Rajasthan Public Service Commission, Ajmer

Syllabus for screening test for the post of

Lecturer - Physics

Technical Education Department

1. Mechanics and Relativity:

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. 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, Kepler problem and planetary motion.

Lagrangian and Hamiltonian formalism, Conservation laws, Canonical transformation and Poission's bracket, small oscillations, normal modes, special theory of relativity, Lorentz transformations, time dilation, length contraction, relativistic kinematics and mass-energy equivalence.

2. Electromagnetics and Optics:

Gauss's law and its applications, Laplace and Poisson equations and their applications, Ampere's law, Biot-Savart law, Faraday's laws of electromagnetic induction, LCR circuits, alternating current circuits. Maxwell's equations, Scalar and Vector Potentials., Electromagnetic waves – Reflection, refraction, dispersion and Polarization. Radiation from moving charge and radiation from dipole.

Concept of coherent sources, Interference, Diffraction of Light – Fresnel and Fraunhofer diffraction, Resolving power.

3. Thermodynamics and Statistical Physics:

Laws of thermodynamics and their consequences. Thermodynamic potential and Maxwell's relations. Chemical potential, phase equilibrium, Free energy and relation with thermodynamic quantities. Phase space. Thermo-dynamic probability: Maxwell – Boltzmann, Fermi- Dirac and Bose – Einstein Statistics, properties of ideal Bose and Fermi gases, Bose – Einstein condensation. Blackbody radiation and Planck's distribution law.

4. Quantum Mechanics:

Wave particle duality, Schrodinger equation (time – dependent and time –independent); Eigen value problems such as particle in a box, harmonic oscillator etc; Commutators and Heisenberg's uncertainty principle, Tunneling through a barrier ; Motion in a central potential ; Orbital angular momentum, Angular momentum algebra, spin; Addition of angular momenta ; Hydrogen atom, Time dependent and time independent perturbation theory. Elementary theory of scattering in a central potential, partial wave and phase-shift analysis. Identical particles and spin statistics.

5. Electronics:

Physics of P-N junction, Diode as circuit element, clipping and clamping, Rectification, Zener regulated power supply, Transistor as a circuit element, CC, CB and CE configuration, field effect transistor, Transistor as a switch, Feedback in amplifiers.

Operational amplifiers and its applications, inverting and non-inverting amplifiers, adder, integrator, differentiator, wave-form generator, comparator, Schmitt trigger.

Digital electronics – Basic Logic gates: OR, AND and NOT. NAND and NOR gates as building blocks, X-OR gate, Half and Full adder circuits, Flip – Flops, Counters and Registers.

6. Atomic and Molecular Physics:

Quantum states of an electron in an atom. Electron spin. Hydrogen atom spectra, Pauli's Principle, Spin-Orbit interactions and fine structure, Zeeman effect, Paschen – Back effect, Stark effect, LS and JJ coupling, Hyperfine structure. X-ray and Auger transitions, Compton effect.

Rotational and Vibrational spectra, Raman spectra, Selection rules, Electronic states of diatomic molecules, Franck- Condon Principle. Lasers, optical pumping and Population inversion, temporal and spatial coherence; He-Ne laser.

7. Solid State Physics:

Crystal Binding and Crystal Structure: Bravis Lattice, Miller Indices and Crystal Structure, X-ray Diffraction and Bragg's Law, Laue equation of X-ray diffraction. Lattice Vibrations, Phonons, specific heat of solids, Free electron theory, Energy band. Semi conductors – statistics of intrinsic and extrinsic semi-conductors, Electrical Conductivity and its temperature dependence, Recombination mechanism. Hall effect. Diamagnetism and Paramagnetism, Ferromagnetism and anti ferromagnetism, Super conductivity.

8. Nuclear and Particle Physics:

Basic nuclear properties – Size, shape, charge distribution, spin, parity, binding energy. Semi – empirical mass formula, liquid drop model. Nature of nuclear force, Nuclear shell structure, Collective model, Interaction of charged particles and electromagnetic radiation with matter. Basic principles of Nuclear detectors – Ionization chamber, Proportional Counter, GM counter. Scintillation detector and Semi-conductor detectors. Radioactive decays, Nuclear reaction. Elementary idea of Fission, fusion and Nuclear reactors, Radiation safety. Elementary particles (quarks, baryons, mesons, leptons), quark model. Types of interaction between elementary particles, symmetry and conservation laws.

Note: Pattern of Question Paper
   1. Objective type paper
   2. Maximum Marks: 100
   3. Number of Questions: 100
   4. Duration of Paper: Two Hours
   5. All questions carry equal marks.
   6. There will be Negative Marking.