Syllabus for Ph.D. (Computer Engineering) Entrance Exam Paper -II

UNIT-1	Engineering Mathematics

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

Linear Algebra: Matrices, determinants, system of linear equations, eigenvalues and eigenvectors, LU decomposition

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

UNIT-2	Programming and Data Structures

Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs.

Searching, sorting, hashing. Asymptotic worst case time and space complexity. Algorithm design techniques: greedy, dynamic programming and divide-and-conquer. Graph traversals, minimum spanning trees, shortest paths

UNIT-3	Operating System and Databases

System calls, processes, threads, inter-process communication, concurrency and synchronization. Deadlock. CPU and I/O scheduling. Memory management and virtual memory. File systems. ER-model. Relational model: relational algebra, tuple calculus, SQL. Integrity constraints, normal forms. File organization, indexing (e.g., B and B+ trees). Transactions and concurrency control.

UNIT-4	Computer Networks

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; 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; Application layer protocols: DNS, SMTP, HTTP, FTP, Email.

UNIT-5	Cyber Security

Information Security fundamentals, Elements of Information Security, Network Security, Cyber Laws, Physical Security, endpoint security, database security, wireless security, Application security.

References:

1. Thomas H. Cormen. Introduction to Algorithms
2. Peter Linz. An Introduction to Formal Languages and Automata
3. William Stallings. Computer Organization and Architecture
4. Galvin. Operating System Concepts
5. Andrew S. Tanenbaum and David J. Wetherall. Computer Networks
6. Fourozon. Networks by Fourozon
7. Henry Korth. Database System Concepts
8. Kenneth H Rosen. Discrete Mathematics and its Applications
9. Morris Mano. Logic and Computer Design Fundamentals