

SYLLABUS FOR WRITTEN TEST AND DOMAIN SKILL TEST FOR THE POST OF JUNIOR SYSTEM ENGINEER

I. Syllabus for Domain Skill Test : The syllabus for trade test will be based on the job description as given in general instructions provided on the institute website against advt. No. 227/2023.

Job Description for Junior System Engineer (Advt. No. 227/2023) :

- Maintain Computer Systems/Servers.
- Develop interfaces as per the specifications laid.
- Develop experiments/equipment needed in the laboratories.
- Document hardware.
- Maintenance of wired and wireless networking.
- Fabricate & test interfaces.

II. Syllabus for Written Test : The syllabus for the written test is given below and it will include subjective / short answer type / numerical solving / algorithm writing questions. The total marks allocation to the written test question paper is 100 marks.

- Operating System

System calls, processes, threads, inter-process communication, concurrency and synchronization, Deadlock, CPU and I/O scheduling, Memory management and virtual memory, File systems.

- Databases

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.

- Computer Organization and Architecture

Machine instructions and addressing modes. ALU, data-path and control unit. Instruction pipelining, pipeline hazards.

Memory hierarchy : cache, main memory and secondary storage; I/O interface (interrupt and DMA mode).

- 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.

- Digital Circuits

Number Representations : binary, integer and floating-point- numbers. Combinatorial circuits: Boolean algebra, minimization of functions using Boolean identities and Karnaugh map, logic gates and their static CMOS implementations, arithmetic circuits, code converters, multiplexers, decoders.

Sequential Circuits : latches and flip-flops, counters, shift-registers, finite state machines, propagation delay, setup and hold time, critical path delay.

Data Converters : sample and hold circuits, ADCs and DACs.

Semiconductor Memories : ROM, SRAM, DRAM.

Computer Organization: Machine instructions and addressing modes, ALU, data-path and control unit, instruction pipelining.

- Communications

Random Processes : Autocorrelation and power spectral density, properties of white noise, filtering of random signals through LTI systems.

Analog Communications : amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, super heterodyne receivers.

Information Theory : entropy, mutual information and channel capacity theorem.

Digital Communications : PCM, DPCM, digital modulation schemes (ASK, PSK, FSK, QAM), bandwidth, inter-symbol interference, MAP, ML detection, matched filter receiver, SNR and BER.

Fundamentals of error correction, Hamming codes, CRC.

- Analog Circuits

Diode Circuits : clipping, clamping and rectifiers.

BJT and MOSFET Amplifiers: biasing, ac coupling, small signal analysis, frequency response, Current mirrors and differential amplifiers.

Op-amp Circuits : Amplifiers, summers, differentiators, integrators, active filters, Schmitt triggers and oscillators.

- Electronic Devices

Energy bands in intrinsic and extrinsic semiconductors, equilibrium carrier concentration, direct and indirect band-gap semiconductors.

Carrier Transport : diffusion current, drift current, mobility and resistivity, generation and recombination of carriers, Poisson and continuity equations.

P-N junction, Zener diode, BJT, MOS capacitor, MOSFET, LED, photo diode and solar cell.

