Mathematics

Algebra: (a) Functions – Types of functions – Algebra of real valued functions. b) Mathematical induction and applications. c) Permutations and Combinations – linear and circular permutations – combinations. d) Binomial theorem – for a positive integral index – for any rational index – applications – Binomial Coefficients. e) Partial fractions. f) Exponential and logarithmic series. g) Quadratic expressions, equations and inequations in one variable. h) Theory of equations – Relations between the roots and Coefficients in any equation – Transformation of equations – reciprocal equations. i) Matrices and determinants – Types of matrices – Algebra of matrices – Properties of determinants – simultaneous linear equations in two and three variables – Consistency and inconsistency of simultaneous equations. j) Complex numbers and their properties – De Moivre's theorem – Applications – expansions of trigonometric functions.

Trigonometry (a) Trigonometric functions – Graphs – periodicity. b) Trigonometric ratios of compound angles, multiple and sub-multiple angles. c) Transformations. d) Trigonometric equations. e) Inverse trigonometric functions. f) Hyperbolic and inverse hyperbolic functions. g) Properties of Triangles. h) Heights and distances (in two-dimensional plane)

Vector Algebra (a) Algebra of vectors – angle between two non-zero vectors – linear combinations of vectors – vector equation of line and plane. b) Scalar and vector product of two vectors and their applications. c) Scalar and vector triple products – Scalar and vector products of four vectors

Probability (a) Random experiments – Sample space – events – probability of an event – addition and multiplication theorems of probability – Baye's theorem. b) Random variables – Mean and variance of a random variable – Binomial and Poisson distributions

Coordinate Geometry (a) Locus – Translation and rotation of axes. b) Straight line. c) Pair of straight lines. d) Circles and system of circles. e) Conics – Parabola – Ellipse – Hyperbola – Equations of tangent, normal and polar at any point of these conics. f) Polar Coordinates. g) Coordinates in three – dimensions – distances between two points in the space – Section formula and their applications. h) Direction Cosines and direction ratios of a line – angle between two lines. i) Cartesian equation of a plane in (i) general form (ii) normal form and (iii) intercept form – angle between two planes. j) Sphere – Cartesian equation – Centre and radius

Calculus (a) Functions – limits – Continuity. b) Differentiation – Methods of differentiation. c) Successive differentiation – Leibnitz's theorem and its applications. d) Applications of differentiation. e) Partial differentiation including Euler's theorem on homogeneous functions. f) Integration – methods of integration. g) Definite integrals and their applications to areas – reduction formulae. h) Numerical integration – Trapezoidal and Simpson's rules. i) Differential equations – order and degree – Formation of differential equation – Solution of differential equation by variable separable method – Solving homogeneous and linear differential equations of first order and first degree.

Physics

UNITS AND DIMENSIONS Units for fundamental and derived quantities; Systems of Units; SI system of units – rules for writing unit, derived units, multiple units and sub multiple units in SI system; Measurement for quantitative study, Accuracy and precision of measuring instruments; Errors due to external causes – constant type, systematic type and environmental type; Errors due to imperfections in experimental techniques/procedure/personal/observation – random errors, gross errors, absolute errors, mean absolute error and relative error, percentage error; errors due to addition, subtraction, multiplication division and powers of observed quantities; dimensions of physical quantities, dimensional formulae, applications and limitations of dimensional analysis.

ELEMENTS OF VECTORS: Classification of physical quantities as vectors and scalars Geometrical representation of vectors – Addition and subtraction of vectors. Laws of addition of vectors – Equal and null vectors. Unit vectors – Unit vectors in Cartesian co-ordinate system – position vector and its magnitude. Parallelogram law of vectors – Expression for the resultant vector. Triangle law and polygon law of vectors – concept of relative velocity- application to relative motion of a boat in a river. Multiplication of a vector with a scalar – Scalar product with examples of work and energy – Vector product with examples of torque and angular momentum – Vector and Scalar product of unit vectors.

KINEMATICS: Description of Uniform and accelerated motion using velocity-time and position-time graphs; Concept of acceleration due to gravity – Equations of motion of freely falling body – vertically projected body from ground and tower – Projectiles with examples – Oblique projection from ground and horizontal projection from the top of tower – Path of projectile. Maximum height, time of flight and range. Concept of resultant force.

DYNAMICS: Newton's laws of motions and their applications to objects suspended by strings; Atwood's machine; blocks placed in contact with each other on frictionless horizontal surface; apparent weight in a lift – Impulse – Law of conservation of linear momentum (statement only) – Work –Power – Energy – Definitions and units – Expressions for P.E. & K.E – Work – Energy theorem – Law of conservation of energy – Examples – Vertically projected and freely falling bodies.

COLLISIONS AND CENTER OF MASS: Collision of two bodies in one dimension – Elastic and in-elastic collisions – One body at rest – two bodies moving in the same and opposite directions – Co-efficient of restitution, equation for height attained by freely falling body after a number of rebounds on the floor. Definition of center of mass with examples – Difference between Center of Mass and Center of gravity – Co-ordinates of center of mass; centre of mass of rigid body with homogeneous distribution of mass, thin rod, a circular ring, circular disk and sphere; Velocity and acceleration of centre of mass (Two dimensional) – Characteristics of center of mass – Explosion; Motion of centre of mass of earth-moon system.

FRICTION: Causes of friction – Static, Kinetic and rolling frictions – Angle of friction – Laws of friction – Lubricants – Motion of a body on the rough horizontal plane – Pushing and pulling of lawn roller –Expression for acceleration of a body sliding down are sliding up a smooth/ rough inclined planes (without rolling).

ROTATORY MOTION: Concepts of torque and couple – Relation between angular momentum and torque – Moment of inertia – Parallel and perpendicular axes theorems – Expressions for M.I.of a thin rod, uniform disc, rectangular

lamina, solid sphere and hollow sphere, circular ring and solid cylinder and hollow cylinder- Law of conservation of angular momentum with examples – Motion in vertical circle.

GRAVITATION: Basic forces in nature; Nature of gravity; Relation between Universal gravitational constant (G) and acceleration due to gravity(g); variation of "g" with altitude, depth, latitude and shape of earth; Limitations of Newton's third Law – Universal law of gravitation – Black Hole. Idea of inertial and non-inertial frames – Inertial and gravitational masses – Escape velocity, orbital velocity and relation between them – Geo stationary Satellites and their uses.

SIMPLE HARMONIC MOTION: Definitions and examples – Expressions for displacement, velocity, acceleration, time period and frequency – Expressions for the time period of a simple pendulum and loaded spring – force constant, Expressions for the KE and PE of a body in SHM –Law of conservation of Energy in the case of simple pendulum.

ELASTICITY : Elasticity & Plasticity – Stress and Strain – Hooke's Law, Moduli of elasticity (Y, n, K) – Poission's ratio – definition and its limit; behaviour of wire under gradually increasing load – Elastic fatigue, strain Energy – Experimental determination of Y- Searle's apparatus.

SURFACE TENSION: Surface Tension Definition and Examples – Molecular Phenomenon – Angle of contact – Capillarity with examples in nature – Experimental Determination of surface tension by capillary rise method with necessary theory. Expression for excess pressure inside a liquid drop and soap bubble.

FLUID MECHANICS: Explanation and Statement of Poisuille's expression – Streamline flow – Stokes formula – terminal velocity – Principle of buoyancy –Pressure energy in a fluid; equation of continuity and Bernoulli's theorem – application to aerodynamic lift and motion of spinning ball (qualitative treatment only).

TEMPERATURE AND THERMAL EXPANSION OF SOLIDS, LIQUIDS AND GASES : Vibrations of atoms in a solid –Potential Energy Curve – anharmonicity of vibrations – Explanation of thermal expansion (only qualitative treatment – No expressions)- Coefficients of linear , areal and volume expansions. The coefficients of real and apparent expansion of liquids and the derivation of the relationship between them- Variation of density of solids and liquids with temperature. Determination of coefficient of apparent expansion of liquid by specific gravity bottle method; Anomalous expansion of water and its significance in nature. Volume and pressure coefficients of gases – their relationship – Experimental determination of volume coefficient by Regnault's apparatus; pressure coefficient by Jolley's bulb apparatus; Kelvin Scale of Temperature- Boyle's law and Charle's law- Ideal gas equation – significance of universal gas constant.

THERMO DYNAMICS: Definition of Calorie, thermal capacity, specific heat and latent heat- Experimental determination of specific heat and latent heat by method of mixtures -Joule's law and mechanical equivalent of heat (J); Principles of heat engines and Refrigerators. Three phases of matter & triple point of water. Definitions of specific heats of gases (Cp & Cv) – Isothermal and adiabatic processes- Relationships between P, V & T in adiabatic process; external work done by an ideal gas in adiabatic and isothermal process; Internal energy – Statements and explanation of Zero'th, first and second laws of Thermodynamics – Relationship between Cp and Cv (without using Maxwell's Equations).

TRANSMISSION OF HEAT: Conduction of Heat – Coefficient of thermal conductivity – Convection of Heat- Nature and properties of Thermal Radiation – Prevost's Theory of heat exchange- Emissive and absorptive power of bodies- Black body radiation – Kirchoff's laws and its applications – Stefan's law, Newton's law of cooling.

WAVE MOTION AND SOUND: Longitudinal and transverse waves, equation for a progressive wave, principle of superposition of waves, reflection of waves, formation of stationary waves in stretched strings, laws of vibrating strings, Experimental verification by Sonometer; Characteristics of a sound, speed of sound in solids, liquids and gases (Only formulae to be considered); Free vibrations, forced vibrations and resonance; standing waves in organ pipes, open and closed pipes (Harmonics and overtones); Beats – definition and explanation, – Doppler Effect – Definition, Formulae for apparent frequency of a sound note for various cases (neglect wind velocity) ; Applications and limitations of Doppler Effect – Echoes, Absorption of sound Waves – Reverberation time – Fundamentals of Building acoustics – Statement of Sabine's formulae.

RAY OPTICS AND OPTICAL INSTRUMENTS: Nature of Light – Newton's corpuscular theory – Huygen's wave theory – Electromagnetic wave theory, Electromagnetic spectrum; Refraction through prism; derivation of refractive index of material of prism for minimum deviation – Critical angle – Total internal reflection – Relation between critical angle and refractive index – Application of total internal reflection to optical fibers. Defects in images – Spherical and chromatic aberrations and methods of their reduction (Qualitative treatment) – Microscopes; Formula for magnification of simple microscope and compound microscope; Telescope; Formula for magnification of astronomical and terrestrial telescopes; Construction of Ramsden's and Huygen's eyepieces; Dispersion of light – Dispersive Power – Pure and impure spectra conditions for obtaining pure spectrum. Different kinds of spectra – Emission spectra-line, band and continuous spectra; Absorption spectra – significance of emission and absorption spectra; Fraunhoffer lines and their significance.

PHYSICAL OPTICS : Interference of light – Coherent sources – Conditions for interference; Young's double slit experiment –Derivation of intensity and fringe width; uses of interference. Diffraction; Fresnel and Fraunhoffer Diffraction (without expressions) – and their Applications – Polarisation – concepts of polarization – production of plane polarised light by reflection and refraction- double refraction – Polaroids.

MAGNETISM : Coulomb's inverse square law – Definition of Magnetic field – Magnetic lines of force, uniform and non-uniform magnetic field. Couple acting on a bar magnet placed in a uniform magnetic field. Definition of magnetic moment of magnet. Magnetic induction due to a bar magnet on axial and equatorial lines. Superposition of magnetic fields – Tangent Law – Deflection Magnetometer. Comparison of Magnetic Moments in Tan A, Tan B positions by equal distance method and null method. Verification of inverse Square Law. Vibration magnetometer – principle and description: Experimental determination of M and BH earth's horizontal component using vibration magnetometer. Types of magnetic materials – dia, para ferromagnetic materials; properties and uses.

ELECTROSTATICS : Charges – conservation of charge and additive property of charges; Coulomb's inverse square law – permittivity of free space and medium – Force between two point charges; force due to multiple charges – principle of superposition with examples; concept of electric filed – Electric lines of force and their properties – Electric intensity definition – Force on a charge in an electric filed (F=Eq) – Electric intensity due to isolated charge and due to multiple charges – electrostatic potential, definition – Potential due to point charge and group of charges –

relation between electrostatic potential and electric intensity; Electrostatic potential energy of a system of a charges ; electric flux – definition; Gauss Law: Statement – Application of Gauss Law to find electric intensity and electrostatic potential due to continuous charge distribution of infinite long wire and infinite plane sheet and spherical shell (only formulae). Capacitance – Definition of Electrical Capacity of a Conductor – Capacitance – Dielectric constant – Definition of Condenser, its uses – Parallel plate Condenser – formula for capacitance of parallel Plate Condenser – Dielectric, Dielectric strength – Effect of dielectric on capacitance of capacitors. Capacitors in series and in parallel – derivation of the equivalent capacitance for the series and the parallel combination; Energy stored in a condenser – Effect of dielectric on Energy of Condenser – Types of capacitors – their users.

CURRENT ELECTRICITY : Electric current – Flow of electric charges in metallic conductor – Drift velocity and mobility – Relation between electric current and drift velocity – Ohm's Law – Statement – Ohmic and NonOhmic elements with examples – conductance – specific resistance – variation of resistivity with temperature – Variation of Resistance with temperature – Thermistor – E.M.F. of cell – Internal resistance and back E.M.F. – difference between EMF of a cell and potential difference – Electrical energy – Power and their units; definition of KWHr, Kirchoff's laws; statement of Kirchoff's voltage of law – Kirchoff's current law – Application to wheatstone bridge – condition for balancing – meter bridge – determination of resistance of a conductor using meter bridge – Principle of potentiometer – determination of internal resistance and E.M.F. of a cell using potentiometer – Series and parallel combination of cells – derivation of equivalent E.M.F. for the series and parallel combination of cells.

THERMOELECTRICITY : Seebeck effect – Peltier and Thomson effects and their coefficients – variation of thermo e.m.f. with temperature – Neutral and inversion temperatures – applications of thermo couples.

ELECTROMAGNETICS : Oersted's experiment – Biot-savart Law – Ampere Law – Magnetic field near a long straight wire and magnetic field at the center of a circular coil carrying current (with derivation) – Field on the axis of a circular coil carrying current (with expressions only)Tangent Galvanometer – principle and working – Definition of reduction factor – force on a moving charge in a magnetic field – force on a current carrying conductor in a magnetic field – force between two long straight parallel conductors carrying current – definition of ampere – Fleming's left hand rule-current loop as a magnetic dipole, force and torque on current loop in a uniform magnetic field – magnetic dipole moment of a revolving electron – principle , construction and working of a moving coil galvanometer – conversion of moving coil galvanometer into ammeter and voltmeter – comparison of M.C.G with T.G.
Electromagnetic induction – Magnetic flux and induced emf- Faraday's and Lenz's Laws – Fleming's right hand rule – self inductance – mutual inductance –principle of transformer. Growth and decay of charge in R.C.Circuit connected to D.C.source – Equations for charge on condenser – Current in inductor. Time constant – Definition and its significance.
Alternating Currents– instantaneous, maximum and rms values of alternating current – alternating voltage applied to a pure resistor, pure inductor – pure capacitor – L-R, C-R and L-C-R (expressions for impedance and phase only).

ATOMIC PHYSICS : Discovery of electron – e/m of electron by Thomson's method – charge of an electron by Millikan's Oil drop method (Principle only) – Photoelectric effect-definition – laws of photo electric emission – Einstein's explanation of Photoelectric effect – Einstein's photo electric equation and its experimental verification by Millikan's method – photoelectric cells working and uses. X-rays – Production of X-rays – Coolidge tube – X-rays spectrum – Continuous X-ray spectra – characteristic X-ray spectra – Mosley's law and its importance – Compton

effect (Statement only) –dual nature of matter – DeBroglie's hypothesis (concepts only)- Expression for de Broglie Wavelength.

NUCLEAR PHYSICS : Composition and size of nucleus – mass defect and binding energy and their relation (Explanations with examples) – Natural radioactivity – alpha beta and gamma radiation and their properties, radioactive decay law, half life and average life of a radioactive substance. Nuclear forces – Their properties – Artificial transmutation of elements – Discovery of Neutron – Radio isotopes and their uses – nuclear fission – chain reaction – Principle and working of a nuclear reactor – Nuclear radiation hazards – protective shielding – types of reactors – Breeder Reactor – power reactor and their uses – Nuclear fusion – energy of the sun and the stars (Carbon – Nitrogen cycle and Proton – Proton cycle) – elementary particles.

SEMI-CONDUCTOR DEVICES AND COMMUNICATION SYSTEMS : Introduction – intrinsic and Extrinsic semiconductors (n and p type) Junction diode – p-n junction, depletion layer and barrier potential, forward and reverse bias – current voltage characteristics of junction diode – p-n diode as half wave and full wave rectifier, (only qualitative treatment) Zener diode as a voltage regulator – Transistor – function of emitter, base and collector – p-n-p, n-p-n transistors – Biasing of transistors, current, voltage- Characteristics of transistor in CE configuration – Transistor as common emitter amplifier (qualitative treatment). Logic gates (OR, AND, NOT, NAND, and NOR) – Communication Systems; Elements of communication systems (block diagrams only) Bandwidth of signals (speech, TV and digital data) bandwidth of Transmission medium – Propagation of electromagnetic waves in the atmosphere, sky and space wave propagation- Modulation – Need for modulation.

CHEMISTRY

ATOMIC STRUCTURE: Characteristics of electron, proton and neutron. Rutherford model of an atom. Nature of electromagnetic radiation. Planck's quantum theory. Explanation of photo electric effect. Dual behavior of electromagnetic radiation. Features of atomic spectra – Emission and absorption spectra. Characteristics of hydrogen spectrum. Bohr's theory of the structure of the atom – Postulates, Theory of hydrogen atom, Energy of an electron. Bohr's explanation of spectral lines. Failure of Bohr's theory. Wave-particle nature of electron. De Broglie's hypothesis, Heisenberg's uncertainty principle. Important features of the quantum mechanical model of an atom – Meaning and significance of wave function. Quantum numbers, concept of orbitals, definition of atomic orbital in terms of quantum Numbers – shapes of s, p and d orbitals, Aufbau principle, Pauli's exclusion principle and Hund's rule of maximum multiplicity. Electronic configuration of atoms. Explanation of stability of half filled and completely filled orbitals.

CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES: Concept of grouping elements in accordance to their properties – Mendeleef's Periodic Table. Periodic law – Mendeleef's classification of elements. Significance of atomic number and electronic configuration as the basis for periodic classification. Classification of elements into s, p, d, f blocks and their main characteristics. Periodic trends in physical and chemical properties of elements: Atomic radii, Ionic radii, Inert gas radii, Ionization energy, Electron gain energy, Electro- negativity, Valency, variation of oxidation states, Electropositivity – Metallic and Non-metallic nature, Nature of Oxides, Diagonal relationship. Variation of atomic radii in inner transition elements.

CHEMICAL BONDING AND MOLECULAR STRUCTURE: Kossel -Lewis approach to chemical bonding. Factors favorable for the formation of ionic bond, energy changes in ionic bond formation. Crystal lattice energy – calculation of lattice energy – Born – Haber cycle. Crystal structures of sodium chloride and Caesium chloride, Coordination number. Properties of ionic compounds. Covalent bond – VSEPR theory – Lewis representation of covalent compounds, Formal charge, geometry of simple molecules. The valence bond approach for the formation of covalent bonds. Directional properties of covalent bond. Properties of covalent bond. Hybridization – different types of hybridization involving s, p and d orbitals. Shapes of simple covalent molecules. Definition of coordinate covalent bond with examples.

STOICHIOMETRY: Laws of chemical combination. Molar mass, concept of equivalent weight with examples. Percentage composition of compounds and calculation of empirical and molecular formulae of compounds. Chemical reactions and equations, Stoichiometry. Oxidation number concept. Balancing of redox reactions by ion electron method and oxidation number method. Types of redox reactions.

STATES OF MATTER: GASES Graham's law of diffusion, Dalton 's law of partial pressures, Avogadro's law. Ideal behavior, empirical derivation of gas equation, ideal gas equation. Kinetic molecular theory of gases. Kinetic gas equation (No derivation) – deduction of gas laws. Distribution of molecular velocities and types of molecular velocities – Average, Root Mean Square and Most Probable Velocity.

SOLUTIONS: Classification of solutions, molarity, normality, molality and mole fraction. Dilute solutions, vapor pressure, Raoult's law, Limitations of Raoult's law. Colligative properties – (i) Relative lowering of vapor pressure (ii) Elevation of B.P (iii) Depression in freezing point and their relation to molar mass. Osmosis and osmotic pressure – theory of dilute solutions. Determination of molar mass using colligative properties: Ostwald's dynamic method, Cottrell's method, Rast's method and Berkeley Hartley's method. Abnormal molecular mass.

ELECTRO CHEMISTRY: Conductance in electrolytic solutions. Specific, Equivalent and Molar conductance – variation of conductance with concentration. Kohlrausch's law – application to calculation of equivalent conductance of weak electrolytes. Electrolytes and non-electrolytes, redox reactions. Electrolysis. Some typical examples of electrolysis viz; Fused Sodium hydroxide, Fused sodium chloride, Brine solution, Fused Magnesium chloride. Faraday's laws of electrolysis and applications. Gavanic and voltaic cells. Representation and notation of electrochemical cells with and without salt bridge. Standard hydrogen electrode, electrode potentials, electrochemical series. EMF of the cell, Nernst equation and its application to calculate EMF of electrochemical cells. Primary cell – dry cell / Lechlanche cell. Secondary cells – Fuel cells: Hydrogen – Oxygen fuel cell and Hydrocarbon – Oxygen fuel cell. Corrosion – mechanism, factors to promote corrosion and prevention of corrosion. Passivity. Lead accumulator

SOLID STATE : Classification of solids based on different binding forces as molecular, ionic, covalent solids, and metallic solids. Elementary treatment of metallic bond. Metallic solids, amorphous and crystalline solids. Unit cell in two dimensional and three dimensional lattices. Seven crystal systems, Bravais lattices. Bragg's equation, X-ray study of crystal structure, Bragg's method. Calculation of density of unit cell, packing in solids, voids, number of atoms per cubic unit cell. Point defects – Schottky and Frenkel defects. Electrical and magnetic properties.

CHEMICAL KINETICS: Concepts of reaction rate, factors affecting reaction rates. Rate law, Units of rate constant. Order and molecularity. Methods of determination of order of a reaction. Integrated rate equations and half lives for zero and first order reaction. Collision theory of reaction rates (elementary ideas). Concept of activation energy.

Equilibrium: Equilibrium in physical and chemical processes, dynamic nature of equilibrium, Law of mass action, equilibrium constant. Factors affecting equilibrium. Relation between Kp and Kc Le Chatelier's principle, application to industrial synthesis of (i) Ammonia (ii) Sulphur trioxide.

Acids and Bases: Lowry-Bronsted acid base theory. Lewis theory, limitation of Lewis theory, Ionic equilibrium. Ionization of acids and bases, strong and weak electrolytes, degree of ionization. Ionic product of water. Concept of pH. Hydrolysis of salts (elementary idea), hydrolysis constant, buffer solutions. Solubility product and common ion effect with illustrative examples.

THERMODYNAMICS: Concept of system, types of systems, surroundings, work, heat, energy, extensive and intensive properties, state functions. First law of thermodynamics – Internal energy and Enthalpy. Heat capacity and Specific heat, Exothermic and Endothermic reactions, measurement of "U and "H". Enthalpy of bond dissociation, combustion, neutralization, formation, atomization, sublimation, phase transition, ionization and dilution. Thermo chemical equations. Hess's law of constant heat summation. Driving force for a spontaneous process. Thermodynamic representation of criteria of spontaneity in terms of entropy, entropy as a state function. Gibbs free energy, Gibbs free energy change for spontaneous, non spontaneous and equilibrium processes.

SURFACE CHEMISTRY: Adsorption, Physical and chemical adsorption, adsorption of gases on solids, factors affecting it – pressure (Langmuir and Freundlich Isotherms) and temperature. Catalysis – types of catalysis, autocatalysis. Colloidal state: colloidal solutions, classification of colloidal solutions, protective colloids and Gold number, Properties of colloids – Tyndall effect, Brownian movement. Coagulation. Emulsions, classification of emulsions, micelles, cleansing action of soap.

HYDROGEN AND ITS COMPOUNDS: Position of hydrogen in periodic table. Occurrence, isotopes of hydrogen. Hydrogen – Preparation, properties and uses including as a fuel. Reactions of hydrogen leading to ionic, molecular and non – stoichiometric hydrides. Physical and Chemical properties of water and heavy water. Hardness of water and its removal. Hydrogen peroxide – methods of preparation, physical and chemical properties - oxidation, reduction, decomposition, disproportionation and addition reactions. Detection, structure and uses of Hydrogen Peroxide.

ALKALI AND ALKALINE EARTH METALS: Electronic configuration, occurrence, Anomalous properties of the first element in each group. Diagonal relationship. Trends in properties like ionization enthalpy, atomic and ionic radii, reactivity with oxygen, hydrogen, halogens and water, uses of alkali and alkaline earth metals. Preparation and properties of Sodium hydroxide, Sodium carbonate and sodium hydrogen carbonate. Preparation and uses of Calcium oxide, Calcium carbonate and Calcium sulphate.

p-BLOCK ELEMENTS: GROUP 13 ELEMENTS: (IIIA GROUP ELEMENTS): Electronic configuration, occurrence. Variation of properties and oxidation states, trends in chemical reactivity. Anomalous properties of first element of the group. Boron- boron hydrides. Aluminum: uses, reactions with acids and alkalis. Potash alum.

p-BLOCK ELEMENTS: GROUP 14 ELEMENTS: (IVA GROUP ELEMENTS): Electronic configuration, occurrence. Variation of properties and oxidation states, trends in chemical reactivity. Anomalous behavior of first element. Carbon – catenation, allotropic forms, physical and chemical properties and uses. Similarities between carbon and silicon, uses of oxides of carbon. Important compounds of Silicon – Silicon dioxide. Manufacture and uses of Producer gas and Water gas.

p- BLOCK ELEMENTS: GROUP 15 ELEMENTS (VA GROUP ELEMENTS): Occurrence – physical states of nitrogen and phosphorous, allotropy, catenation capacity, electronic configuration, Oxidation states. General characteristics of hydrides, oxides and halides. Structure of Hydrides. Oxoacids of nitrogen and phosphorous. Manufacture and uses of nitric acid, ammonia and Super phosphate of lime.

p- BLOCK ELEMENTS: GROUP 16 ELEMENTS (VIA GROUP ELEMENTS): Occurrence, electronic configuration, oxidation states. Physical states of oxygen and sulphur and their structure, allotropy. General characteristics of hydrides, oxides and halides. Structural aspects of oxy acids of chalcogens. Preparation, Properties and uses of Ozone, Sodium thiosulphate. Manufacture of Sulphuric acid.

P- BLOCK ELEMENTS: GROUP 17 ELEMENTS (VIIA GROUP ELEMENTS): Occurrence, electronic configuration and oxidation states. Physical states of halogens. Ionization Potential, Electro negativity, Electron affinity, bond energies and chemical reactivity. Oxidizing power of fluorine and chlorine. Structural aspects of oxy acids of chlorine. Preparation, properties and uses of fluorine, chlorine and bleaching powder. Structures of Inter halogen compounds.

GROUP 18 ELEMENTS: (ZERO GROUP ELEMENTS): Electronic configuration, occurrence and isolation. Trends in physical and chemical properties and uses. Structures of Xenon oxides and halides.

TRANSITION ELEMENTS: General introduction, electronic configuration, occurrence and characteristics of transition metals. General trends in properties of first row transition metals – metallic character, ionization energy, variable oxidation states, atomic and ionic radii, color, catalytic property, magnetic property, interstitial compounds. Alloy formation.

Lanthanides: Electronic configuration, variable oxidation states, chemical reactivity and lanthanide contraction.
Coordination compounds: Introduction, ligands, coordination number. Werner's theory of coordination compounds. Valence bond theory – shapes of coordination compounds. IUPAC nomenclature of mono molecular coordination compounds. Bonding and EAN rule. Isomerism. Importance of coordination compounds in qualitative analysis, extraction of metals and biological systems.

GENERAL PRINCIPLES OF METALLURGY: Principles and methods of extraction – concentration, reduction by chemical and Electrolytic methods and refining. Occurrence and principles of extraction of Copper, Zinc, Iron and Silver. Molten electrolysis processes of Aluminium, Magnesium and Sodium.

ENVIRONMENTAL CHEMISTRY: Definition of terms, types of Pollution, Air, Water and Soil pollution. Oxides of carbon, carbon monoxide, oxides of nitrogen and sulphur, chloro fluoro carbons. Chemical reactions in atmosphere, smogs, major atmospheric pollutants, acid rain. Ozone and its reactions, effects of depletion of ozone layer. Green house effect and global warming. Pollution due to industrial wastes.

HYDROCARBONS: Classification and IUPAC nomenclature of organic compounds. Types of organic reactions – substitution, addition, elimination and rearrangement reactions. Classification of hydrocarbons. **Alkanes** - Nomenclature, isomerism. Methods of preparation of ethane. Physical properties, chemical reactions including free radical mechanism of halogenation, Combustion and Pyrolysis of ethane. **Alkenes** – Nomenclature, structure of double bond (ethane), geometrical isomerism, physical properties. **Ethylene:** Methods of preparation, physical properties and chemical reactions – addition of hydrogen, halogen, water, hydrogen halides (Markovnikov's addition and peroxide effect), Ozonolysis oxidation.

ALKYNES: Nomenclature, structure of triple bond. Acetylene – Methods of preparation, Physical properties and chemical reactions: acidic character of acetylene, addition reaction of – hydrogen, halogens, hydrogen halides and water. **Aromatic hydrocarbons:** Introduction, IUPAC nomenclature; **Benzene:** resonance and aromaticity, Chemical properties: Mechanism of electrophilic substitution – Nitration, Sulphonation, Halogenation, Friedel Craft's alkylation and Acylation.

STEREO CHEMISTRY: Optical activity-discovery, determination using a polarimeter, specific rotation, Chirality – Chiral objects, Chiral molecules. Configuration and Fischer projections, Asymmetric carbon, elements of symmetry, compounds containing one chiral centre, enantiomers, D-L and R-S nomenclature, racemic forms, racemisation. Compounds containing two chiral centers, diastereo isomers, meso form, resolution, importance of stereochemistry.

HALOALKANES: Nomenclature, nature of C-X bond, Preparation and physical and chemical properties of ethyl chloride and chloroform. Mechanism of S N1 , and S N2 reactions. **Haloarenes:** Nature of C-X bond, Chlorobenzene: Preparation and substitution reactions (directive influence of halogen for mono substituted compounds only). **Alcohols, Phenols and Ethers: Alcohols** : Nomenclature of alcohols, Methods of preparation and physical and Chemical properties of ethyl alcohol, Mechanism of dehydration. Identification of primary, secondary and tertiary alcohols. Uses methanol and ethanol. **Phenols:** Nomenclature of Phenols. Methods of preparation and Physical and chemical properties of phenol, acidic nature of phenol. Electrophilic substitution reactions, uses of phenols. **Ethers:** Nomenclature of ethers. Methods of preparation, Physical and chemical properties and uses of diethyl ether.

ALDEHYDES AND KETONES: Nomenclature, and nature of carbonyl group. Methods of preparation and Physical and Chemical properties and uses of acetaldehyde and acetone. Mechanism of nucleophilic addition, Reactivity of alpha hydrogen in aldehydes;

CARBOXYLIC ACIDS: Nomenclature and acidity of carboxylic acids. Methods of preparation, Physical and chemical properties and uses of acetic acid.

ORGANIC COMPOUNDS CONTAINING NITROGEN: Nitrobenzene: Preparation, properties and uses. **Amines:** Nomenclature and classification of amines. Structure, methods of preparation, physical and chemical properties and

uses of Aniline. Identification of primary secondary and tertiary amines. **Diazonium salts:** Preparation, Chemical reactions and importance of diazonium salts in synthetic organic chemistry. Azo dyes and their uses.
POLYMERS: Classification of polymers. Addition and condensation polymerization. Copolymerization. Natural rubber, vulcanization of rubber, synthetic rubber – Neoprene and Buna- S. Molecular weights of polymers – Number average and weight average molecular weights (definition only) Biopolymers – Carbohydrates and Proteins. Biodegradable polymers and some commercially important polymers like polythene, nylon, polyesters and bakelite.

BIOMOLECULES Carbohydrates: Classification (aldoses and ketoses). Monosaccharides (glucose and fructose). Oligosaccharides (sucrose, lactose, maltose). Polysaccharides (starch, cellulose, glycogen) – preparation, properties, structures and Importance. **Proteins:** Elementary idea of Alpha amino acids, peptide bond. Polypeptides and proteins. Primary, secondary, tertiary and quaternary structures of Proteins (Qualitative idea only). Denaturation of proteins; enzymes. **Vitamins:** Classification and functions of vitamins in biosystems. **Nucleic Acids:** Types of nucleic acids, primary building blocks of nucleic acids. Chemical composition of DNA & RNA, Primary structure of DNA and its double helix. Replication. Transcription and protein synthesis, Genetic code. **Lipids:** Classification, structure and functions of lipids in biosystems. **Hormones:** Classification, structural features and functions of hormones in biosystems.

CHEMISTRY IN EVERYDAY LIFE: Uses of Chemicals in medicine: Analgesics : Narcotics (morphine, codeine). Non-narcotics (Aspirin, Ibuprofen). Antipyretic (Analgin, phenacetin and paracetamol). Tranquilizers (Barbituric acid, Luminal, seconal, valium, serotonin). Antiseptics (Chloroxylenol, bithional), Disinfectants (formalin, formaldehyde). Antimicrobials (lysozyme, lactic acid, hydrochloric acid in stomach). Antifertility drugs (oral pills). Antibiotics (pencillin, chloramphenicol, sulphadiazine). Antacids (omeprazole, lansoprazole), antihistamines. Chemicals in food preservatives (sodium benzoate, sulphur dioxide, potassium metabisulphite). Artificial sweetening agents (Aspartame, alitane, sucrolose).

BOTANY

BOTANY INTRODUCTION: 1.1) Origin, development and scope of Botany. 1.2) Classification of plant kingdom (outlines only). 1.3) Branches of Botany: Morphology, Cytology, Embryology, Palynology, Taxonomy, Physiology, Ecology, Palaeobotany, Genetics, Phytogeography, Phycology, Mycology, Lichenology, Bryology, Pteridology, Microbiology, Bacteriology, Virology. 1.4) Parts of angiospermic plant

EXTERNAL MORPHOLOGY: a) Vegetative morphology: 2.1) Root: root systems, types, characteristics and functions, Modifications of roots (Storage roots, Velamen roots, Photosynthetic roots, Respiratory roots, Nodular roots and Parasitic roots). 2.2) Stem: characteristics and functions of the stem; Modifications of stems: Aerial: Tendrils, Thorns, Hooks, Phylloclade, Tuberous stems and Bulbils. Sub-Aerial: Runners, Stolons, Suckers & Offsets, Underground: Rhizome, Corm, Stem tuber & Bulb. 2.3) Leaf: Parts of Leaf, venation, types of leaves, Phyllotaxy, Leaf modifications: -Tendrils, Spines, Scale leaves, Phyllode, Reproductive & Trap leaves (Details of Nepenthes only). **b) Reproductive Morphology:** 2.4) Inflorescence: Types of Inflorescence: a) Terminal, axillary and intercalary, b) Racemose, Cymose and Special Types. 2.5) Flower: Parts of flower, Structure of flower, Sex distribution, Symmetry of flower, Position of gynoecium on the thalamus. Detailed description of flower: Perianth, Calyx, Corolla, aestivation,

Androecium – Parts, fixation, lengths of stamens, union of stamens, dehiscence of anther, Gynoecium – number of carpels, fusion of carpels, ovary – number of locules , placentation, Types of styles, Stigma.

REPRODUCTION IN ANGIOSPERMS: 3.1) Introduction – Sporophytic and Gametophytic stages. 3.2) Structure of Anther; Microsporogenesis and development of male gametophyte. 3.3) Ovule – Structure and Types; megasporogenesis – development and structure of embryo sac. 3.4) Pollination: Types of pollination – self and cross pollination, advantages of cross pollination, contrivances for cross pollination and self pollination, agents of cross pollination. 3.5) Fertilization – Process, Post – fertilization changes; Seed structure (Dicot & Monocot) and types of seed germination (epigeal, hypogeal & vivipary). 3.6) Fruits: Classification; false fruits and true fruits – Simple fruits (fleshy fruits – berry, pome, pepo, hesperidium, drupe; Dry fruits – dehiscent- legume, septicidal capsule, loculicidal capsule, septifragal capsule, Indehiscent fruits – caryopsis, cypsela, nut: schizocarpic – lomentum, schizocarp), Aggregate and Multiple fruits

PLANT TAXONOMY: 4.1) Introduction – alpha and omega taxonomy; Aspects of taxonomy – Identification – Flora, herbaria, botanical gardens (RBG – Kew, IBG – Kolkata, NBG – Lucknow), Nomenclature, ICBN, Classification – Types, Units and Brief account of Bentham & Hooker's system Study of the following families including economic importance: 4.2) Malvaceae. 4.3) Fabaceae 4.4) Solanaceae 4.5) Liliaceae

CELL BIOLOGY: 5.1) Introduction, Techniques of Cell Biology – microscopy (light, electron, fluorescent, phase contrast, SEM, TEM – only uses). 5.2) Ultrastructure of plant cell (Eukaryotic cell – Structure of cell wall and cell membrane, Protoplasm, Cytoplasm, Plastids, Mitochondria, Endoplasmic reticulum, Ribosomes, Golgi complex, Lysosomes, Peroxisomes and Glyoxysomes, Vacuoles and Nucleus). 5.3) Chromosomes. 5.4) Nucleic acids. 5.5)Cell Cycle: Mitosis and Meiosis.

NTERNAL ORGANIZATION OF PLANTS: Tissues – Structure, types (Meristematic and Permanent) and functions. 6.2) Internal structure of Dicot root (Primary) and Monocot root. 6.3) Internal structure of Dicot stem (Primary) and Monocot stem. 6.4) Internal structure of leaf (Dicot and Monocot). 6.5) Secondary growth in dicot stem.

PLANT ECOLOGY: Introduction. 7.2) Plant communities – Hydrophytes, Mesophytes and Xerophytes; Ecological adaptations (Morphological & Anatomical) of Hydrophytes and Xerophytes.

GENETICS: 8.1) Introduction. 8.2) Mendel's Principles – Monohybrid cross, Dihybrid cross, Back cross, Test cross, Concept of probability in relation to Mendel's laws. 8.3) Linkage and crossing over (only concept and significance). 8.4) Mutations – Types of Mutations and significance.

PLANT KINGDOM : 9.1) Introduction. 9.2) Spirogyra – Distribution and habitat, thallus structure, cell structure, reproduction – vegetative, asexual, sexual, life cycle. 9.3) Rhizopus – Distribution and habitat, structure of mycelium and hypha, reproduction – vegetative, asexual, sexual, life cycle, sexuality in Rhizopus. 9.4) Funaria: Distribution and habitat, external morphology of the gametophore, anatomy of the stem, reproduction – vegetative and sexual, sporophyte, protonema, life cycle. 9.5) Pteris: Distribution and habitat, external morphology of the sporophyte, anatomy of the rhizome(stem), vegetative, asexual and sexual reproduction, life cycle. 9.6) Cycas: Distribution and habitat, Morphology of the sporophyte, anatomy of the coralloid root and leaflet, Reproduction, life cycle.

MICROBIOLOGY: 10.1) Introduction and importance of microbiology. 10.2) Bacteria – Discovery, Distribution, sizes, shapes, Gram stain (in brief), structure of cell, nutrition, reproduction –asexual (binary fission), sexual – conjugation (F + and F – only), transformation and transduction (only definition, discoverer and example for transformation and transduction), economic importance – beneficial (Agriculture, industry, Medicine, Biotechnology), harmful (spoilage of food, plants, human and animal diseases). 10.3) Viruses – Historical account, types, structure (TMV and T 4 details), general account of sizes, shapes, replication, plant diseases caused by viruses, transmission of viruses and control measures of viral diseases. **XI. PLANT PHYSIOLOGY :** 11.1) Introduction **A. WATER RELATIONS OF PLANTS:** 11.2) Absorption of water – Introduction, soil water, water potential, diffusion, Imbibition, osmosis, plasmolysis, absorption of water. 11.3) Ascent of Sap **:** Definition, Cohesion – Tension theory. 11.4) Transpiration **:** Definition and types of transpiration, mechanism of stomatal movement, factors, significance, anti- transpirants. **B. NUTRITION IN PLANTS** 11.5) Introduction, types of nutrition (symbiosis, parasitism, chemotrophism, autotrophism). 11.6) Mineral nutrition – Introduction, soil as source, criteria of essentiality, importance of macro and micro elements, ion absorption – passive and active (carrier concept), biofertilizers. **C. METABOLISM :** 11.7) Enzymes – introduction, properties, IUB classification, mechanism of enzyme action (lock & key theory), enzyme inhibition. 11.8) Photosynthesis – Definition, pigments, structural organization of chloroplast: light reaction – Hill's reaction, Emerson enhancement effect, PSI and PSII, electron transport and proton translocation, photophosphorylation: C 3 , C 4 pathways, Factors, photorespiration Blackman's law. 11.9) Respiration – definition, Types, Mechanism of aerobic (Glycolysis, Krebs cycle, oxidative decarboxylation of pyruvic acid & electron transport system – oxidative phosphorylation) and anaerobic respiration, Respiratory quotient (RQ). 11.10) Nitrogen metabolism: Nitrogen cycle, Biological nitrogen fixation (symbiotic, non – symbiotic), Genetic code, Protein synthesis. 11.11) Plant growth & its regulators: Growth curve; introduction to growth regulators: physiological effects of auxins, gibberellins, cytokinins, abscisic acid and ethylene and their applications in agriculture and horticulture: Photoperiodism and Vernalization.
PLANTS AND HUMAN WELFARE: 12.1) Crop improvement – Introduction, aim and objectives of plant breeding; methods – definition, methodology, advantages and achievements of introduction, selection (Mass, pure-line, clonal), hybridization (Heterosis- only concept); mutation breeding and polyploidy breeding. **Biotechnology:** 2.2) Introduction, definition, scope and applications of Biotechnology. 12.3) Genetic Engineering – Recombinant DNA Technology, gene cloning; transgenic plants; GM crops, biosafety issues, applications of Genetic Engineering. 12.4) Tissue Culture – Techniques and applications. 12.5) Single cell protein – Advantages and source of single cell protein. 12.6) Mushroom Cultivation **:** Morphology and types of mushrooms; food value, cultivation of white button mushroom.

ZOOLOGY

Unit – I Zoology – The Basics a) Nature and scope of Zoology: meaning of Zoology, areas of study under Zoology. b) Relation between Zoology and other sciences c) Basic principles of classification: i) Need for classification. ii) Nomenclature. iii) Levels of classification. iv) Concept of species **Unit – II: LOCOMOTION AND REPRODUCTION IN PROTOZOA** a) Types and structure of locomotory organelles – Pseudopodia, Cilia and Flagella giving examples. b) Amoeboid movement (Pseudopodial movement – sol-gel theory only) c) Ciliary and Flagellar movements – Synchronal and Metachronal movements (example: Paramoecium), Effective stroke and Recovery stroke (example: Euglena) d) Types of Reproduction: i) Asexual reproduction and methods – Binary fission (transverse and longitudinal in Paramoecium and Euglena respectively). ii) Sexual reproduction – conjugation as exemplified by Vorticella and its significance.

III Animal Organisation a) Multicellularity: Diploblastic and Triploblastic condition. b) Symmetry – Types and characteristic features of each symmetry, giving an example for each type from the representative phyla – Asymmetry, Radial symmetry, Biradial symmetry and Bilateral symmetry. c) Coelom: i) Definition of Acoelom, Pseudo-coelom and Eucoelom – examples from the representative phyla. ii) Formation of Eucoelom -Schizocoelic and Enterocoelic coelom d) Animal Tissues: (brief account only) i) Epithelial tissue – types. ii) Connective tissue-connective tissue proper, skeletal tissue – types, Fluid tissue – Blood, Lymph. iii) Muscular Tissue types. iv) Nervous Tissue

Unit – IV: Phylum Annelida: Pheritima posthuma : Type study in detail. Different species, Habit and Habitat, External characters, structure and arrangement of setae, body wall, Coelom, wall of alimentary canal, locomotion, Digestive system, Respiratory system, Excretory system, Nervous system, Receptor organs, Blood vescular system, Blood glands, Reproductive system, Copulation, cocoon formation, development, regeneration and Economic importance.

Unit – V: Phylum Arthropoda: a) Cockroach – Periplaneta americana – external characters, digestive, respiratory, nervous systems and sense organs only. b) Insect mouth parts of the following types: i) Biting and chewing Eg: Cockroach. ii) Piercing and sucking Eg: Mosquito. iii) Sponging and sucking Eg: Housefly. iv) Siphoning Eg: Butterfly c) Economic importance of insects: i) Useful insects, viz., Honey bee, Lac insect, Silk worm – their produce and general features. ii) Harmful insects, viz., Bed bug, Head Louse, mosquito and housefly – their general features, harmful effects and diseases spread by them.

Unit – VI: Animal Associations: a) Definition and 1 or 2 examples of the following associations: i) Symbiosis: Commensalism, Mutualism, Parasitism. ii) Predation b) Structure, Life cycle, Pathogenesis and Prophylaxis of the following parasites: i) Entamoeba histolytica. ii) Plasmodium vivax. iii) Taenia solium. iv) Wuchereria bancrofti

Unit-VII General Characters and Classification of Invertebrate Phyla upto The Level of Classes with Examples . a) Phylum: Protozoa. b) Phylum: Porifera, Systematic position. c) Phylum: Coelenterata (Cnidaria). d) Phylum: Platyhelminthes. e) Phylum: Nemathelminthes. f) Phylum: Annelida. g) Phylum: Arthropoda. h) Phylum: Mollusca. i) Phylum: Echinodermata

Unit – VIII: Man and Biosphere: a) Components of environment – atmosphere, hydrosphere and lithosphere. b) Hierarchy among the living organisms(definitions- population, community, biome, biosphere).
c) Structural components of an ecosystem: Abiotic factors – Light, temperature and water – their biological effect on organisms. Biotic factors – producers, consumers and decomposers. d) Functional aspects of ecosystem – Energy flow, Food chains, Food web, Ecological pyramids. e) Lake as an example of fresh water ecosystem – Littoral zone, Limnetic zone, and profundal zone. f) Population Ecology – Population density, growth, age distribution and population regulation. g) Biodiversity and its conservation. h) Wild life and its conservation

Unit – IX: Phylum Chordata: a) General characters, ancestry and theories of origin and outline classification of Chordata upto classes with typical examples. b) Sub-phylum Vertebrata; **i) Pisces** : Distinctive features of Placodermi, chondrichthyes & osteichthyes with typical examples, classification of chondrichthyes (upto subclasses) and osteichthyes (upto orders). **ii) Amphibia** : Distinctive features of Urodela, Anura, Apoda with typical examples. **iii) Reptilia** : Distinctive features of Squamata, Rhynchocephalia, Crocodelia and Chelonia with typical examples.

Identification of poisonous and non-poisonous snakes, poisonous apparatus, toxicity of snake venom and treatment of snake bite including first aid. **iv) Aves:** Distinctive features of Archeaeornithes & Neornithes(upto super orders only) with typical examples. **v) Mammalia:** Distinctive features of Prototheria, Metatheria and Eutheria with typical examples.

Unit – X: Functional Anatomy of Rabbit – External characters, Digestive, respiratory and circulatory systems. a) Digestive system: Alimentary canal, Digestive glands, Process of Digestion, Role of vitamins and Minerals in nutrition. b) Respiratory system – Structure, mechanism of breathing and transport of respiratory gases. c) Circulatory system of Rabbit: Structure of heart, Arterial and venous system, Working of the heart, Coagulation of blood

Unit – XI: Functional Anatomy of Rabbit – Excretory, Musculo – skeletal, Reproductive systems, Nervous and Endocrine systems. a) Excretory system: Excretory organs , Structure and function of Nephron, Urine formation and its composition: Micturition. b) Musculo-skeletal system: Ultra structure, mechanism of muscle contraction (sliding filament theory), Elementary approach of axial and appendicular skeleton of Rabbit, Types of joints. c) Reproductive system: Anatomy of male and female reproductive systems, Fertilization, Development upto gastrulation, extra-embryonic membranes, Placenta, gestation. d) Nervous System: Central, peripheral and autonomic nervous system, Structure of neuron, Production and propagation of nerve impulse, synaptic transmission. e) Endocrine system – Chemical messengers, hormones and mechanism of their action. Endocrine glands (Pituitary, Pancreas, Thyroid, Para-thyroid, Adrenal, Gastrointestinal, Pineal gland, Thymus, Ovary, Testis and Placenta). Endocrine disorders in human beings(pituitary thyroid, para thyroid, adrenal, pancreatic islet). f) Immunology: Types of Immunity, organs of Immune system, cells of Immune system, soluble mediators of Immunity, Antigens, Mechanism of humoral and cell mediated immunities, Immunological disorders (AIDS, Hepatitis and Hypersensitivity).

UNIT – XII GENETICS: a) Multiple alleles: A,B,O Blood groups, Rh Antigens, their significance in transfusion and Pregnancy. b) Sex determination: Sex chromosomes, xx-xo, zo-zz, xx-xy, zz-zw methods, Genic balance theory, sex determination and sexual differentiation in human beings (Turner's syndrome, Klinefelter syndrome, Barr bodies), Haplo-diploidy in Honeybees, Hormonal control of sex, effect of environment on sex determination. c) Sex-linked Inheritance: Sex linkage in Drosophila, Genes on the sex chromosomes, sex linked characters in human beings, xy-linked characters, sex-limited and sex-influenced inheritance. d) Gene expression and regulation: Genetic material, Functions of the gene, Gene regulation in prokaryotes (lac operon concpt only), Gene expression in eukaryotes, concepts of gene action (one gene one polypeptide concept only). e) Basic concepts of animal breeding: system of breeding, Heterosis and progeny test, cloning and transgenic animals. f) Human Genetic Applications: Human genome project, Gene mapping, DNA finger printing, an elementary idea of gene therapy.

UNIT XIII: ORGANIC EVOLUTION a) Evolutionary concepts, Origin of life and Experimental verification of chemical origin of life. b) Theories of organic evolution – Lamarckism, Darwinism, Sexual selection, Artificial selection, Mutation theory, Synthetic theory – Hardy Weinberg Equilibrium, Evolutionary forces (Natural selection, genetic drift, gene flow, genetic load, change in mutation rate), Speciation.

UNIT XIV: APPLIED ZOOLOGY a) Aqua culture i) Types of Fishery. ii) Important Organisms of Aquaculture. iii) Organisations Concerned with Aquaculture in India . iv) Nutritional and Commercial values of aquatic organisms. v) Craft and Gear. vi) Fish culture and rearing methods. b) Poultry i) Poultry- in general. ii) Poultry farming methods, Layers and Broilers. iii) Poultry diseases (Bacterial, Viral and Fungal) c) Biotechnology i) Recombinant DNA

technology. ii) Industrial use of microorganisms and Recombinant DNA technology – Vaccines, Enzymes, Hormones, Interferons, Monoclonal Antibodies, Alcohols, Acids, Vitamins, Antibiotics, Pollution control. ii) Cell Cycle regulation – cancer biology (types and characters of tumours; stages, types and causative agents of cancer). iii) Stem cells. Biomedical technology: X ray -radiography, CAT scan, MRI, ECG and EEG, Transplantation, ELISA