

# Medi-Caps University

## Syllabus for Ph. D. Entrance Exam in Computer Science

**Discrete Mathematics:** Set, Posets, Relations, Recurrence relations, Functions, Combinatorics, Lattices, Boolean Algebra.

**Operating Systems:** 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.

**Data Structures:** Definition, Arrays, Stacks, Queues, Dequeues, Linked Lists, Singly and Doubly linked list., **Trees :** Definition, Tree types and their and Implementation. Preorder, post order, inorder traversal, Graphs: Definition and implementation. Hashing, Hash function, Collision Resolution Techniques, Hashing Applications, Standard Template Libraries Time Complexity, Big – Oh - notation, Running Times, Best Case, Worst Case, Average Case, Factors depends on running time, Introduction to Recursion, Divide and Conquer Algorithm, Evaluating time Complexity. Straight Sequential Search, Binary Search, Interpolation Search. Sorting: Introduction, Sorting by exchange, selection, insertions, Bubble sort, Selection sort, Insertion sort, Efficiency of above algorithms, Merge sort, Quick sort Algorithm, Heap sort, Radix sort, Order Analysis: Objectives of time analysis of algorithms; Big-oh and Theta notations, Master Theorem and its proof, solution of divide and conquer recurrence relations, Dynamic Programming: methodology and examples. Graph Algorithms: Basics of graphs and their representations. BFS. DFS. Topological sorting.

**Database Technologies:** Various views of data, data independence, schema & sub-schema, primary concept of data models, database languages, transaction management, database administrator & user, data dictionary, database architectures. ER model, Reduction of ER Schema to tables, candidate, primary, alternate & foreign keys, attributes, relationships, degree, unary, binary, ternary, n-ary, cardinalities constraints, ER modeling examples. Enhanced ER modeling: supertype, subtypes, specialization, generalization, specifying constraints in EER models, Disjointness, discriminators, defining super/sub type hierarchies Relational Algebra, SQL: DDL, DML, DCL Queries, Relational Database, Programming concepts of PL/SQL, Stored procedure, Database connectivity with ODBC/JDBC. SQL Extensions. Functional dependencies, Normalization, basic normal forms, definition of first, second, third normal form and removing anomalies from the relations. De-normalization and merging relations. Database Integrity, Transaction Management, Concurrency & Recovery, Query processing, Query optimization, File Organization: File organization, Organization of records in files, basic concept of Indexing, ordered indices: B+ tree & B tree index files. RAID. Object Oriented Databases, Spatial Databases.

**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.

**Computer Organization:** Digital and Analog computers, CPU, Hardware, Software and Firmware. Number Systems: Binary Numbers, Number Base Conversions, Octal and Hexadecimal Numbers, Complements, Signed Binary Numbers, Binary Codes: BCD code, Gray Code, ASCII code, Excess 3 Code, Error detecting Code. Computer Arithmetic, Logic gates, Integrated Circuits, K-Map, AND, OR, NAND and NOR implementations, Exclusive-OR function. Combinational Logic: Combinational Circuits, Binary adder, subtracter, multiplier, Decoders, Encoders, Multiplexes, and Demultiplexers. Sequential circuits, Latches, Flip Flops: SR, D, JK, T. Master Slave JK Flip flop. Characteristic equations and Excitation tables of flip-flops. Shift Registers, Counters. Computer organization: The memory unit, the input and output subsystem, the bus structures, ALU. Program development tools: Compiler, interpreter, and assembler. 8085/86 micro processor architecture, Instruction set. Integer division. BCD arithmetic, Design of ALU.

**Software Engineering:** System Development Life Cycles (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.

**Introduction to C:** Data types, Constants and Variables, Expressions and Operators and Decision Control Structures in C. Loop Control Structures, Case Control Structures. One dimensional and multidimensional array. Pointers and their Applications, String Handling Functions: Standard and User defined Function, Parameter passing, Scope Rule. Recursion. Structures and Union, Arguments to main, Enumerations and bit fields. Pre-Processors: {def, include, macro's, ifdef etc.}, File Handling.

**Introduction to C++:** Structures, Variables in C++, References, Functions, Function Overloading, Default Values for Formal Arguments of Functions, Inline Functions. Class and Objects: Introduction to Classes and Objects Constructors, destructors, friend function, dynamic memory allocation, Inheritance, Overloading, Polymorphism, Templates.

**Introduction to Java:** Features of Java, Object-oriented programming overview, Introduction of Java Technologies, How to write simple Java programs, Data Types, Variables, Memory concepts, decision making operators, Naming Conventions Introduction to Class, Objects, Methods and Instance Variables, Primitive type Vs Reference Type, Initializing Objects with Constructors. Static Method, static field, String Handling in JAVA, Arrays, Using Command-line Arguments. final Instance Variables, this reference, static import, overloaded Constructors, Garbage collection and method finalize , Overloading methods, Parameter passing. Inheritance, Polymorphism, Packages and Interfaces, Exception Handling, Streams and Files, Multithreading, GUI in JAVA, Applets, Generic and Collection API, Database connectivity: JDBC.