Punyashlok Ahilyadevi Holkar Solapur University, Solapur

NAAC Accredited-2022
'B++'Grade (CGPA 2.96)

Name of the Faculty: Science & Technology

Syllabus: Computer Science & Engineering

Name of the Course: Entrance Examination – Paper II
(PET- 9)

(Syllabus to be implemented from June 2024)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

PET 9

Syllabus: Ph. D. Entrance Exam 2024

Section 1. Foundations of Computing and Mathematics

- Propositional and first-order logic, Sets, relations, functions, partial orders, lattices., Monoids, Groups., Graph theory: connectivity, matching, coloring., Combinatorics: counting, recurrence relations, generating functions., Linear Algebra: Matrices, determinants, system of linear equations, eigenvalues, eigenvectors, LU decomposition. Calculus: Limits, continuity, differentiability, maxima, minima, mean value theorem, integration. Probability and Statistics: Random variables, distributions (uniform, normal, exponential, Poisson, binomial), mean, median, mode, standard deviation, conditional probability, Bayes theorem.

Section 2: Logical Systems and Hardware Architecture

- Boolean algebra., Combinational and sequential circuits., Minimization techniques., Number representations and computer arithmetic (fixed and floating point)., Machine instructions, addressing modes., ALU, data-path, control unit., Instruction pipelining, pipeline hazards., Memory hierarchy: cache, main memory, secondary storage., I/O interface (interrupt and DMA mode).

Section 3: Software Development and Design Principles"

- Searching, sorting, hashing algorithms., Asymptotic worst-case time and space complexity analysis., Algorithm design techniques: greedy, dynamic programming, divide-and-conquer., Graph traversals, minimum spanning trees, shortest paths., Regular expressions, finite automata., Context-free grammars, push-down automata., Regular and context-free languages, pumping lemma., Turing machines, undecidability., Lexical analysis, parsing, syntax-directed translation., Runtime environments. Intermediate code generation., Local optimization., Data flow analyses: constant propagation, liveness analysis, common sub expression elimination., System calls, processes, threads., Inter-process communication, concurrency, synchronization., Deadlock prevention., CPU and I/O scheduling., Memory management, virtual memory., File systems.

Section 4: Networks and Systems Management

- 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, congestion control, UDP, TCP, sockets., Application layer protocols: DNS, SMTP, HTTP, FTP, Email. 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.