# SUBJECT: MATHEMATICS

## ALGEBRA

a) **Functions**: Types of functions – Definitions - Inverse functions and Theorems - Domain, Range, Inverse of real valued functions.

b) **Mathematical Induction**: Principle of Mathematical Induction & Theorems - Applications of Mathematical Induction - Problems on divisibility.

c) **Matrices**: Types of matrices - Scalar multiple of a matrix and multiplication of matrices - Transpose of a matrix - Determinants - Adjoint and Inverse of a matrix - Consistency and inconsistency of Equations- Rank of a matrix - Solution of simultaneous linear equations.

d) **Complex Numbers**: Complex number as an ordered pair of real numbers- fundamental operations - Representation of complex numbers in the form a+ib - Modulus and amplitude of complex numbers –Illustrations - Geometrical and Polar Representation of complex numbers in Argand plane-Argand diagram.

e) **DeMoivre's Theorem**: De Moivre's theorem- Integral and Rational indices - $n^{th}$ roots of unity- Geometrical Interpretations –Illustrations.

f) **Quadratic Expressions**: Quadratic expressions, equations in one variable - Sign of quadratic expressions – Change in signs – Maximum and minimum values – Quadratic inequations.

g) **Theory of Equations**: The relation between the roots and coefficients in an equation - Solving the equations when two or more roots of it are connected by certain relation - Equation with real coefficients, occurrence of complex roots in conjugate pairs and its consequences-Transformation of equations- Reciprocal Equations.

h) **Permutations and Combinations**: Fundamental Principle of counting – linear and circular permutations- Permutations of 'n' dissimilar things taken 'r' at a time - Permutations when repetitions allowed - Circular permutations - Permutations with constraint repetitions - Combinations-definitions, certain theorems and their applications.

i) **BinomialTheorem**:Binomial theorem for positive integral index-Binomial theorem for rational Index(without proof) - Approximations using Binomial theorem.

j) **Partial fractions**: Partial fractions of f(x)/g(x) when g(x) contains non –repeated linear factors - Partial fractions of f(x)/g(x) where both f(x) and g(x) are polynomials and when g(x) contains repeated and/or non-repeated linear factors - Partial fractions of f(x)/g(x) when g(x) contains irreducible factors.

## DELETIONS FROM ALGEBRA:

a) **Complex Numbers**: 1.2.8-> Square root of a Complex Number and related problems in solved and exercise-1(b)

b) **Quadratic Expressions**: 3.3-> Quadratic inequations including exercise-3(c)

c) **Theory of Equations**: 4.4-> Transformation of Equations including exercise-4(d)

d) **Permutations and Combinations**: Derivation of formula npr and ncr. Theorems:5.2.1 and 5.6.1

e) **Binomial Theorem**: *Entire Chapter Deleted.*

f) **Partial fractions**: 7.3.8 and including exercise 7(d)

## TRIGONOMETRY

a) **Trigonometric Ratios upto Transformations**: Graphs and Periodicity of Trigonometric functions - Trigonometric ratios and Compound angles - Trigonometric ratios of multiple and sub- multiple angles - Transformations - Sum and Product rules.

b) **Trigonometric Equations**: General Solution of Trigonometric Equations - Simple Trigonometric Equations – Solutions.

c) **Inverse Trigonometric Functions**: To reduce a Trigonometric Function into a bijection - Graphs of Inverse Trigonometric Functions - Properties of Inverse Trigonometric Functions.

d) **Hyperbolic Functions**: Definition of Hyperbolic Function – Graphs - Definition of Inverse Hyperbolic Functions – Graphs - Addition formulae of HyperbolicFunctions.

e) **Properties of Triangles**: Relation between sides and angles of a Triangle - Sine, Cosine, Tangent and Projection rules- Half angle formulae and areas of a triangle–Incircle and Excircle of a Triangle.

## VECTOR ALGEBRA

a) **Addition of Vectors**: Vectors as a triad of real numbers - Classification of vectors - Addition of vectors - Scalar multiplication - Angle between two non-zero vectors - Linear combination of vectors - Component of a vector in three dimensions - Vector equations of line and plane including their Cartesian equivalent forms.

b) **Product of Vectors**: Scalar Product - Geometrical Interpretations - orthogonal projections - Properties of dot product - Expression of dot product in i, j, k system - Angle between two vectors - Geometrical Vector methods - Vectorequationsofplaneinnormalform-Anglebetweentwoplanes-Vectorproductoftwovectorsandproperties- Vector product in i, j, k system - Vector Areas - Scalar Triple Product - Vector equations of plane in different forms, skew lines, shortest distance and their Cartesian equivalents. Plane through the line of intersection of two planes, condition for coplanarity of two lines, perpendicular distance of a point from a plane, angle between line and a plane. Cartesian equivalents of all these results - Vector Triple Product –Results.

## MEASURES OF DISPERSION AND PROBABILITY

a) **Measures of Dispersion** - Range - Mean deviation - Variance and standard deviation of ungrouped/grouped data – Coefficient of variation and analysis of frequency distribution with equal means but different variances.

b) **Probability**: Random experiments and events - Classical definition of probability, Axiomatic approach and addition theorem of probability - Independent and dependent events - conditional probability- multiplication theorem and Baye's theorem and applications.

c) **Random Variables and Probability Distributions**: Random Variables - Theoretical discrete distributions – Binomial and Poisson Distributions.

## DELETIONS FROM MEASURES OF DISPERSION AND PROBABILITY:

a) **Measures of Dispersion** - Range - Mean deviation - Variance and standard deviation of ungrouped/grouped data - Coefficient of variation and analysis of frequency distribution with equal means but different variances.

## COORDINATEGEOMETRY

a) **Locus**: Definition of locus –Illustrations-To find equations of locus-Problems connected to it.

b) **Trans formation of Axes**: Transformation of axes - Rules, Derivations and Illustrations - Rotation of axes - Derivations –Illustrations.

c) **The Straight Line**: Revision of fundamental results - Straight line - Normal form – Illustrations - Straight line - Symmetric form - Straight line - Reduction into various forms - Intersection of two Straight Lines - Family of straight lines - Concurrent lines - Condition for Concurrent lines - Angle between two lines - Length of perpendicular from a point to a Line - Distance between two parallel lines - Concurrent lines - properties related toa triangle.

d) **Pair of Straight lines**: Equations of pair of lines passing through origin - angle between a pair of lines - Condition for perpendicular and coincident lines, bisectors of angles - Pair of bisectors of angles - Pair of lines - second degree general equation - Conditions for parallel lines - distance between them, Point of intersection of pair of lines - Homogenizing a second degree equation with a first degree equation in x and y.

e) **Circle** : Equation of circle -standard form-centre and radius equation of a circle with a given line segment as diameter & equation of circle through three non collinear points - parametric equations of a circle - Position of a point in the plane of a circle – power of a point-definition of tangent-length of tangent - Position of a straight line in the plane of a circle-conditions for a line to be tangent – chord joining two points on a circle – equation of the tangent at a point on the circle- point of contact-equation of normal - Chord of contact - pole and polar-conjugate points and conjugate lines - equation of chord in term of its midpoint - Relative position of two circles- circles touching each other externally, internally- common tangents –centers of similitude- equation of pair of tangents from an externalpoint.

f) **System of circles**: Angle between two intersecting circles - Radical axis of two circles- properties- Common chord and common tangent of two circles – radicalcentre.

g) **Parabola**: Conic sections –Parabola- equation of parabola in standard form-different forms of parabola- parametric equations - Equations of tangent and normal at a point on the parabola (Cartesian and parametric) - conditions for straight line to be atangent.

h) **Ellipse**: Equation of ellipse in standard form- Parametric equations - Equation of tangent and normal at a point on the ellipse (Cartesian and parametric) - condition for a straight line to bea tangent.

i) **Hyperbola**: Equation of hyperbola in standard form- Parametric equations - Equations of tangent and normal at a point on the hyperbola (Cartesian and parametric) - conditions for a straight line to be a tangent-Asymptotes.

j) **Three Dimensional Coordinates**: Coordinates - Section formulae - Centroid of a triangleand tetrahedron.

k) **Direction Cosines and Direction Ratios**: Direction Cosines - DirectionRatios.

l) **Plane**: Cartesian equation of Plane - SimpleIllustrations.

**DELETIONS FROM COORDINATEGEOMETRY:**

a) **Circle**: 1.5-> Relative positions of two circles including Ex 1(e) and solved problems

b) **Parabola**: 3.2-> Tangents & Normal including Ex 3(b)

c) **Ellipse**: 4.2-> Equations of tangents & Normal including Ex 4(b)

**CALCULUS**

a) **Limits and Continuity**: Intervals and neighborhoods – Limits - Standard Limits –Continuity.

b) **Differentiation**: Derivative of a function - Elementary Properties - Trigonometric, Inverse

Trigonometric, Hyperbolic, Inverse Hyperbolic Function – Derivatives - Methods of Differentiation - SecondOrder Derivatives.

c) **Applications of Derivatives**: Errors and approximations - Geometrical Interpretation of a derivative - Equations of tangents and normals - Lengths of tangent, normal, sub tangent and sub normal - Angles between two curves and condition for orthogonality of curves - Derivative as Rate of change - Rolle's Theorem and Lagrange's Mean value theorem without proofs and their geometrical interpretation - Increasing and decreasing functions - Maxima and Minima.

d) **Integration**: Integration as the inverse process of differentiation- Standard forms -properties of integrals - Method of substitution- integration of Algebraic, exponential, logarithmic, trigonometric and inverse trigonometric functions - Integration by parts – Integration by Partial fractions method – Reduction formulae.

e) **Definite Integrals**: Definite Integral as the limit of sum - Interpretation of Definite Integral as an area - Fundamental theorem of Integral Calculus (without proof) – Properties - Reduction formulae - Application of Definite integral toareas.

f) **Differential equations**: Formation of differential equation-Degree and order of an ordinary differential equation - Solving differential equation by i) Variables separable method, ii) Homogeneous differential equation, iii) Non - Homogeneous differential equation, iv) Linear differentialequations.

**DELETIONS FROM CALCULUS:**

a) **Definite Integrals**: 7.1 and 7.2 -> Definite integral as the limit of the sum and limit of the sum and related problems in exercise 7(a) and 7(b) and Examples 7.6-> Application of Definite integrals to areas including exercise 7(d)

b) **Differential equations**: 8.17-> Formation of Differential Equations and problems related to it 8.2(C): Non – Homogeneous Differential Equations including Ex 8(d) Solution of linear differential Equations of the type dx+Px=Q, Where P and Q

## SUBJECT: PHYSICS

# Physics-I: Intermediate First Year

**1. PHYSICAL WORLD:** What is physics? Scope and excitement of physics. Physics, technology and society Fundamental forces in nature. Nature of physical laws

**2. UNITS AND MEASUREMENTS:** The international system of units, Measurement of Length, Measurement of Large Distances, Estimation of Very Small Distances, Size of a Molecule, Range of Lengths, Measurement of Mass, Range of Masses, Measurement of time, Accuracy, precision of instruments and errors in measurement, Systematic errors, random errors, least count error, Absolute Error, Relative Error and Percentage Error, Combination of Errors, Significant figures, Rules for Arithmetic Operations with Significant Figures, Rounding off the Uncertain Digits, Rules for Determining the Uncertainty in the Results of Arithmetic Calculations, Dimensions of Physical Quantities, Dimensional Formulae and dimensional equations, Dimensional Analysis and its Applications, Checking the Dimensional Consistency of Equations, Deducing Relation among the Physical Quantities.

**3. MOTION IN A STRAIGHT LINE:** Position, path length and displacement, average velocity and average speed, instantaneous velocity and speed, acceleration, kinematic equations for uniformly accelerated motion, relative velocity.

**4. MOTION IN A PLANE:** Scalars and vectors, position and displacement vectors, equality of vectors, multiplication of vectors by real numbers, addition and subtraction of vectors - graphical method, resolution of vectors, vector addition - analytical method, motion in a plane, position vector and displacement, velocity, acceleration, motion in a plane with constant acceleration, relative velocity in two dimensions, projectile motion, equation of path of a projectile, time of maximum height, maximum height of a projectile, horizontal range of projectile, uniform circular motion.

**5. LAWS OF MOTION:** Aristotle's fallacy, The law of inertia, Newton's first law of motion, Newton's second law of motion, momentum, Impulse, Newton's third law of motion, Conservation of momentum, Equilibrium of a particle, Common forces in mechanics, friction, types of friction, static, kinetic and rolling frictions, Circular motion, Motion of a car on a level road, Motion of a car on a banked road, solving problems in mechanics.

**6. WORK, ENERGY AND POWER:** The Scalar Product, Notions of work and kinetic energy, The work-energy theorem, Work, Kinetic energy, Work done by a variable force, The work-energy theorem for a variable force, The concept of Potential Energy, The conservation of Mechanical Energy, The Potential Energy of a spring, Various forms of energy, Heat, Chemical Energy, Electrical Energy, The Equivalence of Mass and Energy, Nuclear Energy, The Principle of Conservation of Energy, Power, Collisions, Elastic and Inelastic Collisions, Collisions in one dimension, Coefficient of Restitution and its determination, Collisions in Two Dimensions.

**7. SYSTEMS OF PARTICLES AND ROTATIONAL MOTION:** Rigid body motion, Centre of mass, Centre of Gravity, Motion of centre of mass, Linear momentum of a system of particles, Vector product of two vectors, Angular velocity and its relation with linear velocity, Angular acceleration, Kinematics of rotational motion about a fixed axis, Moment of force (Torque), Angular momentum of particle, Torque and angular momentum for a system of a particles, conservation of angular momentum, Equilibrium of a rigid body, Principle of moments, Moment of inertia, Theorems of perpendicular and parallel axes, Dynamics of rotational motion about a fixed axis, Angular momentum in case of rotation about a fixed axis, Rolling motion, Kinetic Energy of Rolling Motion.

**8. OSCILLATIONS:** Periodic and oscillatory motions, Period and frequency, Displacement, Simple harmonic motion (S.H.M.), Simple harmonic motion and uniform circular motion, Velocity and acceleration in simple harmonic motion, Force law for Simple harmonic Motion, Energy in simple harmonic motion, some systems executing Simple Harmonic Motion, Oscillations due to a spring, The Simple Pendulum, damped simple harmonic motion, Forced oscillations and resonance.

**9. GRAVITATION:** Kepler's laws, Universal law of gravitation, central forces, the gravitational constant, Acceleration due to gravity of the earth, Acceleration due to gravity below and above the surface of earth, Gravitational potential energy, Escape speed, Orbital Speed, Earth satellites, Energy of an orbiting satellite, Geostationary and polar satellites, Weightlessness.

**10. MECHANICAL PROPERTIES OF SOLIDS:** Elastic behavior of solids, Stress and strain, Hooke's law, Stress-strain curve, Elastic moduli, Young's Modulus, Determination of Young's Modulus of the Material of a Wire, Shear Modulus, Bulk Modulus, Poisson's Ratio, Elastic Potential Energy in a Stretched wire, Applications of elastic behavior of materials.

**11. MECHANICAL PROPERTIES OF FLUIDS:** Pressure, Pascal's Law, Variation of Pressure with Depth, Atmospheric Pressure and Gauge Pressure, Hydraulic Machines, Archimedes' Principle, Streamline flow, Bernoulli's principle, Speed of Efflux, Torricelli's Law, Venturi- meter, Blood Flow and Heart Attack, Dynamic Lift, Viscosity, Variation of Viscosity of fluids with temperature, Stokes' Law, Reynolds number, Critical Velocity, Surface tension and Surface Energy, Angle of Contact, Drops and Bubbles, Capillary Rise, Detergents and Surface Tension.

**12. THERMAL PROPERTIES OF MATTER:** Temperature and heat, Measurement of temperature, Ideal-gas equation and absolute temperature, Thermal expansion, Specific heat capacity, Calorimetry, Change of state, Triple Point, Regelation, Latent Heat, Heat transfer, Conduction, Convection, Radiation, Black body Radiation, Greenhouse Effect, Newton's law of cooling and its experimental verification.

**13. THERMODYNAMICS:** Thermal equilibrium, Zeroth law of thermodynamics, Heat, Internal Energy and work, First law of thermodynamics, Specific heat capacity, Specific heat capacity of water, Thermodynamic state variables and equation of State, Thermodynamic processes, Quasi-static process, Isothermal Process, Adiabatic Process, Isochoric Process, Isobaric process, Cyclic process, Heat engines, Refrigerators and heat pumps, Second law of thermodynamics, Reversible and irreversible processes, Carnot engine, Carnot's theorem.

**14. KINETIC THEORY:** Molecular nature of matter, Behaviour of gases, Boyle's Law, Charles' Law, Kinetic theory of an ideal gas, Pressure of an Ideal Gas, Kinetic interpretation of temperature, Law of equipartition of energy, Specific heat capacity, Monatomic Gases, Diatomic Gases, Polyatomic Gases, Specific Heat Capacity of Solids, Specific Heat Capacity of Water, Mean freepath.

## Physics-II: Intermediate Second Year

**1. WAVES:** Transverse and longitudinal waves, displacement relation in a progressive wave, amplitude and phase, wavelength and angular wave number, period, angular frequency and frequency, the speed of a travelling wave, speed of a transverse wave on stretched string, speed of a longitudinal wave (speed of sound), the principle of superposition of waves, reflection of waves, standing waves and normal modes, beats, Doppler effect: source moving and observer stationary, observer moving and source stationary, both source and observer moving.

**2. RAY OPTICS AND OPTICAL INSTRUMENTS:** Reflection of light by spherical mirrors, sign convention, focal length of spherical mirrors, the mirror equation, refraction, total internal reflection, total internal reflection in nature and its technological applications, refraction at spherical surfaces and by lenses, power of a lens, combination of thin lenses in contact, refraction through a prism, dispersion by a prism, some natural phenomena due to sunlight, the rainbow, scattering of light, optical instruments, the eye, the simple and compound microscopes, refracting telescope and Cassegrain reflecting telescope.

**3. WAVE OPTICS:** Huygens principle, refraction and reflection of plane waves using Huygens principle, refraction in a rarer medium (at the denser medium boundary), reflection of a plane wave by

a plane surface, the Doppler effect, coherent and incoherent addition of waves, interference of light waves and Young's experiment, diffraction, the single slit diffraction, resolving power of optical instruments, the validity of ray optics, polarisation, polarisation by scattering, polarisation by reflection.

**4. ELECTRIC CHARGES AND FIELDS:** Electric charge, conductors and insulators, charging by induction, basic properties of electric charges, additivity of charges, conservation of charge, quantization of charge, Coulomb's law, forces between multiple charges, electric field, electric field due to a system of charges, physical significance of electric field, electric field lines, electric flux, electric dipole, the field of an electric dipole for points on the axial line and on the equatorial plane, physical significance of dipoles, dipole in a uniform external field, continuous charge distribution, Gauss's law, applications of Gauss's law, field due to an infinitely long straight uniformly charged wire, field due to a uniformly charged infinite plane sheet, field due to a uniformly charged thin spherical shell.

**5. ELECTROSTATIC POTENTIAL AND CAPACITANCE:** Electrostatic potential, potential due to a point charge, potential due to an electric dipole, potential due to a system of charges, equipotential surfaces, relation between field and potential, potential energy of a system of charges, potential energy in an external field, potential energy of a single charge, potential energy of a system of two charges in an external field, potential energy of a dipole in an external field, electrostatics of conductors, electrostatic shielding, dielectrics and polarisation, electric displacement, capacitors and capacitance, the parallel plate capacitor, effect of dielectric on capacitance, combination of capacitors, capacitors in series, capacitors in parallel, energy stored in a capacitor, Van de Graaff generator.

**6. CURRENT ELECTRICITY:** Electric current, electric current in conductors, Ohm's law, drift of electrons and the origin of resistivity, mobility, limitations of Ohm's law, resistivity of various materials, colour code of resistors, Temperature dependence of resistivity, electrical energy, power, combination of resistors – series and parallel. Cells, EMF, internal resistance, cells in series and in parallel, Kirchhoff's rules, Wheatstone Bridge, Meter Bridge, Potentiometer.

**7. MOVING CHARGES AND MAGNETISM:** Magnetic force, sources and fields, magnetic field, Lorentz force, magnetic force on a current carrying conductor, motion in a magnetic field, helical motion of charged particles, motion in combined electric and magnetic fields, velocity selector, Cyclotron, magnetic field due to a current element, Biot – Savart's law, Magnetic field on the axis of a circular current loop, Ampere's circuital law, the solenoid and the toroid, force between two parallel current carrying conductors, the ampere (UNIT), torque on current loop, magnetic dipole, torque on a rectangular current loop in a uniform magnetic field, circular current loop as a magnetic dipole, the magnetic dipole moment of a revolving electron, the Moving Coil Galvanometer; conversion into ammeter and voltmeter.

**8. MAGNETISM AND MATTER:** The bar magnet, the magnetic field lines, bar magnet as an equivalent solenoid, The dipole in a uniform magnetic field, the electrostatic analog, Magnetism and Gauss's Law, The Earth's magnetism, magnetic declination and dip, magnetisation and magnetic intensity, susceptibility, magnetic properties of materials; Diamagnetism, Paramagnetism, Ferromagnetism, Hysteresis loop, permanent magnets and electromagnets.

**9. ELECTROMAGNETIC INDUCTION:** The experiments of Faraday and Henry, magnetic flux, Faraday's Law of induction, Lenz's law and conservation of energy, motional electromotive force, energy consideration - a quantitative study, Eddy currents, inductance, mutual inductance, self-inductance, AC generator.

**10. ALTERNATING CURRENT:** AC voltage applied to a resistor, representation of AC current and voltage by rotating vectors - Phasors, AC voltage applied to an inductor, AC voltage applied to a capacitor, AC voltage applied to a series LCR circuit, Phasor – diagram solution, analytical solution, resonance, sharpness of resonance, power in AC circuit, the power factor, LC oscillations,

transformers.

**11. ELECTROMAGNETIC WAVES:** Displacement current, Maxwell's equations, electromagnetic waves, sources of electromagnetic waves, nature of electromagnetic waves, electromagnetic spectrum: radio waves, microwaves, infrared waves, visible rays, ultraviolet rays, X-rays, gamma rays.

**12. DUAL NATURE OF RADIATION AND MATTER:** Electron emission, Photoelectric Effect, Hertz's observations, Hallwachs and Lenard's observations, experimental study of photoelectric effect, effect of intensity of light on photocurrent, effect of potential on photoelectric current, effect of frequency of incident radiation on stopping potential, Photoelectric effect and Wave theory of Light, Einstein's Photoelectric equation, Energy Quantum of Radiation, particle nature of light, the photon, wave nature of matter, photocell, Davisson and Germer experiment.

**13. ATOMS:** Alpha particle scattering and Rutherford's nuclear model of atom, alpha particle trajectory, electron orbits, atomic spectra, spectral series, Bohr model of the hydrogen atom, energy levels, Franck – Hertz experiment, the line spectra of the hydrogen atom, deBroglie's explanation of Bohr's second postulate of quantization, LASERlight.

**14. NUCLEI:** Atomic masses and composition of nucleus, discovery of neutron, size of the nucleus, Mass - Energy and Nuclear Binding Energy, Nuclear Force, Radioactivity, Law of radioactive decay, Alpha decay, Beta decay, Gamma decay, Nuclear Energy, Fission, Nuclear reactor, nuclear fusion, energy generation in stars, controlled thermonuclear fusion.

**15. SEMICONDUCTOR ELECTRONICS: MATERIALS, DEVICES AND SIMPLE CIRCUITS:** Classification of metals, conductors, and semiconductors on the basis of conductivity and energy bands, Band theory of solids, Intrinsic semiconductor, Extrinsic semiconductor, p-type semiconductor, n-type semiconductor, p-n junction formation, semiconductor diode, p-n junction diode under forward bias, p-n junction diode under reverse bias, Application of junction diode as a rectifier, special purpose p-n junction diodes, Zener diode, Zener diode as voltage regulator, Optoelectronic junction devices, Photodiode, light emitting diode, solar cell. Junction transistor, structure and action, Basic transistor circuit configurations and transistor characteristics, transistor as a switch and as an amplifier (CE – Configuration), Feedback amplifier and transistor oscillator, Digital Electronics and Logic gates, NOT, OR, AND, NAND and NOR Gates, Integrated circuits.

**16. COMMUNICATION SYSTEMS:** Elements of a Communication system, basic terminology used in electronic communication systems, bandwidth of signals, bandwidth of transmission medium, propagation of electromagnetic waves, ground waves, sky waves, space wave, modulation and its necessity, size of the antenna or aerial, effective power radiated by an antenna, mixing up of signals from different transmitters, amplitude modulation, production of amplitude modulated wave, detection of amplitude modulated wave.

## DELETIONS FROM PHYSICS 2nd YEAR INTERMEDIATE SYLLABUS:

**1. WAVES:** Doppler effected and its two situations.

**2. RAY OPTICS AND OPTICAL INSTRUMENTS:** Reflection of light by spherical mirrors, the mirror equation. Scattering of light reddish appearance of the sun at sunrise and sunset and blue colors of sky.

**3. WAVE OPTICS: Diffraction**: Resolving power of optical instruments (microscope and astronomical telescope). **Polarisation**: Polarisation of reflection (Brewster's law) plane polarized light (uses) polaroids, polarization by scattering.

**4. ELECTRIC CHARGES AND FIELDS:** Application of Gauss's law: Field due to uniformly charged thin spherical shell (field inside and outside).

**6. CURRENT ELECTRICITY:** Colour code for carbon resistors, series and parallel Combinations of resistors.

**7. MOVING CHARGES AND MAGNETISM:** Cyclofron.

**8. MAGNETISM AND MATTER:** Magnetic field intensity due to a magnetic dipole (Bar magnet) along its axis and perpendicular to its axis (Bar magnet as an equivalent solenoid), the dipole in a uniform magnet field Magnetic property of materials (Para, dia and ferro) and its examples, permanent magnets and electromagnets

**10. ALTERNATING CURRENT:** Power in AC circuit–The power factor, wattles current.

**11. ELECTROMAGNETIC WAVES:** Displacement current.

**12. DUAL NATURE OF RADIATION AND MATTER:** Davisson and Germer experiment.

**14. NUCLEI:** Radio activity (alpha, beta and gamma particles and their properties) Law of radioactive decay, half-life and mean life of a Radioactive material, Binding energy per nucleon and its variation with mass number.

**15. SEMICONDUCTOR ELECTRONICS: MATERIALS, DEVICES AND SIMPLE CIRCUITS:** Purpose of P-N junction diode 1. Zener diode and their characteristics 2. Zener diode as a voltage regulator.

# SUBJECT: CHEMISTRY
# Chemistry-I: Intermediate First Year

**1. ATOMIC STRUCTURE:** Sub- atomic particles; Atomic models –Rutherford's Nuclear model of atom; Developments to the Bohr's model of atom; Nature of electromagnetic radiation; Particle nature of electromagnetic radiation- Planck's quantum theory; Bohr's model for Hydrogen atom; Explanation of line spectrum of hydrogen; Limitations of Bohr's model; Quantum mechanical considerations of sub atomic particles; Dual behaviour of matter; Heisenberg's uncertainty principle; Quantum mechanical model of an atom. Important features of Quantum mechanical model of atom; Orbitals and quantum numbers; Shapes of atomic orbitals; Energies of orbitals; Filling of orbitals in atoms. Aufbau Principle, Pauli's exclusion Principle and Hund's rule of maximum multiplicity; Electronic configurations of atoms; Stability of half-filled and completely filled orbitals.

**2. CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES:** Need to classify elements; Genesis of periodic classification; Modern periodic law and present form of the periodic table; Nomenclature of elements with atomic number greater than 100; Electronic configuration of elements and the periodic table; Electronic configuration and types of elements s,p,d. and f blocks; Trends in physical properties:(a) Atomic radius, (b) Ionic radius (c) Variation of size in inner transition elements, (d) Ionization enthalpy,(e) Electron gain enthalpy, (f) Electro negativity; Periodic trends in chemical properties: (a) Valence or Oxidation states, (b) Anomalous properties of second period elements - diagonal relationship; Periodic trends and chemical reactivity.

**3. CHEMICAL BONDING AND MOLECULAR STRUCTURE:** Kossel - Lewis approach to chemical bonding, Octet rule, Representation of simple molecules, formal charges, limitations of octet rule; Ionic or electrovalent bond - Factors favourable for the formation of ionic compounds- Crystal structure of sodium chloride, General properties of ionic compounds; Bond Parameters - bond length, bond angle, and bond enthalpy, bond order, resonance-Polarity of bonds dipole moment-Fajan rules; Valence Shell Electron Pair Repulsion (VSEPR) theory; Predicting the geometry of simple molecules; Valence bond theory-Orbital overlap concept-Directional properties of bonds-overlapping of atomic orbitals-types of overlapping and nature of covalent bonds-strength of sigma and pi bonds-Factors favouring the formation of covalent bonds; Hybridisation- different types of hybridization involving s, p and d orbitals- shapes of simple covalent molecules; Coordinate bond - definition with examples; Molecular orbital theory - Formation of molecular orbitals, Linear combination of atomic orbitals (LCAO)-conditions for combination of atomic orbitals - Energy level diagrams for molecular orbitals -Bonding in some homo nuclear diatomic molecules- $H_2$, $He_2$, $Li_2$, $B_2$, $C_2$, $N_2$ and $O_2$; Hydrogen bonding-cause of formation of hydrogen bond - Types of hydrogen bonds-inter and intra molecular-General properties of hydrogen bonds.

**4. STATES OF MATTER: GASES AND LIQUIDS:** Intermolecular forces; Thermal Energy; Intermolecular forces Vs Thermal interactions; The Gaseous State; The Gas Laws; Ideal gas equation; Graham's law of diffusion - Dalton's Law of partial pressures; Kinetic molecular theory of gases; Kinetic gas equation of an ideal gas (No derivation) deduction of gas laws from Kinetic gas equation; Distribution of molecular speeds - rms, average and most probable speeds-Kinetic energy of gas molecules; Behaviour of real gases - Deviation from Ideal gas behaviour - Compressibility factor Vs Pressure diagrams of real gases; Liquefaction of gases; Liquid State - Properties of Liquids in terms of Inter molecular interactions - Vapour pressure, Viscosity and Surface tension (Qualitative idea only. No mathematical derivation).

**5. STOICHIOMETRY:** Some Basic Concepts - Properties of matter - uncertainty in Measurement-significant figures, dimensional analysis; Laws of Chemical Combinations - Law of Conservation of Mass, Law of Definite Proportions, Law of Multiple Proportions, Gay Lussac's Law of Gaseous Volumes, Dalton's Atomic Theory, Avogadro Law, Examples; Atomic and molecular masses- mole concept and molar mass. Concept of equivalent weight; Percentage composition of compounds and calculations of empirical and molecular formulae of compounds; Stoichiometry and stoichiometric

calculations-limiting reagent; Methods of Expressing concentrations of solutions-mass percent, mole fraction, molarity, molality and normality; Redox reactions-classical idea of redox reactions, oxidation and reduction reactions-redox reactions in terms of electron transfer; Oxidation number concept; Types of Redox reactions- combination, decomposition, displacement and disproportionation reactions; Balancing of redox reactions - oxidation number method Half reaction (ion-electron) method; Redox reactions in Titrimetry.

**6. THERMODYNAMICS:** Thermodynamic Terms; The system and the surroundings; Types of systems and surroundings; The state of the system; The Internal Energy as a State Function. (a) Work (b) Heat (c) The general case, the first law of Thermodynamics; Applications; Work; Enthalpy, H- a useful new state function; Extensive and intensive properties; Heat capacity; The relationship between $C_p$ and $C_v$; Measurement of □ U and □ H: Calorimetry; Enthalpy change, □$_r$H of reactions - reaction Enthalpy (a) Standard enthalpy of reactions, (b) Enthalpy changes during transformations, (c) Standard enthalpy of formation, (d) Thermo chemical equations (e) Hess's law of constant Heat summation; Enthalpies for different types of reactions. (a) Standard enthalpy of combustion ($\Delta_cH^\square$), (b) Enthalpy of atomization ($\Delta_aH^\square$), phase transition, sublimation and ionization, (c) Bond Enthalpy ($\Delta_{bond}H^\square$), (d) Enthalpy of solution ($\Delta_{sol}H^\square$) and dilution-lattice enthalpy; Spontaneity. (a) Is decrease in enthalpy a criterion for spontaneity? (b) Entropy and spontaneity, the second law of thermodynamics, (c) Gibbs Energy and spontaneity; Gibbs Energy change and equilibrium; Absolute entropy and the third law ofthermodynamics.

**7. CHEMICAL EQUILIBRIUM AND ACIDS-BASES:** Equilibrium in Physical process; Equilibrium in chemical process - Dynamic Equilibrium; Law of chemical Equilibrium - Law of mass action and Equilibrium constant; Homogeneous Equilibria, Equilibrium constant in gaseous systems. Relationship between $K_P$ and $K_c$; Heterogeneous Equilibria; Applications of Equilibrium constant; Relationship between Equilibrium constant K, reaction quotient Q and Gibbs energy G; Factors affecting Equilibria.-Le-chatlier principle application to industrial synthesis of Ammonia and Sulphur trioxide; Ionic Equilibrium in solutions; Acids, bases and salts- Arrhenius, Bronsted-Lowry and Lewis concepts of acids and bases; Ionisation of Acids and Bases - Ionisation constant of water and its ionic product- pH scale-ionisation constants of weak acids-ionisation of weak bases-relation between $K_a$ and $K_b$-Di and poly basic acids and di and poly acidic Bases-Factors affecting acid strength- Common ion effect in the ionization of acids and bases-Hydrolysis of salts and pH of their solutions; Buffer solutions- designing of buffer solution-Preparation of Acidic buffer; Solubility Equilibria of sparingly soluble salts. Solubility product constant Common ion effect on solubility of Ionic salts.

**8. HYDROGEN AND ITS COMPOUNDS:** Position of hydrogen in the periodic table; Dihydrogen-Occurrence and Isotopes; Preparation of Dihydrogen; Properties of Dihydrogen; Hydrides: Ionic, covalent, and non-stoichiometric hydrides; Water: Physical properties; structure of water, ice. Chemical properties of water; hard and soft water, Temporary and permanent hardness of water; Hydrogen peroxide: Preparation; Physical properties; structure and chemical properties; storage and uses; Heavy Water; Hydrogen as a fuel.

**9. THE s - BLOCK ELEMENTS (ALKALI AND ALKALINE EARTH METALS):**

**Group 1 Elements :** Alkali metals; Electronic configurations; Atomic and Ionic radii; Ionization enthalpy; Hydration enthalpy; Physical properties; Chemical properties; Uses; General characteristics of the compounds of the alkali metals: Oxides; Halides; Salts of oxo Acids; Anomalous properties of Lithium: Differences and similarities with other alkali metals, Diagonal relationship; similarities between Lithium and Magnesium; Some important compounds of Sodium: Sodium Carbonate; Sodium Chloride; Sodium Hydroxide; Sodium hydrogen carbonate; Biological importance of Sodium andPotassium.

**Group 2 Elements:** Alkaline earth elements; Electronic configuration; Ionization enthalpy; Hydration enthalpy; Physical properties, Chemical properties; Uses; General characteristics of compounds of the Alkaline Earth Metals: Oxides, hydroxides, halides, salts of oxoacids (Carbonates; Sulphates and Nitrates); Anomalous behavior of Beryllium; its diagonal relationship with Aluminium; Some important compounds of calcium: Preparation and uses of Calcium Oxide; Calcium Hydroxide;

Calcium Carbonate; Plaster of Paris; Cement; Biological importance of Calcium andMagnesium.

**10. p- BLOCK ELEMENTS GROUP 13 (BORON FAMILY):** General introduction - Electronic configuration, Atomic radii, Ionization enthalpy, Electro negativity; Physical & Chemical properties; Important trends and anomalous properties of boron; Some important compounds of boron - Borax, Ortho boric acid, diborane; Uses of boron, aluminium and their compounds.

**11. p-BLOCK ELEMENTS - GROUP 14 (CARBON FAMILY):** General introduction - Electronic configuration, Atomic radii, Ionization enthalpy, Electro negativity; Physical & Chemical properties; Important trends and anomalous properties of carbon; Allotropes of carbon; Uses of carbon; Some important compounds of carbon and silicon - carbon monoxide, carbon dioxide, Silica, silicones, silicates and zeolites.

**12. ENVIRONMENTAL CHEMISTRY:** Definition of terms: Air, Water and Soil Pollutions; Environmental Pollution; Atmospheric pollution; Tropospheric Pollution; Gaseous Air Pollutants (Oxides of Sulphur; Oxides of Nitrogen; Hydrocarbons; Oxides of Carbon (CO, $CO_2$). Global warming and Greenhouse effect; Acid Rain- Particulate Pollutants- Smog; Stratospheric Pollution: Formation and breakdown of Ozone- Ozone hole- effects of depletion of the Ozone Layer; Water Pollution: Causes of Water Pollution; International standards for drinking water; Soil Pollution: Pesticides, Industrial Wastes; Strategies to control environmental pollution- waste Management-collection and disposal; Green Chemistry: Green chemistry in day-to-day life; Dry cleaning of clothes; Bleaching of paper; Synthesis ofchemicals.

**13. ORGANIC CHEMISTRY-SOME BASIC PRINCIPLES AND TECHNIQUES AND HYDROCARBONS:** General introduction; Tetravalency of Carbon: shapes of organic compounds; Structural representations of organic compounds; Classification of organic compounds; Nomenclature of organic compounds; Isomerism; Fundamental concepts in organic reaction mechanisms; Fission of covalent bond; Nucleophiles and electrophiles; Electron movements in organic reactions; Electron displacement effects in covalent bonds: inductive effect, resonance, resonance effect, electromeric effect, hyper conjugation; Types of Organic reactions; Methods of purification of organic compounds; Qualitative elemental analysis of organic compounds; Quantitative elemental analysis of organiccompounds.

**Hydrocarbons:** Classification of Hydrocarbons; **Alkanes** - Nomenclature, isomerism (structural and conformations of ethane only); Preparation of alkanes; Properties - Physical properties and chemical Reactivity, Substitution reactions – Halogenation (free radical mechanism), Combustion, Controlled Oxidation, Isomerisation, Aromatization, reaction with steam and Pyrolysis; **Alkenes-** Nomenclature, structure of ethene, Isomerism (structural and geometrical); Methods of preparation; Properties-Physical and chemical reactions: Addition of Hydrogen, halogen, water, sulphuric acid, Hydrogen halides (Mechanism- ionic and peroxide effect, Markovnikov's, anti-Markovnikov's or Kharasch effect). Oxidation, Ozonolysis and Polymerization; **Alkynes -** Nomenclature and isomerism, structure of acetylene. Methods of preparation of acetylene; Physical properties, Chemical reactions- acidic character of acetylene, addition reactions- of hydrogen, Halogen, Hydrogen halides and water. Polymerization; **Aromatic Hydrocarbons:** Nomenclature and isomerism, Structure of benzene, Resonance and aromaticity; Preparation of benzene. Physical properties. Chemical properties: Mechanism of electrophilic substitution. Electrophilic substitution reactions- Nitration, Sulphonation, Halogenation, Friedel-Craft' alkylation and acylation; Directive influence of functional groups in mono substituted benzene, Carcinogenicity andtoxicity.

## Chemistry-II: Intermediate Second Year

**1. SOLID STATE:** General characteristics of solid state; Amorphous and crystalline solids; Classification of crystallinesolids based on different binding forces (molecular, ionic, metallic and covalent solids); Probing the structure of solids: X-ray crystallography; Crystal lattices and unit cells. Bravais lattices primitive and centered unit cells; Number of atoms in a unit cell (primitive, body

centered and face centered cubic unit cell); Close packed structures: Close packing in one dimension, in two dimensions and in three dimensions- tetrahedral and octahedral voids- formula of a compound and number of voids filled- locating tetrahedral and octahedral voids; Packing efficiency in simple cubic, bcc and in hcp, ccp lattice; Calculations involving unit cell dimensions-density of the unit cell; Imperfections in solids-types of point defects-stoichiometric and non-stoichiometric defects; Electrical properties-conduction of electricity in metals, semiconductors and insulators- band theory of metals; Magnetic properties.

**2. SOLUTIONS:** Types of solutions; Expressing concentration of solutions - mass percentage, volume percentage, mass by volume percentage, parts per million, mole fraction, molarity and molality; Solubility: Solubility of a solid in a liquid, solubility of a gas in a liquid, Henry's law; Vapour pressure of liquid solutions: vapour pressure of liquid- liquid solutions. Raoult's law as a special case of Henry's law -vapour pressure of solutions of solids in liquids; Ideal and non-ideal solutions; Colligative properties and determination of molar mass-relative lowering of vapour pressure- elevation of boiling point-depression of freezing point-osmosis and osmotic pressure-reverse osmosis and water purification; Abnormal molar masses-van't Hoff factor.

**3. ELECTROCHEMISTRY AND CHEMICAL KINETICS:**
**Electrochemistry:** Electrochemical cells; Galvanic cells: measurement of electrode potentials; Nernst equation- equilibrium constant from Nernst equation- electrochemical cell and Gibbs energy of the cell reaction; Conductance of electrolytic solutions- measurement of the conductivity of ionic solutions-variation of conductivity and molar conductivity with concentration-strong electrolytes and weak electrolytes-applications of Kohlrausch's law; Electrolytic cells and electrolysis: Faraday's laws of electrolysis-products of electrolysis; Batteries: primary batteries and secondary batteries; Fuel cells; Corrosion of metals-Hydrogen economy.
**Chemical Kinetics:** Rate of a chemical reaction; Factors influencing rate of a reaction: dependence of rate on concentration- rate expression and rate constant- order of a reaction, molecularity of a reaction; Integrated rate equations-zero order reactions-first order reactions- half-life of a reaction; Pseudo first order reaction; Temperature dependence of the rate of a reaction -effect of catalyst; Collision theory of chemical reaction rates.

**4. SURFACE CHEMISTRY: Adsorption** : Distinction between adsorption and absorption-mechanism of adsorption-types of adsorption- characteristics of physisorption-characteristics of chemisorption-adsorption isotherms-adsorption from solution phase-applications of adsorption; **Catalysis**: Catalysts, promoters and poisons-auto catalysis- homogeneous and heterogeneous catalysis-adsorption theory of heterogeneous catalysis-important features of solid catalysts: (a)activity (b)selectivity-shape-selective catalysis by zeolites-enzyme catalysis-characteristics and mechanism-catalysts in industry; **Colloids**; Classification of colloids: Classification based on physical state of dispersed phase and dispersion medium- classification based on nature of interaction between dispersed phase and dispersion medium- classification based on type of particles of the dispersed phase- multi molecular, macromolecular and associated colloids- cleansing action of soaps-preparation of colloids-purification of colloidal solutions-properties of colloidal solutions: Colligative properties, Tyndal effect, colour, Brownian movement-charge on colloidal particles, electrophoresis; coagulation-precipitation methods-coagulation of lyophilic sols and protection of colloids- Emulsions; Colloids around us- application of colloids.

**5. GENERAL PRINCIPLES OF METALLURGY:** Occurrence of metals; Concentration of ores-levigation, magnetic separation, froth floatation, leaching; Extraction of crude metal from concentrated ore-conversion to oxide, reduction of oxide to the metal; Thermodynamic principles of metallurgy – Ellingham diagram-limitations-applications-extraction of iron, copper and zinc from their oxides; Electrochemical principles of metallurgy; Oxidation and reduction; Refining of crude metal-distillation, liquation poling, electrolytic refining, zone refining and vapour phase refining; Uses of aluminium, copper, zinc and iron.

**6. p-BLOCK ELEMENTS:**

**Group-15 Elements:** Occurrence- electronic configuration, atomic and ionic radii, ionisation enthalpy, electronegativity, physical and chemical properties; Dinitrogen-preparation, properties and uses; Compounds of nitrogen-preparation, properties and uses of ammonia; Oxides of nitrogen; Preparation and properties of nitric acid; Phosphorous-allotropic forms; Phosphine-preparation, properties and uses; Phosphorous halides; Oxoacids of phosphorous

**Group-16 Elements**: Occurrence- electronic configuration, atomic and ionic radii, ionisation enthalpy, electron gain enthalpy, electronegativity, physical and chemical properties; Dioxygen-preparation, properties and uses; Simple oxides; Ozone-preparation, properties, structure and uses; Sulphur-allotropic forms; Sulphur dioxide-preparation, properties and uses; Oxoacids of sulphur; Sulphuric acid- manufacture, properties anduses.

**Group-17 Elements:** Occurrence, electronic configuration, atomic and ionic radii, ionisation enthalpy, electron gain enthalpy, electro negativity, physical and chemical properties; Chlorine-preparation, properties and uses; Hydrogen chloride- preparation, properties and uses; Oxoacids of halogens; Interhalogen compounds- preparation, properties and uses.

**Group-18 Elements:** Occurrence, electronic configuration, ionization enthalpy, atomic radii, electron gain enthalpy, physical and chemical properties(a) Xenon-fluorine compounds- $XeF_2$,$XeF_4$ and $XeF_6$ - preparation, hydrolysis and formation of fluoro anions-structures of $XeF_2$, $XeF_4$ and $XeF_6$ (b) Xenon-oxygen compounds $XeO_3$ and $XeOF_4$ - their formation and structures-uses of noblegases.

**7. d AND f BLOCK ELEMENTS & COORDINATIONCOMPOUNDS:**

**d and f block elements:** Position in the periodic table; Electronic configuration of the d-block elements; General properties of the transition elements (d-block) -physical properties, variation in atomic and ionic sizes of transition series, ionisation enthalpies, oxidation states, trends in the $M^{2+}/M$ and $M^{3+}/M^{2+}$ standard electrode potentials, trends in stability of higher oxidation states, chemical reactivity and $E^{\theta}$ values, magnetic properties, formation of coloured ions, formation of complex compounds, catalytic properties, formation of interstitial compounds, alloy formation; Some important compounds of transition elements-oxides and oxoanions of metals-preparation, properties and uses of potassium dichromate and potassium permanganate-structures of chromate, dichromate, manganate and permanganate ions; Inner transition elements(f-block)-lanthanoids- electronic configuration-atomic and ionic sizes-oxidation states- general characteristics; Actinoids-electronic configuration atomic and ionic sizes, oxidation states, general characteristics and comparison with lanthanoids; Some applications of d and f block elements.

**Coordination compounds**: Werner's theory of coordination compounds; Definitions of some terms used in coordination compounds; Nomenclature of coordination compounds-IUPAC nomenclature; Isomerism in coordination compounds- (a)Stereo Isomerism-Geometrical and optical isomerism (b)Structural isomerism-linkage, coordination, ionisation and hydrate isomerism; Bonding in coordination compounds. (a)Valence bond theory - magnetic properties of coordination compounds-limitations of valence bond theory (b) Crystal field theory (i) Crystal field splitting in octahedral and tetrahedral coordination entities (ii) Colour in coordination compounds- limitations of crystal field theory; Bonding in metal carbonyls; Stability of coordination compounds; Importance and applications of coordinationcompounds.

**8. POLYMERS:** Classification of Polymers -Classification based on source, structure, mode of polymerization, molecular forces and growth polymerization; Types of polymerization reactions-addition polymerization or chain growth polymerization-ionic polymerization, free radical mechanism-preparation of addition polymers-polythene, teflon and polyacrylonitrile-condensation polymerization or step growth polymerization-polyamides-preparation of Nylon 6,6 and nylon 6-poly esters-terylene-bakelite, melamine-formaldehyde polymers; copolymerization- Rubber- natural rubber-vulcanisation of rubber-Synthetic rubbers-preparation of neoprene and buna-N; Molecular mass of polymers-number average and weight average molecular masses- poly dispersity index(PDI); Biodegradable polymers-PHBV, Nylon 2-nylon 6; Polymers of commercial importance-polypropene, polystyrene, polyvinylchloride (PVC), urea-formaldehyde resin, glyptal and bakelite - their monomers, structures and uses.

**9. BIOMOLECULES: Carbohydrates** - Classification of carbohydrates- Monosaccharides: preparation of glucose from sucrose and starch- Properties and structure of glucose- D,L configurations and (+), (-) notations of glucose-Structure of fructose; Disaccharides: Sucrose-preparation, structure; Invert sugar- Structures of maltose and lactose- Polysaccharides: Structures of starch, cellulose and glycogen- Importance of carbohydrates; **Proteins**- Aminoacids: Natural aminoacids-classification of aminoacids - structures and D and L forms-Zwitter ions; **Proteins:** Structures, classification, fibrous and globular- primary, secondary, tertiary and quarternary structures of proteins- Denaturation of proteins; **Enzymes:** Enzymes, mechanism of enzyme action; **Vitamins:** Explanation-names- classification of vitamins - sources of vitamins-deficiency diseases of different types of vitamins; **Nucleic acids:** chemical composition of nucleic acids, structures of nucleic acids, DNA finger printing biological functions of nucleic acids; **Hormones:** Definition, different types of hormones, their production, biological activity, diseases due to their abnormal activities.

**10. CHEMISTRY IN EVERYDAY LIFE:** Drugs and their classification: (a) Classification of drugs on the basis of pharmacological effect (b) Classification of drugs on the basis of drug action (c) Classification of drugs on the basis of chemical structure (d) Classification of drugs on the basis of molecular targets; Drug-Target Interaction-Enzymes as drug targets (a) Catalytic action of enzymes (b) Drug-enzyme interaction, receptors as drug targets; Therapeutic action of different classes of drugs: antacids, antihistamines, neurologically active drugs: tranquilizers, analgesics-non-narcotic, narcotic analgesics, antimicrobials-antibiotics, antiseptics and disinfectants- antifertility drugs; Chemicals in food-artificial sweetening agents, food preservatives, antioxidants in food; Cleansing agents-soaps and synthetic detergents – types and examples.

**11. HALOALKANES AND HALOARENES:** Classification and nomenclature; Nature of C-X bond; Methods of preparation: Alkyl halides and aryl halides- from alcohols, from hydrocarbons (a) by free radical halogenation (b) by electrophilic substitution (c) by replacement of diazonium group (Sandmeyer reaction) (d) by the addition of hydrogen halides and halogens to alkenes-by halogen exchange reactions; Physical properties-melting and boiling points, density and solubility; Chemical reactions: Reactions of haloalkanes (i) Nucleophilic substitution reactions (a) $SN^2$ mechanism (b)$SN^1$ mechanism (c) stereochemical aspects of nucleophilic substitution reactions-optical activity (ii) Elimination reactions
(iii) Reaction with metals-Reactions of haloarenes: (i) Nucleophilic substitution (ii) Electrophilic substitution and (iii) Reaction with metals; Polyhalogen compounds: Uses and environmental effects of dichloro methane, trichloromethane triiodomethane, tetrachloro methane, freons and DDT.

**12. ORGANIC COMPOUNDS CONTAINING C, H AND O (ALCOHOLS, PHENOLS, ETHERS, ALDEHYDES, KETONES AND CARBOXYLIC ACIDS):**

**Alcohols, Phenols and Ethers:** Alcohols, phenols and ethers -classification; Nomenclature: (a)Alcohols, (b)phenols and (c) ethers; Structures of hydroxy and ether functional groups; Methods of preparation: Alcohols from alkenes and carbonyl compounds, from Grignard reagents; Phenols from haloarenes, benzene sulphonic acid, diazonium salts, cumene; Physical properties of alcohols and phenols; Chemical reactions of alcohols and phenols (i) Reactions involving cleavage of O-H bond in alcohols-Acidity of alcohols and phenols, esterification (ii) Reactions involving cleavage of C- O bond- reactions with HX, $PX_3$, dehydration and oxidation (iii) Reactions of phenols-electrophilic aromatic substitution, Kolbe's reaction, Reimer - Tiemann reaction, reaction with zinc dust, oxidation; Commercially important alcohols (methanol, ethanol); Ethers-Methods of preparation: By dehydration of alcohols, Williamson synthesis- Physical properties-Chemical reactions: Cleavage of C-O bond and electrophilic substitution of aromatic ethers(anisole).

**Aldehydes and Ketones:** Nomenclature and structure of carbonyl group; Preparation of aldehydes and ketones-(1) by oxidation of alcohols (2) by dehydrogenation of alcohols (3) from hydrocarbons -Preparation of aldehydes (1) from acyl chlorides (2) from nitriles and esters(3) from hydrocarbons-Preparation of ketones(1) from acyl chlorides (2)from nitriles (3)from benzene or substituted benzenes; Physical properties of aldehydes and ketones; Chemical reactions of aldehydes and ketones-nucleophilic addition, reduction, oxidation, reactions due toα-

Hydrogen and other reactions (Cannizzaro reaction, electrophilic substitution reaction); Uses of aldehydes and ketones.

**Carboxylic acids**: Nomenclature and structure of carboxylgroup; Methods of preparation of carboxylic acids (1)from primary alcohols and aldehydes (2) from alkylbenzenes(3)from nitriles and amides (4)from Grignard reagents (5) from acyl halides and anhydrides (6) from esters; Physical properties; Chemical reactions: (i) Reactions involving cleavage of O-H bond-acidity, reactions with metals and alkalies (ii) Reactions involving cleavage of C-OH bond- formation of anhydride, reactions with $PCl_5$, $PCl_3$, $SOCl_2$, esterification and reaction with ammonia (iii) Reactions involving-COOH group-reduction, decarboxylation (iv) Substitution reactions in the hydrocarbon part - halogenation and ring substitution; Uses of carboxylicacids.

**13. ORGANIC COMPOUNDS CONTAINING NITROGEN:**

**Amines:** Structure of amines; Classification; Nomenclature; Preparation of amines: reduction of nitro compounds, ammonolysis of alkyl halides, reduction of nitriles, reduction of amides, Gabriel phthalimide synthesis and Hoffmann bromamide degradation reaction; Physical properties; Chemical reactions: basic character of amines, alkylation, acylation, carbyl amine reaction, reaction with nitrous acid, reaction with aryl sulphonyl chloride, electrophilic substitution of aromatic amines (aniline)-bromination, nitration and sulphonation.

**Diazonium Salts:** Methods of preparation of diazonium salts (by diazotization) Physical properties; Chemical reactions: Reactions involving displacement of Nitrogen; Sandmeyer reaction, Gatterman reaction, replacement by i) iodiode and fluoride ions ii) hydrogen, hydroxyl and Nitro groups; reactions involving retention of diazo group; coupling reactions; Importance of diazonium salts in synthesis of aromatic compounds.

**Cyanides and Isocyanides:**

Structure and nomenclature of cyanides and isocyanides; Preparation, physical properties and chemical reactions of cyanides and isocyanide

## DELETIONS FROM CHEMISTRY 2nd YEAR INTERMEDIATE SYLLABUS:

**1. SOLID STATE:** (1.11) Electrical properties. (1.12) Magnetic properties

**2. SOLUTIONS:** (2.7) Abnormal molar masses

**3. ELECTROCHEMISTRY AND CHEMICAL KINETICS:**

**Electrochemistry:** (3.6) Batteries, (3.7) Fuel cells, (3.8) Corrosion

**Chemical Kinetics:** (3.14) Collision theory of chemical reaction rates.

**4. SURFACE CHEMISTRY:** (4.2) Catalysis, (4.5) Emulsions

**5. GENERAL PRINCIPLES OF METALLURGY:** *Entire Chapter Deleted.*

**6. p-BLOCK ELEMENTS:**

**Group-15 Elements:** (6.4) Oxides of Nitrogen- structures only. (6.6) Phosphorus allotropic forms. (6.7) Preparation & Properties of Phosphene. (6.8) Preparation & Properties of and (6.9) Phosphorus Halides & Oxo-acids (elementary idea only)

**Group-16 Elements**: (6.17) Sulphuric acid – Industrial process of manufacture

**7. d AND f BLOCK ELEMENTS & COORDINATIONCOMPOUNDS:** (7.4) Some important Compounds of Transition elements (Preparation & Properties of KMnO4 and K2Cr2O7) (7.5) Chemical reactivity of Lanthanoids (7.6) Actinoids – Electronic configuration, Oxidation states and Comparison with Lanthanoids (7.11) Isomerism in Co-ordination Compounds (7.15) Importance of Co-ordination Compounds

**8. POLYMERS:** *Entire Chapter Deleted.*

**9. BIOMOLECULES:** (9.1) –(i) Sucrose, lactose, maltose importance Polysaccharides (starch, carbohydrates) importance (9.3) Enzymes (9.6) Harmones

**10. CHEMISTRY IN EVERYDAY LIFE:** *Entire Chapter Deleted*.

**11. HALOALKANES AND HALOARENES:** (11.6) Poly Halogen Compounds.

**12. ORGANIC COMPOUNDS CONTAINING C, H AND O (ALCOHOLS, PHENOLS, ETHERS, ALDEHYDES, KETONES AND CARBOXYLIC ACIDS):**(12.7) Some Commercially important alcohols

**13. ORGANIC COMPOUNDS CONTAINING NITROGEN:** *Entire Chapter Deleted*.