

Sher-e-Kashmir University of Agricultural Sciences &  
Technology of Kashmir (SKUAST-K),  
Shalimar, Srinagar (J&K).

**Syllabus for University Entrance Test (UET) for  
admission to UG Programmes – 2024**

**Stream (PCB,PCM&PCBM)**

**PHYSICS | Class XI**

**Unit I: Physical World and Measurement**

**Units and Measurements** - Need for measurement: Units of measurement; systems of units; SI units, fundamental and derived units. Significant figures. Dimensions of physical quantities, dimensional analysis and its applications.

**Units II: Kinematics**

**Motion in a straight Line** - Frame of reference. Motion in a straight line, Elementary concepts of differentiation and integration for describing motion, uniform and non-uniform motion, and instantaneous velocity, uniformly accelerated motion, velocity-time and position-time graphs. Relations for uniformly accelerated motion (graphical treatment).

**Motion in a Plane** - Scalar and vector quantities; position and displacement vectors, general vectors and their notations; equality of vectors, multiplication of vectors by a real number; addition and subtraction of vectors, unit vector; resolution of a vector in a plane, rectangular components, Scalar and Vector product of vectors. Motion in a plane, cases of uniform velocity and uniform acceleration projectile motion, uniform circular motion.

**Unit III: Laws of Motion**

**Laws of Motion** - Intuitive concept of force, Inertia, Newton's first law of motion; momentum and Newton's second law of motion; impulse; Newton's third law of motion. Law of conservation of linear momentum and its applications. Equilibrium of concurrent forces, Static and kinetic friction, laws of friction, rolling friction, lubrication. Dynamics of uniform circular motion: Centripetal force, examples of circular motion (vehicle on a level circular road, vehicle on a banked road).

**Unit IV: Work, Energy and Power**

Work done by a constant force and a variable force; kinetic energy, work energy theorem, power. Notion of potential energy, potential energy of a spring, conservative forces: non-conservative forces, motion in a vertical circle; elastic and inelastic collisions in one and two dimensions.

**Unit V: Motion of System of Particles and Rigid Body**

**System of Particles and Rotational Motion** - Centre of mass of a two-particle system, momentum conservation and Centre of mass motion. Centre of mass of a rigid body; centre of mass of a uniform rod. Moment of a force, torque, angular momentum, law of conservation of angular momentum and its applications. Equilibrium of rigid bodies, rigid body rotation and equations of rotational motion, comparison of linear and rotational motions. Moment of inertia, radius of gyration, values of moments of inertia for simple geometrical objects (no derivation).

## **Unit VI: Gravitation**

Kepler's laws of planetary motion, universal law of gravitation. Acceleration due to gravity and its variation with altitude and depth. Gravitational potential energy and gravitational potential, escape speed, orbital velocity of a satellite.

## **Unit VII: Properties of Bulk Matter**

**Mechanical Properties of Solids** - Elasticity, Stress-strain relationship, Hooke's law, Young's modulus, bulk modulus, shear modulus of rigidity (qualitative idea only), Poisson's ratio; elastic energy.

**Mechanical Properties of Fluids** - Pressure due to a fluid column; Pascal's law and its applications (hydraulic lift and hydraulic brakes), effect of gravity on fluid pressure. Viscosity, Stokes' law, terminal velocity, streamline and turbulent flow, critical velocity, Bernoulli's theorem and its simple applications. Surface energy and surface tension, angle of contact, excess of pressure across a curved surface, application of surface tension ideas to drops, bubbles and capillary rise.

**Thermal Properties of Matter** - Heat, temperature, thermal expansion; thermal expansion of solids, liquids and gases, anomalous expansion of water; specific heat capacity;  $C_p$ ,  $C_v$  - calorimetry; change of state - latent heat capacity. Heat transfer-conduction, convection and radiation, thermal conductivity, qualitative ideas of Blackbody radiation, Wein's displacement Law, Stefan's law.

## **Unit VIII: Thermodynamics**

Thermal equilibrium and definition of temperature, zeroth law of thermodynamics, heat, work and internal energy. First law of thermodynamics, Second law of thermodynamics: gaseous state of matter, change of condition of gaseous state -isothermal, adiabatic, reversible, irreversible, and cyclic processes.

## **Unit IX: Behaviour of Perfect Gases and Kinetic Theory of Gases**

**Kinetic Theory** - Equation of state of a perfect gas, work done in compressing a gas. Kinetic theory of gases - assumptions, concept of pressure, Expression for pressure exerted by a gas. Kinetic interpretation of temperature; rms speed of gas molecules; degrees of freedom, law of equipartition of energy (statement only) and application to specific heat capacities of gases; concept of mean free path, Avogadro's number.

## **Unit X: Oscillations and Waves**

**Oscillations** - Periodic motion - time period, frequency, displacement as a function of time, periodic functions and their applications. Simple harmonic motion (S.H.M) and its equations of motion; phase; oscillations of a loaded spring- restoring force and force constant; energy in S.H.M. Kinetic and potential energies; simple pendulum derivation of expression for its time period.

**Waves** - Wave motion: Transverse and longitudinal waves, speed of travelling wave, displacement relation for a progressive wave, principle of superposition of waves, reflection of waves, standing waves in strings and organ pipes, fundamental mode and harmonics, Beats.

## PHYSICS |Class XII

### Unit I: Electrostatics

**Electric Charges and Fields** - Electric charges, Conservation of charge, Coulomb's law-force between two- point charges, forces between multiple charges; superposition principle and continuous charge distribution. Electric field, electric field due to a point charge, electric field lines, electric dipole, electric field due to a dipole, torque on a dipole in uniform electric field. Electric flux, statement of Gauss's theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell (field inside and outside).

**Electrostatic Potential and Capacitance** - Electric potential, potential difference, electric potential due to a point charge, a dipole and system of charges; equipotential surfaces, electrical potential energy of a system of two-point charges and of electric dipole in an electrostatic field. Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarization, capacitors and capacitance, combination of capacitors in series and in parallel, capacitance of a parallel plate capacitor with and without dielectric medium between the plates, energy stored in a capacitor (no derivation, formulae only).

### Unit II: Current Electricity

Electric current, flow of electric charges in a metallic conductor, drift velocity, mobility and their relation with electric current; Ohm's law, V-I characteristics (linear and non-linear), electrical energy and power, electrical resistivity and conductivity, temperature dependence of resistance, Internal resistance of a cell, potential difference and emf of a cell, Kirchhoff's rules, Wheatstone bridge.

### Unit III: Magnetic Effects of Current and Magnetism

**Moving Charges and Magnetism** - Concept of magnetic field, Oersted's experiment. Biot - Savart law and its application to current carrying circular loop. Ampere's law and its applications to infinitely long straight wire. Straight solenoid (only qualitative treatment), force on a moving charge in uniform magnetic and electric fields. 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 uniform magnetic field; Current loop as a magnetic dipole and its magnetic dipole moment, moving coil galvanometer- its current sensitivity and conversion to ammeter and voltmeter.

**Magnetism and Matter** - Bar magnet, bar magnet as an equivalent solenoid (qualitative treatment only), magnetic field intensity due to a magnetic dipole (bar magnet) along its axis and perpendicular to its axis (qualitative treatment only), torque on a magnetic dipole (bar magnet) in a uniform magnetic field (qualitative treatment only), magnetic field lines. Magnetic properties of materials- Para-, dia- and ferro - magnetic substances with examples, Magnetization of materials, effect of temperature on magnetic properties.

### Unit IV: Electromagnetic Induction and Alternating Currents

**Electromagnetic Induction** - Electromagnetic induction; Faraday's laws, induced EMF and current; Lenz's Law, Self and mutual induction.

**Alternating Current** - Alternating currents, peak and RMS value of alternating current/voltage; reactance and impedance; LCR series circuit (phasors only), resonance, power in AC circuits, power factor, wattless current. AC generator, Transformer.

### **Unit V: Electromagnetic waves**

**Electromagnetic Waves** - Basic idea of displacement current, Electromagnetic waves, their characteristics, their transverse nature (qualitative idea only). Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, X-rays, gamma rays) including elementary facts about their uses.

### **Unit VI: Optics**

**Ray Optics and Optical Instruments** - Ray Optics: Reflection of light, spherical mirrors, mirror formula, refraction of light, total internal reflection and optical fibers, refraction at spherical surfaces, lenses, thin lens formula, lens maker's formula, magnification, power of a lens, combination of thin lenses in contact, refraction of light through a prism. Optical instruments: Microscopes and astronomical telescopes (reflecting and refracting) and their magnifying powers.

**Wave Optics** - Wave optics: Wave front and Huygen's principle, reflection and refraction of plane wave at a plane surface using wave fronts. Proof of laws of reflection and refraction using Huygen's principle. Interference, Young's double slit experiment and expression for fringe width (No derivation final expression only), coherent source and sustained interference of light, diffraction due to a single slit, width of central maxima (qualitative treatment only).

### **Unit VII: Dual Nature of Radiation and Matter**

**Dual Nature of Radiation and Matter** - Dual nature of radiation, Photoelectric effect, Hertz and Lenard's observations; Einstein's photoelectric equation-particle nature of light. Experimental study of photoelectric effect Matter waves-wave nature of particles, de-Broglie relation.

### **Unit VIII: Atoms and Nuclei**

**Atoms** - Alpha-particle scattering experiment; Rutherford's model of atom; Bohr model of hydrogen atom, Expression for radius of nth possible orbit, velocity and energy of electron in nth orbit, hydrogen line spectra (qualitative treatment only).

**Nuclei** - Composition and size of nucleus, nuclear force Mass-energy relation, mass defect; binding energy per nucleon and its variation with mass number; nuclear fission, nuclear fusion.

### **Unit IX: Electronic Devices**

**Semiconductor Electronics** - Materials, Devices and Simple Circuits Energy bands in conductors, semiconductors and insulators (qualitative ideas only) Intrinsic and extrinsic semiconductors- p and n type, p-n junction Semiconductor diode - I-V characteristics in forward and reverse bias, application of junction diode -diode as a rectifier.

# **CHEMISTRY | Class XI**

## **UNIT-1: SOME BASIC CONCEPTS OF CHEMISTRY**

General Introduction: Importance of studying chemistry, Historical approach to particulate nature of matter, Laws of Chemical combination (numerical), Dalton's Atomic Theory, Concept of elements, atoms & molecules. Atomic and molecular masses, Mole concept and molar mass, percentage composition, empirical and molecular formula; chemical reactions, stoichiometry and calculation based on stoichiometry.

## **Unit-II: STRUCTURE OF ATOM**

Discovery of electron, proton and neutron, atomic number, isotopes and isobars. Thompson's model and its limitations, Rutherford's model and its limitations. Bohr's model & its limitations, concept of shells and sub-shells. Dual nature of matter and light, de-Broglie's relationship. Heisenberg's uncertainty principle, concept of orbitals, quantum numbers, shapes of s, p and d- orbitals. Rules for filling electrons in orbitals- Aufbau's principle, Pauli's exclusion principle and Hund's rule. Electronic configuration of atoms, stability of half-filled and completely filled orbitals.

## **Unit-III: CLASSIFICATION OF ELEMENT AND PERIODICITY IN PROPERTIES**

Significance of classification, brief history of the development of periodic table. Modern periodic law and the present form of the periodic table, periodic trends in properties of elements: atomic radii, ionic radii, inert gas radii, ionization enthalpy, electron gain enthalpy, electronegativity, valency.

## **Unit-IV: CHEMICAL BONDING AND MOLECULAR STRUCTURE**

Valence electrons, ionic bond, covalent bond, bond parameters, Lewis structure, polar character of covalent bond, valence bond theory, resonance, geometry of covalent molecules, VSEPR theory, concept of hybridization involving s, p and d-orbitals and shapes of some simple molecules, molecular orbital theory of homonuclear molecules (Qualitative idea only), hydrogen bond.

## **Unit-V: THERMODYNAMICS**

Concepts of system, types of systems, surrounding, work, heat; energy intensive and extensive properties, state functions. First Law of Thermodynamics, internal energy, enthalpy, heat capacity, specific heat, molar heat capacity, measurement of  $\Delta H$  and  $\Delta U$ , Hess's law of constant heat summation, enthalpy of bond dissociation, combustion; formation, atomization, sublimation, phase transition ionization and dilution. Introduction of entropy as a state function, free energy change for spontaneous and non-spontaneous process and equilibrium.

## **Unit-VI: EQUILIBRIUM**

Equilibrium in physical and chemical processes, dynamic nature of equilibrium, law of mass action, equilibrium constant, factors affecting equilibrium: Le-Chatelier's principle equilibrium-ionization of acids and bases, strong and weak electrolytes, degree of ionization, Concept of pH. Hydrolysis of salts (elementary idea), buffer solutions. Solubility product, common ion effect (with suitable examples).

## **Unit-VIII: REDOX REACTIONS**

Concept of oxidation and reduction, redox reactions, oxidation number, balancing of chemical equations in redox reactions, applications of redox reactions.

### **Unit-IX: ORGANIC CHEMISTRY-SOME BASIC PRINCIPLES AND TECHNIQUES**

General introduction to organic chemistry, methods of purification, qualitative and quantitative analysis, classification and IUPAC nomenclature of organic compounds.

Electronic displacement in a covalent bond: inductive effect, electromeric effect, resonance and hyper-conjugation. Homolytic and heterolytic fission of a covalent bond, free radicals, electrophiles, nucleophiles, carbocations and carbanions. Types of organic reactions.

### **Unit-X: HYDROCARBONS**

#### **Classification of hydrocarbons**

**Alkanes:** Nomenclature, isomerism, conformations (ethane only), physical properties. Chemical reactions including free radical mechanism of halogenation, combustion and Pyrolysis

**Alkenes:** Nomenclature, structure of double bond (ethene), geometrical isomerism, methods of preparation, physical properties, chemical reactions- addition of hydrogen, halogen, water, hydrogen halides (Markownikov's addition and peroxide effect). ozonolysis, oxidation, mechanism of electrophilic addition. **Alkynes:** Nomenclature, structure of triple bond (ethyne), physical properties, methods of preparation, chemical reactions: acidic character of alkynes, addition reaction of hydrogen, halogens, hydrogen halides and water, Aromatic hydrocarbons introduction, IUPAC nomenclature, Benzene resonance, aromaticity, chemical properties, mechanism of electrophilic substitution-nitration, sulphonation, halogenations Friedel Craft's alkylation and acylation, directive influence of functional group in mono substituted benzene.

# CHEMISTRY | Class XII

## Unit-I: SOLUTIONS

Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions, colligative properties: relative lowering of vapor pressure of a solution, Raoult's law, elevation of boiling point, depression in freezing point temperature and osmotic pressure), determination of molecular masses using colligative properties. Abnormal molecular mass, Van't Hoff factor and calculations involving it.

## Unit-II: ELECTROCHEMISTRY

Redox reactions, conductance in electrolytic solutions, specific conductivity, molar conductivity, variation of conductivity with concentration, Kohlrausch's law and its applications Electrolysis and laws of electrolysis (elementary idea), dry cell-electrolytic cells and galvanic cells; Lead accumulator, emf of a cell, standard electrode potential, Nernst equation and its application to Chemical cells, relation between Gibb's energy change and emf of a cell, fuel cells, corrosion

## Unit-III: CHEMICAL KINETICS

Rate of reaction (average and instantaneous rate of a reaction), factors affecting rate of reactions: (concentration, temperature, catalyst), rate law, specific rate constant and order, molecularity of a reaction, integrated rate expression of zero and first order reactions and their derivations, half-life period. Concept of collision theory (elementary idea, no mathematical derivation). Activation energy, Arrhenius equation.

## Unit-IV: d and f-BLOCK ELEMENTS

General introduction, electronic configuration, occurrence and characteristics of the transition metals, general trends in properties of first row transition metals (metallic character, IE, electrode potential, oxidation state, ionic radii, catalytic properties, colored ions, complex formation, magnetic properties, interstitial compounds, alloy formation). Preparation and properties of  $K_2Cr_2O_7$  and  $KMnO_4$  Lanthanides: electronic configuration, oxidation state, chemical reactivity and lanthanide contraction and its consequences. Actinides- electronic configuration, oxidation states and comparison with lanthanoids.

## Unit- V: CO-ORDINATION COMPOUNDS

Co-ordination compounds: Introduction, ligands, co-ordination number, color, magnetic properties and shapes, IUPAC nomenclature of mononuclear co-ordination compounds. Bonding (Werner's theory, VBT and CFT), structural and stereoisomerisms, importance of coordination compounds in qualitative inclusion of analysis, extraction of metals and biological systems.

## Unit-VI: HALOALKANES AND HALOARENES

Haloalkanes: Nomenclature, nature of C-X bond, physical & chemical properties, mechanism of substitution reactions. Stability of carbocations, R-S and d-1 configurations Haloarenes: Nature of C-X bond, substitution reactions (directive influence of halogens for mono substituted compounds only), Stability of carbocations, R-S and D-L configurations Uses and environmental effects of dichloromethane, trichloromethane, tetrachloromethane, iodoform, freon, and DDT

## **Unit- VII: ALCOHOLS, PHENOLS AND ETHERS**

**Alcohols:** Nomenclature, methods of preparation, physical & chemical properties (of primary alcohols only), identification of primary, secondary & tertiary alcohols; mechanism of dehydration of alcohols. Uses, some important compounds - methanol and ethanol.

**Phenols:** Nomenclature, methods of preparation, physical & chemical properties, acidic nature of phenol, electrophilic substitution reactions, uses of phenols.

**Ethers:** Nomenclature, methods of preparation, physical & chemical properties and uses.

## **UNIT-VIII: ALDEHYDES, KETONES AND CARBOXYLIC ACIDS**

**Aldehydes and Ketones:** Nomenclature, nature of carbonyl group, methods of preparation, physical & chemical properties & mechanism of nucleophilic addition reaction to C=O group, reactivity of alpha hydrogen in aldehydes, uses

**Carboxylic Acids:** Nomenclature, acidic nature, methods of preparation, physical & chemical properties and uses

## **UNIT-IX: ORGANIC COMPOUNDS CONTAINING NITROGEN**

**Amines:** Nomenclature, classification, structure, methods of preparation, physical & chemical properties, uses, identification of primary, secondary & tertiary amines.

**Cyanides and Isocyanides:** Structures of cyanide and isocyanide groups, nomenclature, preparation, physical properties and chemical reactions.

**Diazonium Salts:** Preparation and chemical reactions (mechanism of diazotization), and importance aesthetic organic chemistry

## **UNIT-X: BIOMOLECULES**

**Carbohydrates:** Classification (aldoses and ketoses), mono saccharides: Glucose, fructose: structure, preparation and chemical reactions, oligosaccharides (sucrose, lactose & maltose) Polysaccharides: (starch cellulose and glycogen); importance.

**Proteins:** Elementary idea of amino acids: peptide bond, polypeptides and primary, secondary, tertiary and quaternary structure of proteins (Qualitative idea only), denaturation of proteins; enzymes, lipids & hormones, their classification & functions.

**Nucleic Acids:** DNA and RNA (purines and pyrimidines, nucleosides, nucleotides and fragments up to four nucleotides).

**Vitamins:** Classification and functions, sources and deficiency diseases.



# **Biology | Class-XI**

## **SECTION A: BOTANY**

### **Unit-I. Diversity of Life**

**Biodiversity:** Variety of living organisms; Need and History of classification Artificial, Natural and Phylogenetic classifications. Biosystematics: Taxonomy and Systematics; Concept of species and Taxonomical hierarchy; Binomial nomenclature; Herbarium.

Two Kingdom and Five kingdom classifications and their merits and demerits; General characters and classification of Monera, Protista and Fungi; Lichens; Status of Viruses, and Viroids.

### **Unit -II. Kingdom Plantae**

Classification of plants into major groups; General characters of Algae, Bryophyta, Pteridophyta and Gymnosperms and their classes. Morphology of Flowering plants and their function: Morphology of root, stem and leaf (without their modifications); Morphology of Inflorescence, flower, fruit and seed. Description of family. Solanaceae.

### **Unit - III: Plant Anatomy**

**Tissue systems in plants-** Epidermal, ground and vascular tissue systems; Anatomy and functions of dicot and monocot root, stem and leaves.

### **Unit-IV Plant Physiology**

**Respiration-** Cellular respiration; Glycolysis, Krebs's cycle and Electron transport system (along with ATP energetics); Chemiosmotic hypothesis; Aerobic and Anaerobic respirations; Amphibolic pathways; Respiratory quotient.

**Photosynthesis:** Historical background; Site of Photosynthesis; Photosynthetic pigments; Mechanism of Photosynthesis Light dependent phase (Light reaction), Photosystems; Cyclic and non-cyclic photophosphorylations; Light independent (biosynthetic) phase Calvin (C3) cycle and Hatch & Slack (C4) cycle; Factors affecting photosynthesis; Photorespiration.

**Plant Growth and Development:** Characteristics of plant growth; phases of growth, growth rate, growth curve; conditions of growth; differentiation, dedifferentiation and redifferentiation. Sequence of developmental process in a plant cell; Plant growth regulators; Discovery and physiological effects of Auxins, Gibberellins, Cytokinins, Ethylene and Abscissic Acid.

## **SECTION B: ZOOLOGY**

### **UNIT I: Diversity in Living World**

Animal Kingdom; General characters and classification of animals (non-chordates up to phyla level and chordates up to the level of class).

National Parks with special reference to Dachigam, Kishtwar, Salim Ali, Kazinag and Hemis. Concept of Sanctuaries and Biosphere reserves.

## **Unit - II: Structural Organisation and Animal Biomolecules**

Morphology, Anatomy and functions of digestive, circulatory, respiratory, nervous and reproductive systems of Frog.

Basic chemical constituents of living bodies; Bio-molecules: Structure and function of Carbohydrates, proteins, lipids and Nucleic acids; Primary and secondary metabolites. Enzymes: Types, Properties and functions

## **Unit-III: Cell Structure and Function**

Cell: Brief description of cell; Cell theory; Prokaryotic and Eukaryotic cell, Cell wall, Membrane and Cell organelles (Plastids, Mitochondria, E.R., Golgi, Ribosomes, Lysosomes, Nucleus, Vacuoles, centrioles and Cytoskeleton); Cilia and Flagella; Nuclear organisation. Cell Division: Cell Cycle, Mitosis and Meiosis.

## **Unit-V Human Physiology**

Breathing and Respiration: Respiratory system in humans; mechanism of breathing and its regulation in humans; respiratory volume; Exchange of gases and their transport; Respiratory disorders.

Body fluids and Circulation: Composition of blood; Blood groups and Rh factor; Lymph; Human Circulatory system; Cardiac cycle and ECG; Double circulation; regulation of cardiac activity; Disorders of circulatory system.

Excretory Products and their Elimination: Modes of excretion; Human excretory system; Urine formation, osmo regulation; regulation of kidney function; Urinary disorders; and artificial kidney.

Locomotion and Movement: Types of movement; Muscle, Contractile proteins and Muscle contraction (Mechanism); Skeletal system and its functions; Joints; Disorders of muscular and skeletal systems.

Neural Control and Coordination: Neuron and nerves; Nervous system in humans; Nerve impulse.

Chemical Coordination and Integration: Human endocrine system; Hormones of Heart, Kidney and G.I. Tract; Mechanism of hormone action (elementary idea); Hormonal disorders.

## **BIOLOGY | Class XII**

### **SECTION A (Botany)**

#### **Unit-I Reproduction in Flowering Plants**

**Sexual Reproduction:** Flower structure; Development of male and female gametophytes; Pollination - types, agencies and examples; Out breeding devices; Pollen-Pistil interactions; Double fertilization; Post fertilization events - Development of Endosperm, embryo; Development of seed and formation of fruit; special modes - apomixis, parthenocarp, polyembryony; Significance of seed and fruit formation.

#### **Unit-II Genetics**

**Heredity and variation:** Mendelian inheritance; deviations from Mendelism: Incomplete Dominance; Co-dominance; Multiple alleles and inheritance of blood groups; Pleiotropy; Elementary idea of polygenic inheritance; Chromosomal theory of Inheritance; Chromosomes and genes.

**Molecular Basis of Inheritance:** Search for genetic material and DNA as genetic material; Structure of DNA and RNA; DNA packaging; DNA replication; Central Dogma; Protein Biosynthesis: Transcription, genetic code, translation; Gene expression and regulation - lac Operon.

#### **Unit-III Biology and Human Welfare**

**Tissue Culture:** Cellular totipotency, technique and application of tissue culture.

**Microbes in Human welfare:** Microbes in food processing, industrial production, sewage treatment, energy generation (Biogas) and microbes as bio-control agents, Biopesticides and Bio-fertilizers. Antibiotics; production and judicious use.

**Application of Biotechnology in Agriculture:** Genetically Modified organisms - BT crops; Biopiracy and patents.

#### **Unit-IV Ecology and Environment**

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

**Ecosystems:** Patterns, components; productivity and decomposition; energy flow; Ecological pyramids: Pyramids of number, biomass and energy.

**Biodiversity and its Conservation:** Biodiversity-Concept, patterns, importance; loss of biodiversity; biodiversity conservation; hotspots, endangered organisms, extinction, Red Data Book; Biosphere reserves, National parks, Wildlife Sanctuaries and Ramsar sites.

## **SECTION B (Zoology)**

### **Unit I: Reproduction in Animals**

**Human Reproduction:** Male and Female reproductive systems; Microscopic anatomy of testis and ovary; Gametogenesis (spermatogenesis and oogenesis; menstrual cycle). Fertilisation, embryo development upto blastocyst formation, implantation; Pregnancy and placenta formation. Elementary idea of Parturition and Lactation.

**Reproductive Health:** Need for reproductive health and prevention of Sexually Transmitted Diseases (STDs); 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) .

### **Unit II: Genetics and Evolution**

Sex determination in humans, birds and honey bee; Linkage and Crossing over. Sex linked inheritance: Haemophilia and colour blindness.

Mendelian disorders in humans Thalassaemia; Chromosomal disorders in humans: Down's syndrome, Turner's syndrome and Klinefelter's syndrome Genome and Human genome project; DNA fingerprinting.

**Evolution:** Origin of life; Biological evolution and evidences for biological evolution; Darwin's contribution, Modern synthetic theory of Evolution; Mechanism of evolution -Variation (Mutation and Recombination) and Natural Selection with examples, types of natural selection; Gene flow and genetic drift; Hardy - Weinberg's principle; adaptive radiation; Human evolution.

### **UNIT: III Biology in Human Welfare**

**Health and Disease:** Basic concepts of immunology - vaccines; Pathogens; parasites causing human diseases (Hepatitis, Malaria, Dengue, Filariasis, Ascariasis, Typhoid, Pneumonia, Common cold, Amoebiasis, Ring worm) and their control; Cancer, HIV and AIDS; Adolescence: drug and alcohol abuse.

### **UNIT: IV Biotechnology and its Applications**

Biotechnology: Principles and processes; Genetic Engineering (Recombinant DNA Technology). Application of biotechnology in health: Human insulin and vaccine production stem cell technology, gene therapy. Transgenic Animals.

Bio-safety issues.

## MATHEMATICS : CLASS 11<sup>TH</sup>

### UNIT-I SETS AND FUNCTIONS

1. Sets and their representations, Empty set, Finite and Infinite sets, Equal sets, Subsets, Subsets of a set of real number especially intervals (with notations). Universal set. Venn diagrams. Union and Intersection of sets. Difference of sets. Complement of a set. Properties of Complement.

2. Relations and Functions. Ordered pairs. Cartesian product of sets. Number of elements in the Cartesian product of two finite sets. Cartesian product of the set of reals with itself (upto  $\mathbb{R} \times \mathbb{R} \times \mathbb{R}$ ). Definition of relation, pictorial diagrams, domain, co-domain and range of a relation. Function as a special type of relation. Pictorial representation of a function, domain, co-domain and range of a function. Real valued functions, domain and range of these functions, constant, identity, polynomial, rational, modulus, signum, exponential, logarithmic and greatest integer functions, with their graphs. Sum, difference, product and quotients of functions.

3. Trigonometric Functions Positive and negative angles. Measuring angles in radians and in degrees and conversion from one measure to another. Definition of trigonometric functions with the help of unit circle. Truth of the identity  $\sin^2 x + \cos^2 x = 1$ , for all  $x$ . Signs of trigonometric functions. Domain and range of trigonometric functions and their graphs. Expressing  $\sin(x \pm y)$  and  $\cos(x \pm y)$  in terms of  $\sin x$ ,  $\sin y$ ,  $\cos x$  &  $\cos y$  and their simple applications. Deducing identities like the following:

$$\tan(x \pm y) = \frac{\tan x \pm \tan y}{1 \mp \tan x \tan y}, \cot(x \pm y) = \frac{\cot x \cot y \mp 1}{\cot y \pm \cot x}$$
$$\sin \alpha \pm \sin \beta = 2 \sin \frac{1}{2}(\alpha \pm \beta) \cos \frac{1}{2}(\alpha \mp \beta)$$
$$\cos \alpha + \cos \beta = 2 \cos \frac{1}{2}(\alpha + \beta) \cos \frac{1}{2}(\alpha - \beta)$$
$$\cos \alpha - \cos \beta = -2 \sin \frac{1}{2}(\alpha + \beta) \sin \frac{1}{2}(\alpha - \beta)$$

Identities related to  $\sin 2x$ ,  $\cos 2x$ ,  $\tan 2x$ ,  $\sin 3x$ ,  $\cos 3x$  and  $\tan 3x$ .

### UNIT II ALGEBRA

1. Complex Numbers and Quadratic Equations Need for complex numbers, especially  $i$ , to be motivated by inability to solve some of the quadratic equations. Algebraic properties of complex numbers. Argand plane

2. Linear Inequalities Linear inequalities. Algebraic solutions of linear inequalities in one variable and their representation on the number line.

3. Permutations and Combinations Fundamental principle of counting. Factorial ( $n!$ ) Permutations and combinations, derivation of Formulae for  $nPr$  and  $nCr$  and their connections, simple applications.

4. Binomial Theorem Historical perspective, statement and proof of the binomial theorem for positive

5. Sequence and Series Sequence and Series. Arithmetic Mean (A.M.) Geometric Progression (G.P.), general term of a G.P., sum of terms of a G.P., infinite G.P. and its sum, geometric mean (G.M.), relation between A.M. and G.M.

### UNIT-III: COORDINATE GEOMETRY

1. Straight Lines Brief recall of two-dimensional geometry from earlier classes. Slope of a line and angle between two lines. Various forms of equations of a line: parallel to axis, point -slope form, slope-intercept form, two-point form, intercept form, Distance of a point from a line.

2. Conic Section Sections of a cone: circles, ellipse, parabola, hyperbola, a point, a straight line and a pair of intersecting lines as a degenerated case of a conic section. Standard equations

and simple properties of parabola, ellipse and hyperbola. Standard equation of a circle.

3. Introduction to Three-dimensional Geometry Coordinate axes and coordinate planes in three dimensions. Coordinates of a point. Distance between two points.

#### **Unit-IV: CALCULUS**

1. Limits and Derivatives Derivative introduced as rate of change both as that of distance function and geometrically. Intuitive idea of limit. Limits of polynomials and rational functions trigonometric, exponential and logarithmic functions. Definition of derivative relates it to slope of tangent of the curve, derivative of sum, difference, product and quotient of functions. Derivatives of polynomial and trigonometric functions.

#### **Unit-V STATISTICS AND PROBABILITY**

1. Statistics Measures of Dispersion: Range, Mean deviation, variance and standard deviation of Ungrouped/grouped data.

##### **2. PROBABILITY**

Events; occurrence of events, 'not' 'and' and 'or' events, exhaustive even exclusive events, Axiomatic (set theoretic) probability, connections with other theories of earlier classes. Probability of an event, probability of 'not', 'and' and 'or'.

### **MATHEMATICS: CLASS 12<sup>th</sup>**

#### **UNIT 1: RELATION AND FUNCTIONS.**

##### **1. Relation and Functions:**

Types of Relations: Reflexive, Symmetric, transitive and equivalence relation. One to one and onto functions.

##### **2. Inverse Trigonometric Functions:**

Definition, range, domain, principal value branch. Graphs of inverse trigonometric function.

#### **UNIT II: ALGEBRA**

##### **1. Matrices.**

Concept, notation, order, equality, types, of matrices, zero matrix, identity matrix, transpose of a matrix, symmetric and skew symmetric and skew symmetric matrices.

Operation on matrices: Addition, Multiplication and scalar multiplication of matrices. Simple properties of addition, multiplication and scalar multiplication. Non-commutativity of multiplication of matrices and existence of non-zero matrices whose products is the zero matrix (restrict to square matrices of order. 2). Invertible matrices and proof of the uniqueness of inverse, if it exists: (Here all matrices will have real entries).

## 2. Determinant:

Determinant of a square matrix (upto 3 x 3 matrices), minors, cofactor and applications of determinants in finding the area of a triangle, Adjoint and inverse of a square matrix. Consistency, inconsistency and number of solutions of system of linear equations by examples, solving system of linear equations in two or three variables (having unique solutions) using inverse of a matrix.

## UNIT III: Calculus:

### 1. Continuity and Differentiability:

Continuity and Differentiability, chain rule, derivatives of inverse trigonometric functions like  $\sin^{-1} x$  and  $\tan^{-1} x$ , derivative of implicit functions. Concept of exponential and Logarithmic differentiation, derivative of functions expressed in parametric forms. Second order derivatives.

#### Application of Derivative.

Application of Derivative: Rate of change of quantities, increasing/decreasing functions, maxima and minima (first derivative test motivated geometrically and second derivative test given as a provable tool). Simple problems (that illustrate basic principles and understating of the subject as well as real- life situation.).

### 3. Integrals.

Integration as inverse process of differentiation, integration of a variety of functions by substitution, by partial fractions and by parts. Evaluation of simple integrals of the following types and problems based on them to be evaluated.

$$\int \frac{dx}{x^2 \pm a^2}, \int \frac{dx}{\sqrt{x^2 \pm a^2}}, \int \frac{dx}{\sqrt{a^2 - x^2}}, \int \frac{dx}{ax^2 + bx + c}, \int \frac{dx}{\sqrt{ax^2 + bx + c}}$$
$$\int \frac{px + q}{ax^2 + bx + c} dx, \int \frac{px + q}{\sqrt{ax^2 + bx + c}} dx, \int \sqrt{a^2 \pm x^2} dx, \int \sqrt{x^2 - a^2} dx, \int \sqrt{ax^2 + bx + c} dx$$

Fundamental Theorem of Calculus (without proof), Basic properties of definite integrals and evaluation of definite integrals.

### 4. Applications of the Integrals:

Applications in finding the area under simple curves, especially lines, circles/parabolas/ellipses (in standard form only).

### 5. Differential Equations.

Definition, order and degree, general and particular solutions of a differential equation. Solution of differential equations by method of separation of variables, Solutions of homogeneous differential equations of first order and first degree. Solutions of linear differential equation of the type:

**$dy/dx + py = q$ , where p and q are functions of x or constants.**

**$dy/dx + px = q$ , where p and q are functions of y or constants.**

## UNIT IV: VECTORS AND THREE – DIMENSIONAL GEOMERTY

### 1. Vectors.

Vectors and scalars, magnitude and direction of a vector. Directions cosines and directions ration of a vector. Types of vectors ( equal, unit, zero, parallel and collinear vectors), position vector of a point , negative of a vector, components of a vector, addition of vectors, multiplication of a vector by a scalar, position cosines and direction ratios of a vector. Vector of a point dividing a line segment in a given ratio. Defination, Geometrical Interpretation, properties and application of scalar (dot) product of vectors. Vector (cross) product of vector.

### 2. Three-dimensional Geometry.

Direction cosines and direction ratios of a line joining two points. Cartesian and vector equation of a line, skew lines, shortest distance between two lines. Angle between the two lines.

## UNIT V: LINER PROGRAMING.

### 1. Liner programing.

Introduction, related terminology such as constraints objective functions, optimization, graphical method of solution for problems in two variables, feasible and infeasible regions (**Bounded or Unbounded**), feasible and infeasible solutions, optimal feasible solutions (up to three non- trivial constraints).

## UNIT VI: Probability

### 1. Probability:

Multiplication theorem on probability. Conditional probability, independent events, total probability. Baye's theorem, Random variable and its probability distribution, mean of random variable.

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