Uchch Madhyamika Sikshak -Teacher Selection Test
Subject - Physics

Unit I- Units and Measurements - Need for measurement, systems of units, S.I. units, fundamental and derived units, measurement accuracy, significant figures, measurement- errors (numerical questions), Scalar and vector quantity, properties of vector, resolution of vectors in a plane, unit rector, zero vector, equal vector, vector algebra, dot and cross product of vectors, dimensional analysis, matrices and determinant, linear algebra, binomial theorem and its application.

Unit 2- Motion in a straight line- Frame of reference, position-time graph, Elementary concept of differentiation and integration for describing motion, speed and velocity, uniform and non-uniform motion, average speed, instantaneous velocity, relative velocity, uniformly accelerated motion, velocity-time graph.
Motion in plane- projectile motion, uniform circular motion.

Unit 3- Laws of motion - Inertia, concept of force, First law of motion, momentum and second law of motion, impulse, third law of motion. law of conservation of linear momentum, Equilibrium of concurrent forces, static and kinetic friction, laws of friction, sliding and rolling friction. Dynamic of uniform circular motion, centripetal force , examples of circular motion- vehicle on a level circular road, vehicle on a banked road.

Unit 4- Work Energy and Power- Work done by a constant force and a variable force, kinetic energy, work energy theorem, potential energy, potential energy of a spring, conservative forces, non-conservative forces, law of conservation of mechanical energy, motion in a vertical circle, elastic and inelastic collision in one and two dimensions.

Unit 5- Rigid body and rotational motion- Centre of mass of a two partial system, conservation of momentum and motion of Centre of mass, Centre of mass of simple geometrical object, moment of a force , torque, angular momentum, law of conservation of angular momentum, and its application, equilibrium of rigid body, rigid body rotation, equations of rotational motion, compression of linear and rotational motions, moment of inertia, radius of gyration, moment of inertia for simple geometrical objects, Parallel and perpendicular axis theorems

Unit 6- Gravitation- Kepler's laws of planetary motion, universal law of gravitation, acceleration due to gravity and it's variation with altitude and depth, gravitational potential energy , gravitational potential, escape velocity, orbital velocity of a satellite, geostationary satellite.

Unit 7- Properties of matter- Mechanical Properties of solids- Elasticity, stress-strain relationship, Hooke's law, Young's modulus, Bulk modulus, shear modulus of rigidity, Poisson's ratio, elastic energy.
Mechanical Properties of Fluids - Pressure, Pascal's law, hydraulic lift, effect of gravity on fluid pressure, viscosity, stroke's law, terminal velocity, stream -line and turbulent flow, critical velocity, Reynold number, Bernoulli's theorem and its application, surface energy, surface tension, angle of contact, access of pressure across a carved surface. (convex and concave) drops and bubbles, capillary rise.

Unit 8- Thermal properties of matters - Heat, temperature, thermal expansion of solids liquids and gases , anomalous expansion of water, specific heat capacity, C_p and C_v change of state and latent heat, heat transfer- conduction, convection and radiation, thermal conductivity, Newton's law of cooling, Black Body radiation, Wein's displacement law, Green house effect.
Thermodynamics -Thermal equilibrium and temperature, zeroth law of thermodynamics, heat work and internal energy, First law of thermodynamics mathematical form, isothermal, adiabatic and cyclic process, Second law of thermodynamics, reversible and irreversible process, heat engine, refrigerator.

Unit-9- Perfect gases and Kinetic theory of gases- Equation of state of a perfect gas, work done in compressing a gas, kinetic theory of gases - assumption, concept of pressure, Kinetic interpretation of temperature, root mean square speed of gas molecules, degrees of freedom, law of equi-partition of energy and application to specific heat capacities of gases, concept of mean free path, Avogadro's number.

Unit10- Oscillations and Waves- Periodic motion, time period, frequency, displacement as a function of time, periodic functions and their applications , simple harmonic motion(SHM) and its equation of motion, phase, Oscillations of a loaded spring- restoring force and force constant, Kinetic and potential energy in simple harmonic motion, simple pendulum- it's time period, concept- and properties of free, forced and damped oscillations, resonance,
Waves - Wave motion, transverse and longitudinal waves, speed of waves, displacement relation for a progressive waves, principle of superposition of waves, standing waves, reflection of waves, standing waves in strings and organ pipe, fundamental mode and harmonics, beats, Doppler's effect.

Unit 11 - Electric charge and fields- conductors and non-conductors, charging due to Induction, Basic properties of electric charge. Coulomb's law, force due to multiple charges, electric field, electric field lines, electric flux, electric dipole, electric dipole in uniform electric field, continuous change distribution, Gauss's law and its application,
Electric potential and capacitance- Electric potential -definition formula, electric potential due a point charge, potential due to multiple charges, potential due to electric dipole, equipotential surface, electric potential energy of system change, electric potential energy of single charge, of a system of two point charges and of electric dipole in external field, dielectric and electric polarization, capacitors, capacitance, combination of capacitors in series and in parallel (numerical questions) capacitance of a parallel plate capacitor, effect of dielectric medium on capacitance, energy stored in a capacitor, Van-de Graff generators.

Unit 12- Current electricity- Electric current, flow of electrons in metallic conductor, Drift velocity, mobility and their relation with electric current, resistivity, Ohm's law and its limitations, resistance of different materials and temperature dependence of resistance, electric energy and power, series and parallel combination of resistance, cell, electromotive force, internal resistance of cell, combination of cell in series and parallel, Kirchhoff's law, Wheatstone bridge, Meter bridge, potentiometer.

Unit 13 – Magnetic effect of current and Magnetism- Magnetic force and field, Lorentz force, moving charge in magnetic field, moving charge in a uniform magnetic and electric field, velocity selector, cyclotron, Biot-Savart law, direction of magnetic field, magnetic field on center and on axis of a current carrying loop, law of liner integration of ampere, solenoid, toroid, force on a current carrying conductor in a uniform magnetic field, force between two parallel current carrying conductors- define ampere, torque experience by a current loop in uniform magnetic field, current loop as a magmatic dipole and its magnetic dipole moment, moving coil galvanometer- its current sensitivity .

Magnetism and Matter- Bar magnet and their field , bar magnate as a solenoid, magnetic field intensity due to a magnetic dipole along its axis and perpendicular to its axis, torque on a magnetic dipole in a magnetic field, work done to rotating a magnet in uniform magnetic field, earth's magnetic field elements V, H, I, relation between them, Para, Dia and Ferro magnetic substance, effect of temperature on magnetic properties, comparison between electro- magnet and permanent magnet.

Unit 14- Electromagnetic Induction and Alternating current- Experiments of Faraday and Henry, Faraday's law of electromagnetic Induction, Lenz's law and energy conservation, eddy current, motional emf, self-induction, mutual induction, AC generator, Alternating current- peak value, rms value, reactance and impedances in AC circuit, difference between AC and DC, electric resonance in series and parallel LCR circuits, Q- factor, power in AC circuits, power factor, wattless current, choke-coil, transformers, energy losses in transformers, dynamo and dc motors.

Unit 15- Electro-magnetic waves and Wave optics - Displacement current and Maxwell's equation, characteristics of electro-magnetic waves, electromagnetic spectrum including elementary facts about its uses, visible light, earth atmosphere, nature of earth's atmosphere towards electromagnetic radiation,

Wave optics - Wave front and Huygens's principle, superposition of light, interference, Young's double slit experiment, fringe width, coherence sources and sustained interference of light, diffraction due to a single slit, width of center maxima, polarisation, Brewster's law, polaride.

Unit 16 - Ray Optics and optical instruments- Reflection of light, spherical mirror, mirror formula, refraction of light, total internal reflection and optical fiber, refraction at spherical surfaces, lenses, thin lens formula, lens maker's formula, magnification, power of a lens, combination of thin lenses in contact, refraction of light through a prism, dispersion, forming of rainbow,

Optical instruments- Microscope and astronomical telescope (reflecting and refracting) and their magnifying power.

Unit 17- Dual nature of radiation and Matter- Types of electron emission, photo electric effect, Lenard's observations, Einstein's photoelectric equation, primary Knowledge of Photon. De-Broglie relation, wave- partial duality, Davisson–Germer experiment, Schrodinger equation, uncertainty principle, solution of one-dimensional Schrodinger equation for a free particle, special theory of relativity.

Unit 18 Atom - Thomson atomic model, Rutherford experiment of alpha particles scattering, Rutherford's atomic model, Bohr's atomic model, radius of orbit according to Bohr's model and calculation of velocity and energy of electrons in it, line spectrum of hydrogen, , structure of hydrogen atom, L-S coupling, J-J coupling, Zeeman effect, Raman effect.

Unit 19- Nuclei - Composition and size of Nucleus, Proton, neutron, isotopes Isobars, number of Nucleons in unit volume, nuclear force, Mass energy relation, mass defect, binding energy per nucleon and its variation with mass number, radioactivity, alpha ,beta and gamma decay, law of radioactivity, half- life, average life, Q- factor in nuclear reactions, Nuclear fission and fusion, Nuclear Reactor, source of energy in stars.

Unit 20 - Semi Conductor electronics- Energy bands in Conductor non-conductors and semiconductor, intrinsic and extrinsic semiconductors'. P type and N-type semi-conductors, P-N Junction, depletion layer, I-V characteristics in forward and Reverse bias, P-N Junction diode as rectifier, photo- diode, Zener diode as a voltage regulator, super conductivity at high temperature- elementary idea, logic gets, A/D and D/A converter.

Note- Questions should be asked from P.G. level syllabus.