Syllabus for Ph.D. Entrance Test

Computer Science

UNIT-I

Discrete Structures : Sets, Relations, Functions. Pigeonhole Principle, inclusion-Exclusion Principle, Equivalence and Partial Orderings, Elementary counting techniques, Probability Measures for information and Mutual information.

Computability: Model of computation-Finite Automata, Pushdown Automata, Nondeterminism and NFA, DPDA and PDAs and language accepted by these structures, Grammar, Languages, non-compatibility and Example 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, Center(s) of a tree Hamiltonian and Eulerian graphs; Planar graphs. *Groups*: Finite fields and Error correcting/detecting codes.

UNIT-II

Computer Arithmetic : Prepositional (Boolean) Logic, Predicate Logic, Well-formed formulae (WFF) Satisfiability and tautology. *Logic Families:* TTL, ECL and C-MOS gates. Boolean algebra and minimization of Boolean functions. Flip-flops-types, race condition and comparison. Design of combinational and sequential circuits. *Representation of Integers:* Octal, Hex. Decimal and Binary. 2's complement and 1's complement arithmetic. Floating-point representation.

UNIT-III

Programming in C and C++: *Programming in C*: Elements of C- Tokens, identifiers, data types in C. Control structures in C. Sequence, selection and iteration(s). Structured data types, arrays, structure, union, string, and pointers. *OO Programming Concepts:* Class, Object, Instantiation, Inheritance, Polymorphism and Overloading.

C++ Programming: Elements of C++-Tokens, identifiers, Variables and constants, Data types, Operators, Control statements, Functions, parameter passing, Class and objects, Constructors and Destructors, Overloading, Inheritance, Templates. Exceptional handling.

Relational Database Design and SQL E-R Diagrams and their transformation to relational design, Normalization-NF, 2NF, 3NF, BCNF and 4NF. Limitations of 4NF and BCNE. *SQL:* Data Definition Language (DLL). Data Manipulation Language (DML), Data Control Language (DCL) commands. Database object like-Views, indexes, sequences, synonyms, data dictionary.
Data and File Structures Data information, Definition of Data Structure, Arrays, Stacks, Queues, Linked List, Trees, Graphs, Priority Queues and Heaps. *File structure :*Fields, Record and Files. Sequential, direct, index-sequential and relative files. Hashing, inverted lists and multi-list B tree and B+ tree.

UNIT-IV

Computer Networks: Networks Fundamentals: Local Area Networks (LAN),Metropolitan Area Network (MAN), Wide Area Networks (WAN), Wireless Networks, Inter Networks. *Reference Models:* The OSI model, TCP/IP model.
Data Communication: Channel capacity, Transmission media-twisted pair, coaxial cables, fiber -optic cables, wireless transmission-radio, microwave, infrared and millimeter waves, Light wave 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, Tunneling, Fragmentation, Firewalls. *Routing:* Virtual circuits and Datagram. 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 Serves.

UNIT-V

System Software and Compilers: Assembly language fundamentals (8085 programming). Assemblers-2-pass and singlepass. Macros and Macro processors, Loading, linking, relocation, program relocatability. Linkage editing. Text editors. Programming Environments: Debuggers and program generators. Compilation and Interpretation. Bootstrap compilers. Phases of compilation process. Lexical analysis. Lex package on Unix system. Context free grammars. Parsing and parse trees. Representation of parse (derivation) trees as rightmost and leftmost derivations. Bottom up parsers-shiftreduce, operator precedence, and LR. Y ACC package on Unix system. Top down parsers-left recursion and its removal. Recursive descent parser. Predictive parser, Intermediate codes-Quadruples, Triples, Intermediate code generation. Code generation. Code optimization.

UNIT-VI
Operating Systems (with Case Study of Unix): Main functions of operating systems, Multiprogramming, multiprocessing and multitasking. *Memory Management:* Virtual memory, paging, fragmentation *Concurrent Processing:* Mutual exclusion. Critical regions, lock and unlock. *Scheduling:* CPU scheduling, I/O scheduling, Resource Scheduling, Deadlock and scheduling algorithms, Banker's algorithm for dead lock handling.

UNIT-VII

UNIX: *The Unix System:* File system, process management, bourne shell, shell variables, command line programming.

Filters and Commands: Pr, head, tail, cut, paste, sort, uniq, tr, join, etc, grep, egrep, fgrep, etc., sed, awk, etc. *System Calls (like):* Create, open, close, read,write, iseek, link, Unlin,stat, fstat, umask, chmod, exec, fork, wait, system. Software Engineering *System Development Life Cycles (SDLC):* Steps. Water fall 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.

UNIT-VIII

Current Trends and Technologies: The topics of current interest in Computer Science and Computer Applications shall be covered. The experts shall use their judgment from time to time to include the topics of popular interest, which are expected to be known for an application development software professional, currently, they include:

UNIT-IX

Parallel Computing: Parallel virtual machine (pvm) and message passing interface (mpi) Libraries and calls. Advanced architectures. Today's fastest computers. Mobile Computing

Mobile connectivity-Cells, Framework, wireless delivery technology and switching methods, mobile information access devices, mobile data internetworking standards, cellular data communication protocols, mobile computing applications. Mobile databases-protocols, scope, tools and technologies. M-business

Electronic Commerce: Framework, Media Convergence of Application, Consumer, Applications, Organization Applications.

Electronic Payment System: Digital Token, Smart Cards, Credit, Risks in Electronic payment system, Designing electronic payment system Electronic Data Interchange (EDI): Concept, Application, (legal, Security and Privacy) issues, (EDI) EDI software Implimentation, EDI envelope for message transport, Internet based EDI.

Digital Libraries and Data Warehousing: Concepts, Types of Digital documents. Issues behind document Infrastructure, Corporate Data Warehouses. *Software Agents:* Characteristics and Properties of Agents. Technology, behind Software Agents (Applets, Browsers and Software Agents)

Data Warehousing: Data Warehouse environment, Architecture of a data warehouse methodology" analysis, design, construction and administration. *Data Mining:* Extracting models and patterns from large databases, data mining techniques, classification, regression, clustering, summarization, dependency modeling, link analysis, sequencing analysis, mining scientific and business data.