

SECTION – B: PHYSICS**UNIT - 1**

- 1. UNITS AND DIMENSIONS :**Units for fundamental and derived quantities; Systems of Units; SI system of units – rules for writing unit, derived units, multiple units and sub multiple units in SI system; Measurement for quantitative study, Accuracy and precision of measuring instruments; Errors due to external causes – constant type, systematic type and environmental type; Errors due to imperfections in experimental techniques/procedure/personal/observation – random errors, gross errors, absolute errors, mean absolute error and relative error percentage error; errors due to addition, subtraction, multiplication division and powers of observed quantities; Significant figures, Dimensions of physical quantities, dimensional formulae, applications and limitations of dimensional analysis.
- 2. ELEMENTS OF VECTORS:** Classification of physical quantities as vectors and scalars Geometrical representation of vectors – Addition and subtraction of vectors. Laws of addition of vectors – Equal and null vectors. Unit vectors – Unit vectors in Cartesian co-ordinate system – position vector and its magnitude. Parallelogram law of vectors – Expression for the resultant vector. Triangle law and polygon law of vectors – concept of relative velocity- application to relative motion of a boat in a river. Multiplication of a vector with a scalar – Scalar product with examples of work and energy – Vector product with examples of torque and angular momentum – Vector and Scalar product of unit vectors.

UNIT - 2

- 1. KINEMATICS :** Force and Inertia, Newton’s Law of Motion, Momentum, Impulse. Concept of resultant force, equilibrium of concurrent forces. Force of Friction, Types of friction, Types of Coefficient of friction. Angle of friction, Angle of repose. Motion of a body on a smooth and rough horizontal surface. Motion of a body on a smooth and rough inclined plane. Law of Conservation of Linear momentum and its applications. Motion in a straight line, speed and velocity. Uniform non uniform motion, average speed and instantaneous velocity, Uniformly accelerated motion. Position-time graph, Velocity-time graph, Acceleration-time graphs relation for uniformly accelerated motion. Motion of freely falling body, Vertically projected body. Projectile motion.
- 2. WORK-POWER-ENERGY:** Work done by a constant force and a variable force. Power, Types of Energies: Mechanical Energy, Potential energy and Kinetic energy. Work energy theorem. Conservative and Non-Conservative forces. Conservation of Mechanical energy. Potential energy of a spring.

UNIT - 3

- 1. CENTRE OF MASS:** Introduction, Centre of mass, difference between centre of mass and centre of gravity. Co-ordinates of centre of mass. Centre of mass of particles along a line, center of mass of system of particles in a plane, center of mass of system of particles in space. Centre of mass of rigid body with homogenous distribution of mass of a thin rod, circular ring, disc and sphere. Motion of centre of mass (Velocity and acceleration of center of mass) characteristics of centre of mass, laws of motion of the centre of mass, velocity and acceleration. Explosion - motion of the centre of mass of earth - moon system
- 2. COLLISIONS:** Introduction - Elastic and inelastic collisions. Collisions in one dimension (elastic and inelastic) body at rest, bodies moving in same direction and opposite directions. Co-efficient of restitution definition. Equation for height attained for freely falling body after number of rebounds on floor. Two dimensional collision.

UNIT - 4

- 1. ROTATORY MOTION:** Introduction, uniform circular motion, concept of angular displacement, angular velocity and angular acceleration, relation between linear velocity and angular velocity, centripetal acceleration and Centripetal force, torque, couple. Moment of Inertia: Perpendicular axis theorem. Parallel axis theorem. MI of a thin rod, uniform disc, rectangular lamina, solid and hollow spheres, circular ring and cylinder. Angular Momentum: Relation between angular momentum and torque, law of conservation of angular momentum with examples. Motion in vertical circle.

Rolling without slipping and toppling.

- 2. GRAVITATION:** Basic forces in nature; The Universal law of gravitation; Nature of gravity; Relation between Universal gravitational constant (G) and acceleration due to gravity(g); variation of "g" with altitude, depth, latitude and shape of earth; Limitations of Newton's third Law. Idea of inertial and non-inertial frames – Inertial and gravitational masses – Gravitational Potential and Gravitational Potential Energy. Escape velocity, orbital velocity and relation between them – Geo stationary Satellites, their uses.

UNIT – 5

- 1. ELASTICITY:** Elasticity & Plasticity – Stress and Strain – Hooke's Law, Moduli of elasticity (Y , n , K) – Poisson's ratio – definition and its limit; behaviour of wire under gradually increasing load – elastic fatigue, strain Energy.
- 2. SURFACE TENSION:** Surface tension – definition and applications, Molecular theory of surface tension, surface energy. Angle of contact, Capillarity Determination of surface tension by capillary rise method - theory and experiment. Effect of temperature on surface tension, Excess pressure in liquid drops and soap bubbles.
- 3. FLUID MECHANICS:** Introduction, Principle of Buoyancy, pressure due to fluid column. Pascal's Law and its applications. Stream line flow, Turbulent Flow, Reynolds number, Bernoulli's theorem. Applications- aerodynamic lift, motion of a spinning ball. Viscosity, coefficient of viscosity, effect of temperature on viscosity, Poiseuille's equation. Motion of objects through fluids, Stoke's law, terminal velocity.

UNIT - 6

- 1. THERMAL PROPERTIES OF MATTER:** Temperature and heat, measurement of temperature. Thermal expansion of solids, liquids and gases. Specific heat capacity, Colorimetry, change of state, latent heat, Triple point. Heat transfer, Conduction, Convection and Radiation. Black body radiation, Stefan's Law, Wien's Displacement Law, Newton's Law of Cooling.
- 2. THERMODYNAMICS:** Thermal Equilibrium, Zeroth Law of thermodynamics. Heat internal energy and work. First law of thermodynamics. Thermodynamic processes – Isothermal, Adiabatic, Isobaric, Isochoric, Quasi static processes. Second law of thermodynamics; Reversible and Irreversible processes. Carnot engine and refrigerator.
- 3. KINETIC THEORY OF GASES:** Gas Laws, ideal gas equation, Kinetic theory of gases – assumptions, pressure of an ideal gas. Kinetic interpretation of temperature, RMS speed of a gas molecule. Degree of Freedom, Law of equipartition of energy. Specific heats of gases. Mean free path, Avogadro's number.

UNIT – 7

- 1. SIMPLE HARMONIC MOTION:** Periodic motion – Period, Frequency, Displacement as a function of time. Periodic functions. Simple harmonic motion and its equations, phase. Oscillations of simple pendulum, Oscillations of a spring – Restoring force and force constant. Energy in S.H.M – Kinetic and potential energies. Free, forced and damped oscillations, resonance.
- 2. WAVE MOTION:** Longitudinal and transverse waves, Equation for a progressive wave, principle of superposition of waves, reflection of waves. Formation of stationary waves on a stretched string.
- 3. SOUND:** Characteristics of sound - speed of sound in solids, liquids and gases Standing waves in Organ Pipes - Open Pipes, Closed Pipes, Fundamental frequency, Overtones, Harmonics, Beats. Doppler Effect: Applications and limitations of Doppler Effect. Echoes.

UNIT – 8

- 1. RAY OPTICS AND OPTICAL INSTRUMENTS:** Reflection of light, Reflection of light at plane and spherical surfaces, mirror formula. Reflection of light, Snell's Law, Total internal reflection. Lens formula, Magnification power of a lens, Combination of lenses, Culling of a lens, Silvering of a lens. Refraction through a prism. Microscope and astronomical telescope and their magnifying powers.
- 2. WAVE OPTICS:** Huygens Principle and wavefront. Law of reflection and refraction using Huygens principle. Interference of light, Young's double slit experiment, Fringe width. Diffraction of light, Diffraction due to a single slit, Width of central maxima. Resolving power of a microscope and telescope. Polarization of light, Plane of polarized light. Brewster's law. Polaroids and their uses.

UNIT – 9

- 1. ELECTROSTATICS AND CAPACITORS:** Charges - conservation of charge and additive property of charges. Coulomb's Law: Permittivity of Free Space and Permittivity of Medium - Force between two point charges. Force due to multiple charges - Principle of Superposition with examples. Electric field - Electric lines of force, their properties - Electric intensity definition - Electric intensity due to isolated charge and due to -multiple charges. Electrostatic Potential - Definition of Electrostatic Potential in an electric field - Potential due to single charge - multiple charges - Electrostatic potential energy - Relation between electrostatic potential and electric intensity. Electric Flux Definition, Gauss' Law - Statement of Gauss' Law, Application of Gauss' Law to find electric intensity and electrostatic Potential due to continuous charge distribution of Infinite Long wire, Infinite Plane Sheet and Spherical Shell. Capacitance - Definition of Electrical Capacity of a Conductor - Capacitance - Dielectric constant - Definition of Condenser, its uses - Parallel plate Condenser - Formula for Capacitance of Parallel Plate Condenser, Dielectric - Dielectric Strength - Effect of dielectric on capacitance of capacitors. Capacitors in series and in parallel - derivation of the equivalent capacitance for the above cases. Energy stored in a Condenser - Effect of dielectric on Energy of Condenser - Types of capacitors - their uses.
- 2. CURRENT ELECTRICITY:** Electric current - Flow of Electric charges in a metallic conductor - Drift velocity and mobility - Relation between electric current and drift velocity. Ohm's Law: Ohmic and Non Ohmic elements with examples-conductance-specific resistance-variation of resistivity with temperature-variation of resistance with temperature - thermistors, Colour code for resistors. E.M.F. of Cell - Internal resistance and back E. M.F. - Difference between EMF of a Cell and potential difference. Electrical energy, Power definition of KW hr. Kirchhoffs laws: Statement of Kirchhoff's voltage law - Kirchhoff's current law - Application to Wheatstone bridge - condition for balancing - Meter bridge - Determination of resistance of a conductor using meter bridge. Principle of Potentiometer determination of internal resistance and E.M.F. of a cell using potentiometer. Series and parallel combination of cells - Derivation of equivalent EMF for the above cases.
- 3. CR CIRCUITS (DC ONLY):** Growth of charge in C-R series circuit. Decay of charge in C-R series circuit. Time constant of C-R circuit.

UNIT – 10

- 1. ELECTROMAGNETISM:** Biot-savart Law - Ampere Law - Magnetic field near a long straight wire and magnetic field at the center of a circular coil carrying current (with derivation) - Field on the axis of a circular coil carrying current (with expressions only) Tangent Galvanometer - principle and working - Definition of reduction factor - force on a moving charge in a magnetic field - force on a current carrying conductor in a magnetic field - force between two long straight parallel conductors

carrying current – definition of ampere – Fleming’s left hand rule-current loop as a magnetic dipole, force and torque on current loop in a uniform magnetic field – magnetic dipole moment of a revolving electron – principle , construction and working of a moving coil galvanometer –conversion of moving coil galvanometer into ammeter and voltmeter – comparison of M.C.G with T.G.

2. **MAGNETISM:** Magnetic moment, Magnetic moment of bar magnet. Magnetic induction on the axial and equatorial line of a bar magnet. Couple on a bar magnet in a magnetic field. Elements of Earth’s magnetism dip, declination. Dia, Para, Ferro magnetic substances.
3. **ELECTROMAGNETIC INDUCTION AND AC CIRCUITS:** Faraday’s Law, induced emf and induced current. Lenz’s Law, Fleming’s right hand rule. Self induction, Mutual induction, Motional emf.

Alternating currents. Peak, RMS and average values of AC and AV. Series L-R, C-R, L-C and L-C-R Circuit. Reactance, impedance. Resonance of L-C-R circuit. Quality factor, power in AC circuits, Transformers.

UNIT- 11

1. **DUAL NATURE OF MATTER AND RADIATION:** Dual nature of radiation. Photoelectric effect, Hertz’s and Lenard’s observation. Einstein’s photoelectric equation particle nature of light. Matter wave’s and de-Broglie’s theory, Davison-Germer experiment.
2. **ATOMS AND NUCLEI:** Rutherford’s alpha-particle scattering experiment. Bohr’s atomic model, Hydrogen spectrum, energy levels. Composition of nucleus, atomic mass unit, isotopes, isobars, isotones. Radio activity, Radioactive disintegration law α , β and γ decay. Mass defect, Binding energy, average binding energy. Binding energy curve. Mass energy relation. Nuclear fission and fusion.
3. **SEMI-CONDUCTOR DEVICES AND COMMUNICATION SYSTEMS:** Intrinsic and Extrinsic semiconductors (n and p type) Junction diode – p-n junction, depletion layer and barrier potential, forward and reverse bias – current voltage characteristics of junction diode – p-n diode as half wave and full wave rectifier, (only qualitative treatment) Zener diode as a voltage regulator – I-V characteristics of LED, photodiode, solar cell and Zener diode – Transistor – function of emitter, base and collector - p-n-p, n-p-n transistors – Biasing of transistors, current, voltage – Characteristics of transistor in CE configuration – Transistor as common emitter amplifier (qualitative treatment). Logic gates (OR, AND, NOT, NAND and NOR) – Communication systems; Elements of communication systems (block diagrams only) Bandwidth of signals (speech, TV and digital data) bandwidth of Transmission medium – Propagation of electromagnetic waves in the atmosphere, sky and space wave propagation – Modulation – Need for modulation.
