Computer Science I & IInd

Computer Science
Syllabus
PAPER – I

1. **Computer Organization and Architecture:** Functional units of digital system and their interconnections, buses, bus architecture, types of buses and bus arbitration. Register, bus and memory transfer. Processor organization, general registers organization, stack organization and addressing modes. Arithmetic and Logic Unit, Control Unit, Memory, Input/output devices, interfaces and ports, Interrupts and exceptions. Modes of Data Transfer, Synchronous & asynchronous communication, standard communication interfaces.
2. **Data Structures:** Elementary Data Organization, Built in Data Types in C / C++/JAVA. Algorithm, Efficiency of an Algorithm, Time and Space Complexity, Asymptotic notations: Big Oh, Big Theta and Big Omega, Time-Space trade-off. Abstract Data Types (ADT), Arrays and Application of arrays, parse Matrices and their representations. Linked lists, Stacks, Queues, Searching and sorting, Graphs, Tree, Binary Tree and its applications, Hashing, B+ tree.
3. **Discrete Structures & Theory of Logic:** Set Theory, Relations, Functions, Natural Numbers, Proof Methods, Proof by counter – example, Proof by contradiction. Algebraic Structures, Lattices, Propositional Logic, Trees, Graphs, Combinatorics.
4. **Database Management Systems**: Database System vs File System, Database System Concept and Architecture, Data Model Schema and Instances, Data Independence and Database Language and Interfaces, Data Definitions Language, DML, Overall Database Structure. Data Modeling Using the Entity Relationship and enhanced E-R, Relational data Model and Language, Relational Algebra, Relational Calculus, Tuple and Domain Calculus. SQL, Data Base Design & Normalization, NoSQL, Transaction Processing, Concurrency Control Techniques, Web Interface to DBMS, OO database, Case Studies of commercial DBMS.
5. **Design and Analysis of Algorithm**: Algorithms and its analysis, Complexity of Algorithms, Growth of Functions, Performance Measurements, Sorting and Order Statistics, Red-Black Trees, B – Trees, Binomial Heaps, Fibonacci Heaps, Tries, Skip List, Divide and Conquer with Examples Such as Sorting, Matrix Multiplication, Convex Hull and Searching. Greedy Methods: Optimal Reliability Allocation, Knapsack, Minimum Spanning Trees – Prim's and Kruskal's Algorithms, Single Source Shortest Paths - Dijkstra's and Bellman Ford Algorithms, Dynamic Programming such as Knapsack. All Pair Shortest Paths – Warshal's and Floyd's Algorithms, Resource Allocation Problem. Backtracking, Branch and Bound techniques such as Travelling Salesman Problem, Graph Coloring, n-Queen Problem, Hamiltonian Cycles and Sum of Subsets. Algebraic Computation, Fast Fourier Transform, String Matching, Theory of NP-Completeness, Approximation Algorithms and Randomized Algorithms.

6. **COMPUTER NETWORKS:** Goals and Applications of Networks, Network structure and architecture, The OSI reference model, services, Network Topology Design, Physical Layer Transmission Media, Switching methods, ISDN, Terminal Handling, Medium Access sub layer - Channel Allocations, LAN protocols - ALOHA protocols - Overview of IEEE standards - FDDI. Data Link Layer - Elementary Data Link Protocols, Sliding Window protocols, Error Handling. Network Layer - Point - to Pont Networks, routing, Congestion control Internetworking -TCP / IP, IP packet, IP address, IPv6. Transport Layer - Design issues, connection management, Session Layer-Design issues, remote procedure call. Presentation Layer-Design issues, Data compression techniques, cryptography - TCP - Window Management. Application Layer: File Transfer, Access and Management, Electronic mail, Virtual Terminals, Other application. Internet and Public Networks, Peer to Peer Network.

7. **Principles of Programming Languages**, Role of Programming Languages, Programming Paradigms, Programming Environments, Language Description: Syntactic Structure, Language Translation Issues: Programming Language Syntax, Stages in Translation, Formal Translation Models, Data Types, and Basic Statements, Binding, Type Checking, Scope, Scope Rules , Lifetime and Garbage Collection, Primitive Data Types, Strings, Array Types, Associative Arrays ,Record Types, Union Types, Pointers and References , Arithmetic Expressions , Overloaded Operators, Type Conversions , Relational and Boolean Expressions, Assignment Statements, Mixed Mode Assignments, Control Structures, Selection ,Iterations, Branching, Guarded Statements, Subprograms and Implementations, Design Issues for Functions , Semantics of Call and Return, Implementing Simple Subprograms, Stack and Dynamic Local Variables, Nested Subprograms, Dynamic Scoping. Object-Orientation, Concurrency and Event Handling, Object Oriented Programming using C++ and Java, Functional and Logic Programming Languages.

8. **SOFTWARE PROJECT MANAGEMENT:** Fundamentals of Software Project Management (SPM), Software Project Planning, Software Project Estimation, Project Organization and Scheduling Project Elements, Project Life Cycle and Product Life Cycle, Ways to Organize Personnel, Project Schedule, Scheduling Objectives, Building the Project Schedule, Scheduling Terminology and Techniques, Network Diagrams: PERT, CPM, Bar Charts: Milestone Charts, Gantt Charts, Dimensions of Project Monitoring & Control, Earned Value Analysis, Earned Value Indicators: Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Interpretation of Earned Value Indicators, Error Tracking, Software Reviews, Software Quality Assurance and Testing, Project Management and Project Management Tools, Software Configuration Management, Risk Management, Cost Benefit Analysis, SPM Tools: CASE Tools, Planning and Scheduling Tools, MS-Project.

9. CYBER SECURITY: Information Systems, its types and development, Information Security and its Need, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis. Application Security: Database, E-mail and Internet, Data Security Considerations: Backups, Archival Storage and Disposal of Data, Security Technology:, Firewall and VPNs, Intrusion Detection, Access Control. Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail Viruses, Macro Viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce- Electronic Payment System, e- Cash, Credit/Debit Cards. Digital Signature, Public Key Cryptography, Developing Secure Information Systems, Information Security Governance & Risk Management, Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets, Access Control, CCTV and Intrusion Detection Systems, Backup Security Measures. Security Policies: Development of Policies, WWW Policies, Email Security Policies, Policy Review Process-Corporate Policies-Sample Security Policies, Publishing and Notification Requirement of the Policies. Evolving Technology Security – Mobile, Cloud, Outsourcing, SCM, Information Security Standards: ISO, IT Act, Copyright Act, Patent Law, IPR. Cyber Laws in India, IT Act 2000 Provisions, Intellectual Property Law, Software License, Semiconductor Law and Patent Law. Corporate Security

Computer Science
Syllabus
PAPER – II

1. **OPERATING SYSTEMS:** Operating System definition, function and services, Types and features, Operating System Structure- Layered structure, System Components, Reentrant Kernels, Monolithic and Microkernel Systems, System Calls types, System Programs, Process and Thread: process states, process control block, Inter process communication; Process Synchronization: Classical problems of synchronization, Concurrent Processes CPU Scheduling Criteria and Algorithms, Memory Management, File management, Device Management and Disk scheduling, File Management, UNIX Commands and utilities, Linux: System components, Process management, scheduling, memory management, Networking software layers, Security, various editors, I/O devices, IPC.

2. **COMPUTER GRAPHICS:** Types of computer graphics, Graphic Displays, Random scan displays, Raster scan displays, Frame buffer and video controller, Points and lines drawing algorithms, Circle generating algorithms and parallel version of these algorithms, Basic and Composite Transformations, Reflections and shearing. Windowing and Clipping, 3-D Geometric Primitives, representation, Transformation, projections and Clipping, Curves and Surfaces, Hidden Lines and Surfaces

3. **ARTIFICIAL INTELLIGENCE:** Introduction, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. Computer vision, Natural Language Possessing, strategies, Informed search strategies and algorithms, Knowledge Representation & Reasoning, Machine Learning , Pattern Recognition.

4. **COMPILER DESIGN**: Phases and passes, Bootstrapping, Finite state machines and regular expressions and their applications to lexical analysis, Optimization of DFA-Based Pattern Matchers implementation of lexical analysis, Formal grammars and their application to syntax analysis, BNF notation, ambiguity, YACC. The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG, Parsing Techniques, Syntax-directed Translation, Symbol Tables, Run-Time Administration, Error Detection & Recovery, Code Generation and Code optimization .

5. **SOFTWARE ENGINEERING:** Introduction, Software life-cycle models, Software requirements, Requirements Specification, Software design and Software user interface design, Coding Issues, Software integration and testing, Software support processes and Quality Assurance, IEEE Software Engineering Standards , Software maintenance, Software reuse, SOFTWARE TESTING & AUDIT.

6. **DISTRIBUTED SYSTEM:** Characterization of Distributed Systems, Theoretical Foundation for Distributed System, Distributed Mutual Exclusion, Distributed Deadlock Detection, Agreement Protocols, Distributed Resource Management, Failure Recovery in Distributed Systems, Transactions and Concurrency.

7. **WEB TECHNOLOGIES:** Introduction and Web Development Strategies, Protocols Governing Web, Writing Web Projects, Internet services and tools, Client-server computing. Core Java, Web Page Designing, XML, DOM and SAX, Dynamic HTML, Scripting, Networking, Enterprise Java Bean, Java Database Connectivity (JDBC), Merging Data from Multiple Tables, Servlets, Handling HTTP get and post Requests, Redirecting Requests to Other Resources, Session Tracking, Cookies, Session Tracking with Http Session, Java Server Pages (JSP)

8. **IMAGE PROCESSING: DIGITAL IMAGE FUNDAMENTALS:** Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – Color image fundamentals – RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms – DFT, DCT. **IMAGE ENHANCEMENT:** Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement. **IMAGE RESTORATION:** Image Restoration – degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering, **IMAGE SEGMENTATION:** Edge detection, Edge linking via Hough transform – Thresholding – Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm. **IMAGE COMPRESSION AND RECOGNITION:** Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture – Patterns and Pattern classes – Recognition based on matching.

9. **SOFT COMPUTING:** **Neural Networks, Fuzzy Logic and Genetic Algorithm(GA)**

10. **HIGH PERFORMANCE COMPUTING:** Grid Computing, Cluster Computing, Beowulf Cluster, Cloud Computing.