Darshan UNIVERSITY
योग: कर्मसु कौशलम्

Syllabus for Ph.D. Entrance Examination: Computer Science

Section 1: Computer Organization and Architecture
Machine instructions and addressing modes. ALU, data-path and control unit. Instruction pipelining. Memory hierarchy: cache, main memory and secondary storage; I/O interface (interrupt and DMA mode).

Section 2: Programming and Data Structures
The basic concepts of programming in C, C++, Java. Decision, iteration, function or method call, recursion, Basic notions of space and time complexity, Parameter passing mechanism, scope, binding, Arrays, lists, stacks, queues, binary tree, binary search tree, Basics of searching and sorting, Graph and its representation.

Section 3: Algorithms
Searching, sorting, hashing. Asymptotic worst-case time and space complexity. Algorithm design techniques: greedy, dynamic programming and divide and conquer. Graph search, minimum spanning trees, and shortest paths.

Section 4: TOC & Compiler Design
Regular expressions and finite automata. Context-free grammars and push-down automata. Regular and context-free languages, Lexical analysis, parsing, syntax-directed translation. Runtime environments. Intermediate code generation.

Section 5: Operating System
Processes, threads, inter process communication, concurrency and synchronization. Deadlock. CPU scheduling. Memory management and virtual memory. File systems, I/O systems, Protection and security.

Section 6: Database Management System
ER-model, Relational model, relation model, relational algebra, tuple calculus, Database design (integrity constraints, normal forms), Query languages (SQL), File structures (sequential files, indexing, B and B+ trees), Transactions and concurrency control.

Section 7: Computer Networks
Concept of layering. LAN technologies (Ethernet). Flow and error control techniques, switching. IPv4/IPv6, routers and routing algorithms (distance vector, link state). TCP/UDP and sockets, congestion control. Application layer protocols (DNS, SMTP, POP, FTP, HTTP). Basics of Wi-Fi. Network security: authentication, basics of public key and private key cryptography, digital signatures and certificates, firewalls.

Section 8: Information Systems and Software Engineering

Information gathering, requirement and feasibility analysis, data flow diagrams, UML diagrams, process specifications, input/output design, process life cycle, planning and managing the project, design, coding, testing, implementation, maintenance.

Section 9: AI & Machine Learning

Knowledge Representation and organization, Search and Control Strategies, Fuzzy Logic, Genetic algorithm, Expert System Architecture, Artificial Neural Network, Basics of Machine Learning and ML Algorithms.

Section 10: Basic Mathematics

Probability: Conditional Probability, Mean, Median, Mode and Standard Deviation, Random Variables, Distributions, uniform, normal, exponential, Poisson, Binomial.

Set Theory & Algebra: Sets, Set operations, Relations, Functions, Groups, Partial Orders, Boolean algebra.

Combinatory: Permutations; Combinations; principle of exclusion and inclusion, pigeon-hole principle, Summation; generating functions; recurrence relations, sum and product rule.