General Aptitude (GA)-Multiple Choice Test

- **This Paper Consists of Verbal Ability:** English grammar, verbal analogies, instructions, critical reasoning and verbal deduction, Sentence completion, Word groups.

Section H: Chemistry (Compulsory)

- **Atomic structure and periodicity:** Atomic structure is that which -vely charged electrons surrounds the nuclei. At regular intervals, the situation of being periodic is Periodicity. It include topics- Planck’s quantum theory, wave particle duality, uncertainty principle, quantum mechanical model of hydrogen atom; electronic configuration of atoms; periodic table and periodic properties; ionization energy, electron affinity, electronegativity, atomic size.

- **Structure and bonding:** Structure includes molecular geometry, crystal structure and molecules electronic structure. Bonding means sharing or the participating atoms transferring electrons between them. It include topics- Ionic and covalent bonding, M.O. and V.B. approaches for diatomic molecules, VSEPR theory and shape of molecules, hybridisation, resonance, dipole moment, structure parameters such as bond length, bond angle and bond energy, hydrogen bonding, van der Waals interactions. Ionic solids, ionic radii, lattice energy (Born-Haber Cycle).

- **S.p and d Block Elements:** It tells us about the elements in the periodic table and its properties. It include topics- Oxides, halides and hydrides of alkali and alkaline earth metals, B, Al, Si, N, P, and S, general characteristics of 3d elements, coordination complexes: valence bond and crystal field theory, color, geometry and magnetic properties.

- **Chemical Equilibria:** Condition in which both the reactants as well as products are at such concentration, which with time do not tend to change. It include topics- Colligative properties of solutions, ionic equilibria in solution, solubility product, common ion effect, hydrolysis of salts, pH, buffer and their applications in chemical analysis, equilibrium constants (Kc, Kp and Kx) for homogeneous reactions,

- **Electrochemistry:** When in a solution chemical reactions takes place at the borderline of electron conductor is electron chemistry. It include topics- Conductance, Kohlrausch law, Half Cell potentials, emf, Nernst equation, galvanic cells, thermodynamic aspects and their applications.

- **Reaction Kinetics:** Deals in change of chemical processes. It include topics- Rate constant, order of reaction, molecularity, activation energy, zero, first and second order kinetics, catalysis and elementary enzyme reactions.
• Thermodynamics: It deals with heat and how it is being related to energy as well as work. It include topics- First law, reversible and irreversible processes, internal energy, enthalpy, Kirchoff’s equation, heat of reaction, Hess law, heat of formation, Second law, entropy, free energy, and work function. Gibbs-Helmholtz equation, Clausius-Clapeyron equation, free energy change and equilibrium constant, Troutons rule, Third law of thermodynamics.

• Basis of Organic Reactions Mechanism: A chemical reaction has a lot of reaction mechanism taking place in it so reaction mechanism deals with that. It include topics- Elementary treatment of SN1, SN2, E1 and E2 reactions, Hoffmann and Saytzeff rules, Addition reactions, Markonikoff rule and Kharash effect, Diels-Alder reaction, aromatic electrophilic substitution, orientation effect as exemplified by various functional groups. Identification of functional groups by chemical tests.

• Structure-Reactivity Correlations: Organic molecules physical properties is being implied by its structure. It include topics- Acids and bases, electronic and steric effects, optical and geometrical isomerism, tautomerism, conformers, concept of aromaticity

Section I: Biochemistry

- Biological membranes. Transport across membranes. Signal transduction; hormones and neurotransmitters.

Section J: Botany
Plant Systematics: Plants being categorized biologically. It includes topics: Systems of classification (non-phylogenetic vs. phylogenetic – outline), plant groups, molecular systematics.

Plant Anatomy: Plants insight study about its internal structure in detail. It includes topics: Plant cell structure, organization, organelles, cytoskeleton, cell wall and membranes; anatomy of root, stem and leaves, meristems, vascular system, their ontogeny, structure and functions, secondary growth in plants and stellar organization.

Morphogenesis & Development: An organism generating its shape biologically. It includes topics: Cell cycle, cell division, life cycle of an angiosperm, pollination, fertilization, embryogenesis, seed formation, seed storage proteins, seed dormancy and germination. Concept of cellular totipotency, clonal propagation; organogenesis and somatic embryogenesis, artificial seed, somaclonal variation, secondary metabolism in plant cell culture, embryo culture, in vitro fertilization.

Physiology and Biochemistry: It deals with the way of working of living things. Biochemistry is the chemical process study within as well as relating it to living organisms. It includes topics: Plant water relations, transport of minerals and solutes, stress physiology, stomatal physiology, signal transduction, N₂ metabolism, photosynthesis, photorespiration; respiration, Flowering: photoperiodism and vernalization, biochemical mechanisms involved in flowering; molecular mechanism of senescence and aging, biosynthesis, mechanism of action and physiological effects of plant growth regulators, structure and function of biomolecules, (proteins, carbohydrates, lipids, nucleic acid), enzyme kinetics.

Genetics: Genes study in detail. It includes topics: Principles of Mendelian inheritance, linkage, recombination, genetic mapping; extrachromosomal inheritance; prokaryotic and eukaryotic genome organization, regulation of gene expression, gene mutation and repair, chromosomal aberrations (numerical and structural), transposons.

Plant Breeding and Genetic Modification: It deals with the technique of modifying plants genetics to generate plants traits. It includes topics: Principles, methods – selection, hybridization, heterosis; male sterility, genetic maps and molecular markers, sporophytic and gametophytic self incompatibility, haploidy, triploidy, somatic cell hybridization, marker-assisted selection, gene transfer methods viz. direct and vector-mediated, plastid transformation, transgenic plants and their application in agriculture, molecular pharming, plantibodies.

Economic Botany: Plants being commercially exploited. It includes topics: A general account of economically and medicinally important plants - cereals, pulses, plants yielding fibers, timber, sugar, beverages, oils, rubber, pigments, dyes, gums, drugs and narcotics. Economic importance of algae, fungi, lichen and bacteria.

Plant Pathology: It deals with study of pathogen caused plants diseases in a scientific manner. It includes topics: Nature and classification of plant diseases, diseases of important crops caused by fungi, bacteria and viruses, and their control measures, mechanism(s) of pathogenesis and resistance, molecular detection of pathogens; plant-microbe beneficial interactions.

Ecology and Environment: Study of organisms interplaying with their environment in a scientific manner. It includes topics: Ecosystems – types, dynamics,
degradation, ecological succession; food chains and energy flow; vegetation types of the world, pollution and global warming, speciation and extinction, conservation strategies, cryopreservation, phytoremediation.

Section K: Microbiology

- **Historical Perspective:** It tells us about the history of microbiology. It includes topics: Discovery of the microbial world; Landmark discoveries relevant to the field of microbiology; Controversy over spontaneous generation; Role of microorganisms in transformation of organic matter and in the causation of diseases.

- **Methods in Microbiology:** Different methods to study microscopic organisms. It includes topics: The Pure culture techniques; Theory and practice of sterilization; Principles of microbial nutrition; Enrichment culture techniques for isolation of microorganisms; Light-, phase contrast- and electron-microscopy.

- **Microbial Taxonomy and Diversity:** It refers to categorization of microbes on the basis of rank. It includes topics: Bacteria, Archea and their broad classification; Eukaryotic microbes: Yeasts, molds and protozoa; Viruses and their classification; Molecular approaches to microbial taxonomy.

- **Prokaryotic and Eukaryotic Cells:** Prokaryotic cells without membrane bound nucleus whereas eukaryotic cells have a nucleus. Structure and Function: It includes: Prokaryotic Cells: cell walls, cell membranes, mechanisms of solute transport across membranes, Flagella and Pili, Capsules, Cell inclusions like endospores and gas vesicles; Eukaryotic cell organelles: Endoplasmic reticulum, Golgi apparatus, mitochondria and chloroplasts.

- **Microbial Growth:** It is the study of microbial growth. It includes topics: Definition of growth; Growth curve; Mathematical expression of exponential growth phase; Measurement of growth and growth yields; Synchronous growth; Continuous culture; Effect of environmental factors on growth.

- **Control of Micro-organisms:** Different methods to control the microorganisms. It includes: Effect of physical and chemical agents; Evaluation of effectiveness of antimicrobial agents.

- **Microbial Metabolism:** Study of ways by which microbes get their energy & nutrients so as to be alive and reproduce. It includes: Energetics: redox reactions and electron carriers; An overview of metabolism; Glycolysis; Pentose-phosphate pathway; Entner-Doudoroff pathway; Glyoxalate pathway; The citric acid cycle; Fermentation; Aerobic and anaerobic respiration; Chemolithotrophy; Photosynthesis; Calvin cycle; Biosynthetic pathway for fatty acids synthesis; Common regulatory mechanisms in synthesis of amino acids; Regulation of major metabolic pathways.

- **Microbial Diseases and Host Pathogen Interaction:** Different diseases caused by microbes. It includes: Normal microbiota; Classification of infectious diseases; Reservoirs of infection; Nosocomial infection; Emerging infectious diseases; Mechanism of microbial pathogenicity; Nonspecific defense of host; Antigens and antibodies; Humoral and cell mediated immunity; Vaccines; Immune deficiency; Human diseases caused by viruses, bacteria, and pathogenic fungi.
• Chemotherapy/Antibiotics: Treatment of different diseases by taking the help of chemicals. It includes topics - General characteristics of antimicrobial drugs; Antibiotics: Classification, mode of action and resistance; Antifungal and antiviral drugs.

• Microbial Genetics: Very small organisms gene study. It includes topics - Types of mutation; UV and chemical mutagens; Selection of mutants; Ames test for mutagenesis; Bacterial genetic system: transformation, conjugation, transduction, recombination, plasmids, transposons; DNA repair; Regulation of gene expression: repression and induction; Operon model; Bacterial genome with special reference to E. coli; Phage λ and its life cycle; RNA phages; RNA viruses; Retroviruses; Basic concept of microbial genomics.

• Microbial Ecology: It deals with the relationship of microorganisms with one another as well as with the environment. It includes topics - Microbial interactions; Carbon, sulphur and nitrogen cycles; Soil microorganisms associated with vascular plants.

Section L: Zoology

• Animal world: The world of animals or the details of all animals. It includes - Animal diversity, distribution, systematics and classification of animals, phylogenetic relationships.

• Evolution: It refers to the change in traits that is being passed over successive generation which belongs to biological population. It includes topics - Origin and history of life on earth, theories of evolution, natural selection, adaptation, speciation.

• Genetics: Study of genes. It includes - Principles of inheritance, molecular basis of heredity, mutations, cytoplasmic inheritance, linkage and mapping of genes.

• Biochemistry and Molecular Biology: Study of chemical process within as well as relating it to living organisms. It includes topics - Nucleic acids, proteins, lipids and carbohydrates; replication, transcription and translation; regulation of gene expression, organization of genome, Kreb’s cycle, glycolysis, enzyme catalysis, hormones and their actions, vitamins.

• Cell Biology: Study of many categories of cells. It includes - Structure of cell, cellular organelles and their structure and function, cell cycle, cell division, chromosomes and chromatin structure. Eukaryotic gene organization and expression (Basic principles of signal transduction).

• Animal Anatomy and Physiology: Insight Study of plants internal structure. It includes - Comparative physiology, the respiratory system, circulatory system, digestive system, the nervous system, the excretory system, the endocrine system, the reproductive system, the skeletal system, osmoregulation.

• Parasitology and Immunology: It deals with the study of parasites, hosts and the relation between them. Immunology refers to all the immune system that is present in an organism. It includes - Nature of parasite, host-parasite relation, protozoan and helminthic parasites, the immune response, cellular and humoral immune response, evolution of the immune system.
• Development Biology: study of development of organisms by certain processes. It includes topics - Embryonic development, cellular differentiation, organogenesis, metamorphosis, genetic basis of development, stem cells.

• Ecology: Study of organisms interplay with its environment. It includes - The ecosystem, habitats, the food chain, population dynamics, species diversity, zoogeography, biogeochemical cycles, conservation biology.

• Animal Behaviour: Study of different types of behavior shown by animals. It includes - Types of behaviours, courtship, mating and territoriality, instinct, learning and memory, social behaviour across the animal taxa, communication, pheromones, evolution of animal behaviour.

Section M: Food Technology

• Food Chemistry and Nutrition: Study of interplay of all biological as well as non biological components and the chemical processes included. It includes - Carbohydrates: Structure and functional properties of mono- oligo-polysaccharides including starch, cellulose, pectic substances and dietary fibre; Proteins: Classification and structure of proteins in food; Lipids: Classification and structure of lipids, Rancidity of fats, Polymerization and polymorphism; Pigments: Carotenoids, chlorophylls, anthocyanins, tannins and myoglobin; Food flavours: Terpenes, esters, ketones and quinones; Enzymes: Specificity, Kinetics and inhibition, Coenzymes, Enzymatic and non-enzymatic browning; Nutrition: Balanced diet, Essential amino acids and fatty acids, PER, Water soluble and fat soluble vitamins, Role of minerals in nutrition, Antinutrients, Nutrition deficiency diseases.

• Food Microbiology: Study of contamination of food by microorganisms. It includes topics - Characteristics of microorganisms: Morphology, structure and detection of bacteria, yeast and mold in food, Spores and vegetative cells; Microbial growth in food: Intrinsic and extrinsic factors, Growth and death kinetics, serial dilution method for quantification; Food spoilage: Contributing factors, Spoilage bacteria, Microbial spoilage of milk and milk products, meat and meat products; Foodborne disease: Toxins produced by Staphylococcus, Clostridium and Aspergillus; Bacterial pathogens: Salmonella, Bacillus, Listeria, Escherichia coli, Shigella, Campylobacter; Fermented food: Buttermilk, yoghurt, cheese, sausage, alcoholic beverage, vinegar, sauerkraut and soya sauce.

• Food Products Technology: Technology involved in production of food products. It includes - Processing principles: Canning, chilling, freezing, dehydration, control of water activity, CA and MA storage, fermentation, hurdle technology, addition of preservatives and food additives, Food packaging, cleaning in place and food laws.; Grain products processing: Milling of rice, wheat, and maize, parboiling of paddy, production of bread, biscuits, extruded products and breakfast cereals, Solvent extraction, refining and hydrogenation of oil; Fruits, vegetables and plantation products processing: Extraction, clarification concentration and packaging of fruit juice, Production of jam, jelly, marmalade, squash, candies, and pickles, pectin from fruit waste, tea, coffee, chocolate and essential oils from spices; Milk and
milk products processing: Pasteurized and sterilized milk, cream, butter, ghee, ice-cream, cheese and milk powder; Animal products processing: Drying and canning of fish, post mortem changes, tenderization and freezing of meat, egg powder.

- **Food Engineering:** Applied field of physical science that associate microbiology, science with engineering education to produce food as well as related industries. It include topics- Mass and energy balance; Momentum transfer: Flow rate and pressure drop relationships for Newtonian fluids flowing through pipe, Characteristics of non-Newtonian fluids – generalized viscosity coefficient and Reynolds number, Flow of compressible fluid, Flow measurement, Pumps and compressors; Heat transfer: Heat transfer by conduction, convection, radiation, boiling and condensation, Unsteady state heat transfer in simple geometry, NTU- effectiveness relationship of co-current and counter current double pipe heat exchanger; Mass transfer: Molecular diffusion and Fick’s Law, Steady state mass transfer, Convective mass transfer, Permeability of films and laminates; Mechanical operations: Energy requirement and rate of operations involved in size reduction of solids, high pressure homogenization, filtration, centrifugation, settling, sieving, flow through porous bed, agitation of liquid, solid-solid mixing, and single screw extrusion; Thermal operations: Energy requirement and rate of operations involved in process time evaluation in batch and continuous sterilization, evaporation of liquid foods, hot air drying of solids, spray and freeze-drying, freezing and crystallization; Mass transfer operations: Properties of air-water vapour mixture; Humidification and dehumidification operations.