

Syllabus for Written test of Laboratory Assistant
Center of Excellence Artificial Intelligence and Machine Learning (CoE-AIML), IITRAM

Programming: programming in C; object oriented programming using C++, Java, python;

Data Structures: arrays, stacks, queues, linked lists, trees, binary search trees, heap tree and priority queue, graphs; searching, sorting, hashing; asymptotic time and space complexity;

Algorithms: greedy, dynamic programming and divide-and-conquer; graph search, minimum spanning trees, shortest paths.

Digital systems: binary, integer and floating-point- number representations; combinatorial circuit: logic gates, Karnaugh map, arithmetic circuits, code converters, multiplexers, decoders. Sequential Circuits: latches and flip-flops, counters, shift-registers; Memories: ROM, SRAM, DRAM.

Computer Architecture Machine instructions and addressing modes. ALU, data-path and control unit. Instruction pipelining. Memory hierarchy: cache, main memory and secondary storage; I/O interface (interrupt and DMA mode);

Operating Systems: processes, threads, inter-process communication, concurrency and synchronization; Deadlock; CPU & IO scheduling; Memory management; file system in Windows/Linux; distributed systems; installation and configuration of Unix/Linux operating system, scripting languages;

Databases: ER-model; relational model: relational algebra and tuple calculus; Structured Query Language (SQL); integrity constraints, database normalization; file organization, indexing using B and B+ trees; transactions and concurrency control;

Computer Networks: OSI and TCP/IP protocol stack; packet switching and circuit switching, virtual circuits; Data link layer: framing, error detection, medium access control, Ethernet, WiFi; Network layer: Routing protocols: performance metrics, distance vector and link state routing; IPv4 and IPv6, IP addressing, CIDR notation, 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; Network security: authentication, basics of public key and private key cryptography, digital signatures and certificates, firewalls; installation of Windows and Linux servers; firewall administration, router and switches configuration, user management and server resource allocation;