

## Syllabus of Ph.D. Entrance Examination

### 23. INFORMATION TECHNOLOGY

- 1. Computer Networks:** Network fundamentals; Local Area Networks (LAN), Metropolitan Area Networks (MAN), Wide Area Networks (WAN), Wireless Networks, Internet works. Reference Models: The OSI model, TCP/IP model. Data Communication : Channel capacity. Transmission media- Twisted pair, Coaxial cables, Fibre-optic cables, Wireless Transmission-Radio, Microwave, Infrared and Millimeter waves. Lightwave Transmission. Telephones-Local loop, Trunks, Multiplexing, Switching, Narrowband ISDN, Broadband ISDN, ATM, High speed LANs, Cellular Radio Communication, Satellites-Geosynchronous and Low-Orbit. Internetworking: Switch/Hub, Bridge, Router, Gateways, Concatenated Virtual Circuits, Tunnelling, Fragmentation, Firewalls. Routing; Virtual Circuits and datagrams. Routing Algorithms. Congestion control. Network Security Cryptography-Public key, Secret key, Domain Name System (DNS)-Electronic Mail and Worldwide Web (WWW). The DNS, Resource Records, Name Servers, E-mail- Architecture and Services.
- 2. Data and File Structures:** Data, Information, Definition of data structure, Arrays, Stacks, Queues, Linked Lists, Trees, Graphs, Priority Queues and Heaps. File Structures : Fields, Records and Files. Sequential, Direct, Index-Sequential and relative files. Hashing, Inverted Lists and Multi-lists. B trees and B+ trees.
- 3. Discrete Structures:** Sets, Relation, Functions, Pigeonhole Principle, Inclusion-Exclusion Principle, Equivalence and Partial Orderings, Elementary Counting Techniques, Probability. Measure(s) for information and Mutual Information. Computability : Models of computation-Finite Automata, Pushdown Automata, Non-determinism and NFA, DPDA and PDAs and Languages accepted by these structures. Grammars, Language, Non-computability and Examples of Non-computable problems. Graph :

Definition, walks, Paths, Trails, Connected Graphs, regular and bipartite graphs, cycles and circuits. Tree and rooted tree. Spanning trees. Eccentricity of a vertex radius and diameter of a graph . Central Graphs, Centre(s) of a tree. Hamiltonian and Eulerian Graphs, Planar Graphs. Groups : Finite Fields and Error Correcting/Detecting codes.

4. **Algorithms:** The Role of algorithms in computing, Probabilistic analysis and randomized algorithms, Sorting and order statistics, Heapsort, Quicksort, sorting in linear time, medians and order statistics, Elementary data structures, Hash tables, Binary search trees, Red-Black trees, Augmenting data structures, Dynamic programming, Greedy algorithms, Amortized analysis, B-Trees, Binomial Heaps, Fibonacci Heaps, Data structure for Disjoint sets, Elementary Graph algorithms, Minimum spanning trees, Single-source shortest paths, Maximum flow, Sorting networks, Matrix operations, Linear programming, Number- Theoretic algorithms, String Matching, Approximation algorithms.
5. **Software Engineering:** System Development Life Cycle (SDLC): Steps, Waterfall Model, Prototypes, Spiral Model. Software Metrics : Software Project Management. Software Design : System Design, Detailed Design, Function Oriented Design, Object Oriented Design, User Interface Design, Design Level Metrics. Coding and Testing: Testing Level Metrics. Software quality and reliability, Clean room approach, Software Reengineering.
6. **Artificial Intelligence:** Overview of artificial intelligence, LISP and other AI programming languages, Formalized symbolic logics, Probabilistic reasoning, Structured knowledge: Graphs, frames and related structures, Object oriented representations, Search and control strategies, Matching techniques, Natural language processing, Pattern Recognition, Visual image understanding, General concepts in knowledge acquisition, Machine learning, Learning by induction, Analogical and explanation based learning.

7. **Computer Graphics:** A survey of computer Graphics, Overview of Graphics systems, Output Primitives, Attributes of output primitives, Two-dimensional geometric Transformations, Two-dimensional Geometric Transformations, Two –dimensional viewing, Structures and Hierarchical modeling, Graphical user interfaces and Interactive input methods, Three dimensional concepts, Three dimensional object representations, Three dimensional Geometric and Modeling Transformations, Three dimensional viewing.
8. **Web Design and Development:** Basic web designing: Introduction to web browser, architecture of web browser, web page, static & dynamic web pages, home page, web-site. Web-servers & clients. www. Introduction to HTML: History, structure of HTML document, creating & executing HTML. Tags of HTML: Headings and Title, Character level and paragraph level formatting tags. <Center>, Text-level elements <B>, <U>, <I>, <PRE>, <BIG>, <STRIKE>, <SUB>, <SUP>, <BODY> Tag & its attributes. Changing Colors font, size using <FONT> Tag, Text alignment & paragraph <P> tag. <MARQUEE> Tag, Event Handling & Form Validation: on Click, on Change, on Load, on Select, on Submit, on Mouse Over, on Focus, on Blur, Validation of text box entries, checkboxes, radio buttons, e-mail address validation, date validation. VBScript and Active Server Pages (ASP) VBScript : Introduction, keywords, empty, is empty, nothing, null, true, false. Variable, operators. VBScript Statements: if...then..else, if..then...elseif.., select, for...next, for..each, do...while loop. Arrays & Objects: declaring arrays, types of arrays, VBScript objects, VBScript layout statements, error handling, adding objects, Forms, Controls & managing transactions, VBScript event programming.
9. **Multimedia:** Multimedia in Use: Introduction to multimedia, Definition, Elements of multimedia, Need of multimedia, Applications, Goal & Objectives, Multimedia building blocks, Users of multimedia, Benefits of Multimedia,

Training, Sales, Communication, Medicine. Multimedia & Internet. Multimedia Configuration: Converging technologies, Functions & subsystems (input, development & output). Multimedia PC workstation components. Multimedia platform, Multimedia H/w, System software, Multimedia OS File system (tiff, bmp, pcx, gif, jpeg etc.) Multimedia communication system. Development Tools: Developing applications, commercial tools, standards. Image and application image capture, Compression, text conversion, vaporization, image compression, Standards for encoding images, Standards for compression bitonal images, JPEG, Fractals for compression. Multimedia in Real World: Multimedia on network, Multimedia databases (in Oracle), Windows support for sound, animation, movies, music. Training & education: need for training, multimedia in training and education. Multimedia for information and sales, Multimedia in office & home.

**10. Network Security:** Introduction, Security Concepts, Threats and Risks, Attacks – Passive and Active, Security Services, Confidentiality, Authentication, Non-Repudiation, Integrity, Access Control, Availability, Model for Internet work Security, Internet Standards and RFCs Access Control Mechanisms , Access Matrix, HRU, TAM, ACL and capabilities. Network Security Applications, Authentication Mechanisms: a) Passwords, b) Cryptographic authentication protocol, c) Smart Card, d) Biometrics, e) Digital Signatures and seals, f) Kerberos, g) X.509 LDAP Directory. Web Security: a) SSL Encryption b) TLS, SET. E- mail Security, PGP's / MIME, IP Security, Access and System Security, Intruders, Intrusion Detection and Prevention, Firewall a) Hardware Firewall b) Software Firewall c) Application Firewall d) Packet Filtering. e) Packet Analysis, Proxy Servers, Firewall setting in Proxy, ACL in Proxy.