

**BIRLA INSTITUTE OF TECHNOLOGY**  
(Deemed University u/s 3 of UGC Act 1955)  
**Mesra, Ranchi – 835 215 (Jharkhand)**

**Ph.D. Programme (Session SP/2020)**

**Syllabus for Ph.D. Entrance: Electrical and Electronics Engineering**

- 1. Electric Circuits and Fields:** Network graph, KCL, KVL, node and mesh analysis, transient response of DC and AC networks; sinusoidal steady-state analysis, resonance, basic filter concepts; Thevenin's, Norton's and Superposition and Maximum Power Transfer theorems, three phase circuits, two-port networks, network synthesis using Foster and Cauer network.
- 2. 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-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, Maxwell's equations.
- 3. 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; Fourier and Laplace transforms, Laplace transform, DFT, IIR Filter, FIR Filter.
- 4. Electrical Machines:** Single phase transformer - equivalent circuit, phasor diagram, tests, regulation and efficiency; three phase transformers - connections, auto-transformer; DC machines - types, windings, generator characteristics, armature reaction and commutation; starting and speed control of induction motors; three phase induction motors - principles, types, performance characteristics, starting and speed control; single phase induction motors; synchronous machines - performance, regulation.
- 5. Power Systems:** Basic power generation concepts; load factor, diversity factors, Load curve etc. transmission line models and performance; Basic of underground cable, insulation; corona, radial distribution systems; per-unit quantities; admittance matrices; load flow; voltage control; symmetrical components; fault analysis; principles of over-current, differential and distance protection;
- 6. Control Systems:** Principles of feedback; transfer function; SFG block diagrams; steady-state errors; Time response, Routh and Nyquist techniques; Bode plots; root loci; lag, lead and lead-lag compensation; state space model, Basic of nonlinear systems.
- 7. Electrical and Electronic Measurements:** Bridges and potentiometers; PMMC, moving iron, dynamometer and induction type instruments; measurement of voltage, current, power, energy and power factor; instrument transformers; digital voltmeters and multimeters; phase, time and frequency measurement; oscilloscopes; error analysis, Basic telemetering.
- 8. Analog and Digital Electronics:** Characteristics of diodes, BJT, FET; amplifiers - biasing, equivalent circuit and frequency response; oscillators and feedback amplifiers; operational amplifiers - characteristics and applications; combinational and sequential logic circuits; multiplexer; Schmitt trigger; multi-vibrators; sample and hold circuits; A/D and D/A converters, Flip-flops.
- 9. Power Electronics and Drives:** Power diodes, thyristors, triacs, Power MOSFETs and IGBTs - static characteristics and principles of operation; phase control SCR rectifiers; bridge converters - fully controlled and half controlled; principles of choppers and inverters; cycloconverter, AC voltage controller adjustable speed DC and AC drives.