

PHYSICS

General:

Units and dimensions, dimensional analysis; least count, significant figures; Methods of measurement and error analysis for physical quantities pertaining to the following experiments: Experiments based on using Vernier calipers and screw gauge (micrometer), Determination of g using simple pendulum, Young's modulus by Searle's method, Specific heat of a liquid using calorimeter, focal length of a concave mirror and a convex lens using $u-v$ method, Speed of sound using resonance column, Verification of Ohm's law using voltmeter and ammeter, and specific resistance of the material of a wire using meter bridge and post office box.

Mechanics:

Kinematics in one and two dimensions (Cartesian coordinates only), projectiles: Uniform circular motion; Relative velocity. Newton's laws of motion: Inertial and uniformly accelerated frames of reference: Static and dynamic friction: Kinetic and potential energy; Work and power; Conservation of linear momentum and mechanical energy. Systems of particles: Centre of mass and its motion; Impulse; Elastic and inelastic collisions. Law of gravitation: Gravitational potential and field; Acceleration due to gravity; Motion of planets and satellites in circular orbits; Escape velocity. Rigid body, moment of inertia, parallel and perpendicular axes theorems, moment of inertia of uniform bodies with simple geometrical shapes; Angular momentum; Torque; Conservation of angular momentum; Dynamics of rigid bodies with fixed axis of

rotation; Rolling without slipping of rings, cylinders and spheres;
Equilibrium of rigid bodies; Collision of point masses with rigid bodies.

Linear and angular simple harmonic motions.

Hooke's law, Young's modulus Pressure in a fluid; Pascal's law;
Buoyancy; Surface energy and surface tension, capillary rise; Viscosity
(Poiseuille's equation excluded), Stoke's law; Terminal velocity,
Streamline flow, equation of continuity, Bernoulli's theorem and its
applications. Wave motion (plane waves only), longitudinal and
transverse waves, superposition of waves; Progressive and stationary
waves; Vibration of strings and air columns; Resonance; Beats; Speed of
sound in gases; Doppler effect (in sound). Thermal physics Thermal
expansion of solids, liquids and gases; Calorimetry, latent heat; Heat
conduction in one dimension; Elementary concepts of convection and
radiation; Newton's law of cooling; Ideal gas laws; Specific heats (C_v and
 C_p for monatomic and diatomic gases); Isothermal and adiabatic
processes, bulk modulus of gases; Equivalence of heat and work; First
law of thermodynamics and its applications (only for ideal gases);
Blackbody radiation: absorptive and emissive powers; Kirchhoff's law;
Wien's displacement law, Stefan's law. Electricity and magnetism
Coulomb's law; Electric field and potential; Electrical potential energy of
a system of point charges and of electrical dipoles in a uniform
electrostatic field; Electric field lines; Flux of electric field; Gauss's law
and its application in simple cases, such as, to find field due to infinitely

long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell. Capacitance; Parallel plate capacitor with and without dielectrics; Capacitors in series and parallel; Energy stored in a capacitor. Electric current; Ohm's law; Series and parallel arrangements of resistances and cells; Kirchhoff's laws and simple applications; Heating effect of current. Biot–Savart's law and Ampere's law; Magnetic field near a current-carrying straight wire, along the axis of a circular coil and inside a long straight solenoid; Force on a moving charge and on a current-carrying wire in a uniform magnetic field. Magnetic moment of a current loop; Effect of a uniform magnetic field on a current loop; Moving coil galvanometer, voltmeter, ammeter and their conversions. Electromagnetic induction: Faraday's law, Lenz's law; Self and mutual inductance; RC, LR and LC circuits with d.c. and a.c. sources. Optics Rectilinear propagation of light; Reflection and refraction at plane and spherical surfaces; Total internal reflection; Deviation and dispersion of light by a prism; Thin lenses; Combinations of mirrors and thin lenses; Magnification. Wave nature of light: Huygen's principle, interference limited to Young's double-slit experiment. Modern physics Atomic nucleus; α , β and γ radiations; Law of radioactive decay; Decay constant; Half-life and mean life; Binding energy and its calculation; Fission and fusion processes; Energy calculation in these processes. Photoelectric effect; Bohr's theory of hydrogen-like atoms; Characteristic and continuous X-rays, Moseley's law; de Broglie wavelength of matter waves.