RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

SYLLABUS FOR COMPETITIVE EXAMINATION FOR THE POST OF ASSISTANT PROFESSOR IN PHYSICS FOR COLLEGE EDUCATION DEPARTMENT

PAPER-I

I: Electromagnetic Theory-

Electrostatics: Gauss's Law and its applications; Laplace and Poisson equations, boundary value problems; Magnetostatics: Biot-Savart law, Ampere's theorem, electromagnetic induction; Maxwell's equations in free space and linear isotropic media; boundary conditions on fields at interfaces; Scalar and vector potentials; Gauge invariance; Electromagnetic waves in free space, dielectrics, and conductors; Reflection and refraction, polarization, Fresnel's Law, interference, coherence, and diffraction; Dispersion relations in plasma; Lorentz invariance of Maxwell's equations; Dynamics of charged particles in static and uniform electromagnetic fields; Radiation from moving charges, dipoles and retarded potentials.

II: Electronics-

Physics of P-N junction, Diode as a circuit element, clipping and clamping, Rectification, Zener regulated power supply Transistor as a circuit element, CC, CB and CE configuration, Transistor as a switch, Feedback in amplifiers, Oscillators, FET, MOSFET and their applications, Operational amplifiers and its applications, inverting and non-inverting amplifiers, adder, integrator differentiator, wave form generator, multivibrators, comparator, Schmidt trigger. Boolean Algebra, Digital integrated circuits: Logic gates, NAND and NOR gates as building blocks, X-OR gate, Half and Full adder circuits, Karnaugh map, Flip – Flops, counters and registers.

III: Circuit Analysis-

Energy sources, Active and Passive elements, Kirchhoff's laws and their applications. Four terminal networks, Z, Y and h parameters, Thevenin's and Norton's Theorem, Maximum Power Transfer Theorem, Superposition Theorem, Reciprocity Theorem, Miller Theorem, T and PI Network, Mean and rms values in AC circuits. LR, CR and LCR circuits- series and parallel resonance. Quality factor. Principal of transformer.

IV: Atomic & Molecular Physics-

Quantum states of an electron in an atom; Electron spin; Stern-Gerlach experiment; Spectrum of Hydrogen, helium and alkali atoms; Relativistic corrections for energy levels of hydrogen; Hyperfine structure and isotopic shift; width of spectral lines; LS & JJ coupling; Zeeman, Paschen Back & Stark effect; X-ray spectroscopy; Electron spin resonance, Nuclear magnetic resonance, chemical shift; Rotational, vibrational, electronic, and Raman spectra of diatomic molecules; Frank–Condon principle and selection rules; Spontaneous and stimulated emission, Einstein A & B coefficients; Lasers, optical pumping, population inversion, rate equation.

V: Condensed Matter Physics-

Crystal structure, Miller Indices, Bravais lattices; Reciprocal lattice, diffraction and the structure factor; Bonding of solids; Elastic properties, phonons, lattice specific heat; Free electron theory and electronic specific heat; Einstein and Debye model, Response and relaxation phenomena; Drude model of electrical and thermal conductivity; Boltzman transport equation, Sommerfield theory of electrical conductivity, Mathiessen's rule, Hall effect and thermoelectric power; Origin of Atomic Magnetism, Diamagnetism, paramagnetism, and ferromagnetism; Curie, Langevin and Quantum theories of magnetism, Electron motion in a periodic potential, band theory of metals, Kronig-Penny model, Effective mass, concept of holes, insulators and semiconductors; Superconductivity, type– I and type- II superconductors, BCS theory, DC and AC Josephson Effects, Semiconductor: laws of mass action, Impurity conductivity, Recombination mechanism, Photo conductivity and Photo luminescence.

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