

B. Tech. in INFORMATION TECHNOLOGY

Syllabus of Paper – 1

DATA STRUCTURES

Introduction to Data Structure: Definition, Types, Basic Operations, ADT, Algorithm: complexity and time space trade-off. Array: representation and address calculation, sparse matrix representation, polynomial representation and operations. Sorting: Bubble, Insertion, Selection, Quick, Merge, Radix, Time complexity and Memory requirements. Stack: Definition, Static representation and implementation, Operations: push & pop, Notations: infix, prefix and postfix and conversions among them, Application of Stack: Conversion of Infix to prefix and postfix, evaluation of postfix expressions, recursion, etc. Queue: Static representation and implementation of Linear queue, Operations on queue; add, delete, etc, Problem on linear queue, Circular queue, D-queue, Priority queue, Application of Queues. Linked List: Dynamic Representation and Implementation of Singly Linked Lists, Two way header list, Basic operations on linked list, Doubly, Circular, and Circular doubly linked list. Static representation and implementation of singly linked list. Application of Linked list: Polynomial representation and operations on polynomials, Garbage Collection and compaction etc. Dynamic (linked) representation of stack and queue. Tree: Basic Terminology, Binary tree and types; strictly, complete, skewed, binary expression tree, Representation of binary tree; static and dynamic, Traversals Algorithms; recursive and non-recursive, Threaded binary tree; representation and applications. Binary Search Tree; basic operations on it, AVL tree, basic operations in AVL tree, m-way tree, B-tree; basic operations, B+ tree. Applications of Tree. Heap sort. Max and Min Heap, Graph: Basic terminology, types of graphs, representation methods, traversal methods, minimum spanning tree, shortest path algorithms. Searching Sequential search, Binary search, Hashing: methods, collision, collision resolution techniques; open addressing and chaining, clustering. Comparison of all searching method.

COMPUTER ORGANIZATION

Processor Basics: CPU Organization, Fundamental and features, Data representation – Basic formats, Fixed and Floating point representation, Instruction set, formats, types and programming considerations, Addressing modes. Data Path Design: Fixed point arithmetic multiplication algorithms: hardware algorithms, Booth multiplication algorithm, Division algorithm: Hardware algorithm, Divide overflow algorithm, Combinational ALU and Sequential ALU, Floating point arithmetic operations. Control Design: Basic concepts, Hard-wired control, Micro Programmed Control, CPU control Unit and Multiplier Control Unit, Pipeline control: Instruction pipelines, Pipeline Performance, Superscalar processing. Memory Organization: Memory Device Characteristics, RAM Technologies and Serial Access Memories Technology, Multilevel Memory Systems, Address translation and Memory allocation systems, Cache memory: Features, Address mapping. System Organization: Communication method: Basic concepts, Bus control, Programmed I/O, DMA, Interrupts and I/O processors, Parallel Processing: Processor-level Parallelism, Multiprocessor and Fault Tolerance System.

PRINCIPLES OF COMMUNICATION SYSTEM

Amplitude Modulation System: Need for Modulation, Amplitude Modulation, Amplitude Modulation Index, Modulation Index for Sinusoidal AM, Frequency spectrum for Sinusoidal AM, Average power for Sinusoidal AM, Effective voltage and current for

sinusoidal AM, Balanced Modulator, AM demodulation, The Square law demodulator, PLL, Non sinusoidal modulation, DSBSC Modulation, SSB modulation and generation & demodulation, VSB, FDM. Angle Modulation System: Phase and frequency modulation and their relationship. Frequency deviation, spectrum of FM Signal, BW of FM Signal, Effect of modulation on BW, constant BW, FM phasor diagram, Narrow band FM. Armstrong and Parameter variation methods of FM generation and FM demodulators. Digital Communication: Sampling theorem, Pulse Modulation: PAM, PPM, PWM, Digital Base Band Modulation technique: Bandwidth of digital data, Base band System, Formatting textual data, messages, characters & symbols, Formatting Analogue information, source of corruption, PCM, Uniform & Non-uniform Quantization, Base band modulation, Correlative Coding, Formatting Analogue information, DPCM, Delta Modulation; Digital Modulation Techniques: Fundamentals of Binary ASK, PSK, FSK, Generation & detection of BASK, BPSK, BFSK, Fundamentals of QPSK & DPSK, Generation & detection of QPSK & DPSK, MSK, M-ary PSK signaling schemes, Equalization Principles, Optimum filter, Matched filter, Error probability of various Digital Modulation technique. Elements of Information Theory: Average Information, Entropy, Information Rate. Communication Channel. Discrete and Continuous channel, Shannon-Hartley Theorem and its Implications, Channel capacity, Gaussian channel, Bandwidth s/N trade off. Satellite Communication: Satellite Communication: Components and Block diagram of Satellite communication system, Transponders, Up-link and Down-link budget calculations, Fiber Optic Communication: Principles of light propagation in optical fiber, Losses in fibers, Dispersion.

THEORY OF COMPUTATION

Machines: Basic machine, FSM , Transition graph, Transition matrix, Deterministic and non-deterministic FSM'S, Equivalence of DFA and NDFA, Mealy & Moore machines, minimization of finite automata, Two-way finite automata. Regular Sets and Regular Grammars : Alphabet, words, Operations, Regular sets, Finite automata and regular expression, Pumping lemma and regular sets, Application of pumping lemma, closure properties of regular sets. Formal Grammars & Languages: Basic definitions and examples of languages, Chomsky hierarchy, Regular grammars, context free & context sensitive grammars, context free languages, non-context free languages, Chomsky normal forms, binary operations on languages. Turing Machines & Pushdown Automata: TM model, representation and languages acceptability of TM Design of TM, Universal TM & Other modification, composite & iterated TM, Pushdown automata , Acceptance by PDA. Computability: Basic concepts, primitive & partial recursive function, Recursive function, Decidability, Kleen's theorem. Undecidability: Properties of recursive & recursively enumerable languages, Universal Turing machine and an undecidable problem, Rice's theorem & some more undecidable problems. Computational complexity Theory: Definition, linear speed-up, tape compression & reduction in number of tapes, Hierarchy Theorem, Relation among complexity measures, Transition lemmas & non deterministic hierarchies, properties of general complexity measures, the gap, speed-up, union theorem, Automatic complexity theorem.

OPERATING SYSTEMS

Introduction: Operating system and function, Evolution of operating system, Batch, Interactive, Time Sharing and Real Time System, System protection. Operating System Structure: System Components, System structure, Operating System Services. Processes: Process concept, Principle of Concurrency, Producer Consumer Problem, Critical Section problem, Semaphores, Classical problems in Concurrency, Inter Process Communication, Process

Generation, Process Scheduling. CPU Scheduling: Scheduling Concept, Performance Criteria Scheduling Algorithm, Evolution, Multiprocessor Scheduling. Deadlock: Deadlock Characterization, Prevention, Avoidance and Detection, Recovery from deadlock combined approach. File System: File Concept, File Organization and Access Mechanism, File Directories, File Sharing, Implementation Issues. Memory Management: Multiprogramming with fixed partition, Multiprogramming with variable partition, Multiple base register, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Paged replaced algorithm, Allocation of frames, Thrashing, Cache memory, Organization, Impact on performance. I/O Management & Disk Scheduling: I/O devices and organization of I/O function, I/O Buffering, Disk I/O, Disk scheduling algorithms, Case study: WINDOWS-NT, Linux, Unix.

COMPUTER NETWORKS

Course logistics, Introduction to Networks, OSI layers, Inter-layer communication, PHY layer, NRZ, NRZI, Manchester, 4B/5B, framing, error detection, FEC vs ARQ, Stop-and-Wait, inefficiency of stop-and-wait, bit-pipe model, bandwidth-delay-product. Sliding window protocol, Network topologies (bus, ring, star). Modes of transmission (unicast, broadcast, multicast, anycast), ALOHA, ALOHA analysis, efficiency/throughput, slotted ALOHA. Ethernet PHY properties, cables, CSMA/CD, Ethernet min. frame length requirement, jamming, wireless and lack of collision detection. Wireless CSMA/CA, hidden nodes, RTS/CTS, token ring, Token ring algorithm, Ethernet Vs token ring, , Comparison of switching mechanisms, circuit switching, packet switching, virtual circuit switching, source routing, Ethernet bridging, learning bridges, looping issue, Ethernet spanning tree protocol; Distance vector routing algorithm, Counting to infinity problem, Link state routing algorithm, IP addressing, hierarchical routing, what is Internetworking, IP forwarding algo, ARP, DHCP, IP packet format, IP fragmentation and reassembly, Subnetting, CIDR/ Supernetting, ICMP, ISPs, Autonomous Systems, ISP relationships, Types of AS, BGP: path vector protocol; Transport layer functionalities, application expectations and IP delivery semantics, UDP functionality, UDP header; why is reliability at the transport layer different from reliability at the link layer?, TCP features, byte-stream, connection-oriented, TCP header format, 4-tuple, incarnations of a TCP connection, 3-way handshake, initial sequence numbers, TCP state diagram, TCP sliding window, , RTT estimation, Jacobson/Karel's algorithm for RTT estimation, slow-start, congestion avoidance, self-clocking/ack-clocking, TCP Tahoe, Fast retransmit, fast recovery, Resource allocation models, evaluation metrics, queuing models, quality of service. Real-time applications; classification of applications, Introduction to cryptography and network security, Domain Name System (DNS), Applications: SMTP, RFC622, MIME, Email clients, servers, SMTP gateways, HTTP, persistent TCP connections

DESIGN ANALYSIS OF ALGORITHM

Analyzing algorithms, Algorithm types, Recurrence Equations, Growth function: Asymptotic notation, Standard notation & common functions, Recurrence relation, different methods of solution of recurrence equations with examples. Introduction to Divide and Conquer paradigm, Quick and merge sorting techniques, Linear time selection algorithm, the basic divide and conquer algorithm for matrix multiplication Strassen Multiplication and, Red Black tree, Binary Search tree, heap sort, shell & bucket sort. Overview of the greedy paradigm examples of exact optimization solution (minimum cost spanning tree), Knapsack problem, Single source shortest paths. Overview, difference between dynamic programming and divide and conquer, Applications: Shortest path in graph, Matrix multiplication, Traveling salesman Problem, longest Common sequence. Representational issues in graphs, Depth first search & Breath first search on

graphs, Computation of biconnected components and strongly connected components using DFS, Topological sorting of nodes of an acyclic graph & applications, Shortest Path Algorithms , Bellman-Ford algorithm, Dijkstra's algorithm & Analysis of Dijkstra's algorithm using heaps, Floyd-Warshall's all pairs shortest path algorithm; The general string problem as a finite automata, Knuth Morris and Pratt algorithms, Linear time analysis of the KMP algorithm, The Boyer-Moore algorithm. Backtracking & Recursive backtracking, Applications of backtracking paradigm ,Complexity measures, Polynomial Vs Non polynomial time complexity; NP- hard and NP-complete classes, examples.

Syllabus of Paper - 2

DATABASE MANAGEMENT SYSTEM

Introduction to Database: Advantages of DBMS, Type of Data Models, Classification of DBMS, Schema and instances, DBMS Architecture and Data Independence, Entity- Relationship Model, Attributes and Keys, Relationship Types, Types of Entity, Enhanced E-R Modeling, Specialization and Generalization, Construction & Conversion of E-R Diagram into Tables, Constraints of E-R Diagram, Merits & Demerits of E-R Diagram. Database Design: Logical Database design: various Database Design Strategies, Functional Dependencies, Types and Characteristics of FD, inference Rule, closure set of attributes & applications (equivalences & canonical form), Normalization for Relational Databases: Definition, Types of Normalization: First Normal form, Second Normal form, Third Normal form, Boyce-codd normal form, problem related with normal forms & solutions. Multivalued & Join Dependencies, 4th & 5th Normalization, Numerical based on Normal forms, Merits & Demerits of Normalization. Structured Query Language: Components of SQL: DDL, DML, DCL, View, Index, Cursors and Triggers, Query Processing: Query processing stages, Query interpretation, Query execution plan, Table scans, Classification Queries, Aggregate function, Use of Group By, Having, Order by Clause, sub queries characteristic & classification, Use of Any, All, Exist & Not Exist operator, join operator, types of join, Structure of a query optimizer. Relational Algebra, Relational Calculus & Transaction Processing: Classification of Relational Algebra operator (Native, Extended and Set Operators), Relational data model concepts, constraints, Relational Calculus: Tuple Relational Calculus & Domain Relational Calculus. Transaction Processing: Types of failures, ACID property, Six different isolation problems, schedules and recoverability, serialisability of schedules, Levels of transaction consistency, Deadlocks, Nested transaction, Transaction benchmarking. Indexes, Concurrency Control & Crash Recovery: File Organizations: Introduction, Secondary Storage Devices, Buffering of Blocks, Structure of Files: Types of Single Level ordered indexes, Multilevel indexes, Dynamics Multilevel indexes using B-trees and B+- Trees. Concurrency Control: Different type of concurrency control techniques & their comparative analysis, Locking techniques, Time-stamp ordering, Multi-version techniques, Optimistic techniques, Multiple granularity. Integrity, Security, Non-procedural and procedural integrity constraints, Integrity constraints specifications in SQL. Failure classification, Different type of Recovery techniques & their comparative analysis, deferred update, immediate update, Shadow paging, Check points, On-line backup during database updates,

COMPUTER GRAPHICS

Overview of Graphics System: I/O devices, Raster scan & Random scan system, line and circle generation methods, Filled area primitive, solid area filling algorithms. Transformations & Projection: 2-D Transformation, basic geometric transformations, Transformation in homogeneous coordinate system, 3-D transformations, Projection: parallel projection, perspective projection, Vanishing points. Line Clipping algorithms; Cohen-Sutherland algorithm, Midpoint subdivision algorithm, Cyrus beek algorithm, Polygon Clipping. Curve Design: Parametric curves, Need for cubic parametric curves c_0 , c_1 , c_2 continuity, Bezier curves, Generation through Bernstein polynomials, Condition for smooth joining of 2 segments, Convex Hull property, B-Spline Curves: Properties of B-spline curves, Finding Knot vectors-uniform and open uniform, Non-uniform, rational B-splines, Beta splines, Subdividing curves, Drawing curves using forward differences. Hidden Surface Removal & Fractals: Hidden Surface Removal:

Back face removal, Floating Horizon method for curved objects, Z-Buffer or depth buffer algorithm, Painters algorithm (Depth sorting method), Binary space partitioning trees, Scan-line algorithm, Warnock's algorithm. Fractals: self-similar fractals-fractal dimension, Generation of Terrain-random mid point displacement, Grammar based models, Self-squaring fractals. Solid Modelling: Generation through sweep techniques, Constructive solid geometry, B representations, Octrees, Ray Tracing & their Theory. Shading, Color Issues And Animation: Illumination model, Computing reflection vector, Gouraud and Phong shading, Texture mapping & their characteristics, Handling shadows, Radiosity, Lambert's Law, Modelling transparency, Colour issues: colour model for Images, Additive and Subtractive colour models, Wavelength spectrum, CIE colour standards. Animation: Procedural animation, morphing, creating key frames, steps for creating animation, Frame by Frame animation.

COMPILER DESIGN

Introduction: Introduction to Compiler, single and multi-pass compilers, Translators, Phases of Compilers, Compiler writing tools, Bootstrapping, Back patching. Finite Automata and Lexical Analyzer: Role of Lexical Analyzer, Specification of tokens, Recognition of tokens, Regular expression, Finite automata, from regular expression to finite automata transition diagrams, Implementation of lexical analyzer Tool for lexical analyzer LEX, Error reporting. Syntax Analysis And Parsing Techniques: Context free grammars, Bottom-up parsing and top down parsing. Top down Parsing: elimination of left recursion, recursive descent parsing, Predicative Parsing, Bottom Up Parsing : Operator precedence parsing, LR parsers, Construction of SLR, canonical LR and LALR parsing tables, Construction of SLR parse tables for Ambiguous grammar, the parser generator – YACC, error recovery in top down and bottom up parsing. Syntax Directed Translation & Intermediate Code Generation: Synthesized and inherited attributes, dependency graph, Construction of syntax trees, bottom up and top down evaluation of attributes, S-attributed and L-attributed definitions, Postfix notation; Three address codes, quadruples, triples and indirect triples, Translation of assignment statements, control flow, Boolean expression and Procedure Calls. Runtime Environment: Storage organization, activation trees, activation records, allocation strategies, Parameter passing symbol table, dynamic storage allocation. Code Optimization & Code Generation: Basic blocks and flow graphs, Optimization of basic blocks, Loop optimization, Global data flow analysis, Loop invariant computations. Issue in the design of Code generator, register allocation, the target machine, and simple Code generator.

INTERNET AND WEB TECHNOLOGIES

Introduction To Internet: Introduction, Evolution of Internet, Internet Applications, Internet Protocol -TCP/IP, UDP, HTTP, Secure Http(Shttp) Internet Addressing – Addressing Scheme – Ipv4 & Ipv6, Network Byte Order, Domain Name Server and IP Addresses, Mapping, Internet Service Providers, Types Of Connectivity Such As Dial-Up Leased Vsat Etc. Web Technologies: Three Tier Web Based Architecture; Jsp, Asp, J2ee, .Net Systems. HTML CSS And Scripting: HTML - Introduction, Sgml, Dtd(Document Type Definition, Basic Html Elements, Tags and usages, HTML Standards, Issues in HTML Dhtml: Introduction Cascading Style Sheets: Syntax, Class Selector, Id Selector Dom (Document Object Model) & Dso (Data Source Object) Approaches To Dynamic Pages: Cgi, Java Applets, Plug Ins, Active X, Java Script – Java Script Object Model, Variables-Constant – Expressions, Conditions- Relational Operators- Data Types – Flow Control – Functions & Objects-events and event handlers – Data type Conversion & Equality – Accessing HTML form elements. XML: Basic Standards, Schema Standards, Linking

& Presentation Standards, Standards that build on XML, Generating XML data, Writing a simple XML File, Creating a Document type definition, Documents & Data, Defining Attributes & Entities in the DTD, Defining Parameter Entities & conditional Sections, Resolving a naming conflict, Using Namespaces, Designing an XML data structure, Normalizing Data, Normalizing DTDS. Internet Security & Firewalls: Security Threats From Mobile Codes, Types Of Viruses, Client Server Security Threats, Data & Message Security, Various electronic payment systems, Introduction to EDI, Challenges–Response System, Encrypted Documents And Emails, Firewalls: Hardened Firewall Hosts, Ip- Packet Screening, Proxy Application Gateways, Aaa (Authentication, Authorization And Accounting). Website Planning & Hosting: Introduction, Web Page Lay-Outing, Where To Host Site, Maintenance Of Site, Registration Of Site On Search Engines And Indexes, Introduction To File Transfer Protocol, Public Domain Software, Types Of Ftp Servers (Including Anonymous), Ftp Clients Common Command. Telnet Protocol, Server Domain, Telnet Client, Terminal Emulation. Usenet And Internet Relay Chat.

SOFTWARE ENGINEERING

Software Process: Introduction – Software life cycle models (waterfall, incremental, spiral, WINWIN Spiral, evolutionary, prototyping, object oriented, component based development). Software Development Process System – Verification and Validation, System engineering hierarchy, computer based system. Software Requirements: Functional and non-functional requirements, user and system requirement, requirement engineering, process feasibility studies, elicitation and analysis, validation and management, software prototyping – prototyping in the software process, rapid prototyping techniques, user interface prototyping, SRS. Design Concepts And Principles: Design process and concepts – modular design, design heuristic, design model and document. Architectural design- software architecture data design, architectural design transformation and transaction mapping. User interface design – user interface design principles, monitoring and control system. SCM – need for SCM, version control, introduction to SCM process, software configuration items. UML – components & features, Formal Technical Reviews (FTR), Configuration Audit. Testing And Maintenance: Taxonomy of software testing – levels, test activities, types of s/w tests – black box testing, white box testing, testing boundary condition, structural testing, test coverage criteria. Based on data flow mechanisms – regression testing. s/w testing strategies – strategic approach and issues, unit testing, integration testing, validation testing, system testing and debugging, SQA, CMM software maintenance, Reengineering, Reverse Engineering, cyclomatic complexity, s/w quality metrics; Introduction To Software Project Management: Measures and measurements – s/w complexity and size measure- data and logic structure measure information flow measure. Software cost estimation – function oriented models, COCOMO model, Delphi method, defining a task network, Scheduled Earned Value Analysis, Error Tracking, Software changes, program evolution dynamics software maintenance, Architectural evolution Taxonomy of CASE Tools. Recent trends and development in software engineering, challenges of software engineering in distributed and mobile system.

MANAGEMENT INFORMATION SYSTEM

Management & Organizational Support Systems For Digital Firm: Definition of MIS; Systems approach to MIS: MIS and Human factor considerations, concept of organizational information sub-system, MIS & problem solving. Information Technology Infrastructure for digital firm. Information Systems & Business Strategy : Information Management. Who are the users? Managers, Decision making & information System, Evolution of Computer based information system (CBIS), Model of CBIS. Changing role of Information systems in

organization: Trend to End-User computing, justifying the CBIS, Achieving the CBIS, Managing the CBIS, Benefits & Challenges of CBIS implementation. Strategic Information System, Business level & Firm level Strategy. Information Systems In The Enterprise: Systems from Management & Functional perspective & their relationship: Executive Support System, Decision Support System, Sales & Marketing Information System, Manufacturing Information System, Human-Resource Information System. Finance & Account Information System. Information Technology For Competitive Advantage: Firm in its environment, the information resources, who manages the information resources? Strategic planning for information resources. End-User Computing as a strategic issue, Information resource management concept. Knowledge management & their work system, Business value of information system Related Case Studies. International Information System: Managing International Information Systems: IIS architecture, Global business drivers, challenges, and strategy: divide, conquer, appease, cooptation, business organization, problems in implementing global information systems, Understanding ethical and social issues related to systems, ethics in information society, and Moral dimensions of information systems.

ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

General Issues And Overview of AI: The AI problems; what is an AI technique; Level of model, criteria for success, Characteristics of AI applications, Problem Solving, State Space Search, Production systems, Control strategies: forward and backward chaining, Problem characteristics, Production System characteristics, issues in the design of search program, Data driven and goal driven search, Exhaustive searches: Depth first & Breadth first search. Heuristic Search Techniques: Heuristics & Heuristic function, Heuristic Search – Generate & test, Hill climbing; Branch and Bound technique; Best first search & A* algorithm; AND/OR Graphs; Problem reduction and AO* algorithm; Constraint Satisfaction problems, Means End Analysis. Knowledge Representation: Introduction to knowledge representation-Propositional calculus, First Order Predicate Calculus, conversion to clause form, Unification, Theorem proving by Resolution, Natural Deduction, Inference Mechanisms Horn's Clauses; Knowledge representation issues-Representation and mapping, Approaches to Knowledge representation, Frame Problem, Structured knowledge representation-Semantic Networks Frame representation and Value Inheritance; Conceptual Dependency and Scripts. Introduction to Agent based problem solving. Reasoning Under Uncertainty & Applications of Ai: Source of Uncertainty, Probabilistic Reasoning and Uncertainty; Probability theory; Bayes Theorem and Bayesian networks, Certainty Factor, Dempster-Shafer theory, Non Monotonic Reasoning, Truth maintenance Systems, Overview of Fuzzy Logic. Natural language processing: overview, Basic steps followed for the NLP, concept of NLP, Parsing, machine translation, Planning Overview - An Example Domain: The Blocks World; Component of Planning Systems; Goal Stack Planning (linear planning); Non-linear Planning using constraint posting. Learning, Rote Learning; Learning by Induction, Learning in Problem Solving, Explanation based learning and Discovery. Game Playing, AI Languages & Expert Systems: Game Playing Minmax search procedure; Alpha-Beta cut-offs; Additional Refinements, AI Programming Languages: Introduction to LISP and PROLOG, Syntax and Numeric Functions; List manipulation functions, programming in Lisp/Prolog, Iteration and Recursion. Introduction to Expert Systems, characteristics, Architecture of Expert Systems, Development of Expert System, Software Engineering and Expert System, Expert System Life Cycle model, Expert System Shells; Knowledge Acquisition; Case Studies: MYCIN.
