Syllabus for Ph.D Entrance Examination

Computer Science and Engineering

Theory of Computation : Models of computation-Finite Automata, Pushdown Automata, Nondeterministic and NFA, DPDA and PDAs and Languages accepted by these structures. Grammars, Languages, Non-computability and Examples of non-computable problems.
Programming and Data Structures: Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs. File structures : Fields, Records and files. Sequential, Direct, index-sequential and relative files. Hashing, Inverted lists and multi-lists,
Algorithms and Analysis: Sorting and searching algorithms. Analysis of algorithms, Interpolation and Binary search, Asymptotic notations – big ohm, mega and theta, Average case analysis of simple programs like finding of a maximum of n elements. Recursion and its systematic removal. Quick sort-non-recursive implementation with minimal stack storage. Design of Algorithms (Divide and Conquer, Greedy method, Dynamic programming, Back tracking, Branch and Bound). Lower bound theory, non-deterministic algorithm,-non-deterministic programming constructs. NP-hard and NP-complete problems.
Computer Organization and Architecture: Boolean algebra and Minimization of Boolean functions, Combinational Circuit Design, Sequential Circuit Design. Hardwired and Microprogrammed processor design, Instruction formats, Addressing modes, memory types and organizations, Interfacing peripheral devices, Interrupts. Microprocessor architecture, Instruction set and Programming (8085, P-III/P-IV). Microprocessor applications.
Computer Networks & Internet : Concept of layering. LAN technologies (Ethernet). Flow and error control techniques, switching. IPv4/IPv6, routers and routing algorithms (distance vector, link state). TCP/UDP and sockets, congestion control. Application layer protocols (DNS, SMTP, POP, FTP, HTTP). Basics of Wi-Fi. Network security: authentication, basics of public key and private key cryptography, digital signatures and certificates, firewalls.
Operating Systems: Memory Management : Virtual memory, paging, fragmentation. Concurrent Processing : Mutual exclusion, Critical regions, Semaphores. Scheduling : CPU scheduling, I/O scheduling, resource scheduling, Deadlock and scheduling algorithms. Banker’s algorithm for deadlock handling.