

52. COMPUTER APPLICATIONS & INFORMATION TECHNOLOGY (IT)

Unit 1: Computer Organization and Architecture

Computer Organization and Architecture – Boolean Algebra, Minimization of Boolean Functions, Number System, Basic concepts of floating point number system, Sequential and Combinational Circuits, Flip flops – types, Race Condition and Comparison. Input/Output Unit, Memory Organization, ALU and Control Unit, Instruction and Execution Cycle in CPU, Introduction to Microprocessors, Interrupts, CISC and RISC Architecture.

Unit 2: Programming Languages & Data Structure

Programming Languages (Java, C++), Computer Algorithms, Flow Charts, Encapsulation, Inheritance, Polymorphism, Building Blocks, Control Structures, Arrays, Dynamic Memory Allocation, File management. Internet Programming – Hyper Text Markup Language (HTML) and XML, Building Static and Dynamic Web Pages, Client Side and Server Side Scripting Languages (JSP,.NET,PHP), Interaction with Database.

Data Structure-Representation of Character, String and their Manipulation, Linear List Structure, Stack, Queue, Heaps, Linked list, Arrays. Tree: Representation of Tree Structures and Different Tree Traversal Algorithms, Graph, Sorting and Searching Algorithms.

Unit 3: Software Engineering

Software Engineering Definition; Requirement Analysis and Specification; Software Development: Phases, Process Models, Project Structure, Project Team Structure, Types of Metrics, Measurement, Software Quality Factors. Planning and Software Project : Requirement analysis, Cost Estimation, Project Scheduling, Quality Assurance Plan and Project Monitoring Plans, Gantt Charts, PERT and CPM, Coding Tools and Techniques, Testing Maintenance, CASE Tools, Object Oriented Analysis and Design, UML Modeling and Diagrams.

Unit 4: Networking & Operating System

Types of Networks, Network topology. Data Communication: Concepts of Data, Signal, Channel, Bandwidth, bit-rate and baud rate. Maximum Data-Rate of Channel; Analog and Digital Communications, Asynchronous and Synchronous transmission. ISO-OSI Reference Model, TCP/IP Reference Model – Data Link Layer Function and Protocols: Framing, Error Control, flow control; sliding window protocol, IP-v4 & IP-v6, Dual Stack. Internet standards and Services, Cryptography, Authentication and firewalls, Adhoc networks.

Operating system – Process Management: Inter-Process Communication, Process Scheduling; Memory management: Swapping, Virtual Memory, Paging and Segmentation; Device Management: Deadlocks, Semaphores; File systems – Files, directories, Security and Protection Mechanisms: Basics of Unix/Linux/Windows Server Configuration.

Unit 5: Compiler Construction

Compilers – Regular Expression, Finite automata, Formal languages, Finite State Machines, Lexical Analysis, Semantic Analysis, Parsing Algorithms, Symbol tables, Error Handling, Types of Languages.

Unit 6: Data Base Management System

Definition and Features, Data Models, Relational Database: Logical and Physical Structure, Relational Algebra, Relational Calculus, Database Design, Normalization, Concurrency Control, Security and Integrity, Query Processing and Optimization, Backup and Recovery; Distributed Databases – Concepts, architecture, Design; Structured Query Language (SQL), Concepts and Principles of Data Warehousing, Data Warehousing Design and Schema, GIS Concepts and Principles, Big Data Concepts & Architecture.

Unit 7: Computer Graphics

Raster Scan and Random Scan Graphics; Continual Refresh and Storages Displays; Display Processors and Character Generators; Colour Display Techniques. Frame Buffer and Bit Operations, Raster graphics, Points, Lines and Curves, Scan Conversion; Line-Drawing Algorithms; Circle and Ellipse Generation; Polygon Filling; Conic-Section Generation. Anti-Aliasing; Two-dimensional viewing; Basic Transformations; Co-ordinate systems; Windowing and Clipping; Segments; Interactive Picture-Construction Techniques; Interactive Input/Output Devices. Three-Dimensional Concepts: 3-D Representations and Transformations; 3-D Viewing; Algorithm for 3-D Volumes, Spline Curves and Surfaces.

Unit 8: Artificial Intelligence and Soft Computing

Introduction to Artificial Intelligence (AI); Games, Theorem Proving, Natural Language Processing, Robotics, Expert System. Knowledge: General Concept of Knowledge, Knowledge Based System, Representation of Knowledge, Knowledge Organization and Manipulation, Acquisition of Knowledge, Ontologies. Symbolic Approach: Syntax and Semantics for Propositional Logic (PL) and First Order Predicates Logic (FOPL), Properties of Well-Formed Formulas (wffs), Conversion to clausal form, Inference Rules, Resolution Principle, Non deductive inference methods. Search and Control Strategies: Blind Search, Breadth-first search, Depth – First search, Hill Climbing Method, Branch and Bound Search. Machine Learning: Concept of Learning, Supervised and Unsupervised Learning, Neural Networks, Genetic Algorithms, Fuzzy Logic. Expert Systems: Introduction to Expert System, and its Characteristics, Application and Importance, Rule Based System Architecture; Software Agents.

Unit 9: Statistics, Modeling and Simulation

Frequency distribution, Measures of Central Tendency, Dispersion, Skewness and Kurtosis. Theory of Probability. Random variable and mathematical expectation. Correlation and regression. Basic Principles of Design of Experiments. Analysis of Variance. Completely randomized design (CRD), Randomized complete block design (RCBD), Latin Square Design (LSD), Split Plot and Strip Plot Design. Probability Distributions: Binomial, Poisson, Normal Distributions and their Applications. Concept of sampling, Sampling vs. Complete Enumeration, Sampling from a Finite Population, Simple Random Sampling. Generation and Testing of Random Numbers, Simulation of Stochastic Events and processes, Discrete Event Simulation.

Unit 10: Bioinformatics

Basics of Bioinformatics, Basic Molecular Biology; Introduction to the Basic Principles of Structure/Function Analysis of Biological Molecules; Genome Analysis; Different Types and Classification of Genome Databases (HTGS, DNA, Protein, EST, STS, SNPs, Unigenes etc.) Role of Bioinformatics in Genomics; Nature of Genomic Data; Overview of Available Genomic Resources on the Web; NCBI/ EBI/ EXPASY etc; Nucleic Acid Sequence Databases; GenBank/EMBL/ DDBJ; Database Search engines: Entrez, SRS. Overview/Concepts in Sequence Analysis; Pairwise Sequence Alignment Algorithms: Needleman & Wunsch, Smith & Waterman; BLAST, FASTA; Scoring matrices for Nucleic Acids and Proteins: PAM, BLOSUM, Dynamic Programming Algorithm, Multiple Sequence Alignment: PRAS, CLUSTALW. Sequence Based Gene Prediction and its Function Identification, Use of Various Derived Databases in Function Assignment, Use of SSR, SNPs and Various Markers for Identification of Genetic Traits, Gene Expression. Phylogenetic Analysis Algorithms; Maximum Parsimony, Distance based: UPGMA, Neighbour-Joining.