



Department of Electrical Engineering

Syllabus for entrance examination in PhD (Electrical Engineering)

Electric Circuits

Network graph, KCL, KVL, Node and Mesh analysis, Transient response of dc and ac networks, Sinusoidal steady-state analysis, Resonance, Passive filters, Ideal current and voltage sources, Thevenins theorem, Nortons theorem, Superposition theorem, Maximum power transfer theorem, Two port networks, Three phase circuits, Power and power factor in ac circuits.

Electromagnetic Fields

Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss's Law, Divergence, Electric field and potential due to point, line, plane and spherical charge distributions, Effect of dielectric medium, Capacitance of simple configurations, Biot-Savarts law, Amperes law, Curl, Faradays law, Lorentz force, Inductance, Magnetomotive force, Reluctance, Magnetic circuits, Self and Mutual inductance of simple configurations. Section 4: Signals and Systems Representation of continuous and discrete-time signals, Shifting and scaling operations, Linear Time Invariant and Causal systems, Fourier series representation of continuous periodic signals, Sampling theorem, Applications of Fourier Transform, Laplace Transform and z-Transform.

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, Electromechanical energy conversion principles, DC machines: separately excited, series and shunt, motoring and generating mode of operation and their characteristics, starting and speed control of dc motors; Three phase induction motors: 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; Synchronous machines: cylindrical and salient pole machines, performance, regulation and parallel operation of generators, starting of synchronous motor, characteristics; Types of losses and efficiency calculations of electric machines.

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, Power factor

correction, Symmetrical components, Symmetrical and unsymmetrical fault analysis, Principles of over-current, differential and distance protection; Circuit breakers, System stability concepts, Equal area criterion.

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, State transition matrix.

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 Characteristics of diodes, BJT, MOSFET; Simple diode circuits: clipping, clamping, rectifiers; Amplifiers: Biasing, Equivalent circuit and Frequency response; Oscillators and Feedback amplifiers; Operational amplifiers: Characteristics and applications; Simple active filters, VCOs and Timers, Combinational and Sequential logic circuits, Multiplexer, Demultiplexer, Schmitt trigger, Sample and hold circuits, A/D and D/A converters, 8085 Microprocessor: Architecture, Programming and Interfacing.

Power Electronics Characteristics of semiconductor power devices: Diode, Thyristor, Triac, GTO, MOSFET, IGBT; DC to DC conversion: Buck, Boost and Buck-Boost converters; Single and three phase configuration of uncontrolled rectifiers, Line commutated thyristor based converters, Bidirectional ac to dc voltage source converters, Issues of line current harmonics, Power factor, Distortion factor of ac to dc converters, Single phase and three phase inverters, Sinusoidal pulse width modulation.

Syllabus for Ph.D. Admission Entrance Test 2023

Department of CE/ ECE/ EE/ CSE/ ME/ CS/ FT



Paper – I: Research Methodology for Engineering & Technology

Max. Marks: 35

Unit 1: Research Concepts & Design

Research: Meaning, Objectives and Types. Research Approaches, Research Process, and Criteria for good research. Research Problem: Selecting the Problem, Steps in formulating research problems, Techniques for problem identification. Meaning and importance of research design, Types of research design, Features of a good research design.

Unit 2: Data Collection & Analysis

Data Sources: Primary and secondary. Tools and techniques for data collection (questionnaires, interviews, observations, schedules etc.), Selection of appropriate method of data collection. Logic, Deduction, Numerical Relations & Reasoning, Data Interpretation, Data charts & graphs, 2 and 3-dimensional plots, maps, and tables. Numerical computation and estimation: ratios, percentages, powers, exponents, and logarithms, permutations and combinations, and series.

Unit 3: Statistics & Probability

Measures of Central Tendency & Dispersion: Mean, Mode, Median, Variance & Standard Deviation. Probability, Conditional Probability, Binomial Distribution, Poisson Distribution, Normal Distribution and Exponential Distribution.

Unit 4: Mathematical Aptitude

Vectors, Matrices and Determinants, Eigen Values and Eigen Vectors, Rank, Solution of Linear Equations, Maxima and Minima. Differential Equations of first order, higher order linear differential equations, analytic functions. Numerical Analysis: Interpolation, numerical solution of ordinary differential equations.
