RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER
SYLLABUS FOR EXAMINATION FOR THE POST OF
LECTURER - PHYSICS,
(SCHOOL EDUCATION)
Paper– II

Part – I (Senior Secondary Standard)

1. **Physical world and measurement** - Fundamental and derived units, systems of units, dimensional formula and dimensional equations, Accuracy and error in measurement.

2. **Description of motion** - motion in one dimension, uniformly accelerated motion, motion with uniform velocity/Acceleration in two dimensions, motion of an object in three dimensions, relative velocity.

3. **Vectors** - Scalar and vector quantities, unit vector, addition and multiplication.


5. **Friction** - Types of friction, laws of friction, lubrication.


7. **Rotational motion** - Centre of mass, its motion, rotational motion, Torque, angular momentum, centripetal force, circular motion, moment of inertia, theorems of M.I., Rolling motion.


9. **Gravitation** - Universal law of gravitation, variation of g, orbital and escape velocity, planetary motion, Kepler's law.


11. **Surface tension** - Fluid pressure, Pascal's law, Archemedes principle, molecular theory of surface tension, Excess of pressure inside a drop and soap bubble, angle of contact, Capularity, Detergents.

12. **Liquids in motion** - Type of flow of liquid, Critical velocity, Coefficient of viscosity, Terminal velocity, Stoke's law, Reynold’s number, Bernoulli's theorem - its applications.


16. **Waves** - Type of waves, wave equation, speed of a progressive wave, superposition principle, beats, stationary waves and normal modes, Doppler's effect.

18. **Electrostatics** - Coulomb's law, electric field and potential due to a point charge and Dipole, concept of Dielectric, Gauss theorem - its applications, Electric lines of force, Force and torque experience by a dipole in uniform electric field, potential energy of a system of charges, equipotential surfaces.


20. **Current Electricity** - Ohm's Law, Temperature dependence of resistance, colour code of resistors, series and parallel combination of resistors, resistivity, primary and secondary cells and their combination in series and parallel, Kirchhoff's laws, wheat stone bridge and potentiometer - their applications, electrical energy and power.

21. **Magnetism and magnetic effect of current** - Natural and man made magnet, magnetic lines of force, Bar magnet, magnetism and gauss law, magnetic moment, Torque on a magnetic dipole, magnetic field, magnetic induction, magnetic intensity, permeability, susceptibility & Intensity of magnetisation - their relations. Curie Law, Hysterisis, B-H curve. Classification of magnetic materials. Magnetic force, motion in the magnetic field, Biot - Savarts law, magnetic field by a straight Conductor & Circular Current Carrying Coil, Ampere's Circuital law, Solenoid, Toroid, Moving Coil Galvanometer, Ammeter, Voltmeter.


25. **Photoelectric effect and matter waves** - Einstein's Photoelectric equation, Photocell, matter waves, Debroglie's hypothesis, Davison and Germer’s experiment.

26. **Nuclear Physics and Radioactivity** – Nucleus, size, Mass defect, Binding energy, Nuclear fission and fusion, Nuclear reactor, Radioactivity, laws of disintegration, α,β and γ decays.


**Part – II (Graduation Standard)**

1. **MECHANICS**: Inertial frames, Galilean transformation, Non-inertial frames, fictitious forces, rotating co-ordinate systems, Coriolis force and its applications, postulates of special theory of relativity, Lorentz transformations, relativistic addition of velocities, length contraction, time dilation, Variation of mass with velocity, mass energy relation.

   System of particles, concept of reduced mass, single stage and multistage rocket, Analysis of collision in centre of mass frame. Angular momentum of a system of particles, equation of motion of a rotating body, inertial coefficients, kinetic energy of rotation and idea of principles axes, Euler’s Equations.

   Elasticity, relation between elastic constants. Theory of bending of beams and Cantilever, Torsion of a cylinder, Bending moments and Shearing forces.
WAVES & OSCILLATIONS: Potential well and periodic oscillations. Damped harmonic oscillators, Power dissipation, Quality factor, Driven harmonic oscillator, Transient and steady state, Power absorption, Motion of two coupled oscillators, normal modes.

Waves in media, speed of longitudinal waves in a fluid, energy density and energy transmission in Waves, Group velocity and phase velocity, their measurements.

Noise and Music: The human ear and its responses: limits of human audibility, Intensity and loudness, bel and decibel, the musical scale. Temperament and musical instruments. The acoustics of halls, Reverberation period.

ELECTROMAGNETISM: Concept of multi poles, Electrostatic energy of uniformly charged sphere, classical radius of an electron. Screening of E field by a conductor.

Electric field in matter: atomic and molecular dipoles, dielectrics, polarisability, polarization vector, electric displacement, electrostatic energy of charge distribution in dielectric, Lorentz local field and Clausius-Mossotti equation. Electrostatic field – conductors in electric field, Boundary conditions for potential and field at dielectric surface, uniqueness theorem, Poisson’s and Laplace’s equations in Cartesian cylindrical and spherical polar coordinates, solutions of Laplace’s equations in Cartesian coordinates.

Maxwell’s equations (integral and differential form) and displacement current. E as an accelerating field: Electron gun, case of discharge tube, linear accelerator, E as deflecting field, CRO.

THERMODYNAMICS AND STATISTICAL PHYSICS: Maxwell velocity distribution, Transport Phenomenon: Mean free path, Coefficients of viscosity, thermal conductivity, diffusion and their interrelation. Clausius-Clapeyron equation, vapor pressure curve. Maxwell relations and their applications.

Production of low temperatures, Joule Thomson expansion and J.T. coefficients for ideal as well as van der Waals gas, Temperature inversion, Regenerative cooling, Cooling by adiabatic demagnetization, Liquid Helium, He-I and He-II, Super fluidity, Nernst heat theorem.

Phase space, Micro and Macro states thermodynamic probability, relation between entropy and thermodynamic probability. Specific heat capacity of solids, Bose Einstein statistics and its distribution function, Planck distribution function and radiation formula, Fermi Dirac statistics and its distribution function.

ELECTRONICS and CIRCUIT ANALYSIS: Four terminal networks: current voltage conventions, open, close and hybrid parameters of any four terminal network, Input, output and mutual independence for an active four terminal network. Various circuits theorems: Superposition, Thevenin, Norton, reciprocity, maximum power transfer Theorems.

Rectifiers: Half wave, full wave and Bridge rectifier, calculation of ripple factor, efficiency and regulation. Filters, Series inductor shunts capacitor, L section and π section filters. Voltage regulation and voltage stabilization by Zener diode.

Analysis of transistor amplifiers using hybrid parameters and its gain frequency response, basic idea of R-C coupled amplifiers.


Junction Field effect transistor (JFET), circuit symbols, biasing and volt-Ampere relations.


Lasers and Holography: Spontaneous and stimulated emission, density of states, Einstein’s A and B coefficients, Energy density of radiation as a result of stimulated emission and absorption, Condition for amplification, Population inversion, Methods of optical pumping, Energy level schemes of He-Ne and Ruby lasers, working of a laser source, Special features of a laser source and their origin.
QUANTUM MECHANICS AND SPECTROSCOPY: Failure of classical Physics, Uncertainty principle and its consequences, Application of uncertainty principle.

Schrodinger equation – time dependent and time independent form, Physical significance of the wave function, probability current density, operators in quantum mechanics, Expectation values of dynamical variables, postulates of quantum mechanics, eigen function and eigen value, degeneracy, commutation relations. Ehrenfest theorem.

Time independent Schrodinger equation and stationary state solution, particle in one dimensional box, extension of results for three dimensional case and degeneracy of levels. Potential step and rectangular potential barrier coefficient, square well potential problem. Bound State Problems - Particle in one dimensional infinite potential well and finite depth potential well, simple harmonic oscillator (one dimensional), Schrodinger equation for a spherically symmetric potential, Orbital angular momentum and its quantisation, spherical harmonics, energy levels of H-atom.


Particle and Radiation Detectors : Ionisation Chamber, Region of Multiplicative Operation, Proportion Counter, Geiger-Muller Counter, Scintillation counter, Cloud Chamber.


Superconductivity : Experimental Features of Superconductivity, The Isotope Effect, Special Features of Superconducting Materials, Flux Quantisation, BCS Theory of Superconductivity: Cooper Pairs, High Temperature Superconductors (Basic Ideas)

Part – III (Post Graduation Standard)


2. **Electricity and Magnetism**: Radiation from moving charge and radiation from dipole, concepts of wave guides, retarded potentials, Lienard-Wiechart potential, Bremsstrahlung and Synchrotron radiation, reaction force of e.m.w.


5. **Electronics:** Clipping and clamping circuits of operational amplifiers and its applications, inverting and non-inverting amplifiers, adder, integrator differentiator, Half and Full adder circuits, Flip-Flops, counters and registers.


Semiconductors statistics of pure and impure semi conductors, Electrical conductivity and its temperature dependence, Recombination mechanisms, Photo conductivity, NMR, ESR and Mossbauer effect.


**Part – IV (Educational Psychology, Pedagogy, Teaching Learning Material, Use of computers and Information Technology in Teaching Learning)**

1. Importance of Psychology in Teaching-Learning:
   - Learner,
   - Teacher,
   - Teaching-learning process,
   - School effectiveness.

2. Development of Learner:
   - Cognitive, Physical, Social, Emotional and Moral development patterns and characteristics among adolescent learner.

3. Teaching – Learning:
   - Concept, Behavioural, Cognitive and constructivist principles of learning and its implication for senior secondary students.
   - Learning characteristics of adolescent and its implication for teaching.

4. Managing Adolescent Learner:
   - Concept of mental health and adjustment problems.
   - Emotional Intelligence and its implication for mental health of adolescent.
   - Use of guidance techniques for nurturing mental health of adolescent.

5. Instructional Strategies for Adolescent Learner:
   - Communication skills and its use.
   - Preparation and use of teaching-learning material during teaching.
   - Different teaching approaches:
     - Teaching models- Advance organizer, Scientific enquiry, Information, processing, cooperative learning.
   - Constructivist principles based Teaching.

6. ICT Pedagogy Integration:
   - Concept of ICT.
   - Concept of hardware and software.
   - System approach to instruction.
   - Computer assisted learning.
   - Computer aided instruction.
   - Factors facilitating ICT pedagogy integration.
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<td>Educational Psychology, Pedagogy, Teaching Learning Material, Use of Computers and Information Technology in Teaching Learning</td>
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**Note:** 1 All the question in the Paper shall be Multiple Choice Type Question.

2 Negative marking shall be applicable in the evaluation of answers. For every wrong answer one-third of the marks prescribed for that particular question shall be deducted.

Explanation: Wrong answer shall mean an incorrect answer or multiple answer.

3 Duration of the paper shall be 3 Hours.

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