

## PHYSICS ( CODE NO. 06 )

### 1. Mechanics & Properties of Matter

Dimensional analysis. Newton's laws of motion and their applications. Variable mass system, system of particles, centre of mass. Rotational dynamics : torque, angular momentum, kinetic energy, theorems of moment of inertia. Elastic and inelastic collisions. Central forces. Kepler's laws, gravitational field and potentials due to spherical bodies. Escape velocity and artificial satellite. Special theory of relativity and Lorentz transformations, Length Contraction , Time Dialation , Mass Energy Relation .

Elasticity, Hooke's law, elastic constants for an isotropic solid. Beams & cantilevers. Torsion of a cylinder. Elasticity of gases. Surface tension and surface energy, excess pressure across curved surfaces. Effect of impurities and temperature on surface tension. Streamline and turbulent motion, viscosity, Poiseuille's equation, applications of Bernoulli's equation and Stoke's law.

### 2. Heat and Thermodynamics

Kinetic theory of gases, equation of state of an ideal gas, mean free path, distribution of molecular speeds and energies. Transport phenomena, Andrew's experiments, Vander waal's equation and its applications. Thermal equilibrium and temperature. Laws of thermodynamics, Joule - Kelvin effect and its applications. Carnot engine. Entropy, Clausius

Clapeyron equation and its applications. Thermodynamic Potential, Black body radiations, Stefan Boltzmann law, Kirchoff's laws, Wien, Rayleigh - Jean's and Planck's radiation Law.

### 3. Oscillations and Waves

Simple harmonic motion; Lissajous figures, Damped and forced oscillations, resonance. Phase and group velocities progressive and stationary waves. Beats, Vibration in string and air columns. Ultrasonic waves and their applications, Musical Scale and acoustics of buildings.

#### **4. Optics**

Cardinal points of an optical system. Chromatic and spherical aberration. Achromatic combination of lenses. Optical instruments, eyepieces.

Interference of light, Young's double slit experiment, Newton's rings. Interference by thin films. Fresnel diffraction : half period zones and zone plate. Fraunhofer diffraction, diffraction at N parallel slits, intensity distribution, plane transmission grating, resolution of images, Rayleigh's criterion, resolving power of telescope and microscope. Polarisation, Double refraction and optical rotation, optical activity and its applications. Characteristics of laser light, spatial coherence. Application of laser beams.

#### **5. Electricity and Magnetism**

Gauss law and its applications, electric potential. Parallel plate capacitor. Dielectric polarization. Force per unit area on the surface of a charged conductor. Growth and decay of current in LR and CR circuit, Biot & Savart's Law, Lorentz's force, force on a straight current carrying conductor in magnetic field. Torque on a current loop. Faraday's laws of electromagnetic induction, Lenz's law, self and mutual induction, transformers, A.C. circuit, series and parallel resonance, Q-factor. Maxwell's Equations , Electromagnetic waves, energy transport and Poynting vector.

Magnetism : Magnetic susceptibility dia, para and ferromagnetism Hysteresis.

#### **6. Electronics**

Intrinsic & extrinsic semiconductors, junction diode, Zener Diode , Tunnel Diode , Schottky Diode, Light Emitting Diode, transistors - different configurations & application as an amplifier. Binary numbers, Logic Gates and Truth Tables.

#### **7. Atomic & Nuclear Physics**

Bohr's Theory of hydrogen atom. Photoelectric effect. X-ray spectrum. Wave nature of matter, de Broglie wavelength. Heisenberg Uncertainty Principle , Natural and artificial radio activity, binding energy of nuclei, nuclear fission and fusion. Elementary Particles.