Department of Electrical Engineering

Syllabus for entrance examination in PhD Electrical Engineering

Electric Circuits

KCL, KVL, Node and Mesh analysis, Transient response of dc and ac networks, Sinusoidal steady-state analysis, Resonance, Quality factor – Bandwidth, Passive filters, Ideal current and voltage sources, Thevenin's theorem, Nortons theorem, Superposition theorem, Maximum power transfer theorem, two port networks, Network graph, three phase circuits, Power and power factor in ac, Laplace Transforms, Transfer Function representation – Poles and zeros.

Electromagnetic Fields and Signal Systems

Biot-Savarts law, Amperes law, Curl, Faradays law, Lorentz force, Inductance, Magnetomotive force, Reluctance, Magnetic circuits, Self and Mutual inductance of simple configurations. Signals and Systems Representation of continuous and discrete-time signals, Linear Time Invariant and Causal systems, Fourier series representation of continuous periodic signals, Sampling theorem, Fourier and z-Transforms and their applications in electrical system.

Electrical Machines

Single phase transformer: equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency; Three phase transformers: connections, parallel operation; Auto-transformer, DC machines: separately excited, series and shunt, motoring and generating mode of operation and their characteristics, Three phase induction motors: principle of operation, types, performance, torque-speed characteristics, Synchronous machines: cylindrical and salient pole machines, performance, regulation and efficiency.

Power Systems

Power generation concepts, ac and dc transmission concepts, Models and performance of transmission lines and cables, 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, Symmetrical components, Symmetrical and unsymmetrical fault analysis, Principles of over-current, differential and distance protection; Circuit breakers, System stability concepts.

Control Systems

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

Electrical and Electronic Measurements

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

Analog and Digital Electronics

Diodes, BJT, MOSFET; Oscillators and Feedback amplifiers; Operational amplifiers: Combinational and Sequential logic circuits, Multiplexer, Demultiplexer, Schmitt trigger, Sample and hold circuits, A/D and D/A converters.

Power Electronics and Drives

Characteristics of semiconductor power devices: Diode, Thyristor, Triac, MOSFET, IGBT; DC to DC conversion: Buck, Boost and Buck-Boost converters; Single and three phase configuration of uncontrolled rectifiers, Single phase and three phase inverters, Pulse width modulation (PWM), Fundamentals of electric drives, speed control of dc and ac motors.