

7. भौतिकी

1. Physical World & Measurement -

- **Physics** : Scope and excitement, nature of physical laws, Physics, technology and society.
- **Need of measurement**: Unit of measurements, system of units, S.I. units, fundamental and derived units, length, mass and time measurements, accuracy and precision of measuring instruments, errors in measurement, significant figures, regular and irregular errors.
- Dimension of physical quantities, dimensional analysis and its applications.

2. Kinematics -

- Frame of reference, Motion in straight line, position time graph, speed and velocity, 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).
- 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, relative velocity.
- Unit Vector, resolution of a vector in a plane-rectangular components.
- Motion in a plane, cases of uniform velocity and uniform acceleration – projectile motion, uniform circular motion.

3. 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 level circular road, vehicle on banked road).

4. Work, Energy & Power -

- Scalar product of Vector 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 dimension.

5. Motion of System of Particles & Rigid Body -

- Centre of mass of two-particles system, momentum, conservation and centre of mass motion, centre of mass of a rigid body, centre of mass of circular ring, disc, rod and sphere.
- Vector product of vectors, momentum of a force, torque, angular momentum, conservation of angular momentum with some examples.
- Equilibrium of rigid bodies, rigid body rotation and equations of rotational motion, comparison of linear and rotational motion, moment of inertia, radius of gyration. Values of M.I. for simple geometrical objects (no derivation), statement of parallel and perpendicular axes theorems and their applications.

6. 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, gravitational potential, escape velocity, orbital velocity of satellite, geostationary satellites.

7. Properties of Bulk Matter -

- Elastic behavior, stress-strain relationship, Hooke's law, Young's modulus, Bulk modulus, Deformation, Shear modulus of rigidity.
- Pressure due to fluid column, Pascal's law and its applications / hydraulic lift and hydraulic brakes.
- Effect of gravity on fluid pressure.
- Viscosity, Stoke's law, terminal velocity, Reynold's number, Streamline and turbulent flow, Bernoulli's theorem and its applications.
- Surface energy and surface tension, angle of contact, application of surface tension, ideas of drops, bubbles and capillary rise.

8. Heat & Thermodynamics-

- Heat, temperature, thermal expansion, specific heat capacity, Calorimetry, change of state, latent heat.
- Heat transfer : conduction, convection and radiation, thermal conductivity, Newton's law of cooling. Thermal equilibrium and definition of temperature (Zeroth law of thermodynamics). Heat, work and internal energy.
- First law of thermodynamics.
- Second law of thermodynamics, Reversible and irreversible processes. Heat engines and refrigerators.

9. Behaviour of Perfect Gas & Kinetic Theory of Gases-

- Equation of state of a perfect gas, work done on compressing a 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, concept of mean free path, Avogadro's number.

10. Oscillations & Waves -

- Periodic motion : period, frequency, displacement as a function of time, periodic functions, simple harmonic motion (SHM) and its equation, phase, oscillation of a spring - restoring force and force constant energy in SHM – Kinetic and potential energies, simple pendulum – derivation of expression for its time period) free, forced and damped oscillations (Qualitative ideas only), resonance.
- Wave motion, Longitudinal and transverse waves, speed of wave motion, Displacement relation for a progressive waves, principle of superposition of waves, reflection of waves, standing waves in string and organ pipes, fundamental mode and harmonics, Beats, Doppler effect.

11. Electrostatics : electric charges and their conservation, Coulomb's law, force between two points 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; theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite planesheet and uniformly charged thin spherical shell (field inside and out side).
- Electric potential, potential difference, electric potential due to a point charge, dipole and system of charges, equi-potential 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. Dielectric and electric polarization capacitors and capacitance combination of capacitors in series and in parallel capacitance of a parallel plate capacitor with and without dielectric medium between plates, energy stored in a capacitor, Van de Graff generator.

12. Current Electricity : 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 characteristic (linear and non linear), electrical energy and power, electrical resistivity and conductivity, carbon resistors, colour code for carbon resistors, series & 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.

- Kirchoff's laws and simple applications, Wheatstone bridge, meter bridge.
- Potentiometer – principal and applications to measure potential difference and for comparing emf of two cells, measurement of internal resistance of a cell.

13. Magnetic Effects of Current and Magnetism : Concept of magnetic field, Oersted's experiment Biot-Sevart law and its application to current carrying circular loop.

- Ampere's law and its applications to infinitely long straight wire, straight and toroidal solenoids, force on a moving charge in uniform magnetic field, cyclotron.
- Force on a current carrying conductor in a uniform magnetic field. Force between two parallel current carrying conductor- definition of ampere, torque experienced by a current loop in a uniform magnetic field, moving coil galvanometers, its current sensitivity and conversion to ammeter and voltmeter voltage current loop as a magnetic dipole and its magnetic dipole moment. Magnetic dipole moment of 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, para, dia & Ferro- magnetic substances, with examples, electromagnets and factors affecting their strength, permanent magnets.

14. Electromagnetic Induction and Alternating Currents : Electromagnetic induction, Fraday's law, induced emf and current, Lenz's law, Eddy currents, self and mutual inductance.

- **Need for displacement current.**
- Alternating currents, peak and rms value of A_c /voltage, reactance and impedance, LC, oscillations (qualitative treatment only), LCR series circuit, resonance, power in AC circuits, wattless currents.
- AC generator and transformer.

15. Electromagnetic Waves : Electromagnetic waves and their characteristics (qualitative ideas only), Transverse nature of electromagnetic waves.

- Electromagnetic spectrum / radio waves, micro waves, infrared, visible, ultraviolet, x-ray, gamma rays including elementary facts about their uses.

- 16. Optics:** Reflection of light, spherical mirrors, mirror formula, refraction of light, total internal reflection and its application, 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 and dispersion of light through a prism, scattering of light - blue colour of the sky and reddish appearance of the sun at sunrise and sunset.
- **Optical instrument-** Human eye, image formation and accommodation, correction of eye defects (Myopia, hypermetropia, presbyopia and astigmatism) using lenses, microscopes and astronomical telescope (reflecting and refracting) and their magnifying powers.
 - **Wave Optics :** Wavefronts and Huygen's principle, reflection and refraction of plane wave at a plane surface using wavefronts. Proof of laws of reflection and refraction using Huygen's 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 central maximum. Resolving powers of microscopes and astronomical telescope, polarization, plane polarized light, Brewster's law, uses of plane polarized light and polaroids.
- 17. Dual nature of Matter and Radiation :** Photoelectric effect, Hertz and Lenard's observations. Einstein's photoelectric equation, particle nature of light.
- **Matter waves** – Wave nature of particles, de-Broglie relation, Davisson – Germer experiment.
- 18. Atoms & Nuclei :** Alpha – Particle scattering experiments, Rutherford model of atom, Bohr model, energy levels, hydrogen spectrum
- Composition and size of nucleus, atomic masses, isotopes, isobars, isotones, radioactivity – alpha, beta and gamma particle / rays and their properties, radioactive decay law. Mass energy relation, mass defect, binding energy per nucleon and its variation with mass number, nuclear fission and fusion.
- 19. 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, logic gates (OR, AND, NOT, NAND and NOR), Transistor as a switch, Boolean algebra (Elementary ideas only).
- 20. Communication Systems :** Elements of communication system (block diagram 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, need for modulation, production and detection of an amplitude – modulated wave.
- **Satellite communication system and its uses :** Elementary ideas of electronic gadget used in our daily life like – mobile, fax, modem, computer and internet, remote sensing etc.