

Syllabus for Electronics & Electrical Engineering

Network Elements: Ideal voltage and current sources, dependent sources, R, L, C, M elements; Network solution methods: KCL, KVL, Node and Mesh analysis; Network Theorems: Thevenin's, Norton's, Superposition and Maximum Power Transfer theorem, balanced three phase circuits, star-delta transformation, complex power and power factor in AC circuits.

Electromagnetic Fields: Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss's Law, Divergence, Biot-Savart's law, Ampere's law, Curl, Faraday's law, Lorentz force, Inductance, Magnetomotive force, Reluctance, Magnetic circuits, Self and Mutual inductance of simple configurations.

Electrical Machines

Single phase transformer: equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency; Auto-transformer, Electromechanical energy conversion principles; DC machines: separately excited, series and shunt, motoring and generating mode of operation and their characteristics, speed control of dc motors; Three-phase induction machines: principle of operation, types, performance, torque-speed characteristics, no-load and blocked-rotor tests, equivalent circuit, starting and speed control; Operating principle of single-phase induction motors; Types of losses and efficiency calculations of electric machines.

Power Systems

Basic concepts of electrical power generation, AC and DC transmission concepts, Models and performance of transmission lines and cables, Economic Load Dispatch (with and without considering transmission losses), Series and shunt compensation, Electric field distribution and insulators, Distribution systems, Per-unit quantities, Bus admittance matrix, Gauss-Seidel and Newton-Raphson load flow methods, Voltage and Frequency control, Power factor correction, Symmetrical components, Symmetrical and unsymmetrical fault analysis, Principles of over-current, differential, directional and distance protection; Circuit breakers, System stability concepts, Equal area criterion.

Control Systems

Mathematical modelling and representation of systems, Feedback principle, transfer function, Block diagrams and Signal flow graphs, Transient and Steady-state analysis of linear time invariant systems, Stability analysis using Routh-Hurwitz and Nyquist criteria, Bode plots, Lag, Lead and Lead-Lag compensators; P, PI and PID controllers.

Electrical and Electronic Measurements

Bridges and Potentiometers, Measurement of voltage, current, power, energy and power factor; Instrument transformers, Digital voltmeters and multi-meters, Phase, Time and Frequency measurement; Oscilloscopes, Error analysis.

Analog and Digital Electronics

Simple diode circuits: clipping, clamping, rectifiers; Amplifiers: biasing, equivalent circuit and frequency response; oscillators and feedback amplifiers; operational amplifiers: characteristics and applications; single stage active filters, Butterworth, combinatorial and sequential logic circuits, multiplexers, demultiplexers, Schmitt triggers, sample and hold circuits, A/D and D/A converters.

Power Electronics

Static V-I characteristics and firing/gating circuits for Thyristor, MOSFET, IGBT; DC to DC conversion: Buck, Boost and Buck-Boost Converters; Single and three-phase configuration of uncontrolled rectifiers; Voltage and Current commutated Thyristor based converters; Bidirectional ac to dc voltage source converters; Magnitude and Phase of line current harmonics for uncontrolled and thyristor based converters; Power factor and Distortion Factor of AC to DC converters; Single-phase and three-phase voltage and current source inverters, sinusoidal pulse width modulation.