

परिशिष्ट-2

डिप्लोमा प्रवेश प्रतियोगिता परीक्षा (पार्ष्विक प्रवेश)-2019 के लिये मार्गदर्शक पाठ्यक्रम

PHYSICS

1 Introduction and measurement

Science and scientific method, Physics and its relation with society, Technology and other branches of Science
Physics Quantities and their measurement units system of units, S.I. system, Fundamental and Derived Units.
Dimensions and their applications. Accuracy and Precision, Systematic and random errors. Gaussian distribution
for random errors. Standard deviation, RMS value, Combination of errors, Order of magnitude, Significant
figures, Rounding off.

2 Mathematical Tools

Scalar and vector quantities, vector addition and subtraction, Unit vectors, Null vector Resolution method for
vector addition and subtraction, Scalar and vector Products. Concept of Differentiation and Integration as
applied in Physics. Cartesian Coordinate system. Graphs-plotting and interpreting. Interpretation of slopes of
chords and tangents, Curvature, Maxima and Minima, Area under a curve.

3 Kinematics of Particles

Concept of particles, Uniform rectilinear motion, Uniformly accelerated rectilinear motion-their graphical
representation, Freely falling bodies. Motion in two and three- dimensions. Projectile motion, Change of frame
and relative velocity.

4 Force and Laws of Motion

Interactions and Force, Basic idea about the fundamental forces of Nature (Gravitational, Electromagnetic
and Nuclear forces), Force and Motion : Newton's first law of motion, Concurrent forces and equilibrium,
momentum, Inertial and Non-Inertial reference frames. Newton's second law of motion, Impulse. Newton's
third law of motion. Conservation of Linear momentum. Motion of connected bodies. Rocket propulsion, Static
and kinetic friction, Laws of friction, Rolling friction, Lubrication, motion on rough inclined surface, Uniform
circular motion, Centripetal force and acceleration, Centripetal force of a pseudo force, Banking of roads,
motion of vertical circle conical pendulum.

5 Work, Energy and Power

Work, Kinetic energy, Power, work energy theorem for system of particle, Internal and external forces,
Conservative and dissipative forces, potential Energy, Potential energy for simple systems like simple pendulum,
electron moving around nucleus, satellite, etc. Law of conservation of Energy, Equivalence of Mass and
Energy, Elastic collision in one and two dimensions, Inelastic collision in one dimension, Coefficient of restitution.

6 Rotation

Centre of mass for a two particle system, many particle system and for rigid body, Moment of Inertia and
Radius of Gyration-their physical significance, parallel axis theorem, Perpendicular axes theorem for a lamina,
calculation of moment of inertia of ring, Disk, rod rectangular bar and sphere, Torque, Couple, Equilibrium of
Rigid Bodies, Relation between Torque and angular acceleration, Angular momentum, Conservation, General
motion of rigid body in a plane (Translation of centre of mass and Rotation about axis passing through centre
of mass), Motion of rolling bodies.

7 Gravitation

Newton's law of Universal Gravitation, Inertial and Gravitational Mass, Gravitational potential and field, their
calculation for hollow and solid sphere, Acceleration due to gravity and its variation, Kepler's Laws of planetary
motion (statement only), Satellites.

8 Properties of Matter

Interatomic and intermolecular forces, States of Matter.

Solids : Elastic properties, Hooke's law, Young's modulus, Bulk modulus, Shear and rigidity modulus.

Liquids : Cohesion and Adhesion, Surface tension, Surface energy, Angle of contact, Molecular theory for
surface tension, Capillary action. Excess pressure inside a drop and soap bubble, effect of temperature of
surface tension.

Gases : Kinetic theory of gases, Ideal gas law, Van der Waals equation (Derivation not required).

Fluid Dynamics : Streamlined and Turbulent motion, Viscosity, Coefficient of viscosity, Critical velocity,
Reynold's number, Stoke's law and its derivation using dimensional analysis, Terminal velocity, Bernoulli's
theorem and its applications (Venturi meter, Atomizer, Pitot tube, Dynamic uplift, etc.)

9 Heat and thermodynamics

Concept of Heat and temperature, Thermal equilibrium and Zeroth law of thermodynamics, Temperature
scales, Thermometers (Liquid in Glass, Platinum resistance, Constant volume hydrogen gas, thermometer),
First law of thermodynamics, Specific heat of an ideal gas at constant volume and constant pressure, relation
between them, Thermodynamic state, phase diagrams for H₂O and CO₂ Thermodynamic processes (reversible

and irreversible, isothermal and adiabatic), Carnot cycle, Second law of thermodynamics, efficiency of heat engines. Thermal conductivity determination by Searle's method, Black body radiation, Wien's displacement law, Stefan's law, Newton's law of cooling.

10 Oscillations

Periodic motion, Oscillatory motion. Simple harmonic motion, Kinetic and potential energy in SHM, Simple pendulum, Damped and forced oscillations, Resonance, Composition of SHM in one dimension and two dimensions.

11 Waves and Acoustics

progressive wave, equation of a travelling wave, speed of wave on a string. Longitudinal and transverse waves. Superposition of waves. Interference. Stationary wave and Beats. Sound wave in air, displacement and pressure waves, speed of sound-Newton's formula and Laplace's correction, Effect of temperature, pressure and humidity of velocity of sound, Laws of transverse vibration of stretched strings. Closed and open organ pipes, Doppler effect, Acoustics of buildings, Characteristics of musical sound, Musical scale, Decibel scale.

12 Universe

The constituents of the Universe, Planets-elementary idea about determination of their distances and masses. Stars- brightness, magnitude scale, luminosity, surface temperature, energy source of stars (concept only). Evolution of the Universe, Cosmic background radiation, Red shift, Hubble's law, Chandrasekhar limit, White dwarf. Neutron star and Black hole.

13 Ray Optics

Refraction at spherical surfaces, thin lens, combination of thin lenses in contact and separated by a distance, effect of silvering one face of a lens. Total internal reflection, optical fibre, rainbow. Optical instruments-simple and compound microscopes, Refracting (Astronomical) and reflecting (Newtonian) Telescopes, Defects of vision and their remedies, Dispersion and deviation of light due to a prism. Dispersive power, dispersion without deviation and deviation without dispersion. Spectrometer and its use for determination of refractive index. Emission and absorption spectra (with suitable examples) Scattering of light by the atmosphere (blue colour of the sky and the reddish appearance of Sun at sunrise and sunset, derivation not required).

14 Wave Optics

Wave front and Huygen's Principle, Explanation of reflection and refraction of plane wave at plane surfaces using Huygen's principle, Coherent and non-coherent sources of light, interference of light, Young's double slit experiment, Fringe width, Biprism, Diffraction of Light, Diffraction due to single slit, Polarization, Transverse nature of light waves, linearly polarized light. Brewster's law, Use of Polarized light. Polaroids.

15 Electrostatics

Charges and their conservation, charge quantization, Coulomb's Law, Electric potential and field due to a point charge and dipole in an electric field. Gauss's theorem and its simple applications (Field due to an infinite charged cylinder, plane sheet of charge. Charged conducting sheet, hollow conducting sphere, spherical conductor). Conductors and insulators, Concept of polarization and dielectric constant, Electrostatic induction, Capacitance, parallel plate, cylindrical and spherical capacitors, grouping of capacitors, Energy of capacitors, loss of energy due to sharing of charge Van de Graff generator.

16 Current Electricity

Concept of Drift velocity and Mobility, Current density and electric current, Ohm's law, resistivity, conductivity of various materials, zero conductivity and superconductivity (elementary idea). Carbon resistors and their colour code, temperature dependence of resistance, Kirchoff's current and voltage laws and their simple applications, Wheatstone bridge and its application in meter bridge, Principle of Potentiometer and its application for comparison of emf.

17 Thermal and Chemical effect of current

Heating effect of current Joule's law, Thermocouple, elementary idea of Seebeck, Peltier and Thomson effect, Faraday's law of electrolysis and their verification, Dry cell, Lead accumulator, Nickel-cadmium cell, Button cells.

18 Magnetic effect of current

Oersted's experiment. Biot Savart law, magnetic field due to a straight wire and a circular loop carrying current, magnetic field due to a solenoid, Moving coil galvanometer and its conversion into an ammeter and a voltmeter. Force on a conductor carrying current, torque on a current loop in a magnetic field, force between two parallel conductors carrying current, definition of Ampere.

19 Electromagnetic Induction and Alternating Current

Faraday's and Lenz's laws self and mutual induction- deduction of coefficients, eddy currents, Induced emf in a coil rotating in a uniform magnetic field. Alternative voltage and current, RMS, Peak and average values of voltage and current Reactance and impedance for L, C and R, Behaviour of circuits with L, C and R (Phasor diagrams only), Power factor, resonant circuits, Q-factor. Electrical machines and devices- transformer, AC Generator, Choke and starter.

20 Magnetism

Properties of bar magnets, field and potential due to a magnetic dipole, Current loop as a magnetic dipole, torque on a magnetic dipole placed in a uniform magnetic field lines, Comparison of magnetic fields due to a bar magnet and a solenoid carrying current. Earth's magnetic field and elementary idea about its origin, Paramagnetic and ferromagnetic substances with examples, Electromagnets and permanent magnets, elementary idea about modern theory of magnetism.

21 Electromagnetic waves (Qualitative treatment)

History of electromagnetic waves (Contributions of Maxwell, Hertz, Bose, Marconi), Electromagnetic spectrum (radiowaves, microwave infrared, optical, ultraviolet, x-ray and Gamma rays). Simple ideas about their properties and applications.

22 Atomic and Nuclear Physics

Discovery of electron, Rutherford scattering experiment, Bohr model of atom, hydrogen spectrum, Photoelectric effect, particle nature of light, Einstein's photoelectric equation, photocell, matter waves, De Broglie relation. Composition of nucleus, Size of nucleus, atomic number and mass number, mass-energy per nucleon with mass number, Radioactivity, α , β , and γ rays. Simple explanation of α , β , and γ decay. Radioactive decay law, half life and mean life, nature of nuclear forces, nuclear fission and fusion.

23 Semiconductor devices

Energy bands in solids, band gap conductors semiconductors and insulators, P-n junction semiconductor diode, diode as a rectifier, solar cell, LED, Junction transistor, transistor action, collector amplifiers (elementary idea), Logic gates (AND, OR and NOT gates) and combination of gates NAND and NOR), Binary number system and Boolean algebra, Truth table.

24 Basics of Communication (Qualitative treatment)

Analog and digital signals and their mutual conversion, Amplitude, Frequency and pulse modulation and their demodulation, Principles of digital transmission and retrieval of information, Fax and Modem. Space communication-Propagation of electromagnetic waves in the atmosphere, Sky and space wave propagation, Satellite communication, Applications in Remote Sensing. Line communication two wire lines, cables, telephone links, Optical communication-optical fibres, Basic principles of Lasers and their applications, elementary principles of light modulation.

CHEMISTRY**PHYSICAL CHEMISTRY****1. Mole concept and related numerical analysis**

Laws of chemical combination. Mole concept, equivalent weights, atomic weights, molecular weight, eudiometry, problems based on chemical equations.

2. Oxidation and reduction

Oxidation-reduction as electron transfer processes, Oxidation numbers, calculation of oxidation numbers, balancing of redox equations by oxidation number method and ion-electron method, equivalent weights of oxidants and reductants, Roles of $K_2Cr_2O_7$, $KMnO_4$, O_3 , H_2O_2 , SO_2 , I_2 , $FeSO_4$.

3. States of matter

(A) Gaseous state, Kinetic theory of gases, equation of state, Graham's law of diffusion, Root Mean Square Velocity.

Graphical distribution of molecular speeds of ideal gases and the effect of temperature, Most probable, velocity, average speed, Van der Waals equation and significance of Van der Waals constants.

(B) The liquid state, Properties of liquids, Concept of vapour pressure, surface tension and viscosity

(C) The Solid State. The crystalline state and types of crystals. Seven crystal systems and 14 Bravais lattices, close packing in crystals, fcc, ccp and bcc lattices.

4. Atomic structure.

The Bohr and Sommerfeld models and related calculations, Spectral distribution and the Rydberg constant, deBroglie concept and Heisenberg Uncertainty Principle. The three dimensional atom as in quantum mechanics, Shapes of orbitals, Quantum numbers, Aufbau principle, Hund's rule, Pauli exclusion principle, electronic configuration of elements, and ions (upto at no.34)

5. Radioactivity.

Artificial and natural radioactivity, α , β and γ cause of radioactivity disintegration law, group displacement law, half-life period, average life, mass defect, binding energy, balancing of nucleate reactions, Fission and fusion, isotopes and their uses, isobars and isotones.

6. Chemical bonding:

Octet concept, Types of bond- ionic covalent, coordinate, hydrogen bond ; Vander Waals attractions σ - π and ζ - (τ) bonds, Hybridisation VSEPR theory, dipole moment, resonance, shape of molecules and ions (CH_4 , NH_3 , H_2O , SO_4^{2-} and NO_3^-), Concept of molecular orbitals, MO diagrams of some homonuclear and heteronuclear diatomic molecules (H_2 , H_2 , N_2 , CO and NO).

7. Acids, bases and salts.

Classical concepts, modern concepts (Bronsted-Lewis and SHAB Principles). Salts and their classifications pH and pOH, pKa and pKb, relative strengths of acids and bases, buffer solutions.

8. Volumetry

Standard solutions and primary standards, strength parameter (normality, molarity, molality, %age, mole fraction and ppm). Acid-base titration and indicators (phenolphthalein and methyl orange), redox titration-pemanganometry dichrometry, volume strength of H_2O_2 solution.

9. Energetics, Bond energy and enthalpy of reaction, exo and endo-thermic reactions, first law of thermodynamics, internal energy, pressure-volume-works relationships for gases, enthalpy, extensive and intensive, properties of formation, combustion, neutralization, hydrogenation, fusion and vaporization, Resonance energy.

10. Chemical and related equilibria, Law of mass action, equilibrium constant Le Chatelier's principle, Equilibrium constants of the following reactions- gaseous dissociation of HI, SO_3 and PCl_5 , Esterification and formation of ammonia. Relation between K and ΔG .

11. Colligative properties of solutions, Relative lowering of vapour pressure, elevation of boiling point, depression of freezing points, osmotic pressure, ideal and non-ideal solutions, Vant Hoff factor- dissociation and association, Henry's law.

12. Chemical Kinetics. Rate of chemical reactions, factors affecting rate of reactions, molecularity and order of reactions, rate constants of first order reaction and its characteristics, temperature dependence of rate constant- Arrhenius equation.

13. Electrochemistry. Faraday's law, Electrolytic conductance- specific, equivalent and molar conductivities, Kohlrausch's law, Electrochemical cells and their cell reactions. Electrode potential, electrochemical series, simple calculations based on emf of galvanic cells.

14. Surface chemistry, Elementary idea of adsorption (excluding isotherms), Colloids and their types, Properties of colloids, elementary concepts of emulsions, surfactants and micelles.

INORGANIC CHEMISTRY**1. Periodicity of elements.**

The long periodic table, classification of elements in terms of s,p, d and f meteoroids, periodicity and enthalpy of ionization, electron affinity and electronegativity.

2. Transition elements.

3d series only. General characteristics, Oxidation states and their stability colour, magnetic properties, complexing properties and catalytic properties.

3. Metallurgy, Ores and minerals, gauge, flux and slag.

Commonly occurring ores of iron, copper, lead, magnesium, aluminium, mercury, zinc, silver, gold and tin. General principles and reactions involved in carbon reduction (Fe and Sn), self reduction methods (Cu and Pb), electrolytic reduction method (Al and Mg), cyanide process (Ag and Au).

4. Chemistry of non metals and their compounds.

Carbon- oxides, carbides, halides, fluorene, Industrial fuels, calorific value of fuels, Nitrogen- N_2 , NH_3 and HNO_3 , phosphorous- PH_3 oxides, orthometer and pyro-oxy-acid. Sulphur SO_2 , H_2S , H_2SO_4 (contact process only), Halogens- Hydrides, oxides and oxyacids, Inter-halogens.

Noble gases, Isolation and fluorides of Xe.

5. Principles of qualitative analysis -

Systematic grouping of cations and related group reagents, test for anions (other than fluorides, phosphates, silicates and borates)

6. Preparation of important compounds and their uses, NaOH, Na, $CO_3 \cdot 10H_2O$. Ca (OCI) Cl. $Ca(OH)_2$, $MgSO_4 \cdot 7H_2O$, $CuSO_4 \cdot 5H_2O$, $FeSO_4 \cdot 7H_2O$, $ZnSO_4 \cdot 7H_2O$, $AgNO_3$, $KMnO_4$, $K_2Cr_2O_7$, Mohr's salt, potash alum, plaster of Paris, calomel, corrosive sublimate, vermilion and nessler's reagent.

7. Fertilizers - nitrogen and phosphorous containing

8. Pollution - water and air.

ORGANIC CHEMISTRY

1. Fundamentals. Hybridisation of carbon, structural formulae of organic compounds. Catenation, spatial arrangements around sp^3 sp^2 hybridised carbon atoms, Homologous series and classification of organic compounds, functional groups, nomenclature (IUPAC) of hydrocarbons, mono- and bi-functional group containing compounds. Physical properties of organic compounds - boiling pt, melting pt, solubility and density.

2. **Isomerism** - structural including keto-enol tautomerism, confirmation of ethane and butane- Newmann's projection only. geometrical isomerism - cis and trans, optical isomerism with reference to one and two stereogenic centres (RS nomenclature not required).
3. **General concept** - of Organic reactions. Fission of bonds. reaction intermediates- carbocations, free radicals and carbanions, acidity and basicity due to inductive and resonance effects, Nucleophiles and electrophiles, types of organic reactions-addition substitution and elimination.
4. **Principle** - involved in the preparation of organic compounds and related chemical reactions.
 - (a) **Alkanes** - from unsaturated hydrocarbons, alkyl halides and carboxylic acids, combustion and monohalogenation of alkanes, cracking and refining of petroleum, octane number.
 - (b) **Alkenes** - Form alkyl halides and alcohols, their chemical reactions with Cl_2 , aqueous acid, quos KMnO_4 , ozone and boron hydride Markownikoff and anti-markinokoff addition, hydrogenation of alkenes.
 - (c) **Alkynes**- from metal acetylide and halogen derivatives, reduction, some electrophilic additions, acidity of acetylene.
 - (d) **Halogen derivatives of alkanes** - form alcohol, alkynes and alkynes, Chloroform, haloform reactions, nucleophilic substitution and elimination reaction in monohalogen derivatives, an elementary treatment of Grignard reagent.
 - (e) **Alcohol** - from alkyl halides, aldehydes and ketones, Reactions of alcohols-oxidation esterification, dehydration and reaction with PCl_5 .
 - (f) **Ether**- form alkyl halide and alcohol. Reactions HI, PCl_5 and acetyl chloride.
 - (g) **Aldehydes and ketones** - from alcohol, alkynes, carboxylic acid salts, Reactions with hydroxylamine, phenyl hydrazine, Tollens reagent, Aldol condensation, Prekin reaction Canizzaro reaction and Benzoin condensation.
 - (h) **Carboxylic acids and their derivatives**- from cyanides alcohols and esters. reactions with PCl_5 alcohol ammonia, Rosenmund's reduction.
 - (h) **Carboxylic acids and their derivatives**- from cyanides alcohols and esters. Reactions with PCl_5 , alcohol ammonia, Rosenmund's reduction.
 - (i) **Aromatic compounds** - aromaticity, benzene, phenol and aniline, Diazo coupling.
5. **Polymer** - natural and synthetic- rubber, polythene, PVC, polyester, techniques of polymerisation.

MATHEMATICS

1. **Set Theory** — Sets and their representation, Finite and infinite sets, Empty Set, Equal sets, (Union, Intersection and Difference). Application of sets, ordered pairs, Cartesian product of sets, Relations, domain, co-domain and range, function-into and onto functions, One-one into and one-one onto functions, constant functions, Identity functions, composition of functions, Invertible functions, Binary operations.
2. **Boolean Algebra** — Boolean Algebra as an algebraic structure, Principle of duality, Boolean functions, conditional and biconditional statements, valid arguments, switching circuits, Applications of Boolean algebra to switching circuits.
3. **Mathematical Logic** — Statements, use of venn diagram in logic, Negation operation. Basic logical connectives and compound statements including their negations, Truth tables, Tautology, Duality, Algebra of statements. Application of logic in solving simple problems.
4. **Algebra** — complex numbers, representation of complex numbers as points on Argand Plane, algebra of complex numbers, real and imaginary parts, modulus and argument of complex numbers. Triangle inequality, Polar representations of complex numbers. Square root of a complex number, cube roots of unit, De-moivre's Theorem with application to find the nth root of a complex number.

Sequence and examples of finite and infinite sequences, A.P.G.P., H.P. relation between $AM \geq n$, $\sum n^2$, $\sum n^5$ & HM, evaluation of GM.
5. **Quadratic equations and expressions** — Revision of "Solutions of Quadratic Equations by factorizations and by using formula, Relations between roots and coefficients, nature of Roots, Formation of Quadratic equations with given roots".

Symmetric functions of roots, equations reducible to quadratic forms, extreme values of quadratic expressions in one variable, conditions for resolutions into linear factors of a quadratic expressions in two variables.

Permutations and combinations and problems based on them, principle of mathematical Induction and simple applications.

Binomial theorem : Statements, Proof of Binomial theorem for positive integral index and problems, statements only of Binomial theorem for any index, exponentials functions and logarithmic functions.
6. **Matrices and Determinants** — Concepts of a matrix, types of matrices, equality of Matrices (only real entries). Addition, scalar multiplication and multiplication of matrices, statements and important results on operations of matrices, Determinants of square matrix, properties of determinants, Minors and cofactors, solving system of linear equations, Transpose, adjoint and inverse of matrix. Consistency and inconsistency of system of a linear equations in 2 and 3 variable using inverse of a matrix.
7. **Trigonometry** — Definition of trigonometric functions, periodic functions, concept of periodic of trigonometric

functions, values of trigonometric functions of particular values of x . Compound angles, multiple and submultiple angles, Transformation formula. Conditional identities."

Graphs of sine, cosine, tangent and their reciprocal functions.

General solutions of trigonometrical equations and inverse circular functions.

Properties of triangles

Logarithms

height and distances

8. **Two Dimensional co-ordinate Geometry** —

Cartesian system of co-ordinates, Distance formula, Area of a triangle, conditions of colinearity of 3 points, section formula, centre locus and in centre locus and its equation.

Standard general equation of a straight line, Intersection of Lines, Equations of bisectors of angle between two straight lines. Angle between two line, concurrency of 3 lines, distances of a point from a line. Translation and rotation of axes, Equation of family of lines through and intersection of two lines.

Equation of a circle, general equation of a circle equation of tangent, normal and chord to a circle. Parametric equation of a circle intersection of a circle with a straight line or a circle. Equation of a circle through the points of intersection of two circle and that a circle and straight line. Section of a cone, Equations of the conic sections (Parabola, hyperbola, ellipse in standard forms. Equation of tangent and normal).

9. **Calculus** — Concept of a real function, its domain and range, types of functions and their graphs, Limit of a function. Continuity of a function, Intermediate value property of continuous function.

Relation between continuity and differentiability, Derivative of some simple functions from first principle.

Derivative of a function at a point, derivative of sum, difference, product and quotient of a function. Derivative of a composite function, implicit function, inverse circular functions, Derivatives of functions in parametric form, Derivatives upto order three.

dy/dx as a rate measurer, geometrical interpretation of dy/dx . Equation of tangents and normals.

Increasing and decreasing functions and sign of derivatives, Maxima and minimum, Rollea's Theorem and mean value theorem (without proof). Approximation by differentials, Curve sketching of simple curves.

Integrations as the inverse process of the differentiation. Integration by substitution and by parts ,partial function and their use in integration rational function.

Definite integrals and its simple properties.

Definite integrals as the limit of a sum.

Determination of area enclosed by standard curves (straight lines, circle, parabolas ellipse)

10. **Differential Equations** - definition, order and degree, General and particular solution, Formation of differential equations, Solutions of differential equations by variable method. Homogeneous differential equations of first order, Solution of second order differential

$$\text{equations } \frac{d^2 y}{dx^2} = f(x)$$

11. **Vectors** - vectors and scalars, Types of vector- equal, unit zero, position vector of a point, Local and free vectors etc. Components of a vector, Addition of vectors, Multiplication by scalars, scalar and vector products of 2 vectors with their geometrical meaning, scalar and vector-triple products, Application of geometry, Moment of a vector about a line. Coplanarity of three- vector of four points using scalar triple product.

12. **3-Dimensional co-ordinate geometry**- co-ordinate axes and co- ordinate planes in 3 dimensional space, coordinates of a point in space .distance between 2 points ,section formula, direction co- sines, and direction ratio of a line joining 2 points, projection of the join of 2 points on a given line, Angle between two lines whose direction cosines are given cartesian and vector equations of a line through (i) a point and parallel to a given vector (ii) two points.

Collinearity of 3 points , coplanar and skew lines, Shortest distance between 2 linnes, condition of intersection of 2 lines and 2 planes and a plane.

Conditions of coplanarity of 2 lines in vector and cartesian from length of perpendicular of a point from a plane by both vectors and cartesian method. Equation of a sphere, its centre, radius, diameter.

13. **Statics**- Basic concepts of laws of mechanics, and force. Resultant of coplanar, concurrent and parallel forces , couples and members, conditions of equilibrium of particle under 3 concurrent forces.

14. **Dynamics**- Basic concepts of displacement, speed , velocity, average speed, uniform velocity uniform asseleration, resultant of 2 velocities, motion of a article in a straight line motion under gravity, projectile motion.

15. **Probability**- Random experiments and sample space, events , probability on a discrete sample space, theorems of probability, addition rule multiplication rule, independent and independent events, experiments conditional probability repeated trials.
