RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

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

PAPER-II

I. **Mathematical Methods of Physics-**

Dimensional analysis; Vector algebra and vector calculus; Linear algebra, matrices, Cayley Hamilton theorem, eigen value problems; Linear differential equations; Special functions (Hermite, Bessel, Laguerre and Legendre); Fourier series, Fourier and Laplace transforms; Elements of complex analysis; Elementary ideas about tensors; Introductory group theory; Elements of computational techniques: roots of functions, interpolation, extrapolation, integration by trapezoid and Simpson's rule, solution of first order differential equations using Runge-Kutta method; Finite difference methods; Elementary probability theory, random variables, binomial, Poisson and normal distributions.

II. Classical Mechanics-

Newton's laws of motion. Inertial frames, Galilean transformation, Non-inertial frames, fictitious forces, rotating co-ordinate systems, Coriolis force and its applications. Centre of Mass. Motion of system with varying mass, Elastic and Inelastic Collisions, Elasticity, relation between elastic constants. Theory of bending of beams and Cantilever, Torsion of a cylinder, Bending moments and Shearing forces. Cohesion and adhesion.Surface tension.Viscosity, Stoke's law, and terminal velocity. Central forces, Keplerlaws and planetary motion, Angular momentum, Rigid body dynamics, Moment of Inertia. Lagrangian and Hamiltonian formalism, Conservation laws, Canonical transformation and Poission's bracket, small oscillations, Normal modes, Waves in media, Group and Phase velocity, Superposition of waves, Quality of sound, Chladni figures, Production and detection of Ultrasonic and Infrasonic waves, special theory of relativity, Lorentz transformations, time dilation, length contraction, relativistic kinematics and mass-energy equivalence.

III. Quantum Mechanics-

Wave-particle duality; Wave functions in coordinate and momentum representations; Commutators and Heisenberg's uncertainty principle; Matrix representation; Dirac’s bra and ket notation; Schroedinger equation (time-dependent and time-independent); Eigenvalue problems such as particle-in-a-box, harmonic oscillator, etc; Tunneling through a barrier; Motion in a central potential; Orbital angular momentum, Angular momentum algebra, spin; Addition of angular momenta; Hydrogen atom, spin-orbit coupling, fine structure; Time-independent perturbation theory and applications; Variational method; WKB approximation; Time dependent perturbation theory and Fermi's Golden Rule; Selection rules; Semi-classical theory of radiation; Elementary theory of scattering, phase shifts, partial waves, Born approximation; Identical particles, Pauli's exclusion principle, spin-statistics connection.

IV. Thermodynamic and Statistical Physics-

Laws of thermodynamics and their consequences; Thermodynamic scales, Clausius Clapeyron equation, Heat engine, Carnot cycle, Thermodynamic potentials, Production of low temperature and its applications; Maxwell relations; Chemical potential, phase equilibria; Phase space, micro- and macrostates; Microcanonical, canonical and grand-canonical ensembles and partition functions; Free Energy and connection with thermodynamic quantities; First- and second-order phase transitions; Classical and quantum statistics, ideal Fermi and Bose gases; Blackbody radiation and Planck's distribution law; Bose-Einstein condensation; Kinetic theory of gases: distribution law of molecular velocities, Equipartition of energy, Transport Phenomenon: Viscocity, Thermal conductivity and Diffusion.

V. Nuclear and Particle Physics-

Basic nuclear properties: size, shape, charge distribution, spin and parity; Binding energy, semi-empirical mass formula; Liquid drop model; Fission and fusion; Nuclear Reactors, Radiation safety, Nature of the nuclear force, form of nucleon-nucleon potential; Charge-independence and charge-symmetry of nuclear forces; Isospin; Deuteron problem; Evidence of shell structure, single- particle shell model, its validity and limitations, Elementary ideas of alpha, beta and gamma decays and their selection rules; Nuclear reactions, compound nuclei and direct reactions;

Classification of fundamental forces; Elementary particles (quarks, baryons, mesons, leptons); Spin and parity assignments, isospin, strangeness; Gell-Mann-Nishijima formula; C, P, and T invariance and applications of symmetry arguments to particle reactions, parity non-conservation in weak interaction; Particle accelerators and detectors.

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Note:- **Pattern of Question Paper**

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. **There will be Negative Marking.**
7. **Medium of Competitive Exam: Bilingual in English & Hindi**