Faculty of Science
Shree Ramkrishna Institute of Computer Education & Applied Sciences, Surat

Syllabus for Ph.D Entrance Test in Computer Science, Computer Application and Information Technology

Structured and Object Oriented Programming Concepts
- Programming Language , Concepts, Paradigm and Models, Programming in C-Element of C-Tokens, Identifiers, Data types in C, Control structure in C, Sequence selection and iteration, Structured data types in C, arrays, structure, union, pointers.
- Object Oriented Programming Concepts (C++ and Java): Classes, Object, Constructor, Destructor, Operator Overloading, Functional Overloading, Inheritance, Dynamic Polymorphism, Templates and exception handling.

Database Management Systems
- Basic Concepts of Database systems, data models.
- E-R Diagram, Relational model- relational algebra, tuple calculus, SQL , Relational Database Design Concepts- Functional dependencies, Determining keys, Normalization-1st, 2nd, 3rd, BCNF, Lossless join and dependency preserving decomposition, Integrity constraints,
- File and record organizations, indexing (e.g., B and B+ trees). Transactions and concurrency control.

Operating Systems
- Types and categories of OS, Multi Programming, multiprocessing, and multitasking OS, Main functions of operating systems
- Memory Management - concepts, fundamentals and techniques, Virtual memory, paging, fragmentation.
- Process Management- concepts, PCB, Concurrent processes, Mutual exclusion. Critical regions, lock and unlock.
- Scheduling- CPU scheduling, I/O scheduling, Resource scheduling,
- Deadlock and scheduling algorithms. Banker's algorithm for deadlock handling,
- The Unix System- File system, process management, kernel and shell, shell variables, command line programming.

Software Engineering
- Software engineering concepts, Software Life Cycle Models: SDLC Models, software maintenance.
- Software Requirements Analysis and Specifications-Requirements Engineering, Requirements Elicitation, Requirements Analysis, Requirements Documentation, object oriented analysis- CRC, UML, Use cases scenarios, Use case diagram, activity diagram, sequential diagram,
- Software Project Management- Size Estimation, Cost Estimation, Models, Constructive Cost Model, Software Risk Management, scheduling and tracking
- Software Design- Design Definition, Modularity, abstraction, modularity, refinement, cohesion, coupling, information hiding, structured charts, Strategy of Design, Function Oriented Design, Objected oriented design- class diagram, component design, deployment design, IEEE Recommended Practice for Software Design Description,
- Programming styles, programming methodologies, structured programming, object oriented programming, event driven programming, extreme programming

- Software Testing: Testing Process, Testing approaches, Functional Testing, Structural Testing, Levels of Testing, Debugging, Testing Tools.
- Software Quality Assurance – quality factors, software quality matrices, software quality standards.

Computer Networks

- Networking concepts, Network Types, Transmission Media, Networking Topologies, Network Devices
- Concept of layering: OSI and TCP/IP Protocol Stacks
- Basics of packet, circuit and virtual circuit-switching; Data link layer: framing, error detection, Medium Access Control, Ethernet bridging; Network Layer:Routing protocols: shortest path, flooding, distance vector and link state routing; Fragmentation and IP addressing, IPv4, CIDR notation
- Basics of IP support protocols (ARP, DHCP, ICMP), Network Address Translation (NAT); Transport layer: flow control and congestion control, UDP, TCP, sockets; Session Layer and its functions, Application layer protocols: DNS, SMTP, HTTP, FTP, Email.
- Concept of Internet and WWW, http, DNS, Types of Servers and Clients, Network and internet Security-firewall, IDS, VPN

Data structure and Algorithms

- Primitive and Non-primitive Data Structures, Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs.
- File structures-Fields, Records and files. Sequential, Direct, index-sequential and relative files.
- Hashing, Inverted lists and multi-lists.
- Algorithms - Sorting and searching algorithms, Binary search, Asymptotic notations – big ohm, mega and theta, Algorithm performance analysis, Recursion and its systematic removal. Quick sort non- recursive implementation with minimal stack storage.
- Design of Algorithms (Divide and Conquer, Greedy method, Dynamic programming, Back tracking, Branch and Bound)

Artificial Intelligence, Data warehousing and Data Mining

- A.I. Techniques and its characteristics, Problems and problem spaces, Problems as state space search, Production systems, Control Strategies, Heuristic search, Problem characteristics, Production system characteristics. Problem Solving Methods- Forward versus backward reasoning, Knowledge representation and the frame problem, Generate-and-test, Hill climbing, Breadth-First-Search. Game Playing: Minimax search, Alpha-beta pruning, Secondary search,

- Knowledge Representation using Predicate Logic: Representing simple facts using logic, Resolution, Conversion to clause form, Resolution in clause form, Unification algorithm.
- Fundamentals of ANN: The Biological Neural Network, Artificial Neural Networks, Building Blocks of ANN

- Expert System - Characteristics, Importance, Applications, Examples, Rule based system architecture
- Data Warehouse: Data warehouses and data marts, metadata in the data warehouse, Defining the business requirement: Dimensional analysis, information packages, requirement-gathering methods, Data warehousing architecture.
- Data Mining: The process of knowledge discovery in databases, Predictive and descriptive data mining techniques, Supervised and unsupervised learning techniques.