6L]

- Introduction to analog- digital data conversion, specification of D/A converter.
- D/A conversion- R-2R ladder type, weighted resistor type.
- Specification of A/D converter; A/D conversion- flash type.
- A/D conversion- Flash type, successive approximation type and dual-slope type.

Module-VI

Memory and Programmable Logic Devices & Families [8L]

- Types of Memory and basic definition – Register, Main memory, secondary memory, sequential access memory, random access memory, static and dynamic memory, volatile and non volatile memory, magnetic and semiconductor memory, ROM, PROM, EPROM, EEPROM, RAM, DRAM, SRAM
- Memory decoding, Memory expansion
- Design of combinational logic circuit using ROM PLA,PAL
- Introduction to Digital Logic Families; classification of Digital Logic Families; characteristics of Digital ICs.
- TTL: characteristics, Totem-Pole output, Open Collector output, Tri-state output,
- ECL: characteristics, OR/NOR gate.
- MOS: characteristics, PMOS, NMOS. CMOS: characteristics NAND, NOR, logic circuit realization;

Textbook:

1. Digital Fundamentals by T.L.Floyd&R.P.Jain (Pearson).
2. Fundamental of digital circuits by A.Anand Kumar (PHI).
3. Digital Integrated Electronics by H.Taub&D.Shilling (TMH).

References:

1. Digital Circuit & Design by S.Aligahanan&S.Aribazhagan (Bikas Publishing)
2. Digital Electronics by A.K.Maini (Wiley-India)
3. Digital Circuits-Vol-I & II by D.RayChaudhuri (Platinum Publishers)
4. Modern Digital Electronics by R.P.Jain (McGraw Hill)