Department of Electrical and Electronics Engineering,

MITS Deemed to be University

Ph.D. Administration – Entrance Examination

Syllabus

Signals and networks: Discrete Fourier Transform, Linear Convolution, Circular Convolution, Inverse Discrete Fourier Transform, Sampling, Linear Time Invariant Systems, Two Port Networks, Network Elements, RLC Circuits, Network Theorems, Transient Response.

Control Systems Syllabus: Mathematical modeling of systems, time-domain analysis, steady-state and transient response, stability concepts, root locus technique, frequency response analysis (Bode, Nyquist, gain margin, phase margin), controllers (P, I, D), compensators (lead, lag), state space modeling, state feedback, pole placement techniques, and optimal control using Linear Quadratic Regulator (LQR).

Electrical Machines: *Single phase transformer* - equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency. *Three-phase transformers* - connections, vector groups, parallel operation; 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*. *Synchronous machines*: cylindrical and salient pole machines, performance and characteristics, regulation and parallel operation of generators, starting of synchronous motors. Types of losses and efficiency calculations of electric machines.

Power Systems: *Power System Analysis*: Single line diagrams, machine ratings, and neutral/winding configurations. *Plant Economics & Operations*: Load/capacity factors, reserve capacity, and economic dispatch with penalty factors. *Power Generation & Stability*: Thermal plant energy losses, transient stability, and grid inertia challenges. *Protection & Control*: Relay applications for transmission lines and multi-layer control in DC/AC microgrids. *Smart Grid Technologies*: Point of Common Coupling (PCC), self-healing, net metering, and Time-of-Use (TOU) tariffs. *Renewable Energy Systems*: Solar geometry, wind/tidal turbine dynamics, biogas microbiology, and geothermal cycles.

Analog Electronics: Diode characteristics and applications, BJT/MOSFET biasing, Small signal parameters (gm, ro, rπ), Ampli- fier configurations (CE, CS, CG, differential, cascade), Operational amplifiers, Feedback systems, Oscillators (Wien bridge, phase shift, Colpitts), Frequency response

Digital Electronics: Boolean algebra and K-maps, Logic gates and minimization, Combinational circuits (decoders, encoders, multiplexers), Sequential circuits (flip-flops, counters), Number systems (binary, octal, hex, Gray code, excess-3), ADC/DAC types and specifications.

Power Electronics: Commutation Calculation, Chopper Operation and Calculation, SCR Protection, Device Comparison, SCR Characteristics, Latching Current, Inverter Configuration, Harmonics, Converter Logic, Device Selection, Cycloconverter Commutation, SMPS Performance.