

ELECTRONICS AND COMMUNICATION ENGINEERING

MATERIALS AND COMPONENTS :

Structure and properties of Electrical Engineering materials; Conductors, Semiconductors and Insulators, magnetic, Ferroelectric, Piezoelectric, Ceramic, Optional and Super-conducting materials. Passive components and characteristics Resistors, Capacitors and Inductors; Ferrites, Quartz crystal Ceramic resonators, Electromagnetic and Electromechanical components.

PHYSICAL ELECTRONICS, ELECTRON DEVICES AND ICs:

Electrons and holes in semiconductors, Carrier Statistics, Mechanism of current flow in a semiconductor, Hall effect; junction theory; Different types of diodes and their characteristics; Bipolar Junction transistor; Field effect transistor; Power switching devices like SCRs, GTOs, Power MOSFETS; Basics of ICs-bipolar, MOS and CMOS types; basic of Opto Electronics.

NETWORKS:

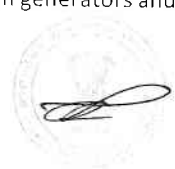
Network graphs: matrices associated with graphs; incidence, fundamental cut set and fundamental circuit matrices. Solution methods : nodal and mesh analysis. Network theorems: superposition, Thevenin and Norton's maximum power transfer, Wye-Delta transformation. Steady state sinusoidal analysis using phasors. Linear constant coefficient differential equations; time domain analysis of simple RLC circuits, Solution of network equations using Laplace transform: frequency domain analysis of RLC circuits. 2-port network parameters: driving point and transfer functions. State equations for networks.

ELECTRONIC DEVICES:

Energy bands in silicon, intrinsic and extrinsic silicon. Carrier transport in silicon: diffusion current, drift current, mobility, and resistivity. Generation and recombination of carriers. P-n junction diode, Zener diode, tunnel diode, BJT, JFET, MOS capacitor, MOSFET, LED, p-I-n and avalanche photo diode, Basics of LASERs. Devices technology: integrated circuits fabrication process, oxidation, diffusion, ion implantation, photolithography, n-tub, p-tub and twin-tub CMOS process.

ANALOG CIRCUITS:

Small Signal Equivalent circuits of diodes, BJTs, MOSFETs and analog CMOS. Simple diode circuits, clipping, clamping, rectifier. Biasing and bias stability of transistor and FET amplifiers. Amplifiers: single and multi-stage, differential and operational, feedback, and power. Frequency response of amplifiers. Simple op-amp circuits. Filters. Sinusoidal oscillators; criterion for oscillation; single transistor and op-amp configurations. Function generators and wave-shaping circuits, 555 Timers. Power supplies.



DIGITAL ELECTRONICS:

Boolean algebra, minimization of Boolean functions; logic gates; digital IC families (DTL, TTL, ECL, MOS, CMOS). Combinatorial circuits: arithmetic circuits, code converters, multiplexers, decoders, PROMs and PLAs. Sequential circuits: latches and flip-flops, counters and shift-registers. Sample and hold circuits, ADCs, DACs, Semiconductor memories. Microprocessor (8085): architecture, programming, memory and I/O interfacing.

SIGNAL AND SYSTEMS:

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. Linear Time-Invariant (LTI) systems: definitions and properties: stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay. Signal transmission through LTI systems.

CONTROL SYSTEMS:

Basic control system components; block diagrammatic description, reduction of block diagrams. Open loop and closed loop (feedback) systems and stability analysis of these systems. Signal flow graphs and their use in determining transfer functions of systems; 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.

COMMUNICATIONS:

Random signals and noise: probability, random variables, probability density function, autocorrelation, power spectral density. Analog communication systems: amplitude and angle modulation and demodulation systems, spectral analysis of these operations, superheterodyne receivers; elements of hardware, realizations of analog communication systems; signal-to-noise ratio (SNR) calculations for amplitude modulation (AM) and frequency modulation (FM) for low noise conditions. Fundamentals of information theory and channel capacity theorem. Digital communication systems: pulse code modulation (PCM), differential pulse code modulation (DPCM), digital modulation schemes: amplitude, phase and frequency shift keying schemes (ASK, PSK, FSK), matched filter receivers, bandwidth consideration and probability of error calculations for these schemes. Basics of TDMA, FDMA and CDMA and GSM.



ELECTROMGNETICS:

Elements of vector calculus: divergence and curl; Gauss' and stokes' theorems, Maxwell's equations: differential and integral forms. Wave equation, Poynting vector. Plane waves: propagation through various media; reflection and refraction; phase and group velocity; skin depth. Transmission lines: characteristics impedance; impedance transformation; Smith chart; impedance matching; S parameters, pulse excitation. Waveguides: modes in rectangular waveguides; boundary conditions; cut-off frequencies; dispersion relations. Basics of propagation in dielectric waveguide and optical fibers. Basics of Antennas: Dipole antennas; radiation pattern; antenna gain.

ELECTRONIC MEASUREMENTS AND INSTRUCMENTATION:

Basic concepts, standards and error analysis; Measurements of basic electrical quantities and parameters; Electronic measuring instruments and their principles of working : analog and digital, comparison, characteristics, application. Transducers; Electronic measurements of non electrical quantities like temperature, pressure, humidity etc; basics of telemetry for industrial use.

