

ELECTRONICS AND INSTRUMENTATION

Unit 1: Engineering Mathematics

Linear algebra-Matrix algebra-eigen values and eigen vectors; Calculus-evaluation of definite integrals, partial derivatives, maxima and minima, multiple integrals; Differential equations-first order (linear and non-linear), higher order linear differential equations with constant coefficients, Cauchy's and Euler's equations, initial and boundary value problems; partial differential equations-variable separable method; Complex variables-analytic functions, Cauchy's integral theorem and integral formula, Taylor's series, residue theorem; Numerical methods-solutions of non-linear algebraic equations and differential equations.

Unit 2: Electric Circuits

Ohm's law, KCL, KVL, node and mesh analysis, ideal current and voltage sources, Network theorems: superposition, Thevenin's, Norton's, maximum power transfer; sinusoidal steady-state analysis; resonance; transient analysis of dc and ac networks; two-port networks; three-phase circuits.

Unit 3: Analog and Digital Circuits

Characteristics of diodes, BJTs, JFETs and MOSFETs; Amplifiers-single and multistage; Frequency response; Operational amplifiers - design, characteristics, linear and non-linear applications; instrumentation amplifiers; precision rectifiers; I-to-V and V-to I converters; active filters; comparators; signal generators and wave shaping circuits.

Combinational logic circuits-minimization of Boolean functions; IC families (TTL, MOS, CMOS); arithmetic circuits, multiplexer and decoders. Sequential circuits-flip-flops, counters, shift registers, schmitt trigger, timers, multivibrators and S/H circuits. Analog-to-digital and digital-to-analog converters. 8-bit and 16-bit microprocessors (architecture, memory and I/O interfacing) and 8-bit microcontroller.

Unit 4: Signals and Systems

Linear Time-Invariant (LTI) Systems-definitions and properties; causality, stability; Laplace transform and transfer function; Fourier series-Fourier transforms; Impulse and frequency responses of first and second order systems; Discrete time systems, difference equations, impulse and frequency responses; Z-transforms and transfer functions; convolution and correlation; IIR and FIR filters.

Unit 5: Electrical and Electronic Measurements

Measurement of R, L and C; bridges and potentiometers; measurement of voltage, current, power, power factor and energy; instrument transformers; Q-meter; waveform analyzers.

Digital volt-meters and multi-meters. Time, phase and frequency measurements; Oscilloscope; Noise and interference in instrumentation. Introduction to virtual instrumentation.

Unit 6: Transducers and Smart Instruments

Static and dynamic characteristics of transducers; units and standards; calibration techniques; classification of errors-error analysis; variable resistance, variable inductance and variable capacitance transducers; piezo-electric transducers; fibre-optic transducers; ultrasonic transducers; smart transducers; introduction to micro electro mechanical systems (MEMS).

Unit 7: Industrial and Analytical instrumentation

Pressure, flow, temperature and level measurements- principle of operation, installation and maintenance, calibration; measurement of force, torque, velocity, vibration, humidity, viscosity, and density.

Spectrophotometers (UV and IR); pH meters; conductivity meters; analyzers (O_2 , NO_2 , H_2S), chromatography (gas and liquid); NMR spectroscopy, X-ray spectroscopy and mass spectrometer.

Unit 8: Control Systems

Principles of feedback; transfer function, signal flow graphs; time response analysis; Bode plots, root-loci, Routh and Nyquist criteria; compensation techniques; State space analysis.

Unit 9: Process control

Batch and continuous process; modeling-level, flow and thermal processes; servo and regulator operations; interacting and non-interacting systems; control actions (on-off, P,I, D, PI and PID) and controller tuning; complex control techniques(feed-forward, cascade, ratio and split-range); dynamic matrix control; distillation column control; control of heat exchanger; valve-types, characteristics, sizing, positioners, cavitation and flashing.

Unit 10: Logic and Distributed control system

PLC-sequential and programmable controllers, programming logic-ladder logic and function block programming; data acquisition system (DAS); direct digital control (DDC); supervisory control and data acquisition system (SCADA); distributed control system (DCS); HART and Field bus, OLE for process control (OPC)