

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING AND INFORMATION TECHNOLOGY**

**Syllabus for PhD Program Entrance Examinations**

**Module 1 - RESEARCH METHODOLOGY**

Types of Research - Research Process - Research Problem - Research Objectives - Research Hypotheses - Types of Research hypothesis - Research Design: Exploratory research Design, Conclusive research Design, Descriptive Research Design, Experimental research design -Features of good research design - Statement of the problem - Measurement and Scaling –Types of Scale - Types of Data - Data Collection Methods - Construction of Questionnaire – Sampling -Statistical Analysis – Univariate Analysis - Bivariate Analysis - Multivariate Analysis - Research Report - Types of research reports - Mechanics of writing Research Report - Research Publications - Plagiarism, Impact Factor, Citation Database - Ethics in Research.

**Module 2 - DIGITAL LOGIC, COMPUTER ORGANIZATION AND ARCHITECTURE**

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. Combinational Circuit Design, Sequential Circuit Design. Hardwired and Micro-programmed processor design, Instruction formats, Addressing modes, memory types and organizations, interfacing peripheral devices, Interrupts.

**Module 3: PROGRAMMING, DATA STRUCTURES AND ALGORITHMS**

Programming in C- Fundamentals- Functions- Arrays- Pointers- Structures- Unions, Recursion, Data Structures - stacks, queues, linked lists, trees, binary search trees, binary heaps, AVL trees, Graphs, Sets, Tables. Files- Sequential, Direct, index-sequential and relative files. Hashing, Inverted lists and multi-lists, Searching, sorting, hashing. Asymptotic notations – big oh, omega and theta, time and space complexity. Algorithm design techniques: Divide and Conquer, greedy, dynamic programming, Backtracking, Branch and Bound. Lower bound theory, nondeterministic algorithm, non-deterministic programming constructs. NP-hard and NP-complete problems.

**Module 4: OPERATING SYSTEMS, COMPUTER NETWORKS**

**Operating Systems:** Basic concepts, processes, threads, inter-process communication, concurrency and synchronization. Deadlock, CPU and I/O scheduling. Memory management and virtual memory. File systems, I/O systems.

**Computer Networks**: Concept of layering: OSI and TCP/IP Protocol Stacks; Data link layer: framing, error detection, Medium Access Control, Ethernet bridging; Routing protocols: shortest path, flooding, distance vector and link state routing; Fragmentation and IP addressing, IPv4; Transport layer: flow control and congestion control, UDP, TCP, sockets; Application layer protocols: DNS, SMTP, HTTP, FTP, Email.

**Module 5: DATABASE SYSTEMS, SOFTWARE ENGINEERING**

**Database Systems**: Database and DBMS, ER model, DDL, DML, JOINS, Nested Sub queries, Integrity Constraints, Normalization File Organization, RAID, Indexing, Transaction, ACID Properties, Serializability, Concurrency Control, Failure Classification.

**Software Engineering**: Requirement and Feasibility, Analysis, Data Flow Diagrams, Process Specifications, Input/ Output Design, Process Life Cycle, Planning and Managing the Project, Software Architecture and Design Patterns, Software Reliability and Advanced Testing Techniques, Implementation, Maintenance, Aspect Oriented Programming.

Recent trends in computer science and information technology related domains.

**(Equal distribution of questions in all the modules)**