RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

SCHEME & SYLLABUS FOR THE POST OF ASSISTANT CONSERVATOR FOREST & FOREST RANGE OFFICER GRADE Ist COMPETITIVE EXAMINATION, 2018
FOREST DEPARTMENT

OPTIONAL SUBJECT - PHYSICS

1.   MECHANICS :
Laws of Motion, Friction, Work Energy and Power, 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, Centre of mass, concept of reduced mass, Analysis of collision in centre of mass frame. Angular momentum of a system of particles, Moment of Inertia, Theorem of Moment of Inertia, Rolling Motion.

Gravitation - Universal law of gravitation, variation of gravitional acceleration, orbital and escape velocity,

planetary motion, Kepler's Law.

2.   GENERAL PROPERTIES OF MATTER :
Elasticity - Hook's law, Young's modulus, bulk modulus and shear modulus of rigidity. Applications of elastic behaviour of matter. Relation between elastic constants. Theory of bending of beams and Cantilever, Torsion of a cylinder, Bending moments and Shearing forces.

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

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

3.   WAVES & OSCILLATIONS :
Oscillatory motion - Periodic motion, S.H.M. its equation, Kinetic and Potential Energies, simple pendulum, oscillation of a loaded spring.

Potential well and periodic oscillations. Damped harmonic oscillators, Power dissipation, Quality factor, Driven harmonic oscillator, Transient and steady state, Power absorption.

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

4. ELECTROMAGNETISM:

Electrostatics - Coulomb's law, electric field and potential due to a point charge and Dipole, Gauss theorem - its applications, Force and torque experienced by a dipole in uniform electric field, potential energy of a system of charges, equipotential surfaces. Electrostatic energy of uniformly charged sphere, classical radius of an electron, Capacitance **-** Capacity of an isolated spherical conductor, capacitor - principle, Parallel plate capacitors, effect of dielectric on capacitance, series and parallel combinations of Capacitors, Energy of a Capacitor.

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.

Current Electricity - Ohm's Law, resistivity and its temperature dependence, Kirchoff's laws, Wheat stone bridge and potentiometer - their applications, electrical energy and power.

Magnetic effect of current - Biot - Savarts law, magnetic field due to Straight Conductor carrying current & Circular Current, Carrying Coil, Ampere's Circuital law, Solenoid, Toroid.

Electromagnetic Induction & Alternating Current (ac) - Faraday's Law, Lenz's Law, Self Induction, Mutual Induction, Mean and rms value of ac, ac Circuit Containing resistance, Inductance and Capacitance, Series resonant Circuit, Q factor, Average power in ac circuits, Wattless Current, L C oscillations, transformer.

5. HEAT AND THERMODYNAMICS :

Concept of Heat and temperature, Temperature Scales, Thermal expansion of solid, liquid and gases, specific heat, change of state, latent heat, Thermal capacity, Zeroth & First law of thermodynamics, thermodynamic process, Second law of thermodynamics, Carnot engine. Concept of entropy.

Radiation - Thermal radiations, Perfect blackbody, Newton's law of cooling.

Kinetic theory of gases - Assumptions of Kinetic theory of gases, Pressure exerted by a gas, Law of equipartition of energy, Degrees of freedom, Specific heats of gases.

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.

6.   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, shunt 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.

Transistor biasing - stability factors, various types of bias circuits for thermal bias stability.

Boolean Algebra, Logic gates; OR,AND,NOT,NAND,NOR,XOR,XNOR.

7.   OPTICS :

Laws of reflection, Reflection by plane and curved mirrors, Laws of refraction, total internal, refraction - application, Lenses, Image formation by lenses, Dispersion by prism, Scattering of light.

Interference of light, coherence requirements of the sources, optical path retardations, lateral shift of fringes, thin films, Newton's ring. Michelson interferometer. Fabry Perot interferometer and etalon. Fresnel diffraction : Half periods zones, circular aperture, Circular disc, straight edge, Fraunhoffer diffraction : double slit, n slit, Plane diffraction grating, reflection grating, concave grating.

Polarisation of light, law of malus. Polarization by reflection and scattering.

8.   QUANTUM MECHANICS :

Photoelectric effect and Matter waves - Einstein's Photoelectric equation, matter waves. de-Broglie's hypothesis, Davison and Germer's experiment. 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).

9   NUCLEAR PHYSICS :
Nucleus, size, Mass defect, Binding energy, Nuclear forces, Nuclear Energy, Nuclear fission and fusion, Nuclear reactor, Radioactivity, laws of disintegration, α, β and γ decays.

Accelerators -Linear Accelerators, Cyclotron, Synchrocyclotron, Betatron : The Electromagneticm Induction Accelerator, Electron Synchrotron, Proton Synchrotron.

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

Elementary Particles : Classfication of Elementary Particles, Fundamental interactions, Unified approch (Basic Ideas), The conservation laws, Quarks (Basic Idea).

10   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.

Thermal Properties of the Solids : Various Theories of Lattice Specific Heat of Solids: The Einstein Model, Debye Model, Electronic Contribution of the internal Energy hence to the Specific Heat of Metals, Thermal Conductivity of the lattice. Band Theory of Solids : Wave Function in a Periodic Lattice and Bloch Theorem, Effective Mass, Momentum, Crystal Momentum.

Electrical Conductivity : Sommerfield Theory of Electrical Conductivity, Mathiessen's Rule, Thermal Conductivity and Wildemann-Franz's Law, The Hall Effect.

Note :- **Pattern of Question Paper**
     1. Objective type paper
     2. Maximum Marks : 200
     3. Number of Questions : 120
     4. Duration of Paper : Three Hours
     5. All questions carry equal marks.
     6. There will be Negative Marking.