

## ELECTRONICS AND COMMUNICATION ENGINEERING

### I-Networks

**Basics of Electrical networks:** Sources and source transformations, Ohm's law, KCL, KVL, Star-Delta transformation and loop & node analysis. **Network Topology:** Network graphs, concept of tree and co-tree, incidence matrix, tie-set and cut-set schedules, formulation of equilibrium equations in matrix form, solution of resistive networks, and principle of duality. **Network Theorems:** Superposition, reciprocity, Millman's, Thevenin's, Norton's, and maximum power transfer theorems. **Resonant Circuits:** Series and parallel resonant circuits. **Steady state and transient response analysis.** **Laplace Transformation:** Solution of networks, step, ramp and impulse responses, and waveform synthesis. **Two-port networks:** Definition of z, y, h and t parameters and driving point and transfer functions.

### II-Electronic Devices

**Semiconductor theory:** Energy bands, intrinsic and extrinsic semiconductors, carrier transport in semiconductors, diffusion current, drift current, mobility, and resistivity, PN Junction theory, and junction breakdowns. **Semiconductor Devices:** PN diode, Zener diode, tunnel diode, LED, PIN diode, and avalanche photo diode; Transistors-Operation principle and construction of BJT, JFET and MOSFETs; and basics and applications of SCRs and LASCRs, ICs. Classification, fabrication process-oxidation, diffusion, ion implantation, and photolithography.

### III-Analog Circuits

**Small-Signal Equivalent circuits:** diodes, BJTs and MOSFETs. **Diode circuits:** clipping, clamping and rectifiers. **Amplifiers:** definition; frequency response; BJT, JFET and MOSFETs as amplifiers; biasing and bias stability of transistor and FET amplifiers; and types-single stage, multi-stage, differential, feedback, and power amplifiers. **Op-amp circuits.** **Filters.** **Regulators.** **Sinusoidal and non-sinusoidal oscillators.** **Function generators.** **Wave-shaping circuits.** **555-Timers.** **Regulated power supplies.**

### IV-Digital Circuits

**Number systems.** **Boolean algebra:** Logic gates and minimization of Boolean functions. **Digital IC families:** TTL, ECL, MOS and CMOS. **Combinatorial circuits:** arithmetic circuits, code converters, multiplexers, decoders, and PLAs. **Sequential circuits:** flip-flops, counters and shift-registers. **Sample and hold circuits.** **ADCs and DACs.** **Semiconductor memories:** ROM, PROM, EPROM, EEPROM, RAM, Flash, Static and Dynamic memories.

## V-Signals and Systems

**Transforms:** Definitions and properties of Laplace transform, continuous-time and discrete-time Fourier series, continuous-time and discrete-time Fourier Transform, DFT and FFT, z- transform.

**Sampling theorem:** time and frequency domain analysis. **Linear Time-Invariant (LTI) Systems:** definitions and properties- causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay.

## VI-Control Systems

**Basics of control systems:** control system components, block diagrammatic description, and reduction of block diagrams. **Open-loop and closed-loop (feedback) systems:** stability analysis of these systems. **Signal flow graphs.** **Transient and steady state analysis of LTI control systems and frequency response.** **Tools and techniques for LTI control system analysis:** root loci, Routh-Hurwitz criterion, Bode and Nyquist plots. **Control system compensators:** elements of lead and lag compensation, elements of Proportional-Integral-Derivative (PID) control. **State variable representation and solution of state equation of LTI control systems.**

## VII-Communication Engineering

**Random signals and noise:** random variables, probability, probability density function, autocorrelation and power spectral density. **Analog communication systems:** amplitude, frequency, and angle modulation and demodulation systems, spectral analysis of these operations, super-heterodyne receivers, signal-to-noise ratio (SNR) calculations for amplitude modulation(AM) and frequency modulation (FM) for low noise conditions. **Information theory:** Entropy and channel capacity theorem. **Digital communication systems:** Sampling theorem, pulse code modulation (PCM), differential pulse code modulation (DPCM). **Digital modulation schemes:** shift keying schemes (ASK, PSK, FSK, QPSK, DPSK), matched filter receivers, bandwidth consideration and probability of error calculations for these schemes. **Multiple Access Techniques:** TDMA, FDMA and CDMA and applications, Optical Communication Systems and Networks.

## VIII-Electromagnetism

**Elements of vector calculus:** divergence and curl, Gauss' and Stokes' theorems. **Wave Equations:** Maxwell's equations, differential and integral forms, and Poynting vector. **Wave Propagation:** Basics of propagation in free-space, dielectric waveguide and optical fibers, reflection and refraction, phase and group velocity, and skin depth. **Transmission lines:** characteristic impedance; impedance transformation; Smith chart; impedance matching; S parameters, and pulse excitation. **Waveguides:** modes in rectangular waveguides; boundary conditions; cut-off frequencies; and dispersion relations. **Micro-wave devices:** TWT, Klystron and magnetron. **Basics of Antennas:** Dipole and dish antennas, radiation pattern and antenna gain, antenna arrays, aperture - antenna, radio wave propagation, antenna radiation pattern measurement.

## IX-Electronics Measurements and Instrumentation

**Measurement standards and Errors.** **Bridges.** **Transducers:** Definition and classification. **Analog instruments:** Voltmeters, Ammeters, Watt meters and Multi-meters. **Digital Instruments:** Digital storage Oscilloscopes and Digital Multi-meters. **Signal Generators.** **LCR meters.** **Display devices:** classification of displays; and display devices-LED and LCD displays. **Bolometer** and **RF power measurement,** spectrum Analyser, Network Analyser, Logic Analyser

## X-Computers and Programming

**Basics of Computers:** Hardware, software and algorithms. **Basics of Computer architecture:** Memory, buses, CPUs. **Programming languages:** Assembly language, high-level languages, and middle-languages. **Programming Paradigms:** POP and OOP. C-programming. **Microcontroller (8051):** architecture, programming, memory and I/O interfacing. **8086 Microprocessor:** architecture and assembly language programming. **Interfacing ICs:** 8251, 8253, 8255 and 8257. **Peripheral Devices.** **Fundamentals of Hardware description languages.**

## XI VLSI

MOSFETS, NMOS, CMOS, Inverter, CMOS, Processing Technology , Layout Design Rules, CAD- Tools for VLSI Design, Delay Models, Power Dissipation, Packing, Scaling of MOS, Transistor, CMOS, Sub-system design, Data Path Operations; Addition, Multiplication, Counters, Shifters, & Memory Elements.