SYLLABUS

PHYSICS

Unit I: Physical World and Measurement

Need for measurement: Units of measurement, systems of units, SI units, fundamental and derived units. Length, mass, and time measurements; accuracy and precision of measuring instruments; errors in measurement; significant figures. dimensional analysis and its applications.

Unit II: Kinematics

Rate of reference. Motion in one, two, and three dimensions: Position-time graph, speed, and velocity. Uniform and non-uniform motion, average speed, and instantaneous velocity. Unifarmly accelerated motion, velocity-time, position-time graphs, relations for unifemty accelerated motion Vectors: Position and displacement vectors addition and subtraction of vectors. Relative velocity. scalar product of vectors, vector product of vectors. Unit vector: Resolution of a vector In a plane—rectangular components. Motion in a plane. Cases of uniform velocity and uniform acceleration projectile motion.

Unit III: Laws of Motion

Intuitive concept of force. Inertia, Newton's first law of motion; momentum, 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. Types of friction, laws of friction. Dynamics of uniform circular motion

Unit IV: 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: conservation of mechanical energy (kinetic and potential energies); non-conservative forces: elastic and inelastic collisions in one and two dimensions.

Unit V: Motion of System of Particles and Rigid Body

Center of mass of a two-particle system, momentum conservation, and center of mass motion. Center of mass of a rigid body; center of mass of an unformed rod; moment of a force, torque, angular momentum, conservation of angular momentum with some examples. Dynamics of rigid bodies, comparison of linear and rotational motions; moment of inertia, radius of gyration. Values of moments of inertia for geometrical objects. Parallel and perpendicular axis theorems and their applications.

Unit VI: Gravitation

Kepler's laws of planetary motion. The universal law of gravitation. Variation of acceleration due to gravity and with altitude, latitude, and depth. Gravitational potential energy; gravitational potential. Escape velocity. Orbital velocity of a satellite. Geostationary satellites.

Unit VII: Properties of Bulk Matter

Elastic behavior, stress-strain relationship, Hooke's law, modulus of elasticity. Pressure due to a fluid column; Pascal's law and its applications Viscosity, Stokes' law, terminal velocity, Reynolds' number, streamline, and turbulent flow. Bernoulli's theorem and its applications. Surface energy and surface tension: the application of surface tension ideas to drops, bubbles, and capillary rise. Heat, temperature, thermal expansion; specific heat—calorimetry; change of state latent heat. Heat transfer-conduction, convection and radiation, thermal conductivity, and Newton's law of cooling.

Unit VIII: Thermodynamics

Thermal equilibrium and definition of temperature (zeroth law of thermodynamics). eat, work, and internal energy. - First law of thermodynamics: Second law of thermodynamics: reversible and irreversible processes. Heat engines and refrigerators. Carnot cycle and Carnot's theorem. Equation of state of a perfect gas, work done on compressing a gas. Kinetic theory of gases, degrees of freedom, law of equipartition of energy, and application of specific heats of gases; concept of mean free path, Avogadro's number.

Unit IX: Oscillations and Waves

Periodic motion—period, frequency, displacement as a function of time. Periodic functions. Simple harmonic motion (S.H.M.) and its equation; phase; oscillations of a ring restoring force and force constant; energy In S.H.M., kinetic and potential energies; simple pendulum derivation resonance of expression for its time period; free, forced, and damped oscillations, resonance

Wave motion. Longitudinal and transverse waves, speed of wave motion, displacement. its 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, Doppler effect.

Unit X: Electrostatics

Electric Charges; Conservation of Charge, Coulomb's Law and Its Application, 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. Gauss's theorem and its applications Electric potential, potential difference, electric potential due to a dipole and system of charges; equipotential surfaces, electrical potential energy of a system with two point charges and of an electric dipole in an electrostatic field. or Conductors and insulators, free charges, and bound charges inside a conductor. Dielectrics and electric polarization, capacitors and capacitance, combination of capacitors, capacitance of a parallel plate capacitor with and without dielectric medium between the plates, energy stored in a capacitor. Van de Graaff generator.

Unit XI: Current Electricity

Electric current, flow of electric charges In a metallic conductor, drift velocity, 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. Carbon resistors, color code for carbon resistors; series and parallel combinations of resistors; 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 applications. Potentiometer—principle and its applications Thermal and chemical effect of current.

Unit XII: Magnetic Effects of Current and Magnetism

Biot-Savart law and its application Ampere's law and its applications to infinitely long straight wires, straight and toroidal solenoids. Lorentz's force. Cyclotron, synchrotron. Interaction of a current-carrying conductor with a magnetic field. Force between two parallel current-carrying conductors. Torque experienced by a current loop In a uniform magnetic field and its application; a current loop as a magnetic dipole and its magnetic dipole moment. Magnetic dipole moments a revolving electron. Magnetic field intensity due to a magnetic dipole (bar magnet) along its axis and perpendicular to its axis. Torque on a magnetic dipole (bar magnet) in a uniform magnetic field; bar magnet as an equivalent solenoid, magnetic field lines; Earth's magnetic field and magnetic elements. Paramagnetic and ferromagnetic substances, with examples. Electromagnets and factors affecting their strengths. Permanent magnets,

Unit XIII: Electromagnetic Induction and Alternating Currents

Electromagnetic induction; Faraday's law, induced emf and current; Lenz's Law, eddy currents, self and mutual inductance. Need for displacement current. Alternating currents and their measurement, reactance and impedance, LC oscillations, LCR series circuits, resonance, power in AC circuits, generators, motors, and transformers.

Unit XIV:: Optics

Reflection of light, spherical mirrors, mirror formula, Refraction of light, total Internal reflection and its applications, optical fibers, refraction at spherical surfaces, lenses, thin lens formula, lens-maker's formula. Magnification, power of a lens, combination of thin lenses In contact. Refraction and dispersion of light through a prism. Scattering of light and its application. Optical instruments: The human eye detects and its correction. Microscopes and astronomical telescopes and their magnifying powers. Wave optics: wavefront and Huygens principle, reflection, and refraction of plane waves at a plane surface using wavefronts. Proof of laws of reflection and refraction using Huygens' principle. Interference, Young's double-slit experiment, and expression for fringe width, coherent sources, and sustained Interference of light. Diffraction due to a single slit, width of the central maximum. Resolving power of microscopes and astronomical telescopes. Polarization, plane polarized light; Brewster's law, uses of plane polarized light, and Polaroids.

Unit XV: Modern Physics

Dual nature of radlatlon. Photoelectric effect, Hertz and Lenard's observations; Einstein's photoelectric equation-particle nature of light. Compton effect, diffraction of X-rays, Bragg's law, Hall effect. Matter waves: the wave nature of particles, de Broglie's relation. Davisson-Germer experiment. Alpha-particle scattering experiment; Rutherford's model of the atom; Bohr model, energy levels, hydrogen spectrum. Composition and size of nucleus, packing fraction and magnetic moment, atomic masses, isotopes, isobars, and isotones. Radioactivity: alpha, beta, and gamma particles/rays and their properties: radioactive decay law. Mass-energy relation, mass defect; binding energy per nucleon and its variation with mass number, liquid drop model of nucleus, nuclear fission, and fusion. critical inass chath resetion and flssion reaction, lonization chamber, Gelger counter and scintillation counter, Imeu: accelerator.

Unit XVI: Electronic Devices

Semiconductors: semiconductor diode I-V characteristics In forward and reverse bias, diode as a rectifier; I-V characteristics of LED, photodiode, solar cell, and Zener diode. Zener diode as a voltage regulator. Junction transistor, transistor action, characteristics of a transistor; transistor as an amplifier (common emitter configuration) and oscillator. Togic gates and its combination. Transistor as a switch.

Teaching Education and Methodology

1. Learning & Teaching
2. Language across the curriculum
3. Understanding discipline and subject
4. Gender school and Society
5. Pedagogy of a school subject
6. Knowledge and curriculum
7. Assessment for learning
8. Creating an inclusive school
9. Childhood and growing up
10. Drama and Art in Education