Ph.D ADMISSION TEST (MR-PAT)

Ph.D. in Computer Science and Engineering

Module 1: Mathematical Foundations

1.1 Probability and Statistics: Random variables; Uniform, normal, exponential, poisson and binomial distributions; Mean, median, mode, and standard deviation; Conditional probability and Bayes theorem.

1.2 Discrete Mathematics: Propositional logic; Sets, relations, functions, partial orders and lattices; Monoids, Groups; Combinatorics: counting, recurrence relations, generating functions.

1.3 Linear Algebra: Matrices, determinants, system of linear equations, eigenvalues and eigenvectors.

Module 2: Computer Architecture

2.1 Computer Organization and Architecture: Boolean algebra, Combinational and sequential circuits, Machine instructions and addressing modes; ALU, data-path and control unit; Instruction pipelining, pipeline hazards; Memory hierarchy: cache, main memory and secondary storage; I/O interface (interrupt and DMA mode).

Module 3: Data Structures and Algorithms

3.1 Arrays, stacks, queues, linked lists, trees, binary search trees, graphs, searching, sorting, hashing; Asymptotic notations; Algorithm design techniques: greedy, dynamic programming and divide-and-conquer; Graph traversals, spanning trees.

Module 4: Theory of Computation

4.1 Regular expressions and finite automata; Context-free grammars and push-down automata; Regular and contex-free languages, pumping lemma, Turing machines.

Module 5: Operating System

5.1 Architecture, system calls, process and threads, inter-process communication, concurrency and synchronization, Deadlock, CPU scheduling, disk scheduling; Memory management and virtual memory; File systems.

Module 6: Database Management Systems

6.1 ER-model; Relational model: relational algebra, SQL, Integrity constraints, normal forms; Transactions and concurrency control.

Module 7: Computer Networks

7.1 OSI and TCP/IP Protocol Stacks; Data link layer: framing, error detection, Medium Access Control; Network Layer: IPv4, CIDR, ARP, DHCP, ICMP, Network Address Translation; Transport layer: flow control and congestion control, UDP, TCP, sockets; Application layer protocols: DNS, SMTP, HTTP, FTP, Email.

Module 8: Software Engineering

8.1 Software Process Models: Understanding various software development life cycle models such as Waterfall, Spiral, V-Model, and Agile methodologies.; Estimation and Scheduling of Software Projects: Techniques for estimating project size, effort, cost, and time, including models like COCOMO; Software Quality: Ensuring software quality through testing strategies, quality assurance processes, and understanding software reliability metrics.

Suggested Readings:

1. Byron Gottfried, 2015, Schaum's Outline of Programming with C: 2nd Ed., McGraw-Hill
2. E Balagurusamy, 2013, Object oriented Programming with C++, 6th Ed., TMH.
3. Seymour Lipschutz, Marc Lipson, Schaum's Outlines Series, Discrete Mathematics, TMH.
4. Avi Silberschatz, Peter Galvin, Greg Gagne, Operating System Concepts Essentials, 10th Edition,Wiley Asia Student Edition.
5. R. Elmasri and S.B. Navathe, 2017, Fundamentals of Database Systems, 7th Ed. Pearson.
6. Behrouz A. Forouzan, 2022, Data Communications and Networking with TCPIP Protocol Suite, 6th Edition, McGraw-Hill.
7. Sommerille, 2011, Software Engineering: 9th edition, Pearson Education.

Weblinks:

1. https://www.geeksforgeeks.org/quiz-corner-gq
2. https://gate2025.iitr.ac.in/mock-test-links.html