

ELECTRONICS & COMMUNICATION

SYLLABUS FOR OLYMPIAD

1. **Networks Systems**: Basics of Network Theory, Network theorems: superposition, Thevenin and Norton's, maximum power transfer; Steady state sinusoidal analysis using phasors; Time domain analysis of simple linear circuits; Solution of network equations using Laplace transform; Frequency domain analysis of RLC circuits; Transient and steady state analysis, Two-port network parameters: driving point and transfer functions; State equations for networks.
2. **Signals & Systems**: Continuous-time signals: Fourier series and Fourier transform representations, sampling theorem and applications; Discrete-time signals: discrete-time Fourier transform (DTFT), DFT, Z-transform, interpolation of discrete-time signals; LTI systems: definition and properties, causality, stability, impulse response, convolution, poles and zeros, frequency response, group delay, phase delay, digital filter design techniques.
3. **Electronic Devices & Circuits**: Energy bands in intrinsic and extrinsic silicon; 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; Special diodes; Integrated circuit fabrication process: oxidation, diffusion, ion implantation.
4. **Analog Electronics**: Circuits Small signal equivalent circuits of diodes, BJTs and MOSFETs; Simple diode circuits: clipping, clamping and rectifiers; Single-stage BJT and MOSFET amplifiers: biasing, bias stability, mid-frequency small signal analysis and frequency response; BJT and MOSFET amplifiers: multi-stage, differential, feedback, power and operational; Simple op-amp circuits; Active filters; Sinusoidal oscillators: criterion for oscillation, single-transistor and op-amp configurations; Function generators, wave-shaping circuits and 555 timers; Voltage reference circuits; Power supplies: ripple removal and regulation.
5. **Digital Circuits**: Number systems; 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 and PLAs; Sequential circuits: latches and flip-flops, counters, shift-registers and finite state machines; Data converters: sample and hold circuits, ADCs and DACs; Semiconductor memories: ROM, SRAM, DRAM; 8-bit microprocessor (8085, programming, memory and I/O interfacing. Logic Families.
6. **Control Systems**: Basic control system components; Feedback principle; Transfer function; Block diagram representation; Signal flow graph; Transient and steady-state analysis of LTI systems; Frequency response; Routh-Hurwitz and Nyquist stability criteria; Bode and root-locus plots; Lag, lead and lag-lead compensation; State variable model and solution of state equation of LTI systems.
7. **Communication**: Probability and random processes, autocorrelation and power spectral density, filtering of random signals through LTI systems; Analog communications: amplitude modulation and demodulation, angle modulation and demodulation, superheterodyne receivers, Information theory: entropy, mutual information and channel capacity theorem; Digital communications: PCM, DPCM, digital modulation schemes, amplitude, phase and frequency shift keying (ASK, PSK, FSK), QAM, MAP and ML decoding, matched filter receiver, calculation of bandwidth, SNR and BER for digital modulation; Fundamentals of error correction, Hamming codes; Timing & frequency synchronization; Satellite communication.
8. **Electromagnetics**: Basics of Electromagnetics, Plane waves and properties, phase and group velocity, propagation through various media, skin depth; Transmission lines: equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart; Waveguides: modes, boundary conditions, cut-off frequencies, dispersion relations; Antennas: antenna types, radiation pattern, gain and directivity, return loss, antenna arrays; Basics of radar.

SUBJECT-WISE MARKS WEIGHTAGE

SUBJECT	<u>WEIGHTAGE %</u>
Networks Systems	<u>10%</u>
Signals & Systems	<u>12%</u>
Electronic Devices & Circuits	<u>16%</u>
Analog Electronics	<u>10%</u>
Digital Circuits	<u>15%</u>
Control Systems	<u>11%</u>
Communication	<u>12%</u>
Electromagnetics	<u>14%</u>