DIGITAL LOGIC DESIGN AND COMPUTER ORGANIZATION

UNIT I - BASIC STRUCTURE OF COMPUTERS AND DATA REPRESENTATION

Introduction to computer architecture- Introduction, Introduction to system design,Organization of digital system, Design concepts, Digital vs analog, Computer components, Computer organization,Types of computer. **Functional units-** Introduction to functional units, Input devices, Output devices, Bus structures, Single bus structure, Multiple bus structure. **Software -** Software, Software, Application software. **Technology – performance – power wall-** Technologies for building processors and memory, Performance, CPU performance and its factors, Power wall. **Multiprocessor systems -** Multiprocessor systems, Multiprocessors, UMA Multiprocessors using crossbar switches, UMA Multiprocessors using multistage switching networks, NUMA Multiprocessor, Multiprocessor operating system types, Multiprocessor synchronization, Multiprocessor scheduling, Cache coherency. **Multi computers -** Introduction to multi computers, Switching schemes, Interprocess communication, User level communication software, Blocking vs non-blocking, Buffers and copying, The problem with messages, Remote procedure call, Multicomputer scheduling, Virtualization, Differentiate between multiprocessors and multicomputer, Signed binary numbers. **Introduction to number system-** What is number system, Types of number systems. **Different types of number system -** Different types of number system, Binary number system, Decimal number system, Octal number system, Hexadecimal number system. **Data representation -** Data representation, Fixed point representation, Floating point representation. **Number base conversion -**Binary to decimal conversion, Conversion of octal number systems, Conversion of hexadecimal number systems. **Complements -** Complement of numbers, 1's and 2's complement, Examples for 1's complement and 2's complement subtraction, 7's and 8's complement arithmetic, Examples for 7's and 8's complement subtraction, 9's and 10's complement arithmetic, Examples for 9's and 10's complement subtraction, 15's and 16's complement arithmetic, Examples for 15's and 16's complement subtraction. **Signed binary numbers -**Signed binary numbers, Representation of binary number. **Binary codes-**Binary codes, BCD (Binary Coded Decimal) code, Excess-3 code, Gray code, Gray to binary and binary to gray code conversion, Five-bit BCD codes.

UNIT II - DIGITAL LOGIC CIRCUITS

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 Maxterms, Complements of Canonical Formulas. **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. **Minimization of Boolean expression -** Minimization of Boolean expression. **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. **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-flops -** 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. **Introduction to Combinational circuit -** Combinational circuit, Introduction of Design Procedure. **Adders -** Half adder, Half adder using NAND gates, Half - adder using NOR gates, Introduction of full adder. **Subtractors -** Half subtractor, Introduction of Full subtractor. **Parallel binary adder -** Introduction of parallel adder, 4-bit parallel adder. **Parallel binary subtractor -** Introduction of Parallel Subtractor, Comparison between Serial and Parallel Adder. **Carry Look Ahead adder -** Introduction of Carry Look Ahead Adder. **Serial adder/subtractor -** Introduction of serial adder, Operation of serial adder, Serial subtractor. **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. **Counters -** Introduction of counters, Asynchronous counters, Asynchronous/ripple down counter, Asynchronous up/down counter, IC 7492/93 (4-bit ripple counter), Introduction of decoding gates, Problem faced by ripple counters (glitch problem), Synchronous counters, Synchronous vs asynchronous counters, Synchronous counter (IC 74191), Changing the counter Modulus, Decade counters, Presettable counters, Counter design as a synthesis problem, Application-digital clock. **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 decoder, Realization of Multiple Output Function using Binary Decoder, BCD to Decimal Decoder, 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, Decoder vs demultiplexer and multiplexer vs decoder, Applications of decoder. **Encoders-** Introduction to encoders, Decimal to BCD encoder, IC 74XX147 decimal to BCD encoder, Introduction of Octal to Binary Encoder, Introduction of Priority Encoder. **Multiplexers -** IWhat is a multiplexer (MUX), 74XX151 8 to 1 multiplexer, 74XX157 Quad 2-Input Multiplexer, 74XX153 Dual 4 to 1 multiplexer, Expanding Multiplexers, Application of Multiplexer. **Demultiplexers -** Introduction of demultiplexer, Introduction of 1 to 16 demultiplexer, IC 74X154 1 to 16 demultiplexer. **Programmable logic devices (PLD's) -** Introduction of Programmable Logic Devices (PLDs), Programmable Read Only Memory (PROM), PLA(Programmable Logic Array), Programmable Array Logic Devices.

UNIT III - COMPUTER ARITHMETIC AND INSTRUCTION SET

Fixed point addition/subtraction using signed magnitude - Representation of fixed point number operations, Addition and subtraction of signed magnitude numbers, X-OR operation for equality check, Subtraction using 2's complement, Fixed point addition/subtraction of numbers, Multiplication, Flowchart for multiply operation, Division of fixed point binary numbers, Flow chart for fixed point division. **Floating point addition/subtraction -** Normalization, Floating point representation, Addition and subtraction of floating point number, Floating point multiplication, Flow chart for multiplication of floating point numbers, Floating point division examples, Floating point division, Flow chart for floating point division. **Implementations of arithmetic and logic operations -** Design of arithmetic unit, Design of logic unit, Combining arithmetic and logic unit. **Arithmetic circuits -** Half adder, Half adder using NAND gates, Half adder using NOR gates, Full adder, Half subtractor, Full subtractor, BCD adder, BCD subtractor, Binary multiplier. **Memory locations and addresses-** Memory locations and addresses, Dealing with strings of characters, Main memory operations. **Instructions -** Introduction to instructions, Instruction sequencing, Register transfer notation, Assembly language notation. **Addressing modes -** Addressing modes. **Instruction format and different machine instruction -** Instruction format, Types of instructions. **IA-32 Pentium example -** Introduction to IA-32 Pentium, IA-32 Registers, IA-32 Addressing modes, IA-32 instructions, IA-32 instructions formats.

UNIT IV - PROCESSOR ORGANIZATION

Fundamental concepts - Introduction to the central processing unit, Fundamental concept of processor, Executing an instruction, Processor organization, Register transfers, Performing arithmetic or logic operations, Fetching a word from memory, Storing a word in memory. **Execution of complete instruction-** Execution of a complete instruction and architecture, Control sequence, Execution of branch instruction. **Multiple bus organization -** Introduction to bus organization, Multiple bus organization, Execution of instruction. **Hardwired control-** Introduction to hardwired control, Hard wired control unit, Hard wired implementation, Hardwired implementation of logic function, State machine, Advantages and disadvantages of hardwired control. **Design methods of hardwired control -** Introduction to design methods of hardwired control, State table method, Delay element method, Sequence counter method, PLA method, Complete process. **Memory basics, memory types-** Introduction, Memory unit, Memory operations, Block diagram of memory unit, Types of memories, Basic concepts, Key characteristics of memory, Physical characteristics of memory, Memory hierarchy, Serial vs random access memory. **Semiconductor RAM memories -** Introduction to semiconductors RAM memories, Internal organization of memory chip, Static memories, TTL RAM cell, MOS static RAM cell. **Asynchronous DRAMs -** Introduction to dynamic RAMs, Basic DRAM operations, Asynchronous operations, Types of DRAMs, Static RAM, Comparison between SRAM and DRAM, DRAM memory organization. **Synchronous DRAMs-** Introduction to synchronous DRAMs, Timing diagram, Performance measures, Double-data rate SDRAM, Structure of large memories, Memory system consideration, RAM bus memory. **Read Only Memory (ROM) -** Introduction to Read Only Memory(ROM), ROM and its organization, (PROM) Programmable Read Only Memory, (EPROM)

Erasable Programmable Read only Memory, (EEPROM) Electrically Erasable Programmable Read Only Memory, Flash memory, Speed, size and cost. **Cache memory** - Introduction to cache memory, Cache memory system, Elements of cache design, Mapping function, Cache write/updating, Cache coherency, Replacement algorithms, Performance considerations, Hit rate and miss penalty, Caches on the CPU chip. **Associative memory -** Introduction to associative memory, Advantages and disadvantages of associative memory, Operations of associative memory, Application of associative memory, Internal organization of associative memory, Read and write operation of associative memory. **Virtual memory -** Introduction to virtual memory, Address translation in virtual memory, Virtual memory implementation in 80386, Demand paging, Page replacement algorithms, Memory management requirements. **Secondary storage -** Introduction to secondary storage, Magnetic disk memory, Data organization and formatting, Characteristics of a magnetic disk, Disk controller and its operation, Loading of operating system from disk. **Floppy disk memory -** Introduction to floppy disk memory, Disk format, Storage density. **RAID disk arrays -** Introduction to RAID disk arrays, RAID techniques, RAID levels, SCSI disk Vs RAID disk. **Optical disk -** Introduction to optical disk, CD-ROM, WORM, Erasable optical disk, DVD technology, Magnetic tape system.

UNIT V - INPUT / OUTPUT ORGANIZATION

I/O Organization - Introduction, Accessing I/O Devices, Address Decoder, I/O Interfacing Techniques, Programmed I/O, Polling, Addressing I/O Devices, I/O Mapping. **Interrupts -**Introduction, Interrupt Processing, Return from Interrupt, Device Identification, Handling multiple interrupts, Interrupt Nesting, Enabling and Disabling interrupts, Vectored Interrupts, Interrupt Priority, Parallel Priority Interrupt, Exception and Debugging, Privilege Exception, Programmed Vs Interrupt. **Direct Memory Access (DMA) -** Introduction, Data Transfer using DMA Controller, DMA controller, DMA Cycle. **Bus control -** Introduction, Bus arbitration, Strobe control - bus control, Handshaking. **Interface circuits -** Introduction, Parallel port, Serial port, Input port, Output port, Programmable port, Standard i/o interface, Bus applications.**PCI bus** - Introduction, Required PCI bus line, PCI commands, PCI transaction types, Arbitration, PCI configuration, PCI bus features, PCI bus signals, SCSI bus, SCSI terms, , SCSI Arbitration, Selection, Information transfer, Reselection. **Universal Serial Bus(USB)** - Introduction, USB feature, USB architecture, Port limitation, Device characteristics, USB protocols, USB hubs, USB transactions, USB Data, Input - output ports. **Input / output devices** - Input devices, Output devices, I / O processor, Features of I / O processor, Amdahl's law, Architecture of 8089, Communication between 8086 and 8089.