DAYANANDA SAGAR UNIVERSITY

SYLLABUS FOR Ph. D ENTRANCE EXAMINATION

School of Computer Applications

Section 1: Mathematics

Discrete Mathematics: Propositional and first order logic. Sets, relations, functions, partial orders and lattices. Groups. Graphs: connectivity, matching, coloring. Combinatorics: counting, recurrence relations, generating functions.

Probability& Statistics: Random variables. Uniform, normal, exponential, Poisson and binomial distributions. Mean, Median, Mode and standard deviation. Conditional probability and Bayes theorem.

Section 2: Computer Organization and Architecture

Digital Logic: Boolean algebra. Combinational and sequential circuits, Minimization; Number representations and computer arithmetic (fixed and floating point)

Computer Organization: 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 3: Programming Languages

Programming in C: Elementary Data Types; Tokens, Identifiers, Data Types, Sequence Control, Subprogram Control, Arrays, Structures, Union, String, Pointers, Functions, File Handling, Command Line Arguments, Preprocessors

Programming in C++: Class, Object, Instantiation, Inheritance, Encapsulation, Abstract Class, Polymorphism, Tokens, Identifiers, Variables and Constants; Data types, Operators, Control statements, Functions Parameter Passing, Virtual Functions;

Programming in Java: The Java Virtual Machine, Data types, Conditional and looping Statements, Arrays, Methods and functions, Constructors, Overloading methods, Garbage collection, Packages

Section 4: Data Structures and Algorithms

Data Structures: Arrays, Stacks, Queues, Linked Lists, Trees, Forests, Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree, B Tree, B+ Tree, B* Tree, Graphs, Sorting, Searching.

Algorithms: Performance Analysis of Algorithms – Time and Space complexities, Divide and Conquer, Dynamic Programming, Greedy Algorithms, Backtracking, Branch and Bound, Breadth-First Search, Depth-First Search, Shortest Path, Minimum Spanning Tree, P and NP Class Problems.

Section 5: Database Management Systems

Database System Concepts: Data Models, Schemas, Architecture, ER Model, Relational Model, Relational Algebra, Relational Calculus. Functional Dependency, Multi valued Dependency, Join Dependency, and Normalization Forms. SQL**:** Types of commands, Constraints, Views, Stored Procedures, Functions, Triggers. Deadlock – Prevention and Avoidance, Heap File Organization, ISAM, Hashing and Indexing

Section 6: Theory of Computation and Compiler Design

Theory of Computation: Regular expressions and finite automata, Context-free grammars and push-down automata, Regular and context-free languages, Turing machines.

Compiler Design: Lexical analysis, parsing, syntax-directed translation.

Section 7: System Software and Operating System

System Software: Machine, Assembly and High-Level Languages; Compilers and Interpreters; Loading, Linking and Relocation; Macros, Debuggers

Operating System: Processes, threads, inter-process communication, concurrency and synchronization; Multicore Programming, Multithreading Models Deadlock; CPU scheduling; Memory management and virtual memory; File systems

Section 8: Data Communication and Computer Networks

Data Communication: simplex, half-duplex and full-duplex mode of data transmission, packet switching and circuit switching, Analog and Digital Signals; Noiseless and Noisy Channels;

Digital and Analog Transmission; Data Encoding and Modulation Techniques; switching; Flow and error control techniques

Computer Networks: Network Hardware, LAN, MAN, WAN, OSI Reference Model, - Protocol IPv4/IPv6, routers and routing algorithms (distance vector, link state); TCP/UDP and sockets, congestion control. Application layer protocols (DNS, SMTP, POP, FTP, HTTP). Network Security: authentication, basics of public key and private key cryptography

Section 9: Computer Graphics and Software Engineering

Computer Graphics: Video-Display Devices, Raster-Scan and Random-Scan Systems; Graphics Monitors, Input Devices, Points and Lines; Line Drawing Algorithms, Translation, Scaling, Rotation, Reflection and Shear Transformations; Matrix Representations and Homogeneous Coordinates, Polygon Surfaces, Quadric Surfaces, Spline Representation, Bezier and B-Spline Curves; Bezier and B-Spline Surfaces.

Software Engineering: The Waterfall Model, Incremental Process Models Evolutionary Process Models, Concurrent Models. Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Adaptive Software Development (ASD), Scrum; Requirements Modelling: Requirements Analysis, Scenario-Based Modelling, UML Models, Design Concepts: The Design Process, Design Concepts, the Design Model, Architectural design, and component-level design. Quality management

Section 10: Advanced Technologies

Artificial Intelligence: Intelligent Agent, State Space Representation, Heuristic Search Techniques, Adversarial Search Techniques, Knowledge Representation, Uncertain Knowledge Representation, Planning, Linear and Non-Linear, Goal Stack, Hierarchical, STRIPS.

Machine Learning: Machine Learning, Types of Learning, Supervised, Unsupervised, Semi-Supervised, Reinforcement Learning Techniques, Models, Tree, Rule, Linear, Distance-Based, Probabilistic.

IoT: Introduction, Characteristics, Elements, Transducers and types, Applications

References:

Algorithms: Introduction to Algorithms by Rivest, Cormen, Stein, Leiserson, MIT Press

Operating System: "Operating System Concepts" by Galvin, Silberschatz. WILEY Publishers

Theory of Computation: "Introduction to Automata Theory, Languages and Computation" by Hopcroft, Ullman. Pearson Education

Computer Networks: "Computer Networking: A top-down approach" by Kurose-Ross. Pearson Education

"Computer Networks" by Tanenbaum, Prentice Hall

Computer Organisation: "Computer Organisation" by Carl Hamacher. McGraw Hill

Programming: "Computer Systems: A Programmer's Perspective", Randal E. Prentice Hall

"Java: The Complete Reference, 8th Edition", Herbert Schildt. McGraw Hill

Database Systems: "Fundamentals of Database Systems" – Ramez Elmasri and Shamkant B Navathe, Pearson Publications.

"Database Management Systems" – Raghu Ramakrishnan and Johannes Gehrke, McGraw Hill Publications.

Software Engineering: Roger S Pressman, "Software Engineering- A Practitioners Approach", Sixth Edition, Mc Graw Hill publishers.

Lan SommerVille, "Software Engineering", Eigith Edition, Pearson Education, 2009.

Compiler Design: "Principles of Compiler Design" by Aho and Ullman. Narosa Publishing House

Digital Logic: "Digital Logic and Design" by Morris Mano. Pearson Education, Prentice Hall

Software Engineering: "Software Engineering: A Practitioner's Approach" by Pressman. Prentice Hall

Data Structure:"Fundamentals of Data Structure in C" – Ellis Horowitz and Sartaj Sahni, University Press.

"Data Structures and Algorithm Analysis in C" - Mark Allen Weiss, Pearson Education.

"Introduction to the Design and Analysis of Algorithms" – Anany Levitin, Pearson Education.

Artificial Intelligence: "Artificial Intelligence" – E. Rich and K. Knight, McGraw Hill Publications.

Machine Learning : "Machine Learning" – Tom M. Mitchell, McGraw Hill Publications.

"Machine Learning: The Art and Science of Algorithms that makes sense of Data" – Peter Flach, Cambridge University Press.

IoT: Bahga, Arshdeep, and Vijay Madisetti. "Internet of Things: A Hands-On Approach." (2014).