(without proof) and their geometric interpretation. **Applications of derivatives -**Applications of derivatives: rate of change of bodies, increasing/decreasing functions, tangents and normal, use of derivatives in approximation, maxima and minima (first derivative test motivated geometrically and second derivative test given as a provable tool). Simple problems (that illustrate basic principles and understanding of the subject as well as real-life situations). **Integrals -** Integration as inverse process of differentiation. Integration of a variety of functions by substitution, by partial fractions and by parts, Definite integrals as a limit of a sum, Fundamental Theorem of Calculus (without proof). Basic properties of definite integrals and evaluation of definite integrals. **Applications of the integrals-**Applications in finding the area under simple curves, especially lines, circles/ parabolas/ellipses (in standard form only), Area between any of the two above said curves (the region should be clearly identifiable). **Differential equations -**Definition, order and degree, general and particular solutions of a differential equation. Formation of differential equation whose general solution is given.

Unit-F: Mathematical reasoning (5 questions)

Mathematically acceptable statements. Connecting words/ phrases - consolidating the understanding of "if and only if (necessary and sufficient) condition", "implies", "and/or", "implied by", "and", "or", "there exists" and their use through variety of examples related to real life and Mathematics. Validating the statements involving the connecting words, difference among contradiction, converse and contrapositive. **Linear programming-** Introduction, related terminology such as constraints, objective function, optimization, different types of linear programming (L.P.) problems, mathematical formulation of L.P. problems, graphical method of solution for problems in two variables, feasible and infeasible regions (bounded or unbounded), feasible and infeasible solutions, optimal feasible solutions (up to three non-trivial constraints).

Unit-G: Statistics and probability (5 Questions)

Statistics -Measures of dispersion: range, mean deviation (Quartile deviation and mean deviation-mean, median, mode) variance and standard deviation of ungrouped/grouped data. Analysis of frequency distributions with equal means but different variances. Probability - Random experiments; outcomes, sample spaces (set representation). Events- algebra of events. Occurrence of events, 'not', 'and' and 'or' events, exhaustive events, mutually exclusive events, Axiomatic (set theoretic) probability, connections with other theories addition and subtraction of probability of occurrence of at least one event. Probability of an event, probability of 'not', 'and' and 'or' events. Conditional probability, multiplication theorem on probability, independent events, total probability, Bayes' theorem, Random variable and its probability distribution, mean and variance of random variable. Repeated independent (Bernoulli) trials and Binomial distribution.

Unit-H: Trigonometric functions (5 Questions)

Positive and negative angles. Measuring angles in radians and in degrees and conversion from one measure to another. Definition of trigonometric functions with the help of unit circle. Truth of the identity $\sin 2x + \cos 2x = 1$, for all x. Signs of trigonometric functions. Domain and range of trigonometric functions and their graphs. Expressing $\sin(x \pm y)$ and $\cos(x \pm y)$ in terms of $\sin x$, $\sin y$, $\cos x$ & $\cos y$ and their simple applications. Identities related to sin2x, cos2x, tan2x, sing3x, trigonometric equations of the type $\sin y = \sin a$, $\cos y = \cos a$ and $\tan y = \tan a$. **Inverse trigonometric functions -** Definition, range, domain, principal value branch. Graphs of inverse trigonometric functions. Elementary properties of inverse trigonometric functions.

PHYSICS

Unit-A (10 Questions)

Physical world- Physics-scope and Expansion; nature of physical laws; Physics, technology

and society.

Units and measurements: Need for measurement, Units of measurement, systems of units; SI units- fundamental, merits of S-I unit, Rules to write name and symbol for units in S.I. system and derived units. Length, mass and time measurements, least count of Vernier Calipers and screw gauge. accuracy and precision of measuring instruments; errors in measurement; systemic, random, gross error, combination of errors, significant figures. Dimensions of physical quantities, dimensional analysis and its applications. Use of dimensional equations and limitations of dimensional equation.

Kinematics- Motion in a straight line- Frame of reference, Motion in a straight line: Position-time graph, speed and velocity. Elementary concepts of differentiation and integration for describing motion, uniform and non- uniform motion, average speed and instantaneous velocity, uniformly accelerated motion, velocity - time and position-time graphs. Relations for uniformly accelerated motion. **Motion in plane-**Scalar and vector quantities; position and displacement vectors, representation of vector, one dimensional, two dimensional and three-dimensional vectors in Cartesian coordinate system, combination of vectors. General vectors and their notations; 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, Scalar and Vector product of vectors. Differential and integer calculus and their trigonometry means, logarithm and its uses. Motion in a plane, cases of uniform velocity and uniform acceleration- uniform circular motion. **Dynamics –** Frame reference Concept of rest and motion, type of motion, distance and displacement, speed and velocity (average and instantaneous), acceleration, (average and instantaneous), displacement and time, velocity and time graph study, equation for motion for uniform accelerated motion, relative motion. Two Dimensional and three-dimensional motion and its example, displacement, velocity and acceleration of particle in two-dimensional motion and their representation. Projectile motion, path of projectile motion, time of flight of a projectile, maximum height and horizontal projectile. Example of three-dimensional motion.

Laws of motion- Intuitive concept of force, Inertia, Inertia and Newton's first law of motion; momentum and Newton's second law of motion, impulse and impulse-momentum theorem, Newton's third law of motion. Law of conservation of linear momentum and its applications. System with variable mass, motion of a rocket, solution of problem in mechanics by concurrent force and force diagram. Friction, type of friction and its law. Equilibrium of concurrent forces, Static and kinetic friction, laws of friction, rolling friction, lubrication. **Dynamics of uniform circular motion:** Circular motion in horizontal and vertical plane. Centripetal force, examples of circular motion (vehicle on a level circular road, vehicle on a banked road). Motion on inclined planes, inertial and Non-inertial frames of references.

Work, energy and power- Work done by a constant force and a variable force; energy and its type: kinetic and potential energy, work-energy theorem, power. Notion of potential energy, potential energy of a spring, conservative forces: conservation of mechanical energy (kinetic and potential energies); conservative and non-conservative forces: motion in a vertical circle; elastic and inelastic collisions in one and two dimensions. power.

System of particles and rotational motion- Centre of mass of a two-particle system, momentum conservation and centre of mass motion. Centre of mass of a rigid body; centre of mass of a uniform rod. Moment of a force, torque, angular momentum, law of conservation of angular momentum and its applications. Equilibrium of rigid bodies, rigid body rotation and equations of rotational motion, comparison of linear and rotational motions. Moment of inertia, theorem of moment of inertia, moment of inertia of circular ring, circular disc, solid cylinder, solid sphere, hollow sphere, Solid sphere, rod, force or torque, angular momentum, relation between torque and angular momentum, relation between torque, moment of inertia and angular acceleration. Radius of gyration, values of moments of inertia for simple geometrical objects (no derivation). Statement of parallel and perpendicular axes theorems

and their applications. Angular velocity, angular acceleration, angular displacement relation between linear and angular acceleration, rolling motion inclined plane, law of conservation of angular momentum.

Unit-B **(10 Questions)**

Gravitation- Kepler's laws of planetary motion, universal law of gravitation. Gravitational field, Acceleration due to gravity and its variation with altitude and depth. Gravitational potential energy and gravitational potential, escape velocity, orbital velocity of a satellite, Geo-stationary satellites. Projection velocity, Gravitational field & its intensity, variation in acceleration due to gravity with shape of earth & its rotation polar satellite, Weightlessness, Orbital Energy. Orbital velocity of satellite, Revolution period, Achievement of India in space.

Properties of bulk matter: Mechanical properties of solids: Elastic behavior, Stress-strain relationship, Hooke's law, Young's modulus, bulk modulus, shear modulus of rigidity, Poisson's ratio; elastic energy. Determination of young's modulus of elasticity by Searl's method. **Mechanical properties of fluids-** Pressure due to a fluid column; Pascal's law and its applications (hydraulic lift and hydraulic brakes), effect of gravity on fluid pressure, Atmospheric pressure, **Viscosity**-Stokes' law, terminal velocity, viscosity coefficient, velocity gradient, Stocks Law, Terminal velocity, streamline and turbulent flow, critical velocity, Bernoulli's theorem and its applications, Reynold's number, equation of continuity, Different energy of flowing liquid, Surface energy and surface tension, angle of contact, excess of pressure across a curved surface, application of surface tension ideas to drops, bubbles and capillary rise, Angle of contact, Cohesive and adhesive forced. **Thermal properties of matter-** Heat, temperature, thermal expansion; thermal expansion of solids, liquids and gases, anomalous expansion of water; specific heat capacity; Cp, Cv - calorimetry; change of state - latent heat capacity. Heat transfer-conduction, convection and radiation, thermal conductivity, qualitative ideas of blackbody radiation: Absorption and emissive power, Newton's law of cooling, Wein's displacement Law, Stefan's law, Greenhouse effect. Calculation of specific heat of liquid by the help of colorimeter.

Thermodynamics- Thermal equilibrium and definition of temperature (zeroth law of thermodynamics), mechanical equivalent of heat, heat, work and internal energy. Different thermodynamic Processes and work. First law of thermodynamics, isothermal and adiabatic processes. Second law of thermodynamics: reversible and irreversible processes, Heat engine and Refrigerator. Carnot Engine and its efficiency,

Behavior of perfect gases and kinetic theory of gases- Kinetic theory of gases - assumptions, concept of pressure. Kinetic interpretation of temperature; rms speed of gas molecules; degrees of freedom, law of equi-partition of energy (statement only) and application to specific heat capacities of gases; concept of mean free path, Avogadro's number.

Mechanical Waves and ray optics: oscillations and waves- Periodic motion- time period, frequency, displacement as a function of time, periodic functions. Simple harmonic motion (S.H.M) and its equation; phase; oscillations of a loaded spring- restoring force and force constant; energy in S.H.M. Kinetic and potential energies; simple pendulum derivation of expression for its time period. Displacement velocity and acceleration for SHM and their graphical representation. Kinetic energy of SHO, graphical representation and energy conservation, example of simple SHM, loaded spring, Simple pendulum, calculation of values of gravitational by simple pendulum, combination of springs, Free, forced and damped oscillations (qualitative ideas only), resonance. **Wave motion-** Transverse and longitudinal waves, speed of wave motion, displacement relation for a progressive wave, principle of superposition of waves, reflection of waves, standing waves in strings and organ pipes, Wave velocity, Relation between amplitude and intercity of waves, progressive wave equation,

Super position of waves, Velocity of transverse waves stretched string, formation of standing waves, Standing waves in stretched string and mode of vibration and laws of vibration, standing waves in air column and mode of vibration, resonance, sonometer, sound waves and velocity of sound in various mediums, Dependency of velocity on sound on temperature, Beats and its application, Doppler's effect in sound waves. **Ray 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** - blue color of sky and reddish appearance of the sun at sunrise and sunset. Optical instruments: Microscopes and astronomical telescopes (reflecting and refracting) and their magnifying powers.

Unit-C **(10 Questions)**

Electrostatics- Electric Charges; types of charge and properties Conservation of charge, Coulomb's law-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 due to a system of charge, electric field lines and properties, electric dipole and dipole movement, electric field due to a dipole, torque on a dipole in uniform electric field. **Gauss's law and its applications-** Electric flux, continuous charge distribution, Gauss's theorem and its derivatives, calculation of intensity of electric field by Gauss's Law i) due to infinitely long straight wire, ii) infinite uniformly charged non conducting sheet iii) uniformly charged infinite conducting plate iv) uniformly charged non-conducting sphere v) uniformly charged thin spherical shell (field inside and outside). **Electrostatic potential and capacitance-** Electric potential, potential difference, electric potential due to a point charge, a dipole and system of charges; equipotential surfaces, relationship between electric field and potential, calculation of electric potential due to I) charged spherical shell ii) charge conducting sphere iii) charged non-conducting sphere, potential energy system of charge, work rotation and potential energy of electric dipole in electric field. 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. Dielectrics and electric polarization, capacitors and capacitance of conductor, capacitance of an isolated spherical conductor, combination of capacitors in series and in parallel, capacitance of a parallel plate capacitor with completely, partial and different thickness and without dielectric medium between the plates, energy stored in a capacitor.

Current electricity-Electric current, flow of electric charges in a metallic conductor, drift velocity, mobility and their relation with electric current; Ohm's law and its deduction, electrical resistance ohmic and non ohmic resistance, V-I characteristics (linear and non-linear), electrical energy and power, electrical resistivity and conductivity. Carbon resistors, colour code for carbon resistors; series and parallel combinations of resistors; temperature dependence of resistance. Internal resistance of a cell, potential difference and emf (Electro motive force) of a cell, terminal voltage, combination of cells in series and in parallel. Electric energy & Electric power, electric circuit, Kirchhoff's laws and simple applications. Wheatstone bridge, Meter Bridge.

Potentiometer – principle, standardization and sensitivity and its applications to measure potential difference and for comparing emf of two cells; measurement of internal resistance of a cell. Determination of internal resistance of primary cells, calibration of voltammeter and ammeter.

Electronics & Communication: classification of metals, conductors & semiconductors, intrinsic & extrinsic semiconductors, p-junction diode, forward & reverse bias, applications of junction diode as rectifier, junction transistor (CE, CB, biasing & characteristics) logic gates (OR, AND, NOT, NAND, NOR, XOR). Elements of communication system and demodulation (AM &FM).

Unit-D **(10 Questions)**

Magnetic effects of current: moving charges and magnetism- Concept of magnetic field, Oersted's experiment. Biot - Savart law, magnetic field due to a long and straight current carrying conductor and circular coil, comparison of small current loop with dipole Helmhottz coils, motion charge in a magnetic field force of speed in magnetic field. Force on speed charge in magnetic field, force on current carrying conductor in magnetic field, magnetic force between two parallel current carrying conducting wire and its application to current carrying circular loop. Definition of standard ampere, force and torque on current carrying rectangular loop in uniform magnetic field. Ampere's law and its applications to infinitely long straight wire. Straight and toroidal solenoids, Force on a moving charge in uniform magnetic and electric fields. Definition of ampere. Torque experienced by a current loop in uniform magnetic field; moving coil galvanometer-its current sensitivity and conversion to ammeter and voltmeter. **Magnetism and matter:** Magnetism and properties of magnetic substance natural and artificial magnet, properties of bar magnet, magnetic field line and magnetic line force, neutral point, magnetic moment of bar magnet, intensity of magnetic field, torque on bar magnetic in uniform magnet field, earth magnetism, elements of earth's magnetism, magnetism and Gauss law, behaviour of substance in magnetic field, intensity of magnetization, magnetizing field, Magnetic permeability, Relationship between different magnetic quantities, classification of magnetic material, Magnetic Hysteresis curve B-H curve, selection of magnetic substance for special use. Curie law and Curie temperature, comparative studies of magnetic substance. 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. Para-, dia- and ferro - magnetic substances, with examples. Electromagnets and factors affecting their strengths. Permanent magnets.

Electromagnetic induction and alternating currents: Electromagnetic induction: Magnetic flux, induction current & charge, Fleming's Right-Hand rule, induced emf in a conductor rod moving in uniform magnetic field, Induced emf and current in rectangular loop moving in non-uniform magnetic field. Energy conservation, induced emf in metal rod, metal disc, Rectangular coil rotating in uniform magnetic field. Faraday's laws, induced emf and current; Lenz's Law, Eddy currents. Self and mutual induction. **Alternating current:** Direct current: Alternating current, Intentonenous peak, Average and root mean square value of Alternating current & voltage, AC voltage in different type of ac circuits and phasor diagram. (I) Pure ohmic resistance, (II)Pure inductor circuit, (III) Pure capacitance circuit, L-R circuit, R-C circuit, LCR series circuit, series L-C-R Resonance circuit, Half power point frequencies, Band width and quality factor of a series Resonance circuit. Average power in AC circuit.

Electromagnetic waves- Basic idea of displacement current, electromagnetic waves, their characteristics, their transverse nature (qualitative ideas only). Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, X-rays, gamma rays) including elementary facts about their uses.

Dual nature of matter and radiation- Dual nature of radiation. Photoelectric effect and matter waves, Wavelength of matter waves associated with different type of partials. Hertz and Lenard's observations; Einstein's photoelectric equation-particle nature of light. Matter waves-wave nature of particles, de Broglie relation. Experimental result of photoelectric effect and their interpretation, concept of Photon, Davisson-Germier experiment, Heisenberg's uncertainly principle. **Atomic & Nuclear Physics**: Ruther ford model of atoms, Bohr model of atom, atomic spectra, line spectra of hydrogen atom, De-Broglie explanation of Bohr's second postulate of quantization. Atomic masses & composition of nucleus, size of nucleolus, Mass energy and nuclear binding energy, radioactivity, half-life and mean life, nuclear fission and fusion. Nuclear reaction.