FUNDAMENTALS OF COMPUTING

UNIT 1: BASICS OF COMPUTERS
Computer fundamentals, Bits and Bytes, CPU, Memory, Input and output devices, I/O devices, Operating system, applications software's. Number system, decimal system, Binary, octal, hexadecimal.

UNIT 2: C PROGRAMMING
The C character set, constants, variable, keywords, operator and expressions, decision controls, loops, case, functions, call by value and by reference, array, single dim, 2 dim, multidimensional arrays, strings, library string functions, structures, pointers and structures, dynamic memory allocation using pointers, searching and sorting, linear, binary search, bubble sort selection sort, insertion sort.

UNIT 3: OPERATING SYSTEM
OS definition, role of OS in computer system, multi programming, time sharing, multitasking, multiprocessing, symmetric and asymmetric, cluster system, real time system, client server computing, distributed OS, function of OS (user interface, GUI, program execution, I/O management, Resource management, dos fundamentals.

UNIT 4: NETWORKING
Network, communication models, transmission media, connection topologies, LAN, WAN, MAN, ISO-OSI model of networking, Internet, ISP, WWW, Email, URL, Web browsers, websites, intranet, extranet.

Unit 5: DBMS
DBMS, DBMS applications, Advantage of DBMS, Data abstraction, data model.

Books:

- Peter Norton, "Introduction to Computers, Tata Mc-Graw Hill.
- M N Doja, "Introduction to Computers and Information Technology"
- B. A. Forouzan, "Data Communication and Networking", TMH, 4th Ed., 2006.
- "An Introduction to Database Systems", C.J.Date, Pearson Education.
- C Programming by Yaswant Kanetkar

DATA STRUCTURE AND ALGORITHMS

UNIT 1: C PROGRAMMING

Introduction, types, Operators and Expressions, Control flow, Function and program structure, pointers and arrays, pointer to a function, structures, Typed of Union, Input/Output in C, File handling, Error handling.

UNIT 2: COMPUTER ALGORITHMS

Problems and specifications, Concept and properties of algorithms, Algorithm correctness: Iterative algorithms, Evaluating efficiency and the 'O' and 'o' notation, Algorithm design.

UNIT 3: DATA STRUCTURES

The notion of a data structure, primitive and composite data types stacks, Queues, Arrays, Linked lists, Algorithms for manipulating data structures, Polish notation and reverse polish notation.

UNIT 4: TREE, SEARCHING AND SORTING ALGORITHMS

Trees, Binary Trees and balancing trees, Binary search trees, Hashing, Searching algorithms: Linear search, Binary search, sorting algorithms: Selection sort, Bubble sort, Quick sort, Merge sort etc.

UNIT 5: INTRODUCTION TO STRUCTUED PROGRAMMING

Concept of structured programming; Its advantages, problems analysis, Program design methods, pseudo code, stepwise refinement, structured Walkthroughs, program testing and implementation.

BOOKS :

- Lipshutz, "Data structures" McGraw Hill Int. 1994
- Tanenbaum, "Data structures using C and C++", PHI 1997.
- Horowitz & sahni, "Fundamentals of computer Algorithms" Galgotia pub. 1995.
- Alfred, Aho, John E. Hopcraft, Jeffrey D. Ullman, "Data structures & Algorithms" Addison-Wesley Publishing Co. 1992.

DIGITAL LOGIC THEORY

UNIT 1: BOOLEAN ALGEBRA AND LOGIC GATES

Introduction, Binary numbers, Base-conversions, Octal and hexadecimal numbers, complements, binary codes, concept of fixed and floating point numbers, Axiomatic definition of Boolean Algebra, Basic Theorems and properties, Boolean functions and representation in canonical and standard forms, SOP and POS forms, other logic operations, Digital logic gates.

UNIT 2: FUNCTION MINIMIZATION

Karnaugh map methods, limitations of K-maps for larger variables, POS-simplification, NAND/NOR implementation, other 2-level implementations, Don't-care conditions, Tabular method.

UNIT 3: COMBINATIONAL SYSTEMS

Standard gate assemblies, Hardware aspect of arithmetic logic functions, Half-Adder, Full-Adder, Binary Adder/Subtractor, Decimal Adder, Magnitude Comparator, DeMultiplexer, Multiplexer, Encoder, Priority Encoder, Parity Checker/Generator, ROM, PALs and PLAs.

UNIT 4: SEQUENTIAL SYSTEMS

Definition and state representation, Flip-Flops, RS, D, JK-M/S, their working characteristics, State Tables, Excitation Tables and triggering, Asynchronous and Synchronous Counters-Design and Analysis, Counter Applications, Description and Operations of Shift Registers, Shift Register/Counters.

UNIT 5: COMPUTER ORGANIZATION

Introduction to Architecture and organization of digital computer, ALU, I/O-Unit, Control Unit, CPU, Microprocessor and Microcomputer, Data and Instruction Formats

Books:

- Morris Mano, "Computer System Architecture", Pearson Education 2005.
- W.I. Fletcher, "An Engineering Approach to Digital Design", PHI, 1990.
- R.J. Tocci, "Digital Systems: Principles, and Applications", PHI 1990.
- T.C. Bartee, "Digital Computer Fundamentals", McGraw Hill, 1994.

DISCRETE MATHEMATICS

UNIT 1: MATHEMATICAL REASONING

Propositional calculus and predicate calculus – application to proving program correctness, Resolution principle, application to logic programming

UNIT 2: SET THEORY

Inductive definition of sets, Paradoxes – Principles of mathematical induction, relations, representation of relations by graphs – elementary graph theory, properties of relations, equivalence relations, partial orders and lattices, applications to relational databases

UNIT 3: FUNCTIONS

Injections, Surjections, Composition of functions, recursive function theory, application to functional programming.

UNIT 4: BASIC COUNTING TECHNIQUES

Permutation and combinations, pigeonhole principle, principle of inclusion and exclusion, recurrence systems, solutions of recurrence equations, generating functions, application to analysis of algorithms.

UNIT 5: ALGEBRAIC STRUCTURES

Definition and elementary properties of groups, semi groups, monoids, rings, fields, vector spaces and Boolean algebra

Books:

- C.L. Liu, Elements of Discrete Mathematics, McGraw Hill International Editions, 1985.
- W.K. Grassman and J.P. Trembly, Logic and Discrete Mathematics, Prentice Hall, 1996.
- D.F. Stanat and D.F. McAllister, Discrete Mathematics in Computer Science, Prentice Hall, 1977.

MATHEMATICS

Unit 1: COMPLEX VARIABLE

Complex number, Arc and diagram, complex functions, limit, continuity and differentiability Cauchy-Reimann equations, harmonic functions, construction of analytic functions, by mile-Thomson method, conformal mapping, transformations W=Z", I/z , e, (az+b)/cz=d).

Unit 2: FOURIER SERIES

Periodic functions, Fourier series of functions with period 2 change of interval, Half range sine and cosine series.

Unit 3: LAPLACE TRANSFORM

Laplace transform, existence theorem, first shift theorem, multiplication and division by T, Laplace transform of deviated inverse Laplace transform, Application to solve Linear differential equations. Unit step function, Dirac delta function-their Laplace transforms, second shifting theorem. Laplace transform of periodic function, Applications.

Unit 4: SERIES SOLUTION OF DIFFERNTIAL EQUATION

Series solution, Frobenious method, Legendre and Bessels equations.

Unit 5: PARTIAL DIFFERNTIAL EQUATION

Linear and non-linear partial differential equation of first order, four standard forms.

Books:

- Kreyszig E."Advanced Engineeering Mathaematics".
- Prasad C,"Advanced Engineering Mathematics".
- Pati T."Functions of Complex Variables".

DATA BASE MANAGEMENT SYSTEM

Unit 1: INTRODUCTION TO DATA BASE CONCEPTS
Data Base Systems and their needs, Components of DBS, Operational data representation, DBS architecture, Data Base Administrator and its role, Storage structure, Indexing Techniques.

Unit 2: DATA MODELS
Relational, Hierarchical and Network Models, Higher level operators, Relational data structural-relations, Domains, Attributes and Keys, Extensions, Intentions, Integrity rules and constraints with examples of relational models

Unit 3: DATA NORMALIZATION
Concept of Normalization and Functional Dependencies (FD), First, Second and Third normal forms of data relations, Fourth normal form, Query facilities: SQL & Embedded SQL, Relational algebra, Relational calculus

Unit 4: DATA BASE ENVIRONMENT
Recovery, Transaction, Commit, Rollback and Sync. Points, Systems and Media recovery, Concurrency problem, Locking, Deadlock, Security: General considerations, Security in SQL, Views, Grant and Revoke mechanism, Integrity: General considerations and examples, Query optimization.

Unit 5: CASE STUDIES
Relational Database System Design, Concepts of ORACLE, Interactive SQL, PL-SQL, Creating Views, Object Oriented Data Base, Parallel & Distributed Data Bases.

Books:

- Date, C. J: "Introduction. To Data Base Systems", Addison Wesley 6th ed. 1996.
- Abraham Silberchatz, "Data Base System Concepts", McGraw Hill Int., 1997.
- Ullman, "Principles of Database Systems". Galgotia Pub. 1995.
- Ivan Bayross. "Oracle Developer 2000", B. P. B. Publication, 1997

Computer Organization

Unit I

Introduction to Computer Organization

Structure and function of a computer, components of a computer, organization of a computer.

Unit II

Process Unit

Instructions, operations, and operands, addressing modes, instruction formats, data path in a CPU, control unit implementation, micro programmed control, characteristics of CISC and RISC processors, performance of a processing unit.

Unit III

Memory Subsystem

Memory hierarchy, main memory unit, internal organization of a memory chip, organization of a main memory unit, SRAM, DRAM, and ROM, error corrective memories, interleaved memory units, cache memory unit, concepts of cache memory, mapping functions, organization of virtual memory, address translation, hardware support for memory management.

Unit IV

Input/Output Subsystems

Access of I/O devices, I/O ports, I/O control mechanism, program controlled I/O, interrupted I/O, DMA controlled I/O, I/O interface, system buses, peripherals, terminals, video displays, magnetic tapes, magnetic storage disks, CD ROMs.

Unit V

High Performance Processor

Instructions pipelining, pipeline hazards, super scalar processors, performance consideration, multi processor system, shared memory systems, interconnection networks, cache in multiprocessor systems.

Unit VI

Number system, Boolean algebra, flip-flops, combinational circuit, sequential circuits.

Books

- J L Hennessy and D A Patterson, Computer Organization and Design, the Hardware/ Software Interface, Morgan Kaufmann, 1994.
- J L Hennessy and D A Patterson, Computer Architecture- A quantitative approach, Morgan Kaufmann, 1994
- V C Hamacher, Z G Vranesic and S G Zaky, Computer Organization, 4th Edition, McGraw Hill, 1996.

Object Oriented Technology

UNIT 1

Object Oriented Paradigm, Structured vs Object Oriented Development, Concept of Object and classes, Encapsulation, Polymorphism, Inheritance Generic Programming, Merits and demerits of OOP.

Classes and Objects, Introduction, Class specification, Class objects, Defining member function, Inline functions, Data Hiding, Empty class, Pointers inside a class, Passing objects as parameters, Returning objects from functions, Friend function and class, Static data and member functions. Constructors and destructors, Overloading of constructors, Dynamic initialization through constructors, Copy constructors, Static data members with constructors and destructors. Pointers to objects, Array of objects, this pointer, Self referential classes.

UNIT 2

Overloading, Function and Operator overloading, Overloading of unary and Binary operators, Limitations of overloading of increment and decrement operators, overloading of arithmetic, Relational, assignment, new and delete, subscript operators. Data conversion between objects. Complete conversion. Overloading through friend functions. Tracing of memory leaks.

UNIT 3

Inheritance: Declaration of derived class, forms of inheritance, constructors and destructors in derived class, types of inheritance, abstract class,

Virtual functions: Need of virtual functions, Pointers to derived class objects, Pure virtual functions, Virtual destructors, Rules of writing virtual function

UNIT 4

Generic programming : Function and Class templates, Overloadable function templates, Inheritance of class templates, Class templates with overloadable operators.

Exception handling: Error and exception, exception handling constructs, Throwing an exception, Catching all exception.

UNIT 5

Stream computation with files: Hierarchy of File stream classes, opening and closing of files, File modes, Saving and reading of objects, handling of errors during file manipulation.

Books:

- The C++ Programming Language by B.Stroustrup, Pearson Education.
- Thinking in C++ by Bruce Eckel , Pearson Education
- Object Oriented Programming in C++ by N.Barkakati, PHI
- Mastering C++ by Venugopal and et all, Tata McGraw Hill
- C++ How to Program by Deital and Deital, Pearson Education

Operating System

Unit 1: Introduction

Evolution of operating system , serial processing, Batch processing system, Multiprogramming system, Multi programmed batch system, Time sharing system, parallel system, distributed system, Real time system, operating system structure, System component.

Unit 2: Process Management

Process state , process control block, process scheduling, type of schedulers, scheduling algorithm. Multiple processor scheduling, Real time scheduling, operation of process, cooperating process, Concept of threading, Interprocess communication, Synchronization, critical section problem, Synchronization of hardware, semaphore, classical problem of synchronization, Critical Region, Monitors

Unit 3: Memory Management

Continuous allocation, Memory allocation, Static and dynamic swapping, relocation, Compaction, protection, sharing, Segmentation, Non contiguous allocation, paging, virtual memory, Management, operation, Allocation and Replacement policies, working set theory, Segmentation AND paging combined, file system structure, file system implementation, directory implementation, Allocation methods.

Unit 4: Scheduling & Deadlocks

Disk structure, Disk-Scheduling: FCFS, SSTF, SCAN, Look, C-Look, Dead lock-deadlock characterization, Methods for handling deadlock, Deadlock prevention, Deadlock avoidance, Deadlock Detection, Recovery from deadlock

Unit 5: Security

Security threats – Protection – intruders – Viruses – trusted System.

BOOKS:

- Operating Systems' – Internal and Design Principles Stallings, Pearson education/PHI
- Operating System Principles- Silberchatz and. Galvin, "Operatng system concept, John Wiley publication

Communication System

UNIT 1 ANALOG MODULATION

Classification of signals, difference between analog& digital signals, elements of a communication system. AM, FM, PM.

UNIT 2 RECEIVERS & TRANSMITTERS

Generation and Detection of AM & FM signals, Radio transmitters and receivers, Introduction to transmitting & receiving Antennas, PLL, AGC, AFC, Tracking Diversity.

UNIT 3 COMMUNICATION MEDIUM

Concept of BW, Noises & Channel Capacity of different communication system such as two wire, Coaxial cable, wave guides, Microwave, Satellite, Fiber-optics etc.

UNIT 4 DIGITAL MODULATION

Information Capacity, sampling Theorem, PCM< Delta modulation, Comparison of PCM & DM .The Complete PCM system, Spread Spectrum, Communication Multiplexing (TDM, FDM) Switching(Circuit, Message,& Packet).

UNIT 5 DIGITAL MODULATION TECHNIQUES

PSK, FSK, DPSK, Synchronous & Asynchronous Communication, Start Stop bit data transfer Bit level transfer Byte level data transfer, data transfer efficiency. Modems (Synchronous & Asynchronous) Error detection and correction methods (Parity bit, Block Parity, Hamming Code Checksum error detection etc.)

Analysis and Design of Algorithm

Unit I

Introduction: What is algorithm? Why analyze algorithm? RAM Model of Computation, Asymptotic Notations, **Solving recurrence equations:** Iterative method, substitution method, a well-used general formula (Master's theorem), proof of master's theorem, homogeneous recurrence equation, and non-homogeneous recurrence equation.
Sorting: Insertion, sort, merge sort, quick sort, selection sort, lower bound of sorting and proof.

Unit II

Divide and Conquer Strategy: Merge sort, quick sort, integer multiplication, matrix multiplication (Strassen's Algorithm), exponentiation problem, convex hull problem, closest pair if points in 2 dimensional space.

Unit III

Graph Algorithm: Topological sort, queue based topological sort, algorithm, shortest path on un-weighted graph, Dijkstra's algorithm for weighted graph, DFS algorithm and finding articulation points in bi-connected graph, finding strongly connected components, articulation points detection. **Greedy Algorithm:** Minimum spanning tree problem, disjoint set data structure, prims and kruskal algorithm, Huffman coding, rational knapsack problem, bin-packing problem. **Backtracking:** The general method, the 8-queen problem, sum of subsets, graph coloring, Hamilton cycle.

Unit IV

Dynamic Programming: Introduction with Fibonacci series calculation, 0-1 knapsack problem, matrix chain multiplication, LCS, optimal binary tree search, Floyd- Warshal's algorithm.

Unit V

String Search Problem: Naïve algorithm, rabin-karp algorithm, FSA based algorithm, knuth-morris-pratt algorithm. **Complexity theory**: Decidability of problems: Halting problem, NP-class of problem, P class of problem, NP=P question, Polynomial reduction problem, Cook's theorem, NP hardness and NP completeness.

Books:

- T H Cormen, C E Leisersor, and R L Rivest, Introduction to Algorithm, PHI
- Richard E Neapolitan and Kumarss Naimipour, Foundation of Algorithms
- A V Aho, J E Hopcroft and J D Ullman, The Design and analysis of computer algorithms, Pearson Education
- E Horwitz, and S Sahni, Fundamentals of Computer Algorithm, PHI

Automata Theory

Unit 1: INTRODUCTION TO FINITE AUTOMATA

Strings, Alphabets and Languages, Graphs & Trees, Sequential machine, State tables & diagram, Mealy & Moore machines, State and Machine equivalence.

Unit 2: REGULAR EXPRESSIONS

Deterministic and Non-deterministic Finite Automata, Regular Expressions, Regular grammar, Minimization of DFA, Pumping Lemma for Regular sets, Properties of Context Free Languages.

Unit 3: CONTEXT FREE GRAMMAR & LANGUAGES

Context free Grammar, Chomsky Normal form and Greibach Normal form, Pushdown Automata, Context Free languages, Chomsky Classification of languages, Simplification of CFG, Pumping Lemma for context free languages, properties of context free languages, Push down automaton (PDA), conversion from PDA to CFG and vice versa.

Unit 4: TURING MACHINES

Turing Machines, Computing with Turing Machines, Non-deterministic Turing Machines, unrestricted grammars, context sensitive languages, Church's Thesis, Universal Turing Machines.

Unit 5: UNCOMPUTABILITY & COMPUTATIONAL COMPLEXITY

Halting Problems, Unsolvable Problems about Turing Machines, Time bounded Turing Machines, The Class P and NP Languages, NP Completeness, Some NP Complete Problems

Books:

- J.E. Hopcroft & J.D. Ullmann, "Introduction to Automata Theory, Language and Computation", Narosa Publications.
- H.R. Lewis & C.H. Papadimitrou, "Elements of the Theory of Computation", PHI
- John C. Martin, "Introduction to Languages and the Theory of Computation", McGraw-Hill International
- D.A. Cohen, "Introduction to Computer Theory", John Wiley
- Zvi Kohavi, "Switching and Finite Automata Theory" , Tata McGraw-Hill

Microprocessor

Unit I: Introduction & Organization
Review, Organization and architecture of 8085 Microprocessor, Instruction of 8085 & Programming techniques, Machine Language Vs Assembly Language, Basic Concepts of timing & control unit, Timing Diagrams for 8085.

Unit II: Interfacing Memory & I/O Devices
Minimal System, Necessity for Interfacing, Address space partitioning, Memory mapped I/O & I/O mapped I/O, Advantages and Disadvantages, Types of Interfacing Devices, I/O ports, programmable peripheral Interfaces 8255,8259,8251,8153,8279

Unit III: Data Transfer Schemes
Hardware schemes for data Transfer, Programmed data transfer, Interrupt Data Transfer, Various Interrupt schemes, multiple interrupt, Enabling, Disabling and Masking of Interrupts particularly in 8085, DMA & DMA Controller.

Unit IV : Architecture and Programming of Advanced Microprocessors.
Study of Important 8-bit Microprocessors & their comparison, introduction to 16-bit Processors-8086, 8088 and 68000, Coprocessors and comparison, Introduction to 32-bit Microprocessors.

Unit V: Microprocessor Applications
Microprocessor based System Design, Introduction and Basic Concepts, Introduction to MDS, System Design Kits, Introduction to Micro controller, Some Practical applications.

Books:

- A.P. Mathur, “An Introduction to Microprocessors” Tata McGraw Hill, 1995.
- K.L. Short, “Microprocessor & Programmed Logic”, 2nd Ed., PHI, 1994
- R.G. Gaonkar, “Microprocessor Architecture programming and application", Wiley Eastern Ltd., 1994.

Software Engineering

Unit1: Introduction
Definition, Program Vs Software, Software processes, Software life cycle models: Build and Fix, Waterfall, Prototype, Iterative Enhancement Model, Evolutionary and Spiral model, RAD Model. *Software Metric:* Size Metrics like LOC, Token Count, Function Count, Design Metrics and Data Structures Metrics Information Flow Metrics.

Unit2: Software Project Planning
Cost estimation, static, Single and multivariate models, COCOMO model, Putnam Resources Allocation Model, Risk management.

Unit3: Software Requirement Analysis and Specifications
Problem Analysis, Data Flow Diagram, Data Dictionaries, Entity-Relationship diagrams, Software Requirement and Specifications, Behavioral and non- behavioral requirement, Software Prototyping.

Unit4: Software Design and Software Reliability
Cohesion & Coupling, Classification of Cohesiveness & Coupling, Function Oriented Design, Object Oriented Design, User Interface Design, Software Reliability: Failure and Faults, Reliability Models: Basic Model, Logarithmic Poisson Model, Calendar time Component, Overview of Quality standards like ISO 9001, SEI-CMM

Unit5: Software Testing and Maintenance
Software process, Functional testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing: path testing Data flow and mutuation testing, unit testing, integration and system testing, Debugging, Testing Tools, & Standards. .Software Maintenance: Management of maintenance, Maintenance Process, Maintenance Models: Quick fix, Iterative Enhancement, Reuse oriented etc. Reverse Engineering, Software Re-engineering, Conguration Management, Documentation

BOOK

- Prof: KK Aggarwal & Yogesh Singh: SOFTWARE ENGG:
- Pankaj Jalote, "An Integrated Approach to Software Engg" Narosa Publishing House, New Delhi.
- Pressman"Priciples of Software Engg" TMC, 5th Ed. 2005

Computer Networks

UNIT – I

Introduction: Review of Physical & Data link layer, ISDN, X.25 Frame Relay, ATM, IP Addresses: Classful, Classless Addressing, CIDR Notation, Special Addresses, Private Addresses, Subnetting and Supernetting.

The Transport Layer**:** The Transport Service, Elements of Transport Protocols, A Simple Transport Protocol, The Internet Transport Protocols; UDP, TCP, Flow control, Silly window syndrome, TCP timers, Performance Issues

UNIT- II

The Data Link Layer: Data Link Layer Design Issues, Error Detection and Correction, Flow Control Protocols, Stop-and-wait Flow Control, Sliding – Window Flow Control, Error Control, Stop-and-wait ARQ, Go-back-N, Selective-repeat, Example of Data Link Protocols- HDLC , The Medium Access Control Sub Layer: The Channel Allocation Problem, ALOHA, Multiple Access Protocols, Collision Free Protocols, IEEE Standards for LANs and MANs, Bridges, wireless LANs, IEEE 802.11, Blue Tooth, High Speed LANs.

UNIT – III

Network Security: Traditional Cryptography, Cryptographic Principles, Secret Key Algorithm: Substitution cipher, Transposition cipher, DES, Public Key Algorithm: RSA, Diffie-Helman , MD5, Authentication protocol, Digital Signature, Security in the Internet, Firewalls.

UNIT – IV

Internet Protocol: Datagram, Fragmentation, Delivery , Forwarding, Routing of IP Packets, ARP and RARP, ICMP, IGMP. IPV4 Protocols , IPV6 (over view), Security in the Internet: IPSec, PGP, VPN.

UNIT – V

Application Layer: Domain Name System , Remote Login , Simple Network Management Protocol, File Transfer Protocol, Electronic Mail: Simple Mail Transfer Protocol, Post Office Protocol, Internet Mail Access Protocol, WWW, HTTP.

TEXT BOOKS:

- B. A. Forouzan, “TCP/IP Protocol Suite”, TMH, 3rd Edition., 2006.
- Andrew S. Tanenbaum “ Computer Networks” by Pearson Education ,fourth edition.

Computer Architecture

Introduction , Architectural classification scheme:-Flynn's, Shore's, Feng's, Handler; Technology Trend, Cost Price and their trend, measuring and reporting performance, Power consumption and efficiency as the metric ,Micron technology, Moor's law, Rock's law,

Design of Arithmetic circuit, Logical circuits, ALU, Modify AC to act as ALU, CPA, CLA,CSA, Speed Calculation of N-bit Parallel Adder, Comparison of Various parallel adders, Array Multiplication, sequential multiplier, Booth recording , Booth Multiplier, signed multiplication, unsigned multiplication, designing fast and efficient algorithm for multiplication and Division , Restoring division, Non Restoring Division, integer representation, floating point representation. Range of representation, Floating point operation, Normalization, IEEE754 floating point standard for both single precision and double precision, rounding, guard bit, sticky bit, demoralized value, NaN.

Register Transfer and Micro operation: Register transfer language, register transfer, bus and memory transfer, arithmetic micro operations, logic micro operations, shift micro operations, using RTL to specify digital system, more complex digital system and RTL, Introduction to VHDL

Hard wired Control unit Design: Basic concepts and its application to implement hardware loops, Hard wired circuit to compute factorial , sum of series ,Booth multiplication etc. Specifying a CPU, Design and implementation of a very simple CPU, a relatively simple CPU-Specification, fetching, decoding, executing, establishing required data paths, design of ALU, Designing control unit using hardwired control, design verification; real world example, short comings of simple CPUs,
Micro programmed Control unit design-Basic concepts, application to implement hardware loops, Hard wired circuit to compute factorial, sum of series ,Booth multiplication etc. Basic Micro sequencer design, design and implementation of a very simple micro sequencer: basic layout, generating the correct sequence and designing the mapping logic, generating the micro operations using horizontal microcode, generating the micro operations using vertical microcode, nano instruction, generating control signal from microcode, design and implementation of a simple micro sequencer:-Modifying the state diagram, designing the sequencing hardware and microcode, completing the design using horizontal microcode, reducing the number of microinstructions ,size of control memory,
Micro programmed control versus Hardwired Control: Complexity of instruction set, ease of modification, Clock speed; Real world example of Micro coded CPU:-Pentium processor

Introduction to Parallel Processing, Parallelism in uni processor system, Introduction to data flow computing, wave front array, Systolic Array
Pipelining:-introduction, design of arithmetic pipeline, instruction pipeline, calculating its throughput, efficiency, speed up, frequency., no of stages, PCR, Pipeline Hazards:-

structural, data ,control, branch; hazards solutions-h/w and s/w solutions. Calculating various attributes of pipeline considering branch instructions, Numericals.

Introduction to superscalar processor, Instruction-level Parallelism: Concepts and challenges, basic concept of Dynamic scheduling , Score boarding Tomasulo's algorithm, overcoming data hazards with dynamic scheduling , reducing branch cost with dynamic hardware prediction, High performance instruction delivery, Taking advantages of more ILP with multiple issues, Hardware based speculation, the P6 micro architecture, Basic compiler techniques for exposing ILP, static branch prediction, static multiple issues: the VLIW approach, advanced compiler support for exposing and exploiting ILP,H/W support for exposing more parallelism at compile time, H/W versus S/W speculation mechanism, Intel IA-64 architecture
Case studies of recent processors (Pentium 4 , Power PC etc)

BOOKS:

- John L. Hennessy & David A. Patterson, "Computer Architecture, A Quantitative Approach", Morgan Kaufmann, 3rd edition, 2003.
- John D. Carpinelli, "Computer System Organization & architecture", Pearson Education
- Rafiquzamman and Chandra, "Modern Computer Architecture". Galgotia Publication.
- Sima, Fountain & Kacsuk, "Advanced Computer architectures a design space approach", Pearson education
- Kai Hwang, "Advanced Computer architectures, Parallelism, Scalability & Programmability", McGraw Hill,
- J. P. Hayes, "Computer Architecture and Organization", McGraw Hill, 1998.
- W. Stallings, "Computer Organization & Architecture", PHI, 2001.
- Dandamudi, "Fundamental of Computer Organization & Design", Wiley Dreamtech,

Compiler Design

Introduction: The tasks of a compiler, Analysis of the Source Program, Phases and Passes in compilers, cousins of compilers, compiler construction tools.

Lexical Analysis: Review of Regular Expressions, Finite State Machines, Finite Automata based Pattern Matching. Specification and recognition of tokens, a language for specifying lexical analyzer, Design of lexical analyzer generator. Programming assignment on lex.

Syntax Analysis: Review of grammars, Chomsky Hierarchy, Context Free Grammars. Ambiguity, Grammar Transformations, Top-down Parsing: Left recursive grammars, Left factoring, LL (1) Parsing, LL (1) grammars, error recovery in Top down parsers.
Bottom Up Parsing: Overview of Shift reduce parsing, Operator precedence parsers, Finite automata of LR(0) items and LR (0) parsing, SLR parsing, Canonical LR Parsing, LALR Parsing. Compaction of LR parsing table, Using ambiguous grammars, Error recovery in bottom up parsers, Yacc: an LALR(1) Parser generator, Abstract Syntax trees, Optimizing a grammar, Programming assignment.

Semantic Analysis: Syntax Directed Definitions and translations, Attributes and Attribute grammar, construction of syntax trees, bottom up evaluation of S attributed definition, L-attributed definition, Top down translation, Bottom up evaluation of inherited attribute, Assigning space at compiler construction time, analysis of syntax directed definitions.

Type Checking: Type systems, Specification of simple type checker, equivalence of type expressions, type conversions, overloading of functions and operators, Polymorphic functions, an algorithm for unification.

Run Time Environments: Storage Organization, Storage allocation strategies, access to non local names, memory allocation in block structured language, various algorithms for Garbage collection, Parameter passing.

Symbol Table Organization, Symbol attributes and Symbol table entries, Local Symbol Table management, Global Symbol table structure, language facilities for dynamic storage allocation, dynamic storage allocation techniques. Symbol Table for block structured language.

Code Generation: Issues in the design of a code generator, The target machine, Run-time storage management, Basic blocks and flow graphs, Next-use information, A simple code generator.

Code Optimization: Early Optimizations: Constant-Expression Evaluation (Constant Folding, Algebraic Simplifications and Reassociation, Value numbering, Copy Propagation. Redundancy Elimination: Common-Subexpression Elimination, Loop-Invariant Code Motion, Partial-Redundancy Elimination, Redundancy Elimination and Reassociation, Code Hoisting. Loop Optimizations: Induction-Variable Optimizations, Unnecessary Bounds – Checking Elimination. Procedure Optimizations: Tail-Call Optimization and Tail-Recursion Elimination, Procedure Integration, In-Line Expansion, Leaf-Routine Optimization and Shrink Wrapping.

Books:

- *Aho, Sethi and Ullmann* "Compilers: Principles, techniques and tools", *Pearson Education Asia*
- Appel, "Modern Compiler Implementation in C", *Cambridge University press*

Software Project Management

UNIT 1:
Introduction to Project Management: Project Management Life Cycle

UNIT 2:
Software Project Planning, Project Activities and Work Breakdown Structure

UNIT 3:
Project Management Plan, Project Scheduling and Tracking Techniques

UNIT 4:
Project Economics: Project Costing, Project Estimation Techniques,
Automated Estimation Tools

UNIT 5:
Project Control and Closure, Project Management Issues with regard to New Technologies

Books:

- Mathur , S.S Principles of Management
- Robbin .S.P. , " Organizational Behavior"
- Prof: K.K Aggarwal & Yogesh Singh :SOFTWARE ENGG:
- Pankaj Jalote, "An Integrated Approach to software Engg" Narosa publishing house, new delhi.
- Pressman "Principles of software Engg" TMC, 5th ED.2005.

Computer Graphics

UNIT –I

Overview of Graphics Systems: Video Display Devices, Refresh cathode ray tubes, Refresh scan displays, Random scan displays, color CRT Monitors, DVST, Flat- Panel displays, Three Dimensional viewing devices, Raster scan systems, Input Devices: Keyboards, Mouse, Track ball, Joysticks, Data Glove, Touch Panels, Light pens.

UNIT - II

Curves and Surfaces: Line Drawing Algorithm, DDA Algorithm, Bresenham's Line Drawing Algorithm, Bresenham's Circle Drawing Algorithm, Ellipse Drawing Algorithm, Bezier Curves, 4 point and 5 point Bezier curves using Bernstein Polynomials, B-Spline Curves, Computing control points given end slopes for a specified curve segment.

UNIT - III

Geometric Transformation: Homogeneous Coordinate System for 2D and 3D, Various 2D, 3D Transformation matrices (Translation, Scaling, Rotation, Shear), Rotation about an arbitrary point (2D), Rotation about an arbitrary axis (3D), Computing location of V.P, Clipping Algorithms, Sutherland-Cohen Clipping Algorithm.

UNIT – IV

Shading and Hidden Surface Removal: Shading, Illumination Model for diffused Reflection, Effect of ambient lighting, distances, Specular Reflection Model, Computing Reflection Vector, Curved Surfaces, Polygonal Approximations, Gourard Shading, Phong Model, Hidden Surface Removal, Floating Horizon Method, Back Face Detection, Depth Buffer (Z-Buffer, A-Buffer) Method, Scan Line Method, Depth Sorting Method, Area Subdivision Method.

UNIT – V

Illumination Model and Surface Rendering: Illumination models,Shading models for curve surfaces, Half tone Pattern and Dithering Techniques, Rendering, Color Models: XYZ Color Model, RGB, YIQ, CMY, HSV, HLS.

BOOKS:

- D. Hearn and P. Baker, "Computer Graphics", Prentice Hall 2nd Edition, 19999.
- R. Plastock and Z.Xiang, "Computer Graphics", 2nd Edition Schaum's Series, McGraw Hill, 2001.
- Foley et. al., "Computer Graphics Principles & practice", Addison Wesley, 1999.

Parallel and Distributed system

Basic Concepts: Introduction to parallel processing, parallel processing terminology,decomposition,complexity,throughput,speedup,measures,data dependence, resource dependence, Bernsteins conditions levels of parallelism in programs, Program flow control ,data flow, Distributed systems-Introduction, advantages, tightly coupled, loosely coupled systems, Hardware and software requirements ,design issues.

Parallel Processing-Structure and organization: Taxonomy of parallel processes: granularity, basic architectures, multiprocessors, vector processors, pipeline-both linear as well as non linear ,optimal design, Arithmetic pipeline, Instruction pipeline, Pipeline hazards and their solution ,reservation table, scheduling: array ,systolic, wave front array, cube architecture, hypercube, CCC, pyramid, prism, network architecture-binary tree, hypercube, butterfly, shuffle, exchange, dataflow architecture, connection machine. System attributes to computers, clock rate, CPI, MIPS rate, throughput rates. Uma, NUMA, COMA models Performance laws, Amdahl, Gustafson, Sun and Ni laws.

Distributed Systems: Introduction, definition, its history, Distributed computing system definition and its evolution, reasons for its popularity, Strength and weaknesses of distributed computing, Different forms of computing, Minicomputer model, workstation model, workstation server model, Processor pool model, Cluster: definitions, reasons for its popularity, cluster computer system architecture, Windows cluster, Solaris cluster, Linux cluster, Using cluster distributed computing system models: Distributed operating system, Introduction to DCE, architecture of distributed applications, toolkits, frameworks, and components, Introduction to UML.

Distributed Operating system, Resource sharing, Message passing, example system, Synchronization aspects, clocks, algorithms, Mutual exclusion, co routines, CSP, DSM, Deadlocks, Distributed deadlock detection, Modeling-Petri Nets, Election algorithms.

Parallel Algorithms: PRAM model of computation, Elementary parallel algorithms-Broadcast, prefix sums, permutation, parallel selection, merging, sorting, Odd Even, Bitonic Merge, dictionary operations, clliss, algorithm graphs, Matrix transportation, multiplication, SIMD algorithm for matrix multiplication, solving linear systems.

Parallel and Distributed programming: Parallel programming environments, models, synchronous programming, modulla-2, occamm, FORTRAN, DAP FORTRAN,C-Linda, Actus, data flow programming, VAL etc., MPI, Open MP

Books:

- Michael J Quinn “Parallel Computing-Theory and practices”, 2nd Edition, TMH
- Kai Hwang, “Advanced Computer Architecture” McGraw hill.

Artificial Intelligence

UNIT 1: INTRODUCTION

AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, and problem formulation.

UNIT 2: SEARCHING

Searching for solutions, uniformed search strategies – Breadth first search, depth first search,

Depth limited search, Iterative-deepening depth first search bi-direction search - comparison. Search with partial information (Heuristic search) Greedy best first search, A* search, Memory bounded heuristic search, Heuristic functions. Local search Algorithms: Hill climbing, simulated, annealing search, local beam search, genetical algorithms. Constrain satisfaction problems: Backtracking search for CSPs local search for constraint satisfaction problems.

UNIT 3: GAME PLAYING

Adversial search, Games, minimax, algorithm, optimal decisions in multiplayer games, Alpha-Beta pruning, Evaluation functions, and cutting of search.

UNIT 4: KNOWLEDGE REPRESENTATION & REASONS LOGICAL AGENTS

Knowledge – Based Agents, the Wumpus world, logic, propositional logic, Resolution patterns in propos ional logic, Resolution, Forward & Backward. Chaining. First order logic. Inference in first order logic, propositional Vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution.

UNIT 5: PLANNING

Classical planning problem, Language of planning problems, Expressiveness and extension, planning with state – space search, Forward states spare search, Backward states space search, Heuristics for stats space search. Planning search, planning with state space search, partial order planning Graphs.

UNIT 6: LEARNING

Forms of learning, Induction learning, Learning Decision Tree, Statistical learning methods, learning with complex data, learning with Hidden variables – The EM Algorithm, Instance Based learning, Neural Networks.

Books:

- Introduction to Artificial Intelligence – Rajendra Akerkar, PHI
- Artificial Intelligence – A Modern Approach. Second Edition, Stuart Russel, Peter Norvig, PHI/Pearson Education.
- Artificial Intelligence, 3rd Edition, Patrick Henry Winston., Pearson Edition,
- Artificial Intelligence , 2nd Edition, E.Rich and K.Knight (TMH).
- Artificial Intelligence and Expert Systems – Patterson PHI
- Expert Systems: Principles and Programming- Fourth Edn, Giarrantana/ Riley, Thomson
- PROLOG Programming for Artificial Intelligence. Ivan Bratka- Third Edition – Pearson Education.