

DEPARTMENT OF ELECTRICAL ENGINEERING
MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Syllabus for PhD Examination

Network theory: Sources, R, L, C elements, KCL, KVL, Node and Mesh analysis, network theorems transient and steady state responses, sinusoidal analysis, resonance, two port networks, balanced three phase circuits, star-delta transformation, complex power and power factor in ac circuits.

Electrical Machines: Single phase transformer, equivalent circuit, representation and tests, regulation and efficiency; three-phase transformers and analysis, electromechanical energy conversion principles, DC machine of all types (generators and motors), analysis, characteristics, operation, tests and control, three-phase and single-phase induction motors, its operation and construction, characteristics, test, control, and applications, synchronous machine (generator and motor), its construction, starting, operation, characteristics, efficiency, and its protection methods.

Signals and Systems: Continuous and discrete time signals, sampling mechanism and its applications, Laplace transform and Z transform, R.M.S. value, average value calculation for any general periodic waveform.

Power Systems: Concepts of power generation, models and performance of transmission lines and cables, economic load dispatch, series and shunt compensation, insulators, distribution systems, per-unit quantities, bus admittance matrix, load flow methods, voltage and frequency control, power factor correction, symmetrical components, fault analysis, principles and operation of protection system, circuit breakers, system stability concepts, equal area criterion.

Control Systems: Modeling and representation of systems, feedback mechanism, transfer function, block diagrams and signal flow graphs, transient and steady-state analysis of LTI systems, stability analysis, Nyquist criteria, Bode methods, lag, lead and lead-lag compensators; P, PI and PID controllers; state space model, solution of state equations of LTI system, introduction to nonlinear systems.

Power Electronics: Characteristics and design of thyristor circuits, MOSFET, IGBT; DC-DC conversion, single and three-phase uncontrolled rectifiers, voltage and current commutated thyristor based converters, bidirectional converters, magnitude and phase of line current harmonics for uncontrolled and thyristor based converters, power factor and distortion factors, voltage and current source inverters, sinusoidal pulse width modulation.

Electromagnetic Fields: Coulomb's law, electric field, electric flux, Gauss's law, divergence, electric field and potential due to point, line, plane and spherical charge distributions, Lorentz force, inductance, magnetomotive force, reluctance, magnetic circuits, self and mutual inductance of simple configurations.

Electrical and Electronic Measurements: Bridges and potentiometers, measurement of voltage, current, power, energy and power factor; instrument transformers, phase, time and frequency measurement; oscilloscopes, error analysis.

Analog and Digital Electronics: Diode circuits, clipping, clamping, rectifiers, amplifiers, biasing, equivalent circuit and frequency response; oscillators and feedback amplifiers, active filters, combinatorial and sequential logic circuits, multiplexers, sample and hold circuits, A/D and D/A converters.