605. ELECTRONICS AND COMMUNICATION ENGINEERING (EC)

Engineering Mathematics

Linear Algebra: Vector space, basis, linear dependence and independence, matrix algebra, eigen values and eigen vectors, rank, solution of linear equations – existence and uniqueness.

Calculus: Mean value theorems, theorems of integral calculus, evaluation of definite and improper integrals, partial derivatives, maxima and minima, multiple integrals, line, surface and volume integrals, Taylor series.

Differential Equations: First order equations (Linear and Nonlinear), higher order linear differential equations with constant coefficients, method of variation of parameters, Cauchy's and Euler's equations, initial and boundary value problems, partial differential equations and variable separable method.

Complex Variables: Analytic functions, Cauchy's integral formula: Cauchy's integral theorem, Taylor's and Laurent' Series, residue theorem.

Probability and Statistics: Probability, Joint and conditional probability, discrete and continuous random variables, probability distribution and density functions. Exponential, Poisson, normal and Binomial Distributions Functions. mean, mean square and standard deviation.

Numerical Methods: Solutions of non-Linear equations, single and multi-step methods for differential equations.

Electronics and Communication Engineering

Networks: Definition and properties of Laplace transform**,** Network 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; Time domain analysis of simple linear 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.

Signals and Systems: 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; Causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay.

Electronic Devices: Energy bands in 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, PIN and Avalanche Photo Diode, Basics of Lasers. Device Technology: Integrated circuits fabrication process, oxidation, diffusion, ion implantation, photolithography and twin-tub CMOS Process.

Analog Circuits: Small signal equivalent circuits of diodes, BJTs, MOFETs and analog CMOS. Simple diode circuits, clipping, clamping, rectifier. Biasing and bias stability of BJT and FET amplifiers. Amplifiers: single- and multi-stage, differential, operational, feedback, and power amplifiers. Frequency response of an 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, regulation.

Digital Circuits: Number Systems, Boolean algebra, minimization of Boolean Functions; logic gates; digital IC families (DTL, TTL, ECL, MOS, CMOS, Number systems.). 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: ROM, SRAM and DRAM, Microprocessor (8085): Architecture, programming, memory and I/O Interfacing.

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.

Communications: Deterministic and Random Signals, types of noise, autocorrelation, power spectral density, properties of white noise, filtering of random signals through LTI systems; analog communication systems: amplitude and angle modulation and demodulation systems, spectra of AM and FM, super-heterodyne receivers, circuits for analog communications; Information theory: entropy, mutual information and channel capacity theorem; Digital communications: Sampling Theory Pulse Code Modulation (PCM), Differential Pulse Code Modulation (DPCM); Digital modulation schemes: Amplitude, phase and frequency shift keying schemes (ASK, PSK, FSK, QAM); Matched filter receiver, calculation of bandwidth, SNR and BER for digital modulation schemes; Fundamental of error correction, Hamming codes; Timing and frequency synchronization, inter-symbol interference and its mitigation; Basics of TDMA, FDMA and CDMA.

Electromagnetics: Maxwell's Equations: differential and integral forms and their interpretation, boundary conditions, wave equation, poynting vector; plane waves and properties: reflection and refraction, polarization, 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, Basics of Radar.

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