

Physics & Mathematics

Physics

Topics covered:

Measures

Direct and indirect measures, fundamental and derived quantities, physical dimensions of quantities, knowledge of the metric system and the CGS System of Units, Technical (or practical) (ST) and International System (SI) units of measurement (names and relationships between fundamental and derived units), multiples and sub-multiples (names and values).

Kinematics

Kinematic quantities, various types of motion with particular regard to uniform and uniformly accelerating rectilinear motion; uniform circular motion; harmonic motion (for all motions: definition and relationships between quantities).

Dynamics

Vectors and vector operations. Forces, moments of forces about a point. Moment of a force couple. Vector composition of forces. Definition of mass and weight. Acceleration due to gravity. Density and specific gravity. The law of universal gravitation, 1st, 2nd and 3rd laws of motion. Work, kinetic energy, potential energy. Principle of conservation of energy. Impulse and momentum. Principle of conservation of momentum.

Fluid mechanics

Pressure, and its unit of measure (not only in the SI system). Archimedes' Principle. Pascal's principle. Stevino's law.

Thermodynamics

Thermometry and calorimetry. Thermal capacity and specific heat capacity. Modes of heat propagation. Changes of state and latent heats. Ideal Gas Laws. First and second laws of thermodynamics.

Electrostatic and electrodynamics

Coulomb's law. Electric field and potential. Dielectric constant. Capacitors. Capacitors in series and in parallel. Direct current. Ohm's Law. Kirchhoff's Principles. Electrical resistance and resistivity, electrical resistances in series and in parallel. Work, Power, Joule effect. Generators. Electromagnetic induction and alternating currents. Effects of electrical currents (thermal, chemical and magnetic).

Mathematics

Topics covered:

Algebra and numerical sets

Natural numbers, integers, rational and real numbers. Sorting and comparison: scales and scientific notation. Operations and their properties. Proportions and percentages. Powers with integer and rational exponents, and their properties. Roots and their properties. Logarithms (base 10 and base e) and their properties. Elements of combinatorics. Algebraic and polynomial expressions. Major products and n^{th} power of binomial expansions, factorisation of polynomials. Algebraic fractions. Algebraic equations and inequalities of the first and second order. Systems of equations.

Functions

Basic concepts of functions and their graphical representations (domain, codomain, sign, continuity, maxima and minima, increasing and decreasing, etc.). Elementary functions: whole and fractional algebraic functions; exponential, logarithmic, and trigonometric functions. Composite and inverse functions. Trigonometric equations and inequalities.

Geometry

Polygons and their properties. Circle and circumference. Measurements of lengths, surfaces and volumes. Isometries, similarities and equivalences in the plane. Geometric loci. Measurement of angles in degrees and radians. Sine, cosine, tangent of an angle and their significant values. Trigonometric formulas. Solving triangles. Cartesian reference system in a plane. Distance between two points and the midpoint of a segment. Straight line equation. Conditions for parallel and perpendicular lines. Distance of a point to a line. Equation of the circle, the parabola, the hyperbola, the ellipse and their representation in the Cartesian plane. Pythagoras' theorem. Euclid's first and second theorems.

Probability and statistics

Frequency distributions and their graphical representations. Concept of random experiments and events. Probability and frequency.