Post Code: TA15; Post Name: Technical Assistant; Area: SAIF

Post Code Name of the post & Area of work	Post Group Pay Band & Grade Pay Level	No. of Posts; Reservation & Age Limit	Essential Qualification	Desirable Qualification / Experience	Job specification
TA15 Technical Assistant SAIF	Gr. III(1) Rs. 35400-112400 Level 6	1 UR 28 Years	1st class B.Sc. (Sci) with one year full time professional qualification in Biomedical instrumentation or one year experience in the sophisticated analytical instrumentation from a recognized institute / organization	MSc Physics / Chemistry / Life Sciences with experience of working in Sophisticated Analytical Instrument Facilities and biomedical instrumentation facilities including NMR / Mass / Electron Microscopy	To be deployed in the Division of Sophisticated Analytical Instrument Facility. To look after quality control and sample analysis and report generation of sophisticated Instruments and technical maintenance support. Candidate will also carry out other tasks assigned by superiors.

Syllabus Structure (100 MCQs) – weightage guidelines for paper setter

PART A: 60 questions as mentioned below:

- 20 Q from Physics (class 12 syllabus)
- 20 Q from Chemistry (class 12 syllabus)
- 20 Q from Biology (class 10 syllabus)

PART B: 40 questions as mentioned below:

- 30 Q from Sophisticated Instrumentation
- 10 Q from Biomedical Instrumentation

PART A

PHYSICS

Unit I: Physical World and Measurement

Chapter–1: 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.

Unit II: Kinematics

Chapter–2: Motion in a Straight Line Frame of reference, Motion in a straight line, Elementary concepts of differentiation and integration for describing motion, uniform and nonuniform motion, and instantaneous velocity, uniformly accelerated motion, velocity - time and position-time graphs. Relations for uniformly accelerated motion (graphical treatment).

Chapter–3: 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 accelerationprojectile motion, uniform circular motion.

Unit III: Laws of Motion

Chapter–4: 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

Chapter–5: Work, Energy and Power Work done by a constant force and a variable force; kinetic energy, workenergy 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

Chapter–6: 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 V: Gravitation

Chapter–7: 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 VI: Properties of Bulk Matter

Chapter–9: 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.

Chapter–10: 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.

Chapter–11: Thermal Properties of Matter Heat, temperature, thermal expansion; thermal expansion of solids, liquids and gases, anomalous expansion of water; specific heat capacity; Cp, Cv - 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 VII: Thermodynamics

Chapter–12: 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 VIII:Behavior of Perfect Gases and Kinetic Theory of Gases

Chapter–13: Kinetic Theory Equation of state of a perfect gas, work done in 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 equi-partition 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

Chapter–14: 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.

Chapter–15: 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.

Unit IX: Electrostatics

Chapter–16: 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).

Chapter–17: 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 X: Current Electricity

Chapter–18: 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, combination of cells in series and in parallel, Kirchhoff's rules, Wheatstone bridge.

Unit XI: Magnetic Effects of Current and Magnetism

Chapter–19: 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.

Chapter–20: 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 XII: Electromagnetic Induction and Alternating Currents

Chapter–21: Electromagnetic Induction

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

Chapter–22: 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 XIII: Electromagnetic waves

Chapter–23: 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 XIV: Optics

Chapter–24: 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.

Chapter–25: 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 sources and sustained interference of light, diffraction due to a single slit, width of central maxima (qualitative treatment only).

Unit XV: Dual Nature of Radiation and Matter

Chapter–26: 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 XVI: Atoms and Nuclei

Chapter–27: 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).

Chapter–28: 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 XVII: Electronic Devices

Chapter–29: 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

Unit I: Some Basic Concepts of Chemistry

General Introduction: Importance and scope of Chemistry. 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, empirical and molecular formula, chemical reactions, stoichiometry and calculations based on stoichiometry.

Unit II: Structure of Atom

Discovery of Electron, Proton and Neutron, atomic number, isotopes and isobars. Thomson'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's exclusion principle and Hund's rule, electronic configuration of atoms, stability of half-filled and completely filled orbitals.

Unit III: 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, valency. Nomenclature of elements with atomic number greater than 100.

Unit IV: Chemical Bonding and Molecular Structure

Valence electrons, ionic bond, covalent bond, bond parameters, Lewis structure, polar character of 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.

Unit V: Chemical Thermodynamics

Concepts of System and 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 U and H, Hess's law of constant heat summation, enthalpy of bond dissociation, combustion, formation, atomization, sublimation, phase transition, ionization, solution and dilution. Second law of Thermodynamics (brief introduction) Introduction of entropy as a state function, Gibb's energy change for spontaneous and nonspontaneous processes, criteria for equilibrium. Third law of thermodynamics (brief introduction).

Unit VII: 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 poly basic acids, acid strength, concept of pH, hydrolysis of salts (elementary idea), buffer solution, Henderson Equation, solubility product, common ion effect (with illustrative examples).

Unit VIII: Redox Reactions

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

Unit IX: 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, electromeric effect, resonance and hyper conjugation. Homolytic and heterolytic fission of a covalent bond: free radicals, carbocations, carbanions, electrophiles and nucleophiles, types of organic reactions.

Unit X: Hydrocarbons

Classification of Hydrocarbons Aliphatic Hydrocarbons: Alkanes - Nomenclature, isomerism, conformation (ethane only), physical properties, chemical reactions including free radical mechanism of halogenation, combustion and pyrolysis. Alkenes - Nomenclature, structure of double bond (ethene), 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 monosubstituted benzene. Carcinogenicity and toxicity

Unit XI: Solutions

Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions, Raoult's law, colligative properties - relative lowering of vapour pressure, elevation of boiling point, depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties, abnormal molecular mass, Van't Hoff factor.

Unit XII: Electrochemistry

Redox reactions, 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, conductance in electrolytic solutions, specific and molar conductivity, variations of conductivity with concentration, Kohlrausch's Law, electrolysis and law of electrolysis (elementary idea), dry cell-electrolytic cells and Galvanic cells, lead accumulator, fuel cells, corrosion.

Unit XIII: Chemical Kinetics

Rate of a reaction (Average and instantaneous), factors affecting rate 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.

Unit XIV: 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 K2Cr2O7 and KMnO4. Lanthanoids - Electronic configuration, oxidation states, chemical reactivity and lanthanoid contraction and its consequences. Actinoids - Electronic configuration, oxidation states and comparison with lanthanoids.

Unit XV: Coordination Compounds

Coordination compounds - Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds. Bonding, Werner's theory, VBT, and CFT; structure and stereoisomerism, importance of coordination compounds (in qualitative analysis, extraction of metals and biological system).

Unit XVI: Haloalkanes and Haloarenes

Haloalkanes: Nomenclature, nature of C–X bond, physical and chemical properties, optical rotation mechanism of substitution reactions. Haloarenes: Nature of C–X bond, substitution reactions (Directive influence of halogen in monosubstituted compounds only). Uses and environmental effects of - dichloromethane, trichloromethane, tetrachloromethane, iodoform, freons, DDT.

Unit XVII: 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, electrophillic substitution reactions, uses of phenols. Ethers: Nomenclature, methods of preparation, physical and chemical properties, uses.

Unit XVIII: Aldehydes, Ketones and Carboxylic Acids

Aldehydes and Ketones: Nomenclature, nature of carbonyl group, methods of preparation, physical and chemical properties, mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes, uses. Carboxylic Acids: Nomenclature, acidic nature, methods of preparation, physical and chemical properties; uses.

Unit XIX: Amines

Amines: Nomenclature, classification, structure, methods of preparation, physical and chemical properties, uses, identification of primary, secondary and tertiary amines. Diazonium salts: Preparation, chemical reactions and importance in synthetic organic chemistry.

Unit XX: Biomolecules

Carbohydrates - Classification (aldoses and ketoses), monosaccahrides (glucose and fructose), D-L configuration oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose,

glycogen); Importance of carbohydrates. Proteins -Elementary idea of - amino acids, peptide bond, polypeptides, proteins, structure of proteins - primary, secondary, tertiary structure and quaternary structures (qualitative idea only), denaturation of proteins; enzymes. Hormones - Elementary idea excluding structure. Vitamins - Classification and functions. Nucleic Acids: DNA and RNA.

BIOLOGY

1. **Basic Biology**

(i) The cell, a unit of life, protoplasm, basic difference between prokaryotic and eukaryotic cell; differences between an animal and a plant cell.

- A basic understanding of the cell theory, and structure of plant and animal cell with functions of various cell organelles. (Protoplasm, Cytoplasm, Cell Wall, Cell Membrane, Nucleus, Nucleolus, Mitochondria, Endoplasmic Reticulum, Ribosome, Golgi bodies, Plastids, Lysosomes, Centrosome and Vacuole).
- Major differences between a prokaryotic and eukaryotic cell.
- Differences between a plant cell and an animal cell should be mainly discussed with respect to cell wall, centrosome, vacuoles and plastids.

(ii) Tissues: Types of plant and animal tissues.

- A brief understanding of their location, basic structure and functions with examples.
- A brief understanding of their role in different physiological processes in plants and animals.

(iii) Cell Cycle and Cell Division.

(iv) Structure of chromosome.

(v) Genetics: Mendel's laws of inheritance and sex linked inheritance of diseases.

2. Flowering Plants

(i) Flower: Structure of a bisexual flower, functions of various parts.

- A brief introduction to complete and incomplete flowers.
- Essential and non-essential whorls of a bisexual flower; their various parts and functions.
- Inflorescence and placentation (meaning only)

(Charts or actual specimens may be used to help enhance the clarity of concepts.)

(ii) Pollination: self and cross-pollination.

- Explanation, advantages and disadvantages of self and cross-pollination.
- Agents of pollination and the characteristic features of flowers are pollinated by various agents such as insects, wind, and water.
- A brief idea as to how nature favours cross-pollination.

(iii) Fertilisation.

- Events taking place between pollination and fertilisation leading to the formation of zygote in the embryo sac.
- A brief explanation of the terms double fertilization and triple fusion.
- Fruit and Seed - definition and significance.

3. Plant Physiology

(i) Structure of dicot and monocot seeds, Germination of seeds, types, and conditions for seed germination.

- Structure and germination of Bean seed and Maize grain.
- Differences between monocot and dicot seeds.
- Differences between hypogeal and epigeal germination.
- Conditions for seed germination - To be explained and supported by experiments.

(ii) Respiration in plants: outline of the process, gaseous exchange.

- A brief outline of the process mentioning the terms Glycolysis, Krebs cycle and their significance.
- A reference to be made to aerobic and anaerobic respiration with chemical equations in each case.
- Experiments on gaseous exchange and on heat production.

(iii) Absorption by roots, imbibition; diffusion and osmosis; osmotic pressure, root pressure; turgidity and flaccidity; plasmolysis and deplasmolysis,; the absorption of water and minerals, active and passive transport (in brief); The rise of water up to the xylem; Forces responsible for ascent of sap.

(iv) Transpiration - process and significance. Ganong's potometer and its limitations. The factors affecting rate of transpiration. Experiments on transpiration. A brief idea of guttation and bleeding.

(v) Photosynthesis: the process and its importance to life in general; experiments to show the necessity of light, carbon dioxide, chlorophyll, formation of starch and release of oxygen; carbon cycle.

(vi) Chemical coordination in Plants: A general study of plant growth regulators; Tropic movements in plants.

4. Diversity in living organisms

(i) A brief outline of the five Kingdom classification.

- Main characteristics of each kingdom with suitable examples: -Monera, Protista, Fungi.

-Plantae - Thallophyta, Bryophyta, Pteridophyta and Spermatophyta.

- Animalia - non-chordates from Porifera to Echinodermata and Chordates - all five Classes.

(ii) Economic importance of Bacteria.

(a) Useful role of bacteria:

- Medicine: antibiotics, serums and vaccines
- Agriculture: nitrogen cycle (role of nitrogen fixing, nitrifying and denitrifying bacteria)
- Industry -curing of tea, tanning of leather.

(b) Harmful role of bacteria - spoilage of food, diseases in plants and animals, bio-weapons.

(iii)Economic importance of Fungi. A brief idea of the useful role of Fungi in breweries, bakeries, cheese processing, and mushroom cultivation. (Processes of manufacture are not required).

5. Human Anatomy and Physiology

(a) Nutrition:

(i) Classes of food; balanced diet. Malnutrition and deficiency diseases.

- Functions of carbohydrates, fats, proteins, mineral salts (calcium, iodine, iron and sodium), vitamins and water in proper functioning of the body.
- Sources of vitamins, their functions and deficiency diseases.
- Meaning and importance of a 'Balanced Diet'.
- Role of cellulose in our diet.
- Causes, symptoms and prevention of Kwashiorkor and Marasmus.

(ii) The structure of a tooth, different types of teeth.

- Structure of a tooth to be discussed with the help of a diagram.
- Functions of different types of teeth.
- Dental formula of an adult.

(iii)Digestive System: Organs, digestive glands and their functions (including enzymes and their functions in digestion, absorption and assimilation of digested food).

- Organs and glands of the digestive system and their functions with reference to digestion, absorption and assimilation.
- brief idea of peristalsis.

(b) Skeleton - Movement and Locomotion.

- Functions of human skeleton
- Axial and Appendicular Skeleton
- Types of joints with reference to their location: - immovable joints - slightly movable joints - freely movable (hinge joint, ball and socket joint, gliding joint, pivot joint.)

(c) Structure and functions of skin.

- Various parts of the skin and their functions.
- Special derivatives of the skin with reference to sweat glands, sebaceous glands, hair, nails and mammary glands.
- Heat regulation - vasodilation and vasoconstriction.

(d) Respiratory System: Organs; mechanism of breathing; tissue respiration, heat production.

- Structures of the respiratory system.
- Differences between anaerobic respiration in plants and in man.
- Role of the diaphragm and intercostal muscles in breathing to provide a clear idea of the breathing process.
- Brief idea of gaseous transport and tissue respiration. Brief understanding of respiratory volumes.
- Effect of altitude on breathing; asphyxiation and hypoxia.

(e) Circulatory System: Blood and lymph, the structure and working of the heart, blood vessels, circulation of blood (only names of the main blood vessels entering and leaving the heart, liver and kidney will be required). Lymphatic system.

(f) Excretory System: A brief introduction to the excretory organs; parts of the urinary system; structure and function of the kidneys; blood vessels associated with kidneys; structure and function of nephron.

(g) Nervous system: Structure of Neuron; central, autonomous and peripheral nervous system (in brief); brain and spinal cord; reflex action and how it differs from voluntary action. Sense organs - Eye: Structure, functions, defects and corrective measures: Ear: Parts and functions of the ear.

(h) Endocrine System: General study of the following glands: Adrenal, Pancreas, Thyroid and Pituitary. Endocrine and Exocrine glands.

(i) The Reproductive System: Organs, fertilisation functions of placenta in the growth of the embryo Menstrual cycle.

6. Health and Hygiene

(i) A brief introduction to maintaining good health. General idea of personal hygiene, public hygiene and sanitation.

(ii) A brief introduction to communicable, non-communicable, endemic, epidemic, pandemic and sporadic diseases; modes of transmission.

- Meaning of each of the above with examples.
- Modes of transmission: air borne, water borne; vectors (housefly, mosquito, cockroach).

(iii) Bacterial, Viral, Protozoan, Helminthic diseases:

- Bacterial: Cholera, typhoid, tuberculosis.
- Viral: AIDS, Chicken pox, Hepatitis.
- Protozoan: Malaria, Amoebic Dysentery, Sleeping sickness.
- Helminthic: Ascariasis, Taeniasis, Filiariasis. (symptoms and measures to control the above diseases.)

(Scientific names of causative agents not required).

(iv) Aids to Health: Active and passive immunity.

- Meaning of Active and passive immunity.

- An understanding of the use and action of the following – vaccination, immunization, antitoxin, serum, antiseptics, disinfectants, and antibiotics.
- An idea of the local defence system and its merits, difference between antiseptics and disinfectants.

(v) Health Organisations: Red Cross, WHO. Major activities of the Red Cross and WHO

7. Waste generation and management

(a) Sources of waste - domestic, industrial, agricultural, commercial and other establishments.

- Domestic waste: paper, glass, plastic, rags, kitchen waste, etc.
- Industrial: mining operations, cement factories, oil refineries, construction units.
- Agricultural: plant remains, animal waste, processing waste.
- Municipal sewage: Sewage, degradable and non-degradable waste from offices, etc.
- e-waste: brief idea about e-waste.

(b) Methods of safe disposal of waste.

- Segregation, dumping, composting, drainage, treatment of effluents before discharge, incineration, use of scrubbers and electrostatic precipitators.
- Segregation of domestic waste into biodegradable and non-biodegradable by households: garden waste to be converted to compost; sewage treatment plants.

8. Population

Population explosion in India; need for adopting control measures - population control.

9. Human Evolution

Basic introduction to Human evolution and Theories of evolution: Lamarck's theory of inheritance; Darwin's theory of evolution by natural selection.

10. Pollution

(i) Types and sources of pollution; major pollutants.

(ii) Biodegradable and Non-biodegradable wastes.

(iii) Effects of pollution on climate, environment, human health and other organisms; control measures.

PART B

Sophisticated Instrumentation:

Microscopy: Basic principles, instrumentation and applications of microscopy. Optical microscopy – Bright field, phase-contrast, fluorescence and confocal microscopy.

Electron microscopy - Basic Principle, function and applications of Scanning Electron Microscope, Transmission Electron Microscope, Cryo-electron microscope, Atomic Force Microscope.

Spectroscopy: Basic Principle, function and applications of Nuclear Magnetic Resonance spectrometer, Raman Spectrometer, Mass spectrometer, Spectrophotometer

Measurement of voltage, current, temperature, pressure, flow; Grounding, shielding, earthing and instrumentation grounding; Sensors & Transducers – Resistive, Capacitive, inductive, piezoelectric, Hall effect, Thermocouple, RTD etc. Knowledge of Gas, Vacuum and Compressed air lines - Cylinder pressure, regulators

Biomedical Instrumentation

General knowledge of principle of working of biomedical instruments; Importance of calibration of equipment; Transient voltage Protection; Overvoltage protection; Undervoltage protection; Overload protection; Power failure warning; Electric shock hazards; Leakage Currents