

COMEDK UGET 2025

PHYSICS SYLLABUS Class-XI– (2023-24)

Unit I: Physical World and Measurement

Units and Measurements

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

Dimensions of physical quantities, dimensional analysis and its applications.

Unit II: Kinematics

Motion in a Straight Line

Frame of reference, Motion in a straight line: Elementary concepts of differentiation and integration for describing motion Uniform and non-uniform motion, average speed and instantaneous velocity, Uniformly accelerated motion, velocity time and position-time graphs. Relations for uniformly accelerated motion (graphical treatment).

Motion in a Plane

Scalar and vector quantities; Position and displacement vectors, general vectors and their notations; equality of vectors, multiplication of vectors by a real number; addition and subtraction of vectors. Unit vector; Resolution of a vector in a plane - rectangular components. Scalar and Vector product of vectors. Motion in a plane. Cases of uniform velocity and uniform acceleration-projectile motion. Uniform circular motion.

Unit III: Laws of Motion

Laws of Motion 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. Static and kinetic friction, laws of friction, rolling friction, lubrication.

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

Unit IV: Work, Energy and Power

Work, Energy and Power

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: 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

System of Particles and Rotational Motion

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

Centre of mass of a rigid body; centre of mass of a uniform rod.

Moment of a force, torque, angular momentum, laws of conservation of angular momentum and its applications.

Equilibrium of rigid bodies, rigid body rotation and equations of rotational motion, comparison of linear and rotational motions.

Moment of inertia, radius of gyration. Values of moments of inertia, for simple geometrical objects (no derivation).

Unit VI: Gravitation

Gravitation

Kepler's laws of planetary motion. The universal law of gravitation.

Acceleration due to gravity and its variation with altitude and depth.

Gravitational potential energy and gravitational potential. Escape velocity. Orbital velocity of a satellite.

Unit VII: Properties of Bulk Matter

Mechanical Properties of Solids

Elastic behavior, Stress-strain relationship, Hooke's law, Young's modulus, bulk modulus, shear modulus of rigidity, (qualitative idea only), Poisson's ratio; elastic energy.

Mechanical Properties of Fluids

Pressure due to a fluid column; Pascal's law and its applications. (hydraulic lift and hydraulic brakes), Effect of gravity on fluid pressure

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

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

Thermal Properties of Matter

Heat, temperature, thermal expansion; thermal expansion of solids, liquids and gases,

Anomalous expansion of water; specific heat capacity; C_p , C_v - calorimetry; change of state -latent heat capacity.

Heat transfer-conduction, convection and radiation, thermal conductivity, Qualitative ideas of Blackbody radiation, Wein's displacement Law, Stefan's law.

Unit VIII: Thermodynamics

Thermodynamics

Thermal equilibrium and definition of temperature (zeroth law of thermodynamics). Heat, work and internal energy. First law of thermodynamics.

Second law of thermodynamics: gaseous state of matter, change of condition of gaseous state - isothermal, adiabatic, reversible, irreversible, and cyclic processes

Unit IX: Behavior of Perfect Gases and Kinetic Theory of Gases

Kinetic Theory

Equation of state of a perfect gas, work done in compressing a gas.
Kinetic theory of gases - assumptions, concept of pressure. Kinetic interpretation
temperature; rms speed of gas molecules; degrees of freedom, law of equi-partition of energy (statement only) and application to specific heat capacities of gases; concept of mean free path, Avogadro's number.

Unit X: Oscillations and Waves

Oscillations

Periodic motion - time period, frequency, displacement as a function of time. Periodic functions and their application

Simple harmonic motion (S.H.M) and its equation; phase; oscillations of a loaded spring-restoring force and force constant; energy in S.H.M. Kinetic and potential energies; simple pendulum derivation of expression for its time period.

Waves

Wave motion. Transverse and longitudinal waves, speed of travelling wave. 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.

CLASS XII - (2024-25)

Unit I: Electrostatics

Electric Charges and Fields Electric Charges; Conservation of charge, 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 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).

Electrostatic Potential and Capacitance

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 two point 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, formulae only).

Unit II: Current Electricity

Current Electricity

Electric current, flow of electric charges in a metallic conductor, drift velocity, mobility and their relation with electric current; Ohm's law, 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, Wheatstone bridge.

Unit III: Magnetic Effects of Current and Magnetism

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

Ampere's law and its applications to infinitely long straight wire. Straight solenoid (only qualitative treatment), 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 uniform magnetic field; Current loop as a magnetic dipole and its magnetic dipole moment. Moving coil galvanometer-its current sensitivity. and conversion to ammeter and voltmeter

Magnetism and Matter

Bar magnet, bar magnet as an equivalent solenoid, (qualitative treatment only)Magnetic field intensity due to a magnetic dipole (bar magnet) along its axis and perpendicular to its axis. (qualitative treatment only), Torque on a magnetic dipole (bar magnet) in a uniform magnetic field; (qualitative treatment only), magnetic field lines;

Magnetic properties of materials-Para-, dia- and ferro – magnetic substances, with examples

Magnetization of materials, effect of temperature on magnetic properties.

Unit IV: Electromagnetic Induction and Alternating Currents

Electromagnetic Induction

Electromagnetic induction; Faraday's laws, induced EMF and current; Lenz's Law, Self and mutual induction.

Alternating Current

Alternating currents, peak and rms value of alternating current/voltage; reactance and impedance; LCR series circuit, (phasors only), resonance; power in AC circuits, wattless current.

AC generator and Transformer.

Unit V: Electromagnetic waves

Electromagnetic Waves

Basic idea of displacement current. Electromagnetic waves and their characteristics Transverse nature of electromagnetic waves. (Qualitative ideas only).

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

Unit VI: Optics

Ray Optics and Optical Instruments. **Ray Optics:** Reflection of light, spherical mirrors, mirror formula. Refraction of light, total internal reflection and optical fibres, 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.

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

Wave Optics

Wave optics: Wave front and Huygen's principle, reflection and refraction of plane wave at a plane surface using wave fronts. Proof of laws of reflection and refraction using Huygen's principle. Interference, Young's double slit experiment and expression for fringe width, (No derivation final expression only) coherent sources and sustained interference of light. Diffraction due to a single slit, width of central maximum, (qualitative treatment only).

Unit VII: Dual Nature of Matter and Radiation

Dual Nature of Radiation and Matter

Dual nature of radiation. Photoelectric effect, Hertz and Lenard's observations; Einstein's photoelectric equation-particle nature of light. Experimental study of photoelectric effect.

Matter waves-wave nature of particles, de Broglie relation

Unit VIII: Atoms & Nuclei

Atoms

Alpha-particle scattering experiment; Rutherford's model of atom; Bohr model, of hydrogen atom, Expression for radius of nth possible orbit, velocity and energy of electron in this orbit, hydrogen line spectra (qualitative treatment only).

Nuclei

Composition and size of nucleus, nuclear force

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

Unit IX: Electronic Devices

Semiconductor Electronics: Materials, Devices and Simple Circuits

Energy bands in solids conductors, insulator and semiconductors; (Qualitative ideas only) Intrinsic and extrinsic semiconductors- p and n type, p-n junction

Semiconductor diode– I-V characteristics in forward and reverse bias, application of junction diode - diode as a rectifier.