

Requirements for Entrance Examination

PHYSICS:

1. Recommended literature:

Any high school or introductory college physics textbook.

2. Contents:

SI - basic units, conversions of units. The nature of physical quantities; scalars and vectors, vector components; vector addition. Physical application of basic mathematical functions.

MECHANICS

Motion in one dimension; position and displacement, velocity and speed, acceleration. Equations of kinematics for motion with constant velocity and constant acceleration. Free-fall.

Motion in two dimensions; projectile motion; uniform circular motion, centripetal acceleration, centripetal force; satellites in circular orbits; apparent weightlessness and artificial gravity; Equations of kinematics and dynamics of motion in two dimensions

Newton's laws of motion (1st, 2nd, 3rd); the concepts of force and mass; weight and the gravitational force; Newton's law of universal gravitation;

Effect of force; impulse of force; moment of force; pressure. The impulse-momentum theorem. The principle of conservation of linear momentum. The effects of forces and torques on motion of rigid objects; lever

Work and energy; work done by a constant force; work done by variable force spring force; kinetic energy; gravitational potential energy; elastic energy. Conservation of energy; Power.

Mechanics of liquids; model of "ideal liquid"; pressure in liquid induced by the external force; Pascal's law and its application on pressure gauges; hydrostatic pressure; Archimedes' law; buoyant force; fluids in motion; the equation of continuity; Bernoulli's equation.

KINETIC THEORY OF GASES and THERMODYNAMICS

Measuring temperature; Celsius temperature scale; Kelvin temperature scale; Molecular model of an ideal gas; pressure; temperature and root-mean-square speed; the ideal gas law; translational kinetic energy ; processes under constant temperature, pressure or volume. Work done by an ideal gas. First law of thermodynamics: internal energy, heat, work; specific heat capacity;

MECHANICAL WAVE and ACOUSTICS

Ideal spring; pendulum; simple harmonic motion. The nature of mechanical waves; quantities of wave motion description: frequencies, period, amplitude; equations of motion; the nature of sound; speed of sound; sound intensity.

ELECTRICITY and MAGNETISM

Charged objects; electric force; Coulomb's law; the electric field; the electric potential energy; the voltage; electric current; electric resistance, Ohm's law and the simple circuit; branched electric circuit; Kirchhoff's laws; serial and parallel assembly of resistors;. Electric power; capacitor: capacity, arrangement of capacitors. Magnetic field: the force on a moving charge and a current in a magnetic field (Lorenz and Ampere force). Magnetic field produced by current. Faraday's law of electromagnetic induction: induced E_{mf} and induced current. Transformers. Electric oscillating circuit. Alternating current.

OPTICS

The nature of electromagnetic waves; electromagnetic spectrum - survey and properties.

Light as an electromagnetic wave; wave properties: diffraction, interference, polarization (Brewster angle). Double slit experiment, diffraction grating.

Geometric optics: reflection, refraction, total internal reflection. The formation of images by plane mirrors, converging and diverging lenses. The thin-lens equation. Dispersion of light.

The wave-particle duality: quantum properties of light; photoelectric phenomenon. Einstein's equation for photoelectric effect. The wave nature of matter: De Broglie wavelength of particle

ATOMIC and NUCLEAR PHYSICS

Structure of an atom: atomic nucleus, electron shell. Nuclear structure: mass defect of the nucleus, nuclear binding energy. Radioactivity: radioactive decay, alpha, beta and gamma particles. Nuclear reactions.

General requirements

Ability to perform simple numerical calculations related to solution of a given problem; knowledge of basic geometrical formulas; knowledge of basic physical constants.