

## Electrical Engineering; Paper

### Electrical Circuits and Networks:

Circuit elements, KCL, KVL, Nodal and Mesh analysis, Thevenin's, Norton's, Superposition and Maximum power transfer theorems, Steady state and Transient Response of DC and AC networks, Two-part networks, Magnetically coupled circuits.

### Electromagnetic Field Theory:

Electrostatic fields: Gauss's Law, Maxwell's equations, Energy density in electrostatic fields, Properties of materials; Magnetostatic Fields: Biot-Savart's Law, Ampere's circuit law, Maxwell's equations, Application of Ampere's law, Waves and applications.

### Basic Electronics Engineering:

Basics of Semiconductor diodes BJT, FET, MOSFET, and their characteristics, Different types amplifiers, equivalent circuit and frequency response, Oscillator and other circuits, feedback amplifiers.

### Electrical and Electronics Measurements:

Principles of measurement, Accuracy, Precision, Error analysis; Moving coil, Moving iron, Dynamometer and induction types of instruments; Measurement of voltage, Current, Power, Energy and Power factor; Instrument transformer, Bridges and Potentiometers, Electronic instruments, Digital voltmeters, Phase and Frequency measurement, Q-meters, Basics of sensors and transducers.

### Electrical Machines:

Electro Magnetic Energy conversion (EMEC), DC Machines-types, Generator and motor characteristics, Starting and control of motors; Synchronous machines- Principle and performance, Regulation, Parallel operation of generators, Motor starting, Characteristics and application; Single phase, Three phase transformers- Principle, Equivalent circuit, efficiency, Regulation, Connections,

Power Systems:

Basic power generation concepts- Steam, gas and water turbines, Line parameters and calculations, Performance of transmission lines, Mechanical design of overhead lines and insulators, Corona and radio interference, Power factor correction, Symmetrical components, Fault analysis, Load flow equations and methods of solutions; Power system stability- Power system transients and travelling waves, EHV transmission, HVDC transmission, Concepts of FACTS, Voltage control and Economic operation, Concepts of distributed generation, Solar and wind power, Smart grid Concept.

Control System:

Mathematical modelling of physical systems, Principles of feedback, Transfer function, Block Diagram and signal flow graphs, Time response specification, Routh-Hurwitz criterion, Bode plots, root loci, Nyquist technique, Lag, Lead and lead-lag compensation, stability analysis, transient and frequency response analysis, State space model, State transition matrix, Controllability and observability, PID and industrial controllers.

## Electrical Engineering; Paper-

### Analog and Digital Electronics:

Operational amplifiers- Characteristics and applications, combinational and sequential circuits, Multiplexers, Multivibrators, Sample and hold circuits, A/D and D/A converters, Basics of filter circuits and applications, Active filters, Microprocessor basics- Interfaces and applications, Basics of integrated circuits, Analog communication basics, Modulation and Demodulation, Noise and bandwidth, Signal to noise ratio, Transmitters and receivers, Digital communication basics- sampling, quantizing, coding, frequency and time domain multiplexing, Power line carrier communication systems.

### Systems and Signal Processing:

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 transform, Z-transforms, Discrete fourier transform, FFT, Linear convolution, FIR and IIR filters, bilinear transformation.

### Induction and Special Machines:

Three-Phase induction motors- rotating magnetic field theory, Equivalent circuit and determination of its parameters, Torque-slip characteristics, Starters, Speed control; induction generators, Single-phase induction motors- theory, Characteristics, Starting and applications, Servomotors, Stepper motors, brushless DC (BLDC) motors.

### Power System Protection:

Principles and need for protection schemes, Types of faults, Relay application and Characteristics- over current relays, Directional relays, Distance relay, Differential relays, Methods of Arc extinction,

Restriking voltages and recovery voltage, testing of circuit breakers, Protective schemes for power system equipment, Surge in transmission line and protection.

#### Power Electronic and Drivers:

Semiconductor power diodes, Transistors, Thyristors, Triacs, GTOs, MOSFETs, IGBTs- principles of operation and their static characteristics, Triggering circuits, Phase control rectifiers, Bridge convertors- fully controlled and half controlled, Principle of choppers and inverters, Basic concepts of adjustable speed DC and AC drives, DC-DC switched mode converters, DC-AC switched mode converters, Resonant convertors, Basics of electric drives- types, quadrant operation, Reversing and braking of electric motors, Estimation of power ratings, Traction motors.

#### Electrical Material:

Electrical engineering materials, Crystal structures and defects, Ceramic materials, Insulating materials, Magnetic materials- basics, Properties and applications; Ferrites, Ferro-magnetic materials and components, Basics of solid state Physics, Conductors, Photo-conductivities, Basics of Nano materials and superconductors.