

DIGITAL LOGIC DESIGN

UNIT I - DIGITAL SYSTEMS

Introduction to digital electronics - History of digital system, Basics of digital electronics, Digital revolution. **Introduction to number system** - What is number system, Types of number systems. **Different types of number system** - Binary number system, Decimal number system, Octal number system, Hexadecimal number system. **Number base conversion** - Binary to decimal conversion, Conversion of octal number systems, Conversion of hexadecimal number system. **Complements of numbers**- Complement of numbers, 1's and 2's complement, 1's complement and 2's complement subtraction, 7's and 8's complement arithmetic, 7's and 8's complement subtraction, 9's and 10's complement arithmetic, 9's and 10's complement subtraction, 15's and 16's complement arithmetic, 15's and 16's complement subtraction. **Signed binary numbers** - Representation of binary numbers. **Data representation** - Data representation, Fixed point representation, Floating point representation. **Binary codes**- Binary codes, BCD (Binary Coded Decimal) code, Excess-3 code, Gray code, Gray to binary and binary to gray code converter, Five-bit BCD codes. **Error detecting and correction codes** - Error detection, Error correction. **Logic gates** - Introduction to logic gates, Types of logic gates, OR gate, AND gate, NOT gate (inverter), Derived or complex gates, Boolean function for logic gates, Alternative logic-gates Representation. **Universal gates** - Introduction of universal gates, NAND gate, NOR gate, Conversion of AND/OR/NOT Logic to NAND/NOR Logic using Graphical Procedure, Properties of EX-OR gates. **Boolean Algebra and theorems** – Introduction, Boolean postulates and law, Duality theorem. **DeMorgan's theorem** - DeMorgan's theorem, DeMorgan's theorem and other postulates to simplify Boolean expressions. **Boolean Expression** - Boolean Expression, Sum of Product Form, Product of Sum Form, Standard SOP and POS Forms, Converting Expressions in Standard SOP or POS Forms, M-Notations : Minterms and Maxterm, Complements of Canonical Formulas.

UNIT II - MINIMIZATION TECHNIQUES

Minimization of Boolean expression - Minimization of Boolean expression, Combinational circuit minimization. **Karnaugh (K) map** - Introduction of Karnaugh (K) map, Variable of K – map, Plotting a Karnaugh map, Grouping cells for simplification. **Simplification of SOP And POS Expressions** - Simplification of SOP Expressions, Incompletely specified functions (Don't care terms), Describing incomplete boolean function, Don't care conditions in logic design, Minimization of incompletely specified function, Simplification of POS expressions, Five variable K-map. **Quine - Mccluskey method** - Limitations of Karnaugh map, Quine-Mccluskey minimization technique, Example of Quine-Mccluskey method, Quine-Mccluskey using don't care terms, Prime implicant table and Redundant prime implicants. **Implementation of logic function using logic gates** - Implementing the expression with logic gates, Implementation of SOP boolean expression, Implementation of POS boolean expression, NAND – NAND implementation, NOR – NOR implementation. **Multilevel gates** - Multilevel gate implementations, Multilevel NAND and NOR implementation, Multiple output implementation. **Two level implementations** - Two level implementations, Other two level implementation, Nondegenerate

form, AND-OR-INVERT implementation, OR-AND-INVERT implementation.

UNIT III - COMBINATIONAL CIRCUITS (CC)

Introduction to Combinational circuit - Combinational circuit, Introduction of Design Procedure. **Code converters** - Introduction of Code Converter, Binary to BCD Converter, BCD to Binary Converter, BCD to Excess-3, Excess-3 to BCD Code Converter, Binary to Gray Code Converter, Gray Code to Binary Code Converter, Introduction of BCD to Gray code converter, Introduction of Gray to BCD code converter. **Adders** - Half adder, Half adder using NAND gates, Half adder using NOR gates, Introduction of full adder. **Parallel binary adder** - Introduction of parallel adder, 4-bit parallel adder. **Parallel binary adder** - Introduction of parallel adder, 4-bit parallel adder. **Carry Look Ahead adder** - Introduction of Carry Look Ahead Adder. **Subtractors** - Half subtractor, Introduction of Full subtractor. **Parallel binary subtractor** - Introduction of Parallel Subtractor, Comparison between Serial and Parallel Adder. **Serial adder/subtractor** - Introduction of serial adder, Operation of serial adder, Serial subtractor. **Binary multiplier** - Introduction of Binary multiplier. **Magnitude comparators** - Digital comparator, One – bit comparator, Two – bit comparator, 4 – Bit Comparator, IC 7485 (4-bit Comparator), IC 74X682 (8-bit comparator). **Decoders** - Introduction of decoders, Binary decoder, The IC 74X138 (3 to 8 decoder), The IC 74X139 (Dual 2 to 4 Decoder), The IC 74X154 (1 to 16 Decoder, Cascading binary decode, Realization of Multiple Output Function using Binary Decoder, BCD to Decimal Decode, BCD to 7 segment decoder, Basic Connection for Driving 7 – Segment Display, IC 7446A, 7447A and 74LS47, Cascade Non Multiplexed Displays, Ripple Blanking in Multi-digit Displays, Multiplexed Common Anode Displays, Multiplexed Common Cathode Displays, Decoder vs demultiplexer and multiplexer vs decoder, Applications of decode. **Encoders** - Introduction to encoders, Decimal to BCD encoder, IC 74XX147 decimal to BCD encoder, Introduction of Octal to Binary Encode, Introduction of Priority Encoder. **Multiplexers** - What is a multiplexer (MUX)?, 74XX151 8 to 1 multiplexer, 74XX157 Quad 2-Input Multiplexer, 74XX153 Dual 4 to 1 multiplexer, Expanding Multiplexer, Application of Multiplexe. **Demultiplexers** - Introduction of demultiplexer, Introduction of 1 to 16 demultiplexer, IC 74X154 1 to 16 demultiplexer.

UNIT IV - SEQUENTIAL CIRCUITS

Sequential logic circuits - Introduction to sequential logic circuits, Level triggering. **Latch** - Gated SR latch, Gated SR latch, Latches vs flip-flops. **Flip-flops** - Introduction to flip-flop, Preset and clear inputs, Clocked D flip-flop, JK flip-flop, JK flip-flop using NAND gates, Race-around condition. **Master slave flip-flop** - Master-slave JK flip-flop, Master-slave SR flip-flop, Clocked D flip-flop, Clocked T flip-flop, Flip-flop characteristics, Characteristic equations of flip-flops, Flip-flops as finite state machines, Flip-flop excitation table. **Analysis of Synchronous sequential circuit** - Analysis of Synchronous sequential circuit, Example. **Design procedure of Synchronous sequential circuit** - Design procedure of Synchronous sequential circuits. **Design of synchronous counter** - Design of synchronous counter, Design of a synchronous 3-bit up-down counter using JK flip-flops, Design of a synchronous modulo-6 gray code counter, Design of a synchronous modulo-10 gray code counter, Design of a synchronous

BCD counter using JK flip-flops. **Asynchronous counters** - Introduction of counters, Asynchronous counters, Asynchronous/ripple down counter, Asynchronous up/down counter. **Shift registers** - Introduction to registers, Shift registers, Serial-in serial-out shift register, Serial-in parallel-out shift register, Bidirectional shift register, Parallel-in serial-out shift register, Parallel-in parallel out-shift register, 4-bit parallel access shift register (7495), Parallel access shift register (74195), Register with reset facility. **Synchronous counter** - Synchronous counters, synchronous vs asynchronous counters. **Asynchronous sequential circuit** - Design of asynchronous sequential circuit, Analysis of fundamental mode sequential circuit. **Reduction of state and flow tables** - Reduction of state, Flow table. Role **free conditions in sequential circuit** – Hazards, Design of hazard free switching circuit.

UNIT V - MEMORY

Introduction to memories - Introduction to memories. **Classification of memories** - Classification of memories. **Random Access Memory (RAM)** - Introduction of Random Access Memory, Static RAM, Dynamic RAM, Comparison between SRAM and DRAM. **Read Only Memory (ROM)** - Introduction of Read Only Memory, Types of ROM, PROM (Programmable Read Only Memory), EPROM (Erasable Programmable Read Only Memory), EEPROM (Electrically Erasable Programmable Read Only Memory), Comparison of EPROM and EEPROM, Difference between UVROM and EEPROM, Comparison between RAM and ROM, Types of ROM and RAM ICs, Flash Memory. **Memory Decoding** - Introduction of Memory Decoding. **Data bus and Address bus** - The bus, Data bus, Address bus. **Sequential memory** - Sequential memory. **Cache memory** - Introduction of cache memory, Operation of cache, Mapping function of cache. **Programmable logic arrays** - PLA (Programmable Logic Array. **Memory hierarchy** - Memory hierarchy in terms of capacity, Access method.