

SYLLABUS FOR COMMON ENTRANCE TEST

PART-I

PHYSICS

Units and dimensions and their applications, motion in straight line, equations of motion, speed, velocity, vectors in two dimensions, unit vector resolution of vector, scalar and vector product of vectors, motion in two dimensions, projectile motion, circular motion, bending of cyclist and banking of roads, Force and inertia, conservation of linear momentum, rocket propulsion, equilibrium of concurrent forces, laws of friction, angle and coefficient of friction, inertial and non-inertial frames of reference. Work, energy and power, collision in one and two dimensions, mass energy equivalence, conservation of energy.

Marks (10)

Center of mass of two particle system, center of mass of a rigid body, motion of center of mass, torque, angular momentum and its conservation, moment of inertia, parallel axis and perpendicular axis theorems, moment of inertia of a ring, rod bar, disc, sphere. Universal law of gravitation, inertial and gravitational mass, variation of acceleration due to gravity with altitude/depth, latitude and rotation of earth, gravitational potential energy, orbital and escape velocity, geostationary satellite and Kepler's laws.

Marks (07)

Elastic properties, Hook's law, co-efficient of elasticity, Poisson's ratio, elastic energy, viscosity, Stokes law and terminal velocity, Stream line flow, Reynold's number, equation of continuity. Bernoulli's equation, velocity of efflux, surface tension, surface energy, excess of pressure capillarity.

Marks (04)

Kinetic theory of gases, pressure exerted by ideal gas, kinetic interpretation of temperature, gas laws, first law of thermodynamics, C_p and C_v of ideal gas, thermodynamic process (reversible, irreversible, isothermal and adiabatic), Second law of thermodynamics, Carnot's engine and efficiency of heat engine, Black body radiation, Stefan's law, Wien's law, thermal conductivity.

Marks (04)

Periodic motion, simple harmonic motion and its equation of motion, oscillations due to spring, Kinetic energy and potential energy in S.H.M., examples of simple harmonic motion, forced oscillation and damped oscillations, wave motion, speed of a wave, principle of super position, reflection of waves, harmonic waves, standing waves in strings and pipes, laws of string, resonance tube, beats, Doppler effect.

Marks (08)

Coulomb's law, electric field and potential due to a point charge and charged sphere, Dipole — its fields along the axis and perpendicular to the axis, concept of dielectric and dielectric constant, Gauss's law — its applications to find the field due to line charges, infinite sheet of charge and charged sphere, forces and torque experienced by a dipole in an electric field, energy of dipole in an electric field, capacitance, parallel plate capacitor, series, parallel combination of capacitor, energy of charged capacitor.

Marks (06)

Electric current, drift velocity, Ohm's law, resistibility, resistance in series and parallel, Kirchoff's law and its applications, electric power, heating effects of current, Joule's law, EMF and terminal voltage of a cell, internal resistance of a cell, grouping of cells, thermoelectricity, Seebeck effect, Peltier effect.

Marks (05)

Ampere's laws, Bio-savart's law, magnetic field due to solenoid, current loop and straight conductor. Force on moving charge in uniform magnetic field, force between two parallel current carrying conductors, moving coil galvanometer and its conversion into ammeter and voltmeter. Terrestrial magnetism, magnetic elements at a place, para, dia, ferromagnetism.

Marks (06)

Induced EMF, Faraday's law, Lenz's law, electromagnetic induction, self and mutual inductance, alternating current, impedance and reactance, power in AC circuits with L, C and R in series, transformers, AC generators and choke, energy of current carrying inductor.

Marks (04)

Electromagnetic oscillation, electromagnetic waves, spectrum (elementary facts about their uses) and wave fronts and Huygen principle, interference, Young's double slit experiment, diffraction due to single slit, polarization of light and Brewster's law, refraction of light, lateral displacement, and dispersion of light due to prism, dispersive power, Raleigh's, scattering law, total internal reflection, rainbow, types of spectra.

Marks (08)

Thomson's experiment for e/m of electron, charge of electron by Milkan's oil-drop experiment, particle nature of light, Einstein's photoelectric equation, photo cells,

Size of nucleus, Bohr's model of atom, energy quantization, hydrogen, hydrogen spectrum, composition of nucleus, nuclear forces, laws of radioactive decay, half life, decay constant, mass-energy relation, binding energy and mass defect, nuclear fission, nuclear reactor, nuclear fusion.

Marks (08)

Crystalline structure of solids, energy bands in solids, conductors, insulators and semiconductors, PN junction, Junction transistors, diode as a rectifier, transistor as an amplifier and oscillator, logic gates and combination of gates NAND and NOR.

Marks (05)

Note:

1. *20% of the questions should be of numerical type.*
2. *Each numerical should be of the type, it can be solved in about 1½ minutes of time.*

PART-II
CHEMISTRY

Unit I Chemical Arithmetic, Atomic structure and Nuclear Chemistry.

- (a) Laws of chemical combination, mole concept (numericals) calculations using chemical equations. Equivalent weight of oxidizing and reducing agents.
- (b) Atomic structure, Bohr's model of Hydrogen atom, Quantum numbers, Pauli exclusion principle, Hund's rule and Aufbau principle. Heisenberg's uncertainty principle, de-Broglie equation and their significance.
- (c) Nuclear chemistry: Properties of alpha, beta and gamma radiations, Group displacement law, half-life period and average life period. Different types of nuclear reactions using alpha particles, neutrons, protons and deuterons as projectiles, carbon-14 dating. Calculation of numbers of alpha and beta particles.

Marks (07)

Unit II Chemical Equilibrium

- (a) Law of mass action, Le-Chatelier's principle, and its application to physical and chemical equilibria. Ionisation of weak electrolytes (Ostwald's dilution law)
- (b) Acids and bases: Acid base equilibria. Bronsted-Lowry and Lewis concept, of acids and bases. Ionic product of water. pH and pOH scales, pK_a & pK_b values, solubility product, buffer solution, common ion effect, hydrolysis of salts.

Marks (04)

Unit III Chemical Kinetics

Effect of concentration and temperature on rate of chemical reactions, (Arrhenius Equation (Temp, Co-efficient Concept of

activation energy, First and second order reactions, half-life period, Units of rate constant for zero, first and second order reactions.

Marks (03)

Unit IV Solutions

Different ways of expressing the concentration of solutions (molarity, molality, mole fraction, ppm and normality), vapour pressure, Rault's law, ideal and non-ideal solutions, colligative properties, determination of molecular masses of non-volatile solutes involving various colligative properties, abnormal molecular masses and Van't Hoff Factor.

Marks (04)

Unit V Energetic and Chemical Thermodynamics

Energy changes during chemical reactions, internal Energy and enthalpy change, Enthalpy of combustion solution and neutralization, Hess's Law (Numerical problems) First, second ' & third law of thermodynamics, concept of entropy and Free energy, spontaneity of a chemical reaction and Thermodynamic equilibrium.

Marks (04)

Unit VI Redox Reactions and electrochemistry

Determination of oxidation numbers, oxidation and reduction in terms of electron transfer, dependence of electrode and cell potential on concentration (Nernst Equation), electrode potential as a criteria for product formation in electrolysis. E.M.F. of Galvanic cell, relationship between free energy change and E.M.P. F. of a cell, definition and units of equivalent, molar and specific conductivity.

Marks (04)

Unit VII States if Matter

Dalton's law of partial pressure, Graham's law of diffusion of gases, causes of deviation from ideal behaviour, ideal gas equation

and nature of 'R', Vander Vaal's equation, surface tension and viscosity of liquids, crystalline and amorphous solids, crystal lattice, crystal types, radius ratio and structure of NaCl, CsCl and ZnS, co-ordination number, stoichiometric defects (Schottky, Frenkel and interstitial defects.)

Marks (03)

Unit VIII Surface chemistry

Freundlich absorption isotherm, preparation of colloidal solutions by physical and chemical methods, electrical properties (cataphoresis, elector-osmosis, coagulation and protective colloids), homogeneous and heterogeneous catalysis.

Marks (03)

Unit IX Periodic Properties

Classification of elements into s, p, d, and f blocks, variation of ionization energy, election affinity, electronegativity, atomic and ionic radii along the period and down the group.

Marks (02)

Unit X Chemical Bonding and Molecular structure

Types of chemical bonds, quantum theory of covalent bond, pi and sigma bonds, hybridization involving s, p and d-orbitals, dipole moments and hydrogen bond. VSEPR-theory and shapes of simple molecules like H₂O, NH₃, SO₂, CO₂, PCI₃, PCI₅, ClF₃, BF₃, SF₄, XeF₂, XeF₄.

Molecular orbital theory, bond order and its significance, electronic configuration of H₂⁺, H₂⁻, He₂⁺, O₂, O₂⁻, O₂⁺, O₂²⁻, F₂.

Marks (04)

Unit XI Chemistry of Representative Elements

(S and P Block Elements)

Electronic configuration, oxidation states and trends in various properties like ionizaton energy, electron affinity, atomic radii, electronegativity and diagonal relationship of s and p block elements.

- (a) Alkaline metals: Hydration of ions, action with ammonia, flame colouration, solubility of hydroxides, carbonates and sulphates.
- (b) Alkaline earth metals: Solubility of carbonates, hydroxides and sulphates.
- (c) Boron Family: Structure of halides, relative acid strength of trihalides of boron.
- (d) Carbon family: Hydrides and oxides.
- (e) Nitrogen family: Oxides of nitrogen and phosphorous, reducing nature, basic strength and boiling points of their halides.
- (f) Oxygen family: Volatility, thermal stability, and acid character, reducing character and bond angles of their hydrides, oxyacids of sulphur.
- (g) Halogen family: Bond energy, colour and oxidizing power, boiling point, acid strength and dipole moment, thermal stability, reducing power of hydric acids, relative acidity and oxidizing power of oxyacids of halogens.

Marks (04)

Unit XII Transition metal including lanthanides

Electronic configuration, oxidation states, colour and magnetic properties of transition metal oxides of V, Cr and Mn, alloys of copper silver and iron, oxidation states of lanthanides.

Marks (04)

Unit XII Co-ordination chemistry and Organometallics

Werner's theory, nomenclature, isomerism in co-ordination compounds (ionization, linkage, hydrate, co-ordination, geometrical and optical), bonding in co-ordination compounds on the basis of V.B. theory, stability of co-ordination compounds in solution, Ferrocene and Zeise's salt.

Marks (04)

Unit XIV Chemistry of Metal s

General aspects of metallurgy, metallurgy of iron, copper and silver and their properties, preparation, properties and uses of copper sulphate and silver nitrate, various forms of iron.

Marks (03)

Unit XV Nomenclature and basic concepts inorganic chemistry

Nomenclature of organic compounds (monofunctional and polyfunctional groups), priority rule, inductive, electrometric, resonance and hyperconjugation effects, reaction intermediates, carbocations, carbanions and free radicals with their general stability order, types of organic reactions (addition, substitution, elimination and redox reaction), aromaticity on the basis of Huckel rule. Ortho, meta and para directing groups.

Marks (04)

Unit XVI Hydrocarbons

Structural isomerism. in alkanes, alkenes, alkynes and arenes, stereoisomerism: geometrical and optical isomerism, chirality, origin of chirality, specific rotation, racemisation and resolution, conformations in ethane and cyclohexane, relative configuration (D,L-Nomenclature), absolute (R and S system of nomenclature).

Reactions of hydrocarbons: addition, substitution and oxidation reactions, electrophiles and nucleophiles, acidic character of alkynes.

Marks (04)

Unit XVII Organic Chemistry Based on Functional Group-1

(Haloalkanes, haloarenes, alcohols and phenols)

General methods of preparation and properties of haloalkanes, haloarenes, alcohols, phenols, chloroform, iodoform and glycerol.

Marks (04)

Unit XVIII Organic chemistry based on functional Group-II

(Ethers, aldehydes ketones, monocarboxylic acids).

General methods of preparation and properties of ethers, aldehydes, ketones and monocarboxylic acids, derivatives of monocarboxylic acids like acid halides, acid anhydrides, acid amides and esters, relative strength of carboxylic acids.

Marks (04)

Unit XIX Organic Chemistry based on functional Group-III

(Cyanides, isocyanides, nitrocompounds and amines)

General methods of preparation and properties of cyanides, Isocyanides, nitrocompounds and amines, relative basic character of amines.

Marks (04)

Unit XX Molecules of Life

Carbohydrates: definition, classification, mutarotation, Structure of amino-acids, peptides and proteins (Molish and ninhydrin tests). Classification and uses of vitamins.

Marks (02)

Note: *Numericals should not exceed 15%.*

PART- III BIOLOGY

BOTANY

Unit I Cell as a unit of life

Ultra –structure of cell, structure and functions of various organelles.

1. Micromolecules, water, minerals, mono and oligosacharides, amino acids, nueleotides, macro-molecules, polysaccharides proteins and lipids.
2. Cell wall and plasma membrane (special reference to Fluid Mosaic Model)
3. E.R. and ribosomes.
4. Mitochondria
5. Chloroplasts.
6. Golgi Complex
7. Nucleus
8. Lysosomes
9. Cell vacuole and cell inclusions
10. Centriole, basal bodies, cilia and flagella
11. Structure of prokaryotic cell

09 Marks

Unit II Morphology and Anatomy of Anglosperms

1. Modifications of roots and their functions.

2. Modifications of stems and their functions.
3. Modifications of leaves and their functions.
4. Meristematic tissue-characteristics and classifications on the basis of stage of development, origin, location and functions, structure and organization of apical meristems.
5. Simple permanent tissue, parenchyma, collenchyma and sclerenchyma
6. Complex permanent tissue: xylem and phloem
7. Structure of monocot and dicot root
8. Structure of monocot and dicot stem.
9. Structure of monocot and dicot leaf
10. Secondary growth of dicot stem and dicot root.

07 Marks

Unit III Plant Physiology

Water relation of the plants.

1. Cell as an osmotic system, water potential, D.P.D., absorption of water (active and passive), ascent of sap with special reference of transpiration pull theory.
2. Transpiration-mechanism of stomatal transpiration (Levitt hypothesis), factors influencing transpiration.
3. Mineral nutrition-with special reference to nitrogen, phosphorus and potassium uptake of minerals (active and passive).
4. Photosynthesis-photosynthetic pigments, mechanism of photosynthesis, photophosphorylation (cyclic and non-cyclic), C₃ and C₄ pathways photorespiration, C₂ cycle, factors affecting photosynthesis.
5. Cellular respiration, glycolysis, Krebs's cycle, E.T. chain, oxidative phosphorylation, high-energy bonds.
6. Enzymes-chemical nature classification and properties, mechanism of action, Enzyme-substrate complex and allosteric modulation, factors influencing enzyme action.
7. Plant hormones and growth regulation — roles of auxins, gibberellins, cytokinins and abscisic acid.

8. Tropic movements.

07 Marks

Unit IV Developmental Biology (Plants)

1. Structure and life history of:
(a) Chlamydomonas
(b) Rhizopus.
2. Life cycle and alternation of generations of.
(a) Funaria.
(b) Dryopteris.
3. Pinus-External structure of sporophyte, anatomical features of pine needle, male and females cones, seed formation.
4. Structure of flower, anther and ovule, placentation and its types.
5. Inflorescence (Simple).
6. Pollination (self and cross).
 Contrivances favoring self and cross-pollination.
7. Development of male and female gametophytes.
 Fertilization and post-fertilization changes.
8. Structure and germination of seeds — pea, castor and maize.
9. Seed dormancy, importance and causes, methods of breaking seed dormancy.
10. Fruits development (maturation and ripening), parthenocarpy and its importance, simple succulent fruits.

09 Marks

Unit V Applications of Biology

1. Methods of improvements of crop plant — selection, introduction, hybridization, polyploid breeding, induced mutations, tissue culture and genetic engineering.
2. Need of fertilizers — hazards associated with chemical fertilizers.

3. Biofertilizers — green manuring, farmyard manuring, compost manuring, role of bacteria, cyanobacteria and mycorrhizae as bio-fertilizers, importance of biofertilizers.
4. Pesticides, need for pesticides, chemical pesticides, types and their role.
5. Hazards associated with chemical pesticides.
6. New crops and their prospects — Leucaena, jojoba, guayula and winged bean.

05 Marks

ZOOLOGY

Unit VI Heredity and Genetics

1. Principles of inheritance, Mendel's work, principles of dominance, segregation and independent assortment, test cross and back cross.
2. Incomplete dominance, linkage and crossing over, polygenic inheritance, pleiotropy.
3. Structure of eukaryotic chromosomes, nucleosome concept, plasmids and their role.
4. DNA as genetic material — evidence from bacterial transformation and transduction.
5. Nucleic acids — structure of DNA, DNA duplication, structure of RNA and its types.
6. Genetic code, and protein synthesis, transcription, translation, reverse transcription.
7. Gene expression in prokaryotes with special reference to Lac-operon.
8. Cell division- mitosis, meiosis.

9. Aneuploidy of autosomes (Down's, Edward, Patau's syndrome), Aneuploidy of sex chromosomes (Klinefelter's syndrome, super female, super male, Turner's Syndrome), genetic counselling.

09 Marks

Unit VII Anatomy and Physiology

1. Animal tissues: epithelial, connective, muscular and nervous, structure and functions of human skin.
2. Animal nutrition: types, digestive organs of man, physiology of digestion, nutritional requirements of carbohydrates, proteins, fats, vitamins and minerals, digestion of carbohydrates, proteins, fats.
3. Gas exchange and transport: respiratory organs in man, mechanisms of respiration, physiology of respiration, respiratory volumes.
4. Circulation: composition of blood and lymph and their functions, open and closed type of vascular system, structure and pumping action of human heart, pulmonary, portal and systemic circulation, heart beat and blood pressure.
5. Excretion and osmoregulation: structure of human kidney, structure of nephron, physiology of excretion, ammonotelism, ureotelism, uricotelism, role of kidney in osmoregulation.
6. Nervous system: central nervous system, peripheral nervous system, autonomic nervous system, transmission of nerve impulse and reflex action, structure and function of sense organs (eyes and ear).
7. Endocrine system: endocrine glands in man, hormones and their functions, diseases caused by hormonal imbalance.
8. Movement and locomotion: types of joints and fractures, mechanisms of muscle contraction.
9. Human reproductive system: female reproductive system and ovarian cycle, menstrual cycle, male reproductive system, spermatogenesis, oogenesis.
10. Developmental biology: fertilization, zygote formation and cleavage, development of three germinal layers, gerontology,

various cellular and extra cellular changes during ageing, theories of ageing.

12 Marks

Unit VIII Taxonomy

1. Salient features of invertebrate phyla: Porifera, Coelenterate, Platyhelminthes, Nematihelminthes, Annelida, Mollusca, Arthropoda, Echinodermata with typical examples.
2. Salient features of various chordate classes: Cyclostomata, Chondrichthyes, Osteichthyes, Amphibia, reptilia, Aves and Mammalia with typical examples.
3. Animal body pattern and symmetry.
4. Body cavity in invertebrates and vertebrates.

06 Marks

Unit IX Evolution

1. Evidences in favour of organic evolution- morphological, palaeontological, embryological and comparative anatomy.
2. Darwinism and Neo-Darwinism.
3. Evolution of man.
4. Speciation and isolation. (geographical and reproductive)

04 Marks

Unit X Environmental and Human Welfare

1. Environmental pollution: air pollution, major pollutants (oxides of sulphur and oxides of nitrogen; aerosols, carbon monoxide, photochemical oxidants) and their effects, water pollution (pollutants, effluents and their effects, eutrophication and B.O.D.), treatment and recycling of waste water, noise pollution and its hazards, harmful radiations, hazards of nuclear fallout, protective measures against radiations.
2. Communicable diseases, bacterial diseases (cholera, tuberculosis), viral diseases (poliomyelitis, hepatitis, sexually transmitted diseases (V.D. — syphilis, gonorrhoea, AIDS), protozoan diseases (amoebiasis, malaria), helminth diseases (taeniasis, ascariasis).

3. Non-Communicable diseases: heart diseases, strokes, diabetes, arthritis and cancer, allergies and inflammation, bronchial asthma, food allergy and dermatitis.
4. Alcoholism and smoking: short and long term effects of alcohol on human health, ill effects of smoking.
5. Drug abuse: classification of drugs and their hazards on human health.
6. Test-tube baby: amniocentesis.
7. Blood groups: blood group incompatibility; Rh factor & its incompatibility, haemophilia.

07 Marks

PART-IV

MATHEMATICS

Unit I Algebra

- (i) Sets, Relations and Functions:
Sets and their representation, finite and infinite set, subsets, empty set, universal set, complement of a set, union and intersection of sets and their algebraic properties including De-Morgan's Laws. Difference of sets and symmetric difference of sets. Cartesian product of sets, Relations, Equivalence relations. Function (Mapping). Domain and range of function. Into, onto, one-one and many one function. Composites function.
- (ii) Complex number in the form $a+ib$, representation of complex numbers by points in a plane. Argand diagram algebra of complex numbers. Real and imaginary parts of complex numbers. Modulus and argument (amplitude) of a complex number. Complex conjugate. Square root of a complex number-cube roots of unity. Triangle, inequality.

- (iii) Theory of Quadratic Equations Solution of quadratic equation in complex number system $aX^2 + bx + c = 0$; $a \neq 0$, $a, b, c \in \mathbb{R}$.
Relation between roots and coefficients, nature of roots of a quadratic equation. Formation of quadratic equation with given roots.
Symmetric functions of roots viz, $\alpha^2 \pm \beta^2$, $1/\alpha^2 \pm 1/\beta^2$, $\alpha^3 \pm \beta^3$, $1/\alpha \pm 1/\beta$
- (iv) Sequences and progressions
Arithmetic progression and geometric progression, First term, common difference, n th term, sum of n terms of an A.P. Arithmetic mean, insertion of Arithmetic means between any two given numbers, First term, common ratio, n th term sum to n terms and infinite number of terms of a G.P. Insertion of G.M.'s between any two given numbers. Recurring decimal numbers and G.P. Sum to n terms of special cases viz. $\sum n$, $\sum n^2$, $\sum n^3$
- (v) Binomial Theorem: Expansion of binomial with positive integral index, general and particular terms. Finding middle terms and term independent of x Expansion of binomial with any index.

Marks (08)

Unit II Two dimensional Geometry

- (i) Point- Distance formula, area of a triangle. Condition of collinearity of three points and section formula. Centroid and in center of triangle. Locus and its equation. Slope of line. Intercept of a line on coordinate axes.
- (ii) Straight line; various forms of equations of a line, intersection of lines. Angle between two lines. Lines parallel and perpendicular to a given line. Condition for concurrency of three lines. Distance of a point from a line and distance between two parallel lines. Coordinates of orthocentre and circumcentre of a triangle.
- (iii) Pair of straight lines: Homogeneous equation of second degree in x and y , represents a pair of straight lines passing through origin. Angle between pair of lines through origin and condition of parallelism and perpendicularity. Joint equation of angle bisectors.

Condition for general second degree equation to represent a pair of lines.

- (iv) Circle: Standard equation of a circle, general form of the equation of a circle, its center and radius. Equation of circle whose end points of diameter are given. Point of intersection of a line and a circle with center at origin and condition for a line to be tangent to a circle. Length of tangent. Equation of tangent to a circle at a given point. Equation of family of circles through the intersection of two circles.
- (v) Conic section: Equations of parabola, ellipse and hyperbola in standard forms. Condition for a line $y = mx + c$ to be tangent to parabola, ellipse and hyperbola.

Marks (07)

Unit III Trigonometry

- (i) Circular functions and their properties
- (ii) Application of circular functions of difference and sum of two angles. Application of sum and product of sines and of cosines of angles.
- (iii) Application of sine and cosine rule.
- (iv) Trigonometric equations.
- (v) Inverse trigonometric functions — Principle values, properties of inverse trigonometric functions within the principle values viz
 $\sin^{-1}(\sin x) = x$
 $\sin^{-1}(1/x) = \operatorname{Cosec}^{-1} x$, $\sin^{-1} x + \cos^{-1} x = \pi/2$
 $\sin^{-1} x + \cos^{-1} x = \sin^{-1} [x \sqrt{1-y^2} + y \sqrt{1-x^2}]$

Marks (07)

Unit IV Determinants and Matrices

- (i) Determinants: their expansion, minors and cofactor, zero relations and properties of determinants.
- (ii) Application of determinants in solution of equation up to three variables (Cramer rule), Area of triangle.

- (iii) Matrices, definition with examples, types of matrices, equality of matrices. Addition and scalar multiplication of matrices and their properties.
- (iv) Transpose of a matrix, symmetric and skew symmetric matrices, matrix multiplication.
- (v) Adjoint and inverse of matrices. Solution of simultaneous linear equations up to three variables by matrix inversion method.

Marks (08)

Note: *In the treatment up to 3×3 determinants and matrices be considered.*

Unit V Vectors

- (i) Vectors as directed, line segment, magnitude and direction of a vector, equal vectors, unit vector, zero vector, position vector of a point, localized and free vectors, parallel and collinear vectors, components of a vector in two and three dimensions.
- (ii) Addition of vectors, multiplication of a vector by a scalar position vector of a point dividing a line segment in a given ratio.
- (iii) Scalar (or dot) product of two vectors, projection of a vector.
- (iv) Vector (or cross) product of two vectors and its application in finding the area of triangle and parallelogram.
- (v) Scalar triple product in finding the volume of a parallelopiped. Complanarity of three vectors or four points using scalar triple products. Vector triple product.

Marks (07)

Unit VI Three dimensional geometry

- (i) Coordinate axes and planes in three-dimensional space, coordinates of a point in space. Distance between two points, section formula. direction cosines and direction ratios of a line joining two points, angle between two lines whose direction ratios are given.
- (ii) Vector equation of line through a point and parallel to a given vector, vector equation of a line through two points. Collinearity of

three points. Conditions for parallelism and perpendicularity of two lines.

- (iii) Perpendicular distance from a given point to a given line. Distance between two parallel lines. Shortest distance between two skew lines.
- (iv) General equation of a plane, normal and intercept forms of equation of a plane, equation of plane passing through a given point and perpendicular to a given vector. Angle between two planes and conditions for parallelism and perpendicularity.
- (v) Angle between a line and a plane and conditions for parallel and perpendicularity equation of a plane parallel to a given plane. Equation of a plane passing through intersection of two given plane. Distance between two parallel planes.

Marks (08)

Note: *Vector and its Cartesian equivalent will be dealt side by side.*

Unit VII Cubic equation, limit and continuity of a function.

- (i) Statement of factor, theorem, synthetic division, relation between roots and coefficients of a given cubic equation.
- (ii) Solution of cubic whose roots are connected with a given relation and solution of cubic whose roots are in A.P, G.P, H.P
- (iii) Evaluation of symmetric functions of the roots of the cubic equation of the form $\sum 1/\alpha, \sum \alpha^2, \sum \alpha^3, \sum \alpha^2\beta$
- (iv) Concept of $\lim_{x \rightarrow a} f(x), \lim_{x \rightarrow a^+} f(x), \lim_{x \rightarrow a^-} f(x)$

Fundamental theorems on limits. Evaluation of limits using the following standard results

$$\lim_{x \rightarrow a} x^n - a^n / x - a = na^{n-1}, \lim_{x \rightarrow 0} \sin x = 0, \lim_{x \rightarrow 0} \cos x = 1, \lim_{x \rightarrow 0} \sin x / x = 1$$

$$\lim_{x \rightarrow 0} \log (1+x) / x = 1, \lim_{x \rightarrow 0} e^x - 1 / x = 1$$

- $x \rightarrow 0$ $x \rightarrow 0$
- (v) Continuity of a function at a point, sum, product and quotient of continuous functions. continuity of polynomials, exponential, logarithmic and inverse, trigonometric functions.

Marks (08)

Unit VIII

- (i) Derivative of sum, difference, product and quotient of two or more functions.
- (ii) Derivative of a composite, algebraic and trigonometric functions.
- (iii) Derivative of inverse trigonometric functions, logarithmic functions and exponential functions.
- (iii) Applications of derivatives:- increasing and decreasing functions, equations of tangents and normal to a given curve at a given point, maxima and minima (absolute, local) (simple problems only).
- (v) Rolle's Theorem, Lagranges Mean Value Theorem with simple applications.

Marks (07)

Unit IX

- (i) Integration as the inverse process of differentiation, Integration by substitution and by parts.
- (ii) Evaluation of definite integrals
- (iii) Properties of definite integrals
- (iv) Application of integrals in finding the area bounded by a curve between two ordinates and x-axis (simple problems), order and degree of differential equation.
- (v) Solution of differential equations by method of variable separable, solution of linear differential equation of first order of type $dy/dx + py = q$ where p and q are constants or functions of x alone.

Marks (07)

Unit X Mathematical statistics

- (i) Random experiment and its associated sample space, events as subsets of a sample space, probability of an event. Probability of union, intersection of two events which are mutually exclusive/not mutually exclusive (simple problems)
- (ii) Definition of random variable, discrete and continuous type of random variables with example. Probability density function of one random variable x with examples.
- (iii) Mode and median of distribution of one random variable.
- (iv) Distribution function and its properties examples of distribution function.
- (v) Mathematical expectation, mean, variance, standard deviation and m.g.f. of a random variable x . (simple problems)

Marks (08)