RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

SYLLABUS FOR COMPETITIVE EXAMINATION FOR THE POST OF LECTURER IN ELECTRICAL ENGINEERING FOR TECHNICAL EDUCATION DEPARTMENT

PAPER-I

1. **Electrical Circuits:** Ideal Voltage and Current Sources, Circuit elements, Kirchhoff's laws, Mesh and nodal analysis, topological concepts, Network Theorems and applications. Star-Delta Transformation, Complex Power and Power Factor in AC circuits, Natural response and forced response. Steady state and transient response for standard inputs. Properties of network in terms of poles and zeros. Transfer functions. Resonant circuits. Three-phase balanced and unbalanced circuits. Two port networks. Signal flow graphs. Coupled circuits. Filters, image impedance, attenuation, phase shift and insertion losses in constant K and M derived filters. Fourier series, Fourier Transforms, Laplace transforms and their application.
2. **Field Theory:** Electric and magnetic fields, Faraday's Law, Lorentz Force, Biot-Savart's Law, Gauss's Law, Ampere's Law, Coulomb's Law, Divergence and Curl. Electric Fields and Potential due to point, line, plane, and spherical charge distributions, Fields in dielectrics, conductors and magnetic materials, Maxwell's equations. Time varying fields. Wave propagation in dielectric and conducting media.
3. **Electrical Materials:** Classification of materials on the basis of permanent magnetic dipoles. Electrical and electronic behaviour of materials. Classification on the basis of conductivity. Behaviour of dielectrics in steady and alternating fields. Phenomenon of polarization. Super conductivity. Application of magnetic, conducting, dielectric and insulating materials, Piezoelectricity.
4. **Electrical Machines:** Basic concept of rotating machine- magnetic circuits, electromagnetic force and torque equation, principle of energy conversion. DC machines- construction, basic principle of DC motors and generators, their characteristics, speed control and starting of DC Motors, testing of DC Machines, methods of breaking, losses and efficiency of DC machines. Single Phase and Three Phase Transformers- equivalent circuit, phasor diagram, losses, voltage regulation, efficiency, testing, harmonics in magnetization current, phase conversion, Tap changing of Transformer, three winding transformer, auto-transformer. Three Phase induction

Machines- principle of operation, pulsating and evolving magnetic fields, torque- slip characteristics, phasor diagram, losses and efficiency, starting, braking and speed control, doubly fed induction machine. Single Phase Induction motor- starting methods, characteristics, applications in domestic appliances. AC series motor, reluctance motor. Synchronous Machines– construction & its types, circuit model and characteristics, generation of three- phase emf, phasor diagram, synchronous reactance, voltage regulation, parallel operation of alternators, synchronizing power, starting methods and applications of synchronous Motors, V curves and Hunting.

5. **Power Systems:** Thermal power plants basic schemes and working principle, basic Hydroelectric and pumped storage plant, Nuclear power plants, Gas power plants, Renewable Sources- wind, solar, tidal etc. Types of loads and load curves, power plant economics, tariffs, power factor improvement. Transmission line and distribution systems, line diagrams, voltage levels and topologies, three phase systems, overhead transmission lines and cables, corona, Synchronous Machine under balanced terminal short circuit conditions- steady state, transient and sub-transient equivalent circuits, per-unit system and per-unit calculations, over voltage and insulation requirements, Neutral Earthing, Fault analysis and protection systems, circuit breakers and relays, introduction to DC transmission systems, HVDC systems, load-flow analysis, economic operation of power systems, generation and absorption of reactive power by various components, Load Frequency Control, power system steady state and transient stability, equal area criterion, power quality and FACTS, STATCOMs, SCADA systems, power system states.

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Note :- <u>Pattern of Question Paper</u>

1. **Objective type paper**
2. **Maximum Marks : 75**
3. **Number of Questions: 150**
4. **Duration of Paper: Three Hours**
5. **All questions carry equal marks.**
6. **Medium of Competitive Exam: English**
7. **There will be Negative Marking.**