PHYSICS

Test No.	Topic Covered
01	**Minor-1**: **Basic Mathematics Used in Physics & Vectors, Algebra :** Quadratic Equation (Roots of quadratic equation, Solution by Factorization and by Shridharacharya Formula, Properties of roots (real, equal, imaginary etc), Application of Quadratic equation in physics), Binomial Theorem and binomial approximation, Logarithm and Exponents (Laws of logarithms and exponents with applications / examples), Series (Arithmetic Progression and its general term and Sum, Sum of first n Natural numbers, Geometrical Progression and its general term and Sum, Sum of infinite GP), Componendo & Dividendo rule. **Trigonometry :** Angle & its measurement (Sexagesimal and Circular system) , Trigonometric-ratios, Trigonometric identities , Four Quadrants & ASTC rule, T-ratios for general angles , Addition/subtraction Formulae , Small angle Approximation, Ranges of T-functions. **Co-Ordinate Geometry :** Define Origin, Axis or Axes, Co-ordinates of a point in a plane or space (2D or 3D), Distance Formula, Slope of a line and its interpretation, Graphs of commonly used functions (Straight line, Parabola, Circle, Ellipse , Hyperbola including rectangular hyperbola , Sinusoidal functions (sine and cosine functions), Exponential functions. **Calculus :** Differential calculus (Average rate of change and Instantaneous rate of change, Differentiation of commonly used functions, Rules of differentiation including Product and Quotient rules, Application of derivatives: Increasing and Decreasing nature, Maxima and Minima with geometrical / graphical explanation), Integral calculus (Integration is the reverse process of differentiation, Indefinite and Definite Integration, Integration of commonly used functions, Rules of Integration, Application of Integral calculus: Area under a curve and Average value of a continuous function in an interval). **Vectors :** Definition of scalar and vector quantities, Graphical representation of vectors, Notation of Vectors, Angle between two vectors , Types of Vectors (Minor vector, Null vector, Equal vectors and equality of vectors, opposite and Negative of a vector, Parallel and anti-parallel vectors, Co-planar vectors, axial vectors) , Position and displacement vectors , Addition/subtraction of two vectors (Triangle law, Parallelogram law), Addition of many vectors (Polygon law),Minor vectors and their significance (Representation of vector in terms of Minor vector in plane and in space) , Resolution of a Vector into components i.e. Cartesian Components in two and three dimensions and Direction Cosines , Multiplication or Division of a Vector by a Scalar (i.e. Real number) ,Scalar (Dot) product of two Vectors and component of a vector in the direction of another vector , Vector (Cross) product of two Vectors with its geometrical interpretation and Right hand rule for direction. **Unit, Dimensions and Measurement :** Classification of Physical Quantities according to their dependency i.e. Fundamental (or Base) and Derived quantities , Need for measurement (Units of measurement) , Systems of units (FPS, CGS, MKS, SI system of units and Supplementary units, fundamental and derived units , Some idea about Practical and Improper units) , Standards of Length, mass and time measurements, Dimensions of physical quantities, Dimensional Formulae of important physical quantities, Dimensional analysis and its applications & its limitations, SI prefixes and general guidelines for using Symbols of SI units , Errors in measurement (Systematic, Random and Least count Errors), Absolute Error, Relative Error, Percentage Error and Combination of Errors , Significant figures and its rules for Arithmetic operations (i.e. addition, subtraction, multiplication and division) ,Rounding off the uncertain digits. **Electrostatics :** Electric charges and their basic properties, Conductors and Insulators, Method of charging: Charging by Friction, Charging by Induction and Charging by Conduction, Gold-leaf Electroscope, Coulomb's law-force, between two point charges, force, between multiple charges and Superposition principle, Equilibrium of charge systems and SHM, Electric field Intensity, electric field due to a point charge and a system of charges. Electric field due to an arc, Electric field on an axial point of Ring, Electric field lines and their properties, Electric flux, statement of Gauss's theorem and its applications to find field due to [Infinitely long straight wire, Uniformly charged infinite plane sheet, Uniformly charged thin spherical shell (field inside and outside)], Electric potential, Potential difference, Electric potential due to(A point charge, A system of charges, Ring(on an axial point),Conducting and non conducting sphere),Electrical potential energy of a system of two/more than two point charges, Equipotential surfaces, Relation between Field and Potential, Motion of charged particle in Electric Field, Electric dipole and dipole moment(Electric Potential

due to a dipole, Electric field due to a dipole, Torque on a dipole in a uniform electric field, Electrical potential energy of electric diploes in an electrostatic field, Work done in rotating a dipole)

EXPERIMENTAL SKILLS

I. Vernier calipers-its use to measure the internal and external diameter and depth of a vessel.

2. Screw gauge-its use to determine thickness/ diameter of thin sheet/wire.

02 **Minor-2**: **Kinematics :** (Motion along a straight line and Motion in a Plane)

Motion and Rest with introduction of frame of reference , Variables of Translatory Motion (Position/ Displacement / Path length(Distance) , Velocity/ Speed / Average Velocity / Average Speed , Acceleration / Average Acceleration) , Relation among various variables of motion and their applications to variable acceleration , Equations of Motion with constant acceleration (scalar and vector forms), Motion along a straight line, velocity-time and position-time graphs for uniformly accelerated motion (graphical treatment) , Motion under gravity, Free-fall , Motion in a plane with constant acceleration , Projectile Motion – Ground to Ground projection, Projection from a height (Horizontal projection) , Relative Motion in one-dimensions , Relative Velocity in two dimensions (Rain-Man problem, River-Boat Problem & wind based questions)

Current Electricity : Electric current, flow of electric charges in a metallic conductor, drift velocity and mobility, relaxation time and their relation with electric current and current density, Ohm's law, electrical resistance, V-I characteristics (liner and non-linear),Electrical resistivity and conductivity, Series and parallel combinations of resistors, Temperature dependence of resistance, Internal resistance of a cell, potential difference and emf of a cell, combination of cells in series and in parallel, Kirchhoff's laws (KCL and KVL) and simple applications, Wheatstone bridge, Meter Bridge, Moving coil galvanometer and its, Current sensitivity and voltage sensitivity, Conversion to ammeter and voltmeter, Electrical energy and power. Applications to Electric Bulbs and Heaters.

EXPERIMENTAL SKILLS

1. The resistivity of the material of a given wire using a metre bridge.

2. The resistance of a given wire using Ohm 's law.

03 **Minor-3** : **Laws Of Motion And Friction :**

Intuitive concept of force, Basic or Fundamental forces in nature, The law of Inertia, Newton's first law of motion ,Momentum and Newton's second law of motion; impulse , Newton's third law of motion , Common forces in mechanics-Weight, Normal reaction, Friction, Contact force, Tension in string , Free Body diagram, Equilibrium of concurrent forces-Lami's theorem, Motion of bodies in contact or connected by strings, Pulley systems , Frame of Reference-Inertial and Non Inertial Frames. Pseudo Force and its applications , Cause of Friction, Static and Kinetic friction , Laws of friction, Limiting Static and Kinetic friction coefficients, Angle of Friction, Angle of Repose , Rolling friction.

Capacitor : Concept of Capacity, Capacitors and capacitance, Capacity of an Isolated Spherical Capacitor, Sharing of Charges, Capacitance of a parallel plate capacitor with and without dielectric medium between the plates, Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarization, Combination of capacitors in series and in parallel, Work done by Battery in charging of a capacitor. Energy stored in a capacitor, Charging and discharging of a Capacitor.

04 **Review Test - 1 : Syllabus of Test No. 1, 2 & 3**

05 **Minor-4**: **Work, Energy & Power :** Work done by a constant force (use of dot product) and variable force(use of definite integration i.e. area under the curve), Kinetic energy, Work-energy theorem for a Constant and a Variable force , Concept of potential energy, conservative forces and non-conservative forces. Gravitational Potential Energy , Potential energy versus position graph and stable, unstable & neutral equilibrium , Spring force and Elastic Potential energy of a spring , Conservation of mechanical energy (kinetic and potential energies) , Power (Instantaneous and Average power).

Circular Motion : Kinematics of circular motion (Variables of motion (Angular Displacement, Angular Velocity, Angular acceleration), Relations among Angular Variables for constant angular acceleration , General relation among angular variables) , Dynamics of uniform circular motion. Centripetal force, examples of circular motion (vehicle on level circular road, vehicle on banked road) , Dynamics of non-uniform circular motion(Motion in a vertical circle)

Magnetic Effect of Current and Magnetism :

Concept of magnetic field, Oersted's experiment, Biot-Savart law and its application to current carrying circular loop and straight wire, Ampere's law and its applications to (Infinitely long straight wire, Straight and toroidal solenoids),Circular motion of a moving charged particle in uniform magnetic field, Force on a moving charge in uniform magnetic and electric fields (Lorentz force)(Velocity Selector), Force on a current-carrying conductor in a uniform magnetic field, Force between two parallel current-carrying conductors-definition of ampere, Torque experienced by a current loop in a magnetic field, Current loop as a magnetic dipole and its magnetic dipole moment. Magnetic dipole moment of a revolving electron, Bar Magnet(Magnetic field intensity due to a magnetic dipole (bar magnet) along its axis and perpendicular to its axis, Torque on a magnetic dipole (bar magnet) in a uniform magnetic field, Bar magnet as an equivalent solenoid, Magnetic field lines), Magnetic properties of Materials(Diamagnetism with examples, Para magnetism with examples, Ferromagnetism with examples and brief analysis of magnetic Hysteresis).

EXPERIMENTAL SKILLS

1. Resistance and figure of merit of a galvanometer by half deflection method.

06 **Minor-5** : **Collision & Centre of Mass**

Impulse of a force and Impulse-Momentum theorem, Idea about Impulsive forces.

Law of conservation of linear momentum and its applications, Elastic and inelastic collisions in one and two dimensions (Head-on and Oblique collisions), Coefficient of restitution and line of impact, Expression of loss in Kinetic energy in inelastic collision.

Centre of mass of discrete system: two-particle system and n-particle system, Centre of mass of continuous system: General formula, Centre of mass of symmetrical rigid bodies; centre of mass of uniform rod , Centre of mass of composite and truncated bodies, Motion of Centre of Mass.

Electromagnetic Induction : Magnetic Flux, Electromagnetic induction (Faraday's Experiments), Faraday's law, Induced emf, induced, current and induced charge, Lenz's Law and its applications, Static, Dynamic and Rotational Emf, Induced Electric Field and its properties, Eddy currents, Self Induction(Coefficient of self induction (L),Growth and Decay of Current in L-R circuits),Mutual Induction(Coefficient of Mutual induction (M), Coefficient of Coupling (K)],AC generator, Transformer.

07 **Semi Major Test - 1 : Syllabus of Test No. 1 to 6**

08 **Minor-6**: **Rotational Motion :** Kinematics of Rotational Motion about a fixed axis: Comparison of linear and rotational motions, Moment of inertia, radius of gyration and its significance. Values of M.I. for simple geometrical objects (Ring, Rod and Disc with derivation and others with no derivation). Statement of parallel and perpendicular axes theorems and their applications, Moment of a force-torque, Equilibrium of rigid bodies, Angular momentum, Relation between torque and Angular momentum, Conservation of angular momentum with some examples , Pure Rolling or rolling motion on a smooth/rough horizontal surface. Expression for Rotational Kinetic Energy, Rolling motion on an inclined plane, Expression for acceleration and minimum friction coefficient.

Alternating Current : Alternating current and Voltage, Measurement of AC, Comparison between AC and DC, Peak, Average and RMS value of alternating current/ voltage, Circuit elements in ac circuits(Resistive Circuit, Capacitive Circuit, Inductive Circuit),RC, RL circuits and their Reactance & impedance in series and parallel combination, LCR series circuit, Resonance, Quality Factor, Power in AC circuits, Wattles Current, Power Factor.

Electromagnetic Waves : Need for displacement current, Electromagnetic waves and their characteristics (qualitative ideas only),Transverse nature of electromagnetic waves, Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, x-rays, gamma rays) including elementary facts about their uses.

EXPERIMENTAL SKILLS

1. Metre Scale - the mass of a given object by the principle of moments.

09 **Minor-7**: **Thermal Physics** :

Temperature and Thermal Expansion:
(Temperature, Temperature scales, Brief idea about thermometers, Thermal expansion; thermal expansion of solids, liquids, and gases. Anomalous expansion)

Calorimetry : (Heat, Heat capacity, Specific heat capacity, Molar heat capacity, Water Equivalent, Heat of transformation – latent heat, Principle of Calorimetry, Heating curve, Phase diagram)

Heat Transfer Conduction : (Process, Steady State, Law of Conduction, Thermal conductivity, Thermal resistance, Series and Parallel combinations of rods, Growth of ice on ponds) , Convection: Process, Idea about Natural and Forced Convection, Radiation: Qualitative ideas of Black Body Radiation, Ideal Black Body, Absorptive Power, Emissive Power, Spectral Emissive Power, Kirchhoff's Law and its applications, Stefan's Law, Newton's law of cooling, Wien's displacement law and Green House effect, Solar constant.

Thermodynamics : Thermal equilibrium and definition of temperature (Zeroth law of Thermodynamics). Heat, work and internal energy. First law of thermodynamics. Cyclic, Isochoric, Isobaric, Isothermal and Adiabatic processes, Second law of the thermodynamics: Reversible and irreversible processes.

Kinetic Theory of Gases : Gas Laws, Equation of state of a perfect gas, Brief idea of van der Waals' equation and Critical temperature, Assumptions, Concept of pressure. Different types of speeds of gas molecules, Maxwell's velocity distribution curve, Kinetic energy and temperature; Degrees of freedom, Law of equipartition of energy (statement only) and application to specific heat capacities of gases; Concept of mean free path.

Ray Optics and Optical Instruments : Reflection of light(Laws of Reflection, Reflection at Plane Surface (Plane Mirror): Formation of Image, Deviation, Rotation of mirror, Number of images, velocity of image, Minimum length of mirror to see full image of a man, Field of view, Reflection at Spherical Surface(Curved Mirror: Rules of image tracing, Image formation in concave and convex mirrors, Focal length of spherical mirrors, Relation between u,v and f (i.e. Mirror Equation for Para-axial rays), Sign convention, Magnification),Refraction of light at Plane Surface (Snell's law, Total internal reflection and its applications (Mirage, Looming, Diamond, prism and optical fibers), Optical Path, Lateral and normal shift],Refraction at spherical surfaces(single and double surface),Lenses(Thin lens formula, Lens-maker's formula, Magnification, Power of a lens, Combination of thin lenses in contact), Refraction and dispersion of light through a prism, combinations of prisms, Some Natural Phenomena due to Sunlight(Rainbow-dispersion of sun light and TIR) using lenses, Microscopes and telescopes (reflecting and refracting) and their magnifying powers)

EXPERIMENTAL SKILLS

1. Specific heat capacity of a given (i) solid and (ii) liquid by method of mixtures.
2. The focal length of;
   (I) Convex mirror
   (ii) Concave mirror, and
   (iii) Convex lens, using the parallax method.
3. The plot of the angle of deviation vs angle of incidence for a triangular prism.
4. Refractive index of a glass slab using a travelling microscope.

10 Minor-8: Properties Of Matter and Fluid Mechanics :

Elastic behavior, Stress-strain relationship, Hooke's law, Young's modulus, bulk modulus, shear, modulus of rigidity, Poisson's ratio; elastic energy. Pressure, Pascal's law, Archimedes' Principle and Buoyancy. Floatation and Translatory equilibrium, Variation of Pressure with Depth, Atmospheric pressure and Gauge Pressure, Hydraulic Machines, Streamline and turbulent flow, Critical velocity and Reynolds's number, Principle of Continuity, Bernoulli's theorem and its applications. Speed of Efflux: Torricelli's law, Venturi-meter, Dynamic lift, Viscosity, Newton's law of viscous force, Stokes' law, terminal velocity,Surface energy and surface tension, angle of contact, excess of pressure, application of surface tension ideas to drops, bubbles and capillary rise. Detergent and surface tension

Wave Optics : Wave front and Huygens' Principle, reflection and refraction of plane wave at a plane surface using wave fronts. Proof of laws of reflection and refraction using Huygens' Principle, Coherent and incoherent sources, LASER(only qualitative idea),Superposition of Light Waves: Interference, Young's double slit experiment and expression for fringe width, coherent sources and sustained interference of light,Diffraction due to a single slit, width of central maximum, Polarisation, Polarisation by Scattering and Reflection, plane polarized light, Brewster's law, uses of plane polarized light and Polaroid's.

EXPERIMENTAL SKILLS

1. Young's modulus of elasticity of the material of a metallic wire.
2. Surf ace tension of water by capillary rise and effect of detergents.
3. Co-efficient of Viscosity of a given viscous liquid by measuring terminal velocity of a given spherical body.

11 **Review Test - 2 : Syllabus of Test No. 8, 9 & 10**

12 **Minor-9** : **Gravitation :** The universal law of gravitation(Newton's law of Gravitation), Gravitational Field and its Intensity, Brief idea about Inertial and Gravitational mass, Acceleration due to gravity and its variation with altitude and depth. Idea about variation in g due to Shape and Rotation of earth, Gravitational potential energy and gravitational potential, Kepler's laws of planetary motion (The law of orbits, Areas and Periods), Motion of Planets and Satellites in Circular orbits ,Orbital velocity of a satellite, Total Energy and Binding Energy of a satellite, Escape velocity and escape energy.

Oscillations (SHM) : Periodic (harmonic) motion and Oscillatory motion, Periodic motion-period, frequency, displacement as a function of time, Periodic functions, Simple harmonic motion (SHM) and its equation; Velocity, Acceleration and Phase, Oscillations of a spring-restoring force and force constant. Equivalent spring constant of Series and parallel combinations, Energy in SHM –Kinetic and Potential energies, Simple pendulum-derivation of expression for its time period, Superposition of two SHMs of Same Frequency in the same direction.

Modern Physics - I (Dual Nature of Radiation and Matter) : Photoelectric effect Hertz observation, Hallwach's and Lenard's observations, Einstein's photoelectric equation- particle nature of light (photon),Matter waves(Wave nature of particles, de Broglie relation).

Modern Physics - II (Nuclei) : Nuclei Composition and size of nucleus, Atomic masses, Isotopes, isobars, isotones and isodiapheres, Mass-energy relation, mass defect; binding energy per nucleon and its variation with mass number, Nuclear fission and fusion, Nuclear reactor, Nuclear Force and its properties.

Modern Physics - III (Atoms) : Atoms(Alpha- particle scattering experiments; Rutherford's model of atom,Bohr model, energy levels, hydrogen spectrum).

EXPERIMENTAL SKILLS

1. Simple Pendulum-dissipation of energy by plotting a graph between the square of amplitude and time.

13 **Minor-10** : **Wave Motion :** Wave motion, Mechanical Waves, Longitudinal and transverse waves, Equation of Plane Progressive waves, Velocity of Transverse mechanical waves, Intensity of waves , Sound waves: Audible, Infrasonic and Ultrasonic waves , Speed of sound waves: Newton's formula and Laplace correction, Effect of temperature, Pressure and Humidity on speed of Sound waves , Some idea about description of sound waves as Displacement and Pressure waves, Characteristics of sound waves: Pitch, Loudness and Quality, Reflection and transmission of waves & Echo , Principle of superposition of waves, Interference and Beats, Stationary waves, Standing waves in strings and organ pipes, fundamental mode and harmonics. Resonance tube.

Semiconductor and Electronics : Classification of Metals, Conductors and Semi-conductors on the basis of Conductivity, Intrinsic Semi-conductor, Extrinsic Semi-conductor (n-type and p-type), p-n Junction : p-n junction formation, Barrier potential, Semiconductor diode: I-V characteristics in forward and reverse bias, Application of Junction Diode as a Rectifier and Filter (only qualitative idea),Special purpose p-n junction diodes and their I-V characteristics (LED, Photodiode, Solar cell, Zener diode), Junction Breakdown : Zener and Avalanche breakdown, Zener diode as a voltage regulator, Digital Electronics and Logic gates (Law of Boolean algebra and De Morgan's Theorem), Basic Logic gates(OR gate, AND gate, NOT gate)(Combination of gates(NAND gate, NOR gate).

EXPERIMENTAL SKILLS

1. Speed of sound in air at room temperature using a resonance tube.
2. Characteristic curves of a p-n junction diode in forward and reverse bias.
3. Characteristic curves of a Zener diode and finding reverse break down voltage.
4. Identification of Diode, LED, Resistor, A capacitor from a mixed collection of such items.

14 **Semi Major Test - 2 : Syllabus of Test No. 8 to 13**

15 **Syllabus of Test : 11th Class Full Syllabus**

16 **Syllabus of Test : 12th Class Full Syllabus**

Test No. 17 to 26 Full Syllabus

CHEMISTRY

Test No.	Topic Covered

01 **Minor-1** : **Some Basic Concepts of Chemistry :** Matter and its nature, Dalton's atomic theory: Concept of atom, molecule, element and compound : Laws of chemical combination; Atomic and molecular masses, mole concept, molar mass, percentage composition, empirical and molecular formulae: Chemical equations and stoichiometry.

Atomic Structure : Nature of electromagnetic radiation, photoelectric effect; Spectrum of the hydrogen atom. Bohr model of a hydrogen atom - its postulates, derivation of the relations for the energy of the electron and radii of the different orbits, limitations of Bohr's model; Dual nature of matter, de Broglie's relationship. Heisenberg uncertainty principle. Elementary ideas of quantum mechanics, quantum mechanics, the quantum mechanical model of the atom, its important features. Concept of atomic orbitals as one-electron wave functions: Variation of Ψ and Ψ^2 with r for 1s and 2s orbitals: various quantum numbers (principle, angular momentum and magnetic quantum numbers) and their significance; shapes of s, p, and d - orbitals, electron spin and spin quantum number: Rules for filling electrons in orbitals - Aufbau principle. Pauli's exclusion principle and Hund's rule, electronic configuration of elements, extra stability of half-filled and completely filled orbitals.

02 **Minor-2**: **Chemical Kinetics :** Rate of a chemical reaction, factors affecting the rate of reactions: concentration, temperature, pressure, and catalyst; elementary and complex reactions, order and molecularity of reactions, rate law, rate constant and its Minors, differential and integral forms of zero and first-order reactions, their characteristics and half-lives, the effect of temperature on the rate of reactions. Arrhenius theory, activation energy and its calculation, collision theory of bimolecular gaseous reactions (no derivation).

Equilibrium : Meaning of equilibrium, the concept of dynamic equilibrium.

Equilibria Involving Physical Processes : Solid-liquid, liquid - gas and solid-gas equilibria, Henry's law. General characteristics of equilibrium involving physical processes.

Equilibrium Involving Chemical Processes : Law of chemical equilibrium, equilibrium constants (K_p and K_c) and their significance, the significance of ΔG and ΔG° in chemical equilibrium, factors affecting equilibrium concentration, pressure, temperature, the effect of catalyst; Le Chatelier's principle.

Ionic Equilibrium : Weak and strong electrolytes, ionization of electrolytes, various concepts of acids and bases (Arrhenius. Bronsted - Lowry and Lewis) and their ionization, acid-base equilibria (including multistage ionization) and ionization constants, ionization of water. pH scale, common ion effect, hydrolysis of salts and pH of their solutions, the solubility of sparingly soluble salts and solubility products, buffer solutions.

03 **Minor-3**: **Periodic Table :** Modern periodic law and present form of the periodic table. s, p, d and f block elements - periodic trends in properties of elements atomic and ionic radii. ionization enthalpy, electron gain enthalpy, valence, oxidation states and chemical reactivity.

Chemical Bonding And Molecular Structure : Kossel - Lewis approach to chemical bond formation, the concept of ionic and covalent bonds.

Ionic Bonding : Formation of ionic bonds, factors affecting the formation of ionic bonds; calculation of lattice enthalpy.

Covalent Bonding : Concept of electronegativity. Fajan's rule, dipole moment : Valence Shell Electron Pair Repulsion (VSEPR) theory and shapes of simple molecules.

Quantum Mechanical Approach To Covalent Bonding : Valence bond theory - its important features, the concept of hybridization involving s, p, and d orbitals; Resonance.

Molecular Orbital Theory - Its important features, LCAOs, types of molecular orbitals (bonding, anti bonding), sigma and pi-bonds, molecular orbital

electronic configurations of homonuclear diatomic molecules, the concept of bond order, bond length, and bond energy. Elementary idea of metallic bonding. Hydrogen bonding and is applications.

04 **Review Test - 1 : Syllabus of Test No. 1, 2 & 3**

05 **Minor-4**: **Solutions :** Different methods for expressing the concentration of solution - molality, molarity, mole fraction, percentage (by volume and mass both), the vapour pressure of solutions and Raoult's law - Ideal and non-ideal solutions, vapour pressure - composition, plots for ideal and non-ideal solutions; colligative properties of dilute solutions - a relative lowering of vapour pressure, depression of freezing point, the elevation of boiling point and osmotic pressure; Determination of molecular mass using colligative properties; Abnormal value of molar mass, van't Hoff factor and its significance.

Electrochemistry : Electrolytic and metallic conduction, conductance in electrolytic solutions, molar conductivities and their variation with concentration: Kohlrausch's law and its applications.

Electrochemical Cells - Electrolytic and Galvanic cells, different types of electrodes, electrode potentials including standard- electrode potential, half-cell and cell reaction, emf of a Galvanic cell and its measurement : Nernst equation and it's applications; Relationship between cell potential and Gibbs' energy change: Dry cell and lead accumulator, Fuel cells.

Principles Related to Practical Chemistry : The chemistry involved in the titrimetric exercises – Acids, bases and the use of indicators, oxalicacid vs $KMnO_4$, Mohr's salt vs $KMnO_4$, Chemical principles involved in the following experiments :

1. Enthalpy of solution of $CuSO_4$
2. Enthalpy of neutralization of strong acid and strong base.
3. Preparation of lyophilic and lyophobic sols.
4. Kinetic study of the reaction of iodide ions with hydrogen peroxide at room temperature.

06 **Minor-5**: **Chemical Thermodynamics :**

Fundamentals of thermodynamics: System and surroundings, extensive and intensive properties, state functions, types of processes.

The First Law of Thermodynamics - Concept of work, heat internal energy and enthalpy, heat capacity, molar heat capacity; Hess's law of constant heat summation; Enthalpies of bond dissociation, combustion, formation, atomization, sublimation, phase transition, hydration, ionization, and solution.

The Second Law of Thermodynamics - Spontaneity of processes; ΔS of the universe and ΔG of the system as criteria for spontaneity. ΔG° (Standard Gibbs energy change) and equilibrium constant.

Redox Reactions : Electronic concepts of oxidation and reduction, redox reactions, oxidation number, rules for assigning oxidation number, balancing of redox reactions.

07 **Semi Major Test - 1 : Syllabus of Test No. 1 to 6**

08 **Minor-6**: **p-Block Elements :**

Group 13 to Group 18 Elements

General Introduction: Electronic configuration and general trends in physical and chemical properties of elements across the periods and down the groups; unique behaviour of the first element in each group.

Co-Ordination Compounds : Introduction to co-ordination compounds. Werner's theory; ligands, coordination number, denticity. chelation; IUPAC nomenclature of mononuclear co-ordination compounds, isomerism; Bonding-Valence bond approach and basic ideas of Crystal field theory, colour and magnetic properties; importance of co-ordination compounds (in qualitative analysis, extraction of metals and in biological systems).

d and f Block Elements : Transition Elements

General introduction, electronic configuration, occurrence and characteristics, general trends in properties of the first-row transition elements - physical properties, ionization enthalpy, oxidation

states, atomic radii, colour, catalytic behaviour, magnetic properties, complex formation, interstitial compounds, alloy formation; Preparation, properties, and uses of $K_2Cr_2O_7$ and $KMnO_4$.

Inner Transition Element :

Lanthanoids - Electronic configuration, oxidation states, and lanthanoid contraction.

Actinoids - Electronic configuration and oxidation states.

Principles Related to Practical Chemistry : The chemistry involved in the preparation of the following: Inorganic compounds; Mohr's salt, potash alum., Chemical principles involved in the qualitative salt analysis: Cations – Pb^{2+}, Cu^{2+}, Al^{2+}, Fe^{3+}, Zn^{2+}, Ni^{2+}, Ca^{2+}, Ba^{2+}, Mg^{2+}, NH^{+}_{4}

Anions- CO^{2-}_{3}, S^{2-}, SO^{2-}_{4}, NO^{3-}, NO^{2-}, Cl^{-}, Br^{-}, I^{-} (Insoluble salts excluded).

09 **Minor-7**: **Purification And Characterisation of Organic Compounds**

Purification - Crystallization, sublimation, distillation, differential extraction and chromatography - principles and their applications.

Qualitative Analysis - Detection of nitrogen, sulphur, phosphorus and halogens.

Quantitative Analysis (basic principles only) - Estimation of carbon, hydrogen, nitrogen, halogens, sulphur, phosphorus.

Calculations of Empirical Formulae and Molecular Formulae : Numerical problems in organic quantitative analysis.

Nomenclature : Tetravalency of carbon: Shapes of simple molecules - hybridization (s and p): Classification of organic compounds based on functional groups: and those containing halogens, oxygen. nitrogen. and sulphur; Homologous series: **Nomenclature (Trivial and IUPAC)**

General Organic Chemistry : Covalent bond fission - Homolytic and heterolytic : free radicals, carbocations and carbanions; Stability of carbocations and free radicals, electiophiles, and nucleophiles.

Electronic Displacement in a Covalent Bond - Inductive effect, electromeric effect, resonance and hyperconjugation.

Common Types of Organic Reactions - Substitution, addition, elimination and rearrangement.

Isomerism - Structural and Stereoisomerism.

10 **Minor-8**: **Hydrocarbons :** Classification, isomerism, IUPAC nomenclature, general methods of preparation, properties, and reactions.

Alkanes - Conformations: Sawhorse and Newman projections (of ethane): Mechanism of halogenation of alkanes.

Alkenes - Geometrical isomerism: Mechanism of electrophilic addition: addition of hydrogen, halogens, water, hydrogen halides (Markownikoffs and peroxide effect): Ozonolysis and polymerization.

Alkynes - Acidic character: Addition of hydrogen, halogens, water and hydrogen halides. Polymerization.

Aromatic Hydrocarbons - Nomenclature, benzene - structure and aromaticity: Mechanism of electrophilic substitution: halogenation, nitration.

Friedel - Craft's alkylation and acylation, directive influence of the functional group in mono-substituted benzene.

Organic Compounds Containing Halogens (Haloalkanes and Haloarenes)

General methods of preparation, properties and reactions; Nature of C-X bond: Mechanisms of substitution reactions.

Uses; Environmental effects of chloroform, iodoform freons and DDT

11 **Review Test - 2 : Syllabus of Test No. 8, 9 & 10**

12 **Minor-9** : **Organic Compounds Containing**

Oxygen : General methods of preparation, properties, reactions, and uses.

Alcohols, Phenols and Ethers :

Alcohols : Identification of primary. secondary. and tertiary alcohols: mechanism of dehydration.

Phenols : Acidic nature, electrophilic substitution reactions: halogenation nitration and sulphonation. Reimer - Tiemann reaction.

Ethers : Structure.

Aldehyde and Ketones : Nature of carbonyl group; Nucleophilic addition to >C=O group, relative reactivities of aldehydes and ketones; Important reactions such as - Nucleophilic addition reactions (addition of HCN, NH_3, and its derivatives), Grignard reagent; **Oxidation** : reduction (Wolf Kishner and Clemmensen); the acidity of α-hydrogen, aldol condensation, Cannizzaro reaction. Haloform reaction, Chemical tests to distinguish between aldehydes and Ketones.

Organic Compounds Containing Nitrogen :

General methods of preparation, Properties, reactions and uses.

Amines : Nomenclature, classification structure, basic character, and identification of primary, secondary, and tertiary amines and their basic character.

Diazonium Salts : Importance in synthetic organic chemistry.

13 **Minor-10** : **Biomolecules :** General introduction and importance of biomolecules.

Carbohydrates - Classification; aldoses and ketoses: monosaccharides (glucose and fructose) and constituent monosaccharides of oligosaccharides (sucrose, lactose, and maltose).

Proteins - Elementary Idea of α-amino acids, peptide bond, polypeptides, Proteins : primary, secondary, tertiary and quaternary structure (qualitative idea only), denaturation of proteins, enzymes.

Vitamins - Classification and functions.

Nucleic Acids - Chemical constitution of DNA and RNA. Biological functions of nucleic acids.

Hormones (General introduction)

Principles Related to Practical Chemistry :

Detection of extra elements (Nitrogen, Sulphur, halogens) in organic compounds; Detection of the following functional groups; hydroxyl (alcoholic and phenolic), carbonyl (aldehyde and ketones) carboxyl, and amino groups in organic compounds ,The chemistry involved in the preparation of the following: Organic compounds: Acetanilide, p-nitro acetanilide, aniline yellow, iodoform.

14 **Semi Major Test- 2 : Syllabus of Test No. 8 to 13**

15 **Syllabus of Test : 11th Class Full Syllabus**

16 **Syllabus of Test : 12th Class Full Syllabus**

Test No. 17 to 26 Full Syllabus

BIOLOGY

Test No.	Topic Covered
01	**Minor-1**: **The Living World** : What is living ? ; Biodiversity; Need for classification; Taxonomy & Systematics; Concept of species and taxonomical hierarchy; Binomial nomenclature. **Biological Classification :** Five kingdom classification; salient features and classification of Monera; Protista and Fungi into major groups; Lichens; Viruses and Viroids. Prokaryotic Cell (Bacteria) **Plant Kingdom** : Salient features and classification of plants into major groups-Algae, Bryophytes, Pteridophytes, Gymnosperms (three to five salient and distinguishing features and at least two examples of each category). **Animal Kingdom :** Salient features and classification of animals-nonchordate up to phyla level and chordate up to classes level (Three to five salient features and at least two examples).
02	**Minor-2**: **Sexual Reproduction in Flowering Plants:** Flower structure; Development of male and female gametophytes; Pollination-types, agencies and examples; Out breeding devices, Pollen-Pistil interaction; Double fertilization; Post fertilization events-Development of endosperm and embryo, Development of seed and formation of fruit; Special modes-apomixis, parthenocarpy, polyembryony; Significance of seed and fruit formation. **Human Reproduction :** Male and female reproductive systems; Microscopic anatomy of testis and ovary; Gametogenesis-spermatogenesis & oogenesis; Menstrual cycle; Fertilisation, embryo development upto blastocyst formation, implantation; Pregnancy and placenta formation (Elementary idea); Parturition (Elementary idea); Lactation (Elementary idea). **Reproductive Health:** Need for reproductive health and prevention of sexually transmitted diseases (STD); Birth control-Need and Methods, Contraception and Medical Termination of Pregnancy (MTP); Amniocentesis; Infertility and assisted reproductive technologies – IVF, ZIFT, GIFT (Elementary idea for general awareness).
03	**Minor-3**: **Morphology of Flowering Plants** : Morphology and modifications, Tissues, Anatomy and functions of different parts of flowering plants: Root, Stem, Leaf, Inflorescence, Cymose and racemose, flower, Fruit and seed (To be dealt along with the relevant practical of the Practical Syllabus) & Families (Malvaceae, Cruciferae, leguminoceae, compositae, graminae). **Anatomy of Flowering Plants** : Anatomy and functions of different Tissues, Tissue system, Internal structure of root, stem, leaf, secondary growth. **Structural Organisation in Animals : Animal Tissues;** Morphology, anatomy and functions of different systems (digestive, circulatory, respiratory, nervous and reproductive) of an insect **Cockroach, Frog**.
04	**Review Test - 1 : Syllabus of Test No. 1, 2 & 3**
05	**Minor-4**: **Principles of Inheritance and Variation** : Mendelian Inheritance; Deviations from Mendelism-Incomplete dominance, Co-dominance, Multiple alleles and Inheritance of blood groups, Pleiotropy; Elementary idea of polygenic inheritance; Chromosome theory of inheritance; Chromosomes and genes; Sex determination-In humans, birds, honey bee; Linkage and crossing over; Sex linked inheritance-Haemophilia, Colour blindness; Mendelian disorders in humans-Thalassemia; Chromosomal disorders in humans; Down's syndrome , Turner's and Klinefelter's syndromes, Mutation. **Molecular Basis of Inheritance :** Search for genetic material and DNA as genetic material; Structure of DNA and RNA; DNA packaging; DNA replication; Central dogma; Transcription, genetic code, translation; Gene expression and regulation-Lac Operon; Genome and human genome project; DNA finger printing, **protein biosynthesis**.
06	**Minor-5**: **Cell : The Unit of Life :** Cell theory and cell as the basic Unit of life; Structure of prokaryotic and eukaryotic cell; Plant cell and animal cell; Cell envelope, cell membrane, cell wall; Cell organelles-structure and function; Endomembrane system-

endoplasmic reticulum, Golgi bodies, lysosomes, vacuoles; mitochondria, ribosomes, plastids, micro bodies; Cytoskeleton, cilia, flagella, centrioles (ultra structure and function); Nucleus-nuclear membrane, chromatin, nucleolus.

Cell Cycle and Cell Division : Cell cycle, mitosis, meiosis and their significance.

Biomolecules : Chemical constituents of living cells: structure and function of proteins, carbohydrates, lipids, nucleic acids.

Enzyme - Types, properties, enzyme action, classification and nomenclature of enzyme.

Breathing and Exchange of Gases : Respiratory organs in animals (recall only); Respiratory system in humans; Mechanism of breathing and its regulation in humans-Exchange of gases, transport of gases and regulation of respiration; Respiratory volumes; Disorders related to respiration-Asthma, Emphysema, Occupational respiratory disorders.

Body Fluids and Circulation : Composition of blood. blood groups, Coagulation of blood, blood corpuscles: Composition of lymph and its function;

Human circulatory system-Structure of human heart and blood vessels; Cardiac cycle, cardiac output. ECG. Double circulation: Regulation of cardiac activity; Disorders of circulatory system-Hypertension. Coronary artery disease, Angina pectoris, Heart failure.

07 **Semi Major Test - 1 : Syllabus of Test No.1 to 6**

08 **Minor-6 : Biotechnology : Principles and Process** of Biotechnology: Genetic engineering (Recombinant DNA technology).

Biotechnology and Its Applications : Application of Biotechnology in health and agriculture: Human insulin and vaccine production, stem cell technology, gene therapy; Genetically modified organisms-Bt crops; Transgenic Animals; Biosafety issues-Biopiracy and patents, **Tissue culture**.

Organisms and Populations : Population interactions-mutualism, competition, predation, parasitism; Population attributes-growth, birth rate and death rate, age distribution.

Ecosystem: Patterns, components; productivity and decomposition; Energy flow; Pyramids of number, biomass, energy .

Biodiversity and its Conservation: Concept of Biodiversity; Patterns of Biodiversity; Importance of Biodiversity; Loss of Biodiversity; Biodiversity conservation; Hotspots, endangered organisms, extinction, Red Data Book, biosphere reserves, National parks and sanctuaries, Sacred groves.

09 **Minor-7 : Neural Control and Coordination:** Neuron and nerves; Nervous system in humans-central nervous system, peripheral nervous system and visceral nervous system; Generation and conduction of nerve impulse.

Locomotion and Movement: Types of movement- ciliary, flagellar, muscular; Skeletal muscle- contractile proteins and muscle contraction; Skeletal system and its functions (To be dealt with the relevant practical of Practical syllabus); Joints; Disorders of muscular and skeletal system-Myasthenia gravis, Tetany, Muscular dystrophy, Arthritis, Osteoporosis, Gout.

Human Physiology : Excretory Products and Their Elimination : Modes of excretion-Ammonotelism, ureotelisrn, uricotelism;

Human excretory system-structure and faction; Urine formation, Osmoregulation; Regulation of kidney function-Renin-angiotensin, Atrial Natriuretic Factor, ADH and Diabetes insipidus; Role of other organs in excretion; Disorders; Uraemia, Renal failure, Renal calculi, Nephritis; Dialysis and artificial kidney.

Chemical Coordination and Integration Or Regulation : Endocrine glands and hormones; Human endocrine system-Hypothalamus, Pituitary, Pineal, Thyroid, Parathyroid, Adrenal, Pancreas, Gonads; Mechanism of hormone action (Elementary Idea); Role of hormones as messengers and regulators, Hypo-and hyperactivity and related disorders (Common disorders e.g. Dwarfism, Acromegaly, Cretinism, goitre, exopthalmic goitre, diabetes, Addison's disease).

10 **Minor-8 : Evolution (Origin and Evolution) :** Origin ot life; Biological evolution and evidences for biological evolution mom Paleontology, comparative anatomy, embryology and molecular evidence; Darwin's contribution. **Neodarwinism (Gene Flow. Genetic Drift)**, Hardy weinberg's principle (Population Genetics), Modern Synthetic theory' of Evolution, Genetic basis of adaptation, Modern synthetic theory of evolution. Mechanism of evolution - Variation and Natural Selection types of natural, Adaptive Radiation; **Species, Speciation**, Human evolution.

Microbes in Human Welfare : In household food processing, industrial production, sewage treatment, energy generation and microbes as biocontrol agents and biofertilizers.

Human Health and Disease : Pathogens; parasites causing human diseases (Malaria, Dengue, Chikungunya, Filariasis, Ascariasis. Typhoid, Pneumonia, common cold, amoebiasis, ring worm); Basic concepts of immunology-vaccines; Cancer, HIV and AIDS; Adolescence, drug and alcohol abuse, **Tobacco abuse**.

11 **Review Test - 2 : Syllabus of Test No. 8, 9 & 10**

12 **Minor-9**: **Photosynthesis in Higher Plants :** Photosynthesis as a means of Autotrophic nutrition; Site of photosynthesis take place; pigments involved in Photosynthesis (Elementary idea); Photochemical and biosynthetic phases of photosynthesis; Cyclic and non cyclic and photophosphorylation; Chemiosmotic hypothesis ; Photorespiration C_3 and C_4 pathways; Factors affecting photosynthesis.

Respiration in Plants : Exchange of gases; Cellular respiration-glycolysis, fermentation (anaerobic), TCA cycle and electron transport system (aerobic); Energy relations- number of ATP molecules generated, The respiratory balance sheet, Amphibolic pathways; Respiratory quotient.

Plant Growth and Development: Seed germination; Phases of Plant growth and plant growth rate; Conditions of growth; Differentiation, dedifferentiation and redifferentiation; Sequence of developmental process in a plant cell; Growth regulators-auxin,gibberellin, cytokinin, ethylene, ABA.

13 **Minor-10**: **Sexual Reproduction in Flowering Plants :** Flower structure; Development of male and female gametophytes; Pollination-types, agencies and examples; Out breeding devices, Pollen-Pistil interaction; Double fertilization; Post fertilization events-Development of endosperm and embryo, Development of seed and formation of fruit; Special modes-apomixis, parthenocarpy, polyembryony; Significance of seed and fruit formation.

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