

PHYSICS



Unit I: Units and Measurements**(Periods: 04)**

Need for measurement: Units of measurement; systems of units; SI units, fundamental and derived units. Significant figures.

Dimensions of physical quantities, Dimensional formulae and equations, dimensional analysis and its applications.

Unit II: Kinematics**(Periods: 26)**

Frame of reference, Motion in a straight line: speed and velocity. Uniform and non-uniform motion, instantaneous speed and velocity. Uniformly accelerated motion, velocity-time graph and position-time graph, relations for uniformly accelerated motion (graphical treatment).

Elementary concepts of differentiation and integration for describing motion.

Scalar and vector quantities: Position and displacement vectors, general vectors and notation, equality of vectors, multiplication of vectors by a real number; addition and subtraction of vectors.

Unit vectors, Resolution of a vector in a plane—rectangular components.

Scalar and vector products of vectors. Motion in a plane. Cases of uniform velocity and uniform acceleration—projectile motion, uniform circular motion.

Unit III: Laws of Motion**(Periods: 16)**

Intuitive concept of force. Inertia, Newton's first law of motion; momentum and Newton's second law of motion; impulse; Newton's third law of motion. Law of conservation of linear momentum and its applications.

Equilibrium of concurrent forces, common forces in mechanics, Static and kinetic friction, laws of friction, rolling friction, methods of reducing friction.

Dynamics of uniform circular motion: Centripetal force, examples of circular motion (vehicle on level circular road, vehicle on banked road).

Unit IV: Work, Energy and Power**(Periods: 16)**

Work done by a constant force and a variable force; kinetic energy, work-energy theorem, power. Notion of potential energy, potential energy of a spring, conservative forces; conservation of mechanical energy (kinetic and potential energies); non-conservative forces; motion in a vertical circle, elastic and inelastic collisions in one and two dimensions.

Unit V: Motion of System of Particles and Rigid Body**(Periods: 16)**

Centre of mass of a two-particle system, momentum conservation and motion of centre of mass. Centre of mass of rigid bodies.

Moment of a force (torque), angular momentum, conservation of angular momentum with some examples.

Equilibrium of rigid bodies, rigid body rotation and equation of rotational motion, comparison of linear and rotational motions; moment of inertia, radius of gyration, moment of inertia of some regular bodies about specific axes. (no derivation).



Unit VI: Gravitation

(Periods: 14)

Kepler's laws of planetary motion. The universal law of gravitation and gravitational constant. Acceleration due to gravity and its variation with altitude and depth.

Gravitational potential energy; gravitational potential, escape velocity, Earth satellites - orbital velocity and time period of a satellite, energy of an orbiting satellites.

Unit VII: Properties of Bulk Matter

(Periods: 26)

Stress-strain relationship, Hooke's law, stress-strain curve, Young's modulus, bulk modulus, shear modulus of rigidity, Poisson's ratio; elastic energy. Applications of elastic behavior of materials.

Pressure due to a fluid column; Pascal's law and its applications (hydraulic lift & hydraulic brakes).

Fluid Dynamics - Equation of continuity,

Viscosity: Stokes' law, terminal velocity, streamline and turbulent flow. Bernoulli's theorem and its applications.

Surface tension: Surface energy, angle of contact, excess of pressure, application of surface tension ideas to drops, bubbles and capillary rise.

Thermal properties of matter: Heat and temperature, ideal gas equation and absolute temperature, thermal expansion; thermal expansion of solids, liquids and gases. Specific heat capacity: C_p , C_v , calorimetry; change of state-latent heat.

Heat transfer-conduction and thermal conductivity, convection and radiation. Qualitative ideas of Black Body Radiation, Wein's displacement law, Stefan-Boltzmann's law and Newton's law of cooling.

Unit VIII: Thermodynamics

(Periods: 12)

Thermal equilibrium and definition of temperature (zeroth law of Thermodynamics). Heat, work and internal energy. First law of thermodynamics. Specific heat capacity, thermodynamic state variables and equation of state, thermodynamic processes- Isothermal and adiabatic processes.

Second law of thermodynamics: Reversible and irreversible processes. Carnot engine.

Unit IX: Behavior of Perfect Gas and Kinetic Theory

(Periods: 8)

Equation of state of a perfect gas.

Kinetic theory of gases: Assumptions, concept of pressure. Kinetic energy and temperature; *rms* speed of gas molecules; degrees of freedom, law of equipartition of energy (statement only) and application to specific heat capacities of gases and solids; concept of mean free path.

Unit X: Oscillations and Waves

(Periods: 22)

Periodic motion-period, frequency, displacement as a function of time. Periodic functions. Simple harmonic motion (SHM) and its equation; phase; oscillations of a spring-restoring force and force constant; energy in SHM-kinetic and potential energies; simple pendulum-derivation of expression for its time period.

Wave motion: Longitudinal and transverse waves, speed of wave motion. Displacement relation for a progressive wave. Principle of superposition of waves, reflection of waves, standing waves in strings and organ pipes, fundamental mode and harmonics. Beats.

Reference books:

1. A Text book of Physics Part-1 for class XI (Latest revised edition of NCERT text book)
2. A Text book of Physics Part-2 for class XI (Latest revised edition of NCERT text book)



CLASS XII (THEORY)

(Total Periods: 160)

Unit I: Electrostatics

(Periods: 32)

Electric charges and their basic properties. Coulomb's law—force between two point charges, forces between multiple charges; superposition principle and continuous charge distribution.

Electric field: electric field due to a point charge, electric field lines; electric dipole, electric field due to a dipole; torque on a dipole in a uniform electric field.

Electric flux, statement of Gauss's theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell (field inside and outside). Electric potential, potential difference, electric potential due to a point charge, a dipole and system of charges; equipotential surfaces, electrical potential energy of a system of charges and of electric dipole in an electrostatic field.

Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarisation, capacitors and capacitance, combination of capacitors in series and in parallel, capacitance of a parallel plate capacitor with and without dielectric medium between the plates, energy stored in a capacitor (no derivation).

Unit II: Current Electricity

(Periods: 20)

Electric current, flow of electric charges in a metallic conductor, drift velocity and mobility, and their relation with electric current; Ohm's law, electrical resistance, $V-I$ characteristics (linear and non-linear, electrical energy and power, electrical resistivity and conductivity, temperature dependence of resistance.

Internal resistance of a cell, potential difference and emf of a cell, combination of cells in series and in parallel.

Kirchhoff's laws and its simple applications. Wheatstone bridge

Unit III: Magnetic Effects of Current and Magnetism

(Periods: 26)

Concept of magnetic field, Oersted's experiment. Biot-Savart's law and its application to current carrying circular loop.

Ampere's law and its applications to infinitely long straight wire and solenoid. Force on a moving charge in uniform magnetic and electric fields.

Force on a current-carrying conductor in a uniform magnetic field. Force between two parallel current-carrying conductors—definition of ampere. Torque experienced by a current loop in a magnetic field; moving coil galvanometer—its current sensitivity and conversion to ammeter and voltmeter.

Current loop as a magnetic dipole and its magnetic dipole moment. Torque on a magnetic dipole (bar magnet) in a uniform magnetic field; bar magnet as an equivalent solenoid (only expression), magnetic field lines; dipole in a uniform magnetic field, Gauss's law in magnetism. Magnetization and magnetic intensity.

Dia-, para- and ferro - magnetic substances, with examples.



Unit IV: Electromagnetic Induction and Alternating Currents

(Periods: 20)

Electromagnetic induction; Faraday's law, induced emf and current; Lenz's Law, motional emf.

Self and mutual inductance. AC generator.

Alternating currents, peak and rms value of alternating current/voltage; AC applied to a resistor, an inductor and a capacitor, reactance and impedance; LCR series circuit, resonance; power in AC circuits, wattless current. Transformer.

Unit V: Electromagnetic Waves

(Periods: 4)

Need for displacement current. Electromagnetic waves and their characteristics (qualitative ideas only). Transverse nature of electromagnetic waves.

Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, x-rays, gamma rays) including elementary facts about their uses.

Unit VI: Optics

(Periods: 26)

Reflection of light, spherical mirrors, mirror formula. Refraction of light, total internal reflection and its applications, optical fibres, refraction at spherical surfaces, lenses, lens-maker's formula. Magnification, power of a lens, combination of thin lenses in contact. Refraction of light through a prism.

Optical instruments: Microscopes and astronomical telescopes (reflecting and refracting) and their magnifying powers.

Wave optics: Wavefront and Huygens' principle, Proof of laws of reflection and refraction using Huygens' principle.

Interference, Young's double hole experiment, coherent sources and sustained interference of light.

Diffraction due to a single slit,

Polarisation, plane polarized light; uses of Polaroids.

Unit VII: Dual Nature of Matter and Radiation

(Periods: 8)

Photoelectric effect, Hertz and Lenard's observations; Einstein's photoelectric equation—particle nature of light.

Matter waves – wave nature of particles, de Broglie relation.

Unit VIII: Atoms and Nuclei

(Periods: 12)

Alpha-particle scattering experiment; Rutherford's model of atom; Bohr model, energy levels, hydrogen spectrum. De Broglie explanation of Bohr's second postulate.

Composition and size of nucleus, atomic masses, isotopes, isobars; isotones, nuclear forces.

Mass-energy relation, mass defect; binding energy per nucleon and its variation with mass number.

Radioactivity (only types of radioactive decay). Nuclear fission and fusion.

Unit IX: Electronic Devices

(Periods: 12)

Energy bands in solids (qualitative ideas only), conductors, insulators and semiconductors; semiconductor: intrinsic and extrinsic semiconductors, semiconductor diode, I - V characteristics in forward and reverse bias, diode as a rectifier.

Reference books:

1. A Text book of Physics Part-1 for class XII (Latest revised edition of NCERT text book)
2. A Text book of Physics Part-2 for class XII (Latest revised edition of NCERT text book)

