

Faculty of Medicine

B.Sc. Nursing

The candidate will be selected on the basis of Admission Test and the Test shall comprise questions of English, Science (Physics, Chemistry, Biology), General Knowledge and Mathematics.

ENGLISH

(SYLLABUS IS NOT AVAILABLE)

GENERAL KNOWLEDGE

(SYLLABUS IS NOT AVAILABLE)

Biology

CLASS XI (THEORY)

Diversity of Living Organisms

Chapter-1: The Living World

What is living? Biodiversity; Need for classification; three domains of life; taxonomy and systematics; concept of species and taxonomical hierarchy; binomial nomenclature; tools for study of taxonomy-museums, zoological parks, herbaria, botanical gardens.

Chapter-2: Biological Classification

Five kingdom classification; Salient features and classification of Monera, Protista and Fungi into major groups: Lichens, Viruses and Viroids.

Chapter-3: Plant Kingdom

Salient features and classification of plants into major groups - Algae, Bryophyta, Pteridophyta, Gymnospermae and Angiospermae (three to five salient and distinguishing features and at least two examples of each category); Angiosperms - classification upto class, characteristic features and examples.

Chapter-4: Animal Kingdom

Salient features and classification of animals non-chordates up to phyla level and chordates up to class level (three to five salient features and at least two examples of each category).
(No live animals or specimen should be displayed.)

Structural Organisation in Animals and Plants

Chapter-5: Morphology of Flowering Plants

Morphology and modifications: Tissues

Chapter-6: Anatomy of Flowering Plants

Anatomy and functions of different parts of flowering plants: root, stem, leaf, inflorescence, flower, fruit and seed (to be dealt along with the relevant experiment of the Practical Syllabus).

Chapter-7: Structural Organisation in Animals

Animal tissues: Morphology, anatomy and functions of different systems (digestive, circulatory, respiratory, nervous and reproductive) of an insect (cockroach). (a brief account only)

Cell: Structure and Function**Chapter-8: Cell-The Unit of Life**

Cell theory and cell as the basic unit of life: Structure of prokaryotic and eukaryotic cells; Plant cell and animal cell; cell envelope; cell membrane, cell wall; cell organelles - structure and function; endomembrane system, endoplasmic reticulum, Golgi bodies, lysosomes, vacuoles; mitochondria, ribosomes, plastids, microbodies; cytoskeleton, cilia, flagella, centrioles (ultrastructure and function); nucleus, nuclear membrane, chromatin, nucleolus.

Chapter-9: Biomolecules

Chemical constituents of living cells: biomolecules, structure and function of proteins, carbohydrates, lipids, nucleic acids, enzymes, types, properties, enzyme action.

Chapter-10: Cell Cycle and Cell Division

Cell cycle, mitosis, meiosis and their significance.

Plant Physiology**Chapter-11: Transport in Plants**

Movement of water, gases and nutrients; cell to cell transport, Diffusion, facilitated diffusion, active transport; plant-water relations, Imbibition, water potential, osmosis, plasmolysis; long distance transport of water - Absorption, apoplast, symplast, transpiration pull, root pressure and guttation; transpiration, opening and closing of stomata; Uptake and translocation of mineral nutrients - Transport of food, phloem transport, massflow hypothesis; diffusion of gases.

Chapter-12: Mineral Nutrition

Essential minerals, macro- and micronutrients and their role; deficiency symptoms; mineral toxicity; elementary idea of hydroponics as a method to study mineral nutrition; nitrogen metabolism, nitrogen cycle, biological nitrogen fixation.

Chapter-13: Photosynthesis in Higher Plants

Photosynthesis as a mean of autotrophic nutrition; site of photosynthesis, pigments involved in photosynthesis (elementary idea); photochemical and biosynthetic phases of photosynthesis; cyclic and non cyclic photophosphorylation; chemiosmotic hypothesis; photorespiration; C₃ and C₄ pathways; factors affecting photosynthesis.

Chapter-14: Respiration in Plants

Exchange of gases; cellular respiration - glycolysis, fermentation (anaerobic), TCA cycle and electron transport system (aerobic); energy relations - number of ATP molecules generated; amphibolic pathways; respiratory quotient.

Chapter-15: Plant - Growth and Development

Seed germination; phases of plant growth and plant growth rate; conditions of growth; differentiation, dedifferentiation and redifferentiation; sequence of developmental processes in a plant cell; growth regulators - auxin, gibberellin, cytokinin, ethylene, ABA; seed dormancy; vernalisation; photoperiodism.

Human Physiology

Chapter-16: Digestion and Absorption

Alimentary canal and digestive glands, role of digestive enzymes and gastrointestinal hormones; Peristalsis, digestion, absorption and assimilation of proteins, carbohydrates and fats; calorific values of proteins, carbohydrates and fats; egestion; nutritional and digestive disorders - PEM, indigestion, constipation, vomiting, jaundice, diarrhoea.

Chapter-17: Breathing and Exchange of Gases

Respiratory organs in animals (recall only); Respiratory system in humans; mechanism of breathing and its regulation in humans - exchange of gases, transport of gases and regulation of respiration, respiratory volume; disorders related to respiration - asthma, emphysema, occupational respiratory disorders.

Chapter-18: Body Fluids and Circulation

Composition of blood, blood groups, coagulation of blood; composition of lymph and its function; human circulatory system - Structure of human heart and blood vessels; cardiac cycle, cardiac output, ECG; double circulation; regulation of cardiac activity; disorders of circulatory system - hypertension, coronary artery disease, angina pectoris, heart failure.

Chapter-19: Excretory Products and Their Elimination

Modes of excretion - ammonotelism, ureotelism, uricotelism; human excretory system - structure and function; urine formation, osmoregulation; regulation of kidney function - renin - angiotensin, atrial natriuretic factor, ADH and diabetes insipidus; role of other organs in excretion; disorders - uraemia, renal failure, renal calculi, nephritis; dialysis and artificial kidney.

Chapter-20: Locomotion and Movement

Types of movement - ciliary, flagellar, muscular; skeletal muscle- contractile proteins and muscle contraction; skeletal system and its functions; joints; disorders of muscular and skeletal system - myasthenia gravis, tetany, muscular dystrophy, arthritis, osteoporosis, gout.

Chapter-21: Neural Control and Coordination

Neuron and nerves; Nervous system in humans - central nervous system; peripheral nervous system and visceral nervous system; generation and conduction of nerve impulse; reflex action; sensory perception; sense organs; elementary structure and functions of eye and ear.

Chapter-22: Chemical Coordination and Integration

Endocrine glands and hormones; human endocrine system - hypothalamus, pituitary, pineal, thyroid, parathyroid, adrenal, pancreas, gonads; mechanism of hormone action (elementary idea); role of hormones as messengers and regulators, hypo - and hyperactivity and related disorders; dwarfism, acromegaly, cretinism, goiter, exophthalmic goiter, diabetes.

Note: Diseases related to all the human physiological systems to be taught in brief.

CLASS XII (THEORY)

Reproduction

Chapter-1: Reproduction in Organisms

Reproduction, a characteristic feature of all organisms for continuation of species; modes of reproduction - asexual and sexual reproduction; asexual reproduction - binary fission, sporulation, budding, gemmule formation, fragmentation; vegetative propagation in plants.

Chapter-2: Sexual Reproduction in Flowering Plants

Flower structure; development of male and female gametophytes; pollination - types, agencies and examples; outbreeding devices; pollen-pistil interaction; double fertilization; post fertilization events - development of endosperm and embryo, development of seed and formation of fruit; special modes- apomixis, parthenocarpy, polyembryony; Significance of seed dispersal and fruit formation.

Chapter-3: 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); parturition (elementary idea); lactation (elementary idea).

Chapter-4: 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).

Genetics and Evolution

Chapter-5: Principles of Inheritance and Variation

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; chromosome theory of inheritance; chromosomes and genes; Sex determination - in humans, birds and honey bee; linkage and crossing over; sex linked inheritance - haemophilia, colour blindness; Mendelian disorders in humans - thalassemia; chromosomal disorders in humans; Down's syndrome, Turner's and Klinefelter's syndromes.

Chapter-6: Molecular Basis of Inheritance

Search for genetic material and DNA as genetic material; Structure of DNA and RNA; DNA packaging; DNA replication; Central dogma; transcription, genetic code, translation; gene expression and regulation - lac operon; genome and human and rice genome projects; DNA fingerprinting.

Chapter-7: Evolution

Origin of life; biological evolution and evidences for biological evolution (paleontology, comparative anatomy, embryology and molecular evidences); 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.

Biology and Human Welfare

Chapter-8: Human Health and Diseases

Pathogens; parasites causing human diseases (malaria, dengue, chickengunia, filariasis, ascariasis, typhoid, pneumonia, common cold, amoebiasis, ring worm) and their control; Basic concepts of immunology - vaccines; cancer, HIV and AIDS; Adolescence - drug and alcohol abuse.

Chapter-9: Strategies for Enhancement in Food Production

Improvement in food production: Plant breeding, tissue culture, single cell protein, Biofortification, Apiculture and Animal husbandry.

Chapter-10: Microbes in Human Welfare

In household food processing, industrial production, sewage treatment, energy generation and microbes as biocontrol agents and biofertilizers. Antibiotics; production and judicious use.

Biotechnology and Its Applications

Chapter-11: Biotechnology - Principles and processes

Genetic Engineering (Recombinant DNA Technology).

Chapter-12: Biotechnology and its Application

Application of biotechnology in health and agriculture: Human insulin and vaccine production, stem cell technology, gene therapy; genetically modified organisms - Bt crops; transgenic animals; biosafety issues, bio piracy and patents.

Ecology and Environment

Chapter-13: Organisms and Populations

Organisms and environment: Habitat and niche, population and ecological adaptations; population interactions - mutualism, competition, predation, parasitism; population attributes - growth, birth rate and death rate, age distribution.

Chapter-14: Ecosystem

Ecosystems: Patterns, components; productivity and decomposition; energy flow; pyramids of number, biomass, energy; nutrient cycles (carbon and phosphorous); ecological succession; ecological services - carbon fixation, pollination, seed dispersal, oxygen release (in brief).

Chapter-15: Biodiversity and its Conservation

Concept of biodiversity; patterns of biodiversity; importance of biodiversity; loss of biodiversity; biodiversity conservation; hotspots, endangered organisms, extinction, Red Data Book, biosphere reserves, national parks, sanctuaries and Ramsar sites.

Chapter-16: Environmental Issues

Air pollution and its control; water pollution and its control; agrochemicals and their effects; solid waste management; radioactive waste management; greenhouse effect and climate change; ozone layer depletion; deforestation; any one case study as success story addressing environmental issue(s).

ZOOLOGY

- Diversity of living organisms, Classification of the living organisms (Five Kingdom Classification major groups and principles of Classification within kingdom : Protista and Animalia). Systematics and binomial system of nomenclature, Salient features of animal classification (non-chordates up to Phylum level and chordates up to Class level), Zoological Parks and Museum.
- Tissues in animals, Morphology, anatomy and functions of different systems of an annelid (earthworm), an insect (cockroach) and an amphibian (frog).
- Basic chemical constituents of living bodies. Structure and function of carbohydrates, proteins, lipids and nucleic acids, Enzymes : Types, properties and functions.
- Digestion and absorption, Breathing and Respiration, Body fluids and circulation, Excretory-products and elimination, Locomotion and movement, Control and Coordination, Reproductive system in male and female, menstrual cycle, production of gametes, fertilization, implantation, embryo development, pregnancy parturition and lactation, Reproductive Health : birth control, contraception and sexually transmitted diseases, infertility.
- Human Genetics : Sex determination in human being : XX, XY, Linkage and Crossing over. Inheritance pattern of haemophilia and blood groups in human beings, Genome and Human Genome Project, DNA fingerprinting.
- Theories of organic evolution, Evidences and Mechanism of organic evolution.
- Animal Husbandry, Basic concept of immunology, vaccines, Pathogens, parasites, Cancer and AIDS, Adolescence and drug / alcohol abuse, Recombinant DNA technology.
- Species population and community, Animal ecological adaptation, Centres of diversity and conservation of biodiversity, National parks and Sanctuaries.

Note : Morphology and Anatomy of Frog and Earthworm not in syllabus now.

Chemistry

CHEMISTRY (CLASS XI – XII)

Class XI (Theory)

Some Basic Concepts of Chemistry

General Introduction : Importance and scope of chemistry.

Historical approach to particulate nature of matter, laws of chemical combination, Dalton's atomic theory : concept of elements, atoms and molecules.

Atomic and molecular masses. Mole concept and molar mass; percentage composition and empirical and molecular formula; chemical reactions, stoichiometry and calculations based on stoichiometry.

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 and its limitations, concept of shells and subshells, dual nature of matter and light, de Broglie's relationship, Heisenberg uncertainty principle, concept of orbitals, quantum numbers, shapes of s, p and d orbitals, rules for filling electrons in orbitals Aufbau principle, Pauli exclusion principle and Hund's rule, electronic configuration of atoms, stability of half filled and completely filled orbitals.

Classification of Elements and Periodicity in Properties

Significance of classification, brief history of the development of periodic table, modern periodic law and the present form of periodic table, periodic trends in properties of elements – atomic radii, ionic radii, inert gas radii, ionization enthalpy, electron gain enthalpy, electronegativity, valence, Nomenclature of elements with atomic number greater than 100.

Chemical Bonding and Molecular Structure

Valence electrons, ionic bond, covalent bond, bond parameters, Lewis structure, polar character of covalent bond, covalent bond, covalent character of ionic 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 diatomic molecules (qualitative idea only). Hydrogen bond.

States of Matter : Gases and Liquids

Three states of matter, intermolecular interactions, types of bonding, melting and boiling points, role of gas laws in elucidating the concept of the molecule, Boyle's law, Charles's law, Gay Lussac's law, Avogadro's law, ideal behaviour, empirical derivation of gas equation, Avogadro number, ideal gas equation. Kinetic energy and molecular speeds (elementary idea), deviation from ideal behaviour, liquefaction of gases, critical temperature.

Liquid State – Vapour pressure, viscosity and surface tension (qualitative idea only, no mathematical derivations).

Thermodynamics

Concepts 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, measurement of ΔU and ΔH , Hess's law of constant heat summation, enthalpy of : bond dissociation, combustion, formation, atomization, sublimation, phase transition, ionization, solution and dilution.

Introduction of entropy as a state function, Second law of thermodynamics, Gibbs energy change for spontaneous and non-spontaneous process, criteria for equilibrium.

Third law of thermodynamics – Brief Introduction

Equilibrium

Equilibrium in physical and chemical processes, dynamic nature of equilibrium, law of mass action, equilibrium constant, factors affecting equilibrium – Le Chatelier's principle; ionic equilibrium – ionization of acids and bases, strong and weak electrolytes, degree of ionization, ionization of polybasic acids, acid strength, concept of pH, Hydrolysis of salts (elementary idea), buffer solutions, Henderson equation, solubility product, common ion effect (with illustrative examples).

Redox Reactions

Concept of oxidation and reduction, redox reactions, oxidation number, balancing redox reactions in terms of loss and gain of electron and change in oxidation numbers, applications of redox reactions.

Hydrogen

Position of hydrogen in periodic table, occurrence, isotopes, preparation, properties and uses of hydrogen; hydrides – ionic, covalent and interstitial; physical and chemical properties of water, heavy water; hydrogen peroxide – preparation, reactions, use and structure; hydrogen as a fuel.

s-Block Elements (Alkali and Alkaline earth metals)

Group 1 and Group 2 elements

General introduction, electronic configuration, occurrence, anomalous properties of the first element of each group, diagonal relationship, trends in the variation of properties (such as ionization enthalpy, atomic and ionic radii), trends in chemical reactivity with oxygen, water, hydrogen and halogens; uses.

Preparation and Properties of some Important Compounds:

Sodium carbonate, sodium chloride, sodium hydroxide and sodium hydrogencarbonate, biological importance of sodium and potassium.

CaA_2 , CaCO_3 , and industrial use of lime and limestone, biological importance of Mg and Ca.

Some p-Block Elements

General Introduction to p-Block Elements

Group 13 elements : General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous properties of first element of the group; Boron-physical and chemical properties, some important compounds; borax, boric acids, boron hydrides. Aluminium: uses, reactions with acids and alkalis.

Group 14 elements : General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous behaviour of first element. Carbon – catenation, allotropic forms, physical and chemical properties; uses of some important compounds: oxides.

Important compounds of silicon and a few uses : silicon tetrachloride, silicones, silicates and zeolites, their uses.

Organic Chemistry – Some Basic Principles and Techniques

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

Electronic displacements in a covalent bond: inductive effect, electrometric effect, resonance and hyper conjugation.

Homolytic and heterolytic fission of a covalent bond: free radicals, carbocations, carbonions; electrophiles and nucleophiles, types of organic reactions.

Hydrocarbons

Classification of Hydrocarbons.

Aliphatic 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 (ethane), geometrical isomerism, physical properties, methods of preparation; chemical reactions: addition of hydrogen, halogen, water, hydrogen halides (Markovnikov'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, halogenation, Friedel Craft’s alkylation and acylation; directive influence of functional group in mon-substituted benzene; carcinogenicity and toxicity.

Environmental Chemistry

Environmental pollution – Air, water and soil pollution, chemical reactions in atmosphere, smogs, major atmospheric pollutants; acid rain, ozone and its reactions, effects of depletion of ozone layer, greenhouse effect and global warming – pollution due to industrial wastes; green chemistry as an alternative tool for reducing pollution, strategy for control of environmental pollution.

CLASS XII (Theory)

Solid State

Classification of solids based on different binding forces molecular, ionic covalent and metallic solids, amorphous and crystalline solids (elementary idea), unit cell in two dimensional and three dimensional lattices, calculations of density of unit cell, packing in solids, packing efficiency, voids, number of atoms per unit cell in a cubic unit cell, point defects electrical and magnetic properties, Band theory of metals, conductors, semiconductors and insulators and n and p type semiconductors.

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 vapour pressure, Raoult’s law, elevation of B.P., depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties, abnormal molecular mass, Vant Hoff factor.

Electrochemistry

Redox reactions; conductance in electrolytic solutions, specific and molar conductivity variations of conductivity with concentration, Kohlrausch’s Law, electrolysis and laws of electrolysis (elementary idea), dry cell 0 electrolytic cells and Galvanic cells; lead accumulator, EMF of a cell, standard electrode potential, Nernst equation and its application to chemical cells. Relation between Gibbs energy change and EMF of a cell, fuel cells; corrosion.

Chemical Kinetics

Rate of a reaction (average and instantaneous), factors affecting rates of reaction : concentration, temperature, catalyst; order and molecularity of a reaction; rate law and specific rate constant, integrated rate equations and half life (only for zero and first order

reactions); concept of collision theory (elementary idea, no mathematical treatment). Activation energy, Arrhenius equation.

Surface Chemistry

Adsorption – physisorption and chemisorption; factors affecting adsorption of gases on solids; catalysis homogenous and heterogeneous, activity and selectivity: enzyme catalysis; colloidal state: distinction between true solutions, colloids and suspensions; lyophilic, lyophobic multimolecular and macromolecular colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation; emulsions – types of emulsions.

General Principles and Processes of Isolation of Elements

Principles and methods of extraction – concentration, oxidation, reduction electrolytic method and refining; occurrence and principles of extraction of aluminium, copper, zinc and iron.

p-Block Elements

Group 15 elements : General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties; nitrogen – preparation, properties and uses; compounds of nitrogen : preparation and properties of ammonia and nitric acid, oxides of nitrogen (structure only); Phosphorous – allotropic forms; compounds of phosphorous : preparation and properties of phosphine, halides (PCl_3 , PCl_5) and oxoacids (elementary idea only).

Group 16 elements : General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; dioxygen: preparation, properties and uses; classification of oxides; ozone. Sulphur – allotropic forms; compounds of sulphur: preparation, properties and uses of sulphur dioxide; sulphuric acid : industrial process of manufacture, properties and uses, oxoacids of sulphur (structures only).

Group 17 elements : General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; compounds of halogens: preparation, properties and uses of chlorine and hydrochloric acid, interhalogen compounds, oxoacids of halogens (structures only).

Group 18 elements : General introduction, electronic configuration, occurrence, trends in physical and chemical properties, uses.

D and f Block Elements

General introduction, electronic configuration, occurrence and characteristics of transition metals, general trends in properties of the first row transition metals – metallic character, ionization enthalpy, oxidation states, ionic radii, colour, catalytic property, magnetic properties, interstitial compounds, alloy formation. Preparation and properties of $\text{K}_2\text{Cr}_2\text{O}_7$ and KMnO_4 .

Lanthanoids – electronic configuration, oxidation states, chemical reactivity and lanthanoid contraction and its consequences.

Actinoids – Electronic configuration, oxidation states and comparison with lanthanoids.

Coordination Compounds

Coordination compounds : Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds, bonding, Werner's theory VBT, CFT; isomerism (structural and stereo) importance of coordination compounds (in qualitative analysis, extraction of metals and biological systems.).

Haloalkanes and Haloarenes

Haloalkanes: Nomenclature, nature of C-X bond, physical and chemical properties, mechanism of substitution reactions. Optical rotation.

Haloarenes : Nature of C-X bond, substitution reactions (directive influence of halogen for monosubstituted compounds only).

Uses and environmental effects of – dichloromethane, trichloromethane, tetrachloromethane, iodoform, freons, DDT.

Alcohols, Phenols and Ethers

Alcohols : Nomenclature, methods of preparation, physical and chemical properties (of primary alcohols only); identification of primary, secondary and tertiary alcohols; mechanism of dehydration, uses, with special reference to methanol and ethanol.

Phenols : Nomenclature, methods of preparation, physical and chemical properties, acidic nature of phenol, electrophilic substitution reaction, uses of phenols.

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

Aldehydes, Ketones and Carboxylic Acids

Aldehydes and ketones: Nomenclature, nature of carbonyl group, method of preparation, physical and chemical properties, and mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes; uses.

Carboxylic Acids : Nomenclature, acidic nature, methods of preparation, physical and chemical properties; uses.

Organic Compounds Containing Nitrogen

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

Cyanides and Isocyanides – will be mentioned at relevant places in context.

Diazonium salts : Preparation, chemical reactions and importance in synthetic organic chemistry.

Biomolecules

Carbohydrates – Classification (aldoses and ketoses), monosaccharide (glucose and fructose), D-L configuration, oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen); importance.

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

Hormones – Elementary idea (excluding structure).

Vitamins – Classification and functions.

Nucleic Acids : DNA and RNA

Polymers

Classification – Natural and synthetic, methods of polymerization (addition and condensation), copolymerization, Some important polymers; natural and synthetic like polythene, nylon, polyesters, bakelite, rubber, Biodegradable and non-biodegradable polymers.

Chemistry in Every Day Life

1. **Chemicals in medicines** – analgesics, tranquilizers, antiseptic, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.
2. **Chemicals in food** – preservatives, artificial sweetening agents, elementary idea of antioxidants.
3. **Cleansing agents** – soaps and detergents, cleansing action.

PHYSICS

Mechanics

Physical World and Measurement

Physics-scope and excitement, nature of physical laws; Physics, technology and society. Need for measurement: Units of measurement; systems of units; SI units, fundamental and derived units. Length, mass and time measurements; accuracy and precision of measuring instruments, errors in measurement; significant figures. Dimensions of physical quantities, dimensional analysis and its applications.

Kinematics

Frame of reference. Motion in a straight line: Position-time graph, speed and velocity. Uniform and non-uniform motion, average speed and instantaneous velocity.

Uniformly accelerated motion, velocity-time, position-time graphs, relations for uniformly accelerated motion (graphical treatment).

Elementary concepts of differentiation and integration for describing motion.

Scalar and vector quantities: Position and displacement vectors, general vectors and notation, equality of vectors, multiplication of vectors by a real number; addition and subtraction of vectors. Relative velocity.

Unit vector; Resolution of a vector in a plane-rectangular components. Motion in a plane. Cases of uniform velocity and uniform acceleration-projectile motion. Uniform circular motion.

Laws of Motion

Intuitive concepts 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 level circular road, vehicle on banked road).

Work, Energy and Power

Scalar product of vectors. 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: conservation of mechanical energy (kinetic and potential energies); non-conservative forces: elastic and inelastic collisions in one and two dimensions.

Motion of System of Particles and Rigid Body

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 uniform rod.

Vector product of vectors; moment of a force, torque, angular momentum, conservation of angular momentum with some examples.

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). Statement of parallel and perpendicular axes theorems and their applications.

Gravitation

Keplar's laws of planetary motion. The universal law of gravitation. Acceleration due to gravity and its variation with altitude and depth. Gravitational potential energy; gravitational potential. Escape velocity. Orbital velocity of a satellite. Geo-stationary satellites.

Properties of Bulk Matter

Elastic behaviour, Stress-strain relationship, Hooke's law, Young's modulus, bulk modulus, shear, modulus of rigidity. 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, Reynold's number, streamline and turbulent flow. Bernoulli's theorem and its applications. Surface energy and surface tension, angle of contact, application of surface tension ideas to drops, bubbles and capillary rise. Heat, temperature, thermal expansion; specific heat-calorimetry; change of state-latent heat. Heat transfer-conduction, convection and radiation, thermal conductivity, Newton's law of cooling.

Thermodynamics

Thermal equilibrium and definition of temperature (zeroth law of thermodynamics). Heat, work and internal energy. First law of thermodynamics. Isothermal and adiabatic process. Second law of thermodynamics: reversible and irreversible processes. Heat engines and refrigerators.

Behaviour of Perfect Gas and Kinetic Theory

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

Oscillations and Waves

Periodic motion-period, frequency, displacement as a function of time. Periodic functions. Simple harmonic motion (S.H.M) and its equation; oscillations of a spring-restoring force and force constant; energy in S.H.M.-kinetic and potential energies; simple pendulum-derivation of expression for its time period; free, forced and damped oscillations (qualitative ideas only), resonance. Wave motion. Longitudinal and transverse waves, speed of wave motion. 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, Doppler effect.

Electrostatics

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).

Electric potential, potential difference, electric potential due to a point charge, a dipole and system of charge; 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. Van de Graaff generator.

Current Electricity

Electric current flow of electric charges in a metallic conductor drift velocity, mobility and their relation with electric current; Ohm's Law electrical resistance, V-I characteristics (linear and non-linear), electrical energy and power, electrical resistivity and conductivity. Carbon resistors colour code for carbon resistors; series and parallel combinations of resistors; temperature dependence of resistance.

Internal resistance of a cell, potential difference and emf of a cell combination of cells in series and in parallel.

Kirchhoff's laws and simple applications. Wheatstone bridge and metre bridge.

Potentiometer – principle and its applications to measure potential difference and for comparing emf of two cells; measurement of internal resistance of a cell.

Magnetic Effects of Current 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 and toroidal solenoids.

Force on a moving charge in uniform magnetic and electric fields. Cyclotron.

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; moving coil galvanometer – its current sensitivity and conversion to ammeter and voltmeter. Current loop as a magnetic dipole and its magnetic dipole moment. Magnetic dipole, moment of a revolving electron, magnetic field intensity due to a magnetic dipole (bar magnet) along its axis and perpendicular to its axis. Torque on magnetic dipole (bar magnet) in a uniform magnetic field; bar magnet as an equivalent solenoid magnetic field line; Earth's magnetic field and magnetic elements para – dia – and ferro – magnetic

substances, with examples. Electromagnets and factors of affecting their strengths. Permanent magnets.

Electromagnetic Induction and Alternating Currents

Electromagnetic Induction; Faraday's law. Induced emf and current; Lenz's law, Eddy current self and mutual inductance.

Need for displacement current.

Alternating currents, peak and rms value of alternating; current/voltage, reactance and impedance;

LC oscillations (qualitative treatment only), LCR series circuit, resonance; power in ac circuits wattles current.

AC generator and transformer.

Electromagnetic Waves

Displacement current, Electromagnetic wave and their characteristics (qualitative ideas only) Transverse nature of electromagnetic waves.

Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, x-rays, gamma rays) including elementary facts about their uses.

Optics

Reflection of light spherical mirrors, mirror formula refraction of light, total internal reflection and its applications, optical fibres refraction at spherical surfaces, lenses thin lens formula lens maker's Formula. Magnification power of a lens, combination of thin lenses in contract. Refraction and dispersion of light through a prism.

Scattering of light – blue colour of the sky and reddish appearance of the sun at sunrise and sunset.

Optical instruments: Microscopes and astronomical Telescopes (reflecting and refraction) and their magnifying powers.

Waves optics: Wave front and Huygens principle reflection and refraction of plane wave at a plane surface using wave fronts. Proof of laws of reflection and refraction using Huygen's principle. Interference, Young's double slit experiment and expression for fringe width coherent sources and sustained interference of light. Diffraction due to a single slit, width of central maximum. Resolving power of microscopes and astronomical telescopes Polarization, plane polarized light; Brewster's law. Uses of plane polarized light and polaroids.

Dual Nature of Matter and Radiation

Dual nature of Radiation Photoelectric, Hertz and Lenard's observations; Einstein's Photoelectric equation – particle nature of light.

Matter waves-wave nature of particles, de Broglie relation. Davission – Germer experiment.

Atoms & Nuclei

Alpha-particle scattering experiment, Rutherford's model of atom; Bohr model, energy levels hydrogen spectrum.

Composition and size of nucleus, atomic masses, isotopes, isobars; isotones. Radioactivity – alpha, beta and gamma particles/rays and their properties; radioactive decay law Mass-energy relation, mass defect; binding energy per nucleon and its variation with mass number; nuclear fission, nuclear reactor, nuclear fusion.

Electronic Devices

Semiconductors; semiconductor diode – I – V. characteristics in forward and reverse bias, diode as a rectifier; I – V characteristics of LED, photodiode, solar cell and Zener diode: Zener diode as a voltage regulator. Junction transistor, transistor action characteristics of a transistor; transistor as an amplifier (common emitter configuration) and oscillator. Logic gates (OR, AND, NOT, NAND and NOR). Transistor as a switch.

Communication Systems

Elements of a communication system (block diagram 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. Need for modulation. Amplitude modulation

Mathematics

UNIT – I : SETS AND FUNCTIONS

1. SETS (3+3)

Sets and their representations. Empty set. Finite & Infinite sets. Equal sets. Subsets. Subsets of the set of real numbers especially Intervals (with notations). Power set. Universal set. Venn diagrams. Union and Intersection of sets. Difference of sets. Complement of a set.

2. RELATIONS & FUNCTIONS (4+4)

Orders pairs, Cartesian product of sets. Number of elements in the Cartesian product of two finite sets. Cartesian product of the reals with itself (upto $R \times R \times R$). Definition of relation, pictorial diagrams, domain, codomain and range of a relation. Function as a special kind of relation from one set to another. Pictorial representation of a function, domain, co-domain and range of a function. Real valued function of the real variable, domain and range of these functions, constant, identity, polynomial, rational modulus, signum 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 and sketch of their graphs. Expressing $\sin(x + y)$ and $\cos(x+y)$ in terms of $\sin x$, $\sin y$, $\cos x$ and $\cos y$. Deducing the identities like the following :

$$\tan(x \pm y) = \frac{\tan x \pm \tan y}{1 \pm \tan x \tan y}, \quad \cot(x \pm y) = \frac{\cot x \cot y \pm 1}{\cot y \cot x}$$

$$\sin x + \sin y = 2 \sin \frac{x+y}{2} \cos \frac{x-y}{2}, \quad \cos x + \cos y = 2 \cos \frac{x+y}{2} \cos \frac{x-y}{2}$$

$$\sin x + \sin y = 2 \cos \frac{x+y}{2} \sin \frac{x-y}{2}, \quad \cos x - \cos y = 2 \sin \frac{x+y}{2} \sin \frac{x-y}{2}$$

Identities related to $\sin 2x$, $\cos 2x$, $\tan 2x$, $\sin 3x$, $\cos 3x$ and $\tan 3x$.
 General solution of trigonometric equations of the type $\sin \theta = \sin \alpha$

UNIT II : ALGEBRA

1. PRINCIPLE OF MATHEMATICAL INDUCTION (03)

Process of the proof by induction, motivating the application of the method by looking at natural numbers as the least inductive subset of real numbers. The principle of mathematical induction and simple applications.

2. COMPLEX NUMBERS AND QUADRATIC EQUATIONS (3+3)

Need for complex numbers, especially $\sqrt{-1}$, to be motivated by inability to solve every quadratic equation. Brief description of algebraic properties of complex numbers. Argand plane and polar representation of complex numbers. Statement of Fundamental Theorem of Algebra, Solution of quadratic equations in the complex number system.

3. LINEAR INEQUALITIES : (03)

Linear inequalities, Algebraic solutions of linear inequalities in one variable and their representation on the number line. Graphical solution of linear inequalities in two variables. Solution of system of linear inequalities in two variables graphically.

4. PERMUTATIONS AND COMBINATIONS (04)

Fundamental principle of counting. Factorial n ($n!$) Permutations and combinations, derivation of formulae and their connections, simple applications.

5. BINOMIAL THEOREM : (08)

History, statement and proof of the binomial theorem for positive integral indices. Pascal's triangle, General and middle term in binomial expansion, simple applications.

6. SEQUENCE AND SERIES (06)

Sequence and Series, Arithmetic progression (A > P), arithmetic mean (A.M.) Geometric progression (G.P., General term of a G.P., sum of n terms of a G.P., geometric mean (G > M), relation between A.M. and G.M. Sum to a terms of the special series $\sum n$, $\sum n^2$ and $\sum n^3$.

UNIT III : COORDINATE GEOMETRY :

1. STRAIGHT LINES (04)

Brief recall of 2 D from earlier classes. Slope of a line and angel between two lines. Various forms of eqwuations of a line : parallel to axes, point-slope form, slope intercept form, two point form, intercepts form and normal form. General equation of a line. Distance of a point from a line.

2. CONIC SECTION (04)

Sections of a cone : circle, ellipse, parabola, hyperbola, a point, a straight line and pair of intersecting lines as a degenerated case of conoic section. Standard equations and simple properties of parabola, ellipse and hyperbola. Standard equation of a circle.

3. INTRODUCTION TO THREE DIMENSIONAL GEOMETRY (03)

Coordinate axes and coordinate planes in three dimensions. Coordinatoes of a point. Distance between two points and section formula.

UNIT IV : CALCULUS

1. LIMITS AND DERIVATIVES : (04)

Derivative introduced as rate of change both as that of distance function and geometrically, intuitive idea of limit. Definition of derivative, relate 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 : MATHEMATICAL REASONING

1. MATHEMATICAL REASONING (03)

Mathematically acceptable statements. Connecting words / phrases – consolidating the understanding of “if and only if (necessary and sufficient) condition”, “implies”, “and/ or”, “implied by”, “and”, “or”, “there exists” and their use through variety of examples related to real life and mathematics. Validating the statements involving the connecting words – difference between contradiction, converse and contrapositive.

2. PROBABILITY : (03)

Random experiments : Outcomes, sample, spaces (set representation). Events : occurrence of events, ‘not’, ‘and’ and ‘or’ events, exhaustive events, mutually exclusive events Axiomatic (set theoretic) probability, connections with the theories of earlier classes. Probability of an event, Probability of ‘not’, ‘and’ and ‘or’ events.

RECOMMENDED TEXT BOOKS :

- (1) Mathematics Part I – Textbook for Class XI, NCERT Publication.
- (2) Mathematics Part II – Textbook for Class XI, NCERT Publication.

UNIT – I RELATIONS AND FUNCTIONS

1. Relations and Functions :

Types of relations : reflexive, symmetric, transitive and equivalence relations. One to one and onto functions, composite functions, inverse of a function. Binary operations.

2. Inverse Trigonometric Functions :

Definition, range, domain, principal value branches, Graphs of inverse trigonometric functions. Elementary properties of inverse trigonometric functions.

UNIT II : ALGEBRA

1. Matrices :

Concept, notation, order, equality, types of matrices, zero matrix, transpose of a matrix, symmetric and skew symmetric 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 product is the zero matrix (restrict to square matrices of order 2). Concept of elementary row and column operations. Invertible matrices and proof of the uniqueness of inverse, if it exists. (Here all matrices will have real entries).

2. Determinants :

Determinant of a square matrix (upto 3 x 3 matrices), properties of determinants, minors, cofactors and applications of determinants in finding the area of a triangle. A joint 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 solution) using inverse of a matrix.

UNIT III : CALCULUS

1. Continuity and Differentiability :

Continuity and Differentiability, derivative of composite functions, chain rule, derivative of inverse trigonometric functions, derivative of implicit function. Concept of exponential and logarithmic functions and their derivative. Logarithmic differentiation. Derivative of functions expressed in parametric forms. Second order derivatives. Rolle's and Lagrange's Mean Value Theorems (without proof) and their geometric interoperations.

2. Applications of Derivatives :

Applications of derivatives : rate of change, increasing / decreasing functions, tangents and normals, approximation, maxima and minima (first derivative test motivated geometrically and second derivative test given as a provable tool).. Simple problems (that illustrate basic principles and understanding of the subject as well as real life situations).

3. Integrals

Integration as inverse process of differentiation. Integration of a variety of functions by substitution, by partial fractions and by parts, only simple integrals of the type :

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

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

To be evaluated.

Define integrals as a limit of sum, Fundamental Theorem of calculus (without proof). Basic properties of definite integrals and evaluation of definite integrals.

4. Applications of the Integrals :

Applications in findings the area under simple curves, especially lines, areas of circles / parabolas / ellipse (in standard form only), area between the two above said curves (the region should be clearly identifiable).

5. Differential Equations :

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

$$\frac{dy}{dx} + py = q, \text{ where } p \text{ and } q \text{ are functions of } x.$$

UNIT IV : VECTORS AND THREE DIMENSIONAL GEOMETRY :

1. Vectors :

Vectors and scales, magnitude and direction of a vector. Direction cosines / ratios of vectors. 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 vector of a point dividing a line segment in a given ratio Scalar (dot) product of vectors, projection of a vector on a line. Vector (cross) product of vectors.

2. Three – dimensional Geometry :

Direction cosines / ratios of a line joining two points. Cartesian and vector equation of a line, coplanar and skew lines, shortest distance between two lines. Cartesian and vector equation of a plane. Angle between (1) two lines, (ii) two planes, (iii) a line and plane. Distance of a point from a plane.

UNIT V : LINEAR PROGRAMMING

1. Linear programming

Introduction, definition of related terminology such as constraints, objective function, optimization, different types of linear programming (LP) problems, mathematical formulation of LP, problems, graphical method of solution for problems in two variables, feasible and infeasible regions, feasible and infeasible solutions, optional feasible solutions (upto 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 and variance of haphazard variable. Repeated independent (Bernoulli) trials and Binomial distribution.
