

**SYLLABUS FOR WRITTEN TEST
FOR THE POST OF JUNIOR SYSTEM ENGINEER**

1. 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.

2. 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.

3. 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).

4. 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.

5. 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.

6. 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.

7. 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.

8. 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.

