SYLLABUS OF WRITTEN TEST FOR RECRUITMENT TO THE POST OF SCIENTIST/ENGINEER 'SC'
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DOMAIN: POWER ELECTRONICS
Post Code – 09

Electric Circuits

Ideal voltage and current sources, dependent sources, R, L, C, M elements; Network solution methods: KCL, KVL, Node and Mesh analysis; Network Theorems: Thevenin's, Norton's, Superposition and Maximum Power Transfer theorem; Transient response of dc and ac networks, sinusoidal steady-state analysis, resonance, two port networks, balanced three phase circuits, star-delta transformation, complex power and power factor in ac circuits.

Basic Electronics and Control Systems

Semiconductor Physics, Semiconductor Devices & Circuits, Analog & Digital Electronics, Electromagnetic Fields, Mathematical modelling and representation of systems, Feedback principle, transfer function, Transient and Steady-state analysis of LTI systems, Stability analysis using Routh-Hurwitz and Nyquist criteria, Bode plots, Root loci, Lag Lead and Lead Lag compensators; P, PI and PID controllers; State space model, Solution of state equations of LTI systems, Fourier series representation of continuous and discrete time periodic signals, sampling theorem, Applications of Fourier Transform for continuous and discrete time signals, Laplace Transform and Z transform.

Electrical Machines & Drives

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, Electro-mechanical energy conversion principles; DC machines; Three-phase induction machines; Synchronous machines; Types of losses and efficiency calculations of electric machines.

Power Electronics

Static V-I characteristics and firing/gating circuits for Power Electronics Devices & Circuits like Thyristor, MOSFET, IGBT; DC to DC conversion: Buck, Boost, Buck-Boost and Cuk Converters; Power converter analysis & design, Switch Mode Power Supply design and analysis; Single and three-phase configuration of uncontrolled rectifiers; Voltage and Current commutated Thyristor based converters; Bidirectional AC to DC voltage source converters; Magnitude and Phase of line current harmonics for uncontrolled and Thyristor based converters; Power factor and Distortion factor of AC to DC converters; Single-phase and three-phase voltage and current source inverters, sinusoidal and Space Vector pulse width modulation; Resonant converters; soft-switching techniques.

Power Systems

Basic electrical power generation, AC and DC transmission, Series and shunt compensation, Electric field distribution and insulators, Distribution systems, Bus admittance matrix, Gauss-Seidel and Newton-Raphson load flow methods, Voltage and Frequency control, Power factor correction, Symmetrical and unsymmetrical fault analysis, Principles of over-current, differential, directional and distance protection; Circuit breakers, System stability concepts, Equal area criterion, swing equation.

Basic Electronics:

Basic Electronics, Electronic Devices & Circuits, Semiconductor Physics, Network Theory, Analog and digital electronics, electrical measurement and instruments, Control Theory and systems, microprocessor and microcontroller, Electromagnetics, transmission lines, Maxwell equations, FPGA & ASIC fundamentals, wired and wireless communication systems, satellite communication.

Hindi version shall follow.