Pre Ph.D. Course Work

Computer Science/information Technology

Paper-II

Unit I: Discrete Mathematics

Mathematical Logic: Propositional Logic; First Order Logic.
Set Theory & Algebra: Sets; Relations; Functions; Groups; Partial Orders; Lattice; Boolean Algebra.
Graph Theory: Connectivity; spanning trees; Cut vertices & edges; covering; matching; independent sets; Colouring; Planarity; Isomorphism.

Unit II: Computer Organization and Architecture:

Machine instructions and addressing modes, ALU and data-path, CPU control design, Memory interface, I/O interface (Interrupt and DMA mode), Instruction pipelining, Cache and main memory, Secondary storage.

Unit III: Data Structures:

Abstract data types, Arrays, Stacks, Queues, Linked Lists, Trees, Binary search trees, Binary heaps.

Unit IV: Operating Systems

Processes, Threads, Inter-process communication, Concurrency, Synchronization, Deadlock, CPU Scheduling, Memory Management and Virtual Memory, File Systems.

Unit V: Algorithms

Analysis, Asymptotic notation, Notions of space and time complexity, Worst and average case analysis; Design: Greedy approach, Dynamic programming, Divide-and-conquer, Backtracking, Branch and bound, Basic concepts of complexity classes P, NP, NP-hard, NP-complete.

Unit VI: Theory of Computation

Regular languages and finite automata, Context free languages and Push-down automata, Recursively enumerable sets and Turing machines, Undecidability.

Unit VII: Databases

ER-model, Relational model (relational algebra, tuple calculus), Database design (integrity constraints, normal forms), Query languages (SQL), File structures (sequential files, indexing, B and B+ trees), Transactions and concurrency control.

Unit VIII: Computer Networks

ISO/OSI stack, LAN technologies (Ethernet, Token ring), Flow and error control techniques, Routing algorithms, Congestion control, TCP/UDP and sockets, IP(v4), Application layer protocols (icmp, dns, smtp, pop, ftp, http); Basic concepts of hubs, switches, gateways, and routers.

Unit IX: Compiler Design

Lexical Analysis, Parsing, Syntax directed translation, Run time Environments, Intermediate and target code generation, Basics of code optimization.

Unit X: Web technologies

HTML, XML, basic concepts of client-server computing.

References:

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5. Fundamentals of Data Structures in C++, Horowitz, Sahni, Mehta, GALGOTIA Publication.
6. Operating System Concepts, Peterson Silberschats, Addition Wesley Publication.
7. Operating System, Achut Godbole, TMH.
8. Fundamentals of Computer Algorithms, Horowitz and Sahni, Galgothia publications.
9. Introduction to the design and analysis of Algorithms, Anany Levitin : Pearson Education,
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11. J.E.Hopcraft, R. Motwani and J.D.Ullman, Introduction to Automata Theory languages & Computation, Pearson Education Asia.
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21. Mastering Html 4 Premium Edition, D. S. Ray, BPB Publications.