Part IV: Biology

1: Diversity in Living World
1.1 Biology – its meaning and relevance to mankind
1.2 What is living; Taxonomic categories and aids; Systematics and Binomial system of nomenclature.
1.3 Introductory classification of living organisms (Two-kingdom system, Five-kingdom system);
1.4 Plant kingdom – Salient features of major groups (Algae to Angiosperms);
1.5 Animal kingdom – Salient features of Nonchordates up to phylum, and Chordates up to class level.

2: Cell: The Unit of Life; Structure and Function
2.1 Cell wall; Cell membrane; Endomembrane system (ER, Golgi apparatus/Dictyosome, Lysosomes,
Vacuoles); Mitochondria; Plastids; Ribosomes; Cytoskeleton; Cilia and Flagella; Centrosome and Centriole; Nucleus; Microbodies.

2.2 Structural differences between prokaryotic and eukaryotic, and between plant and animal cells.

2.3 Cell cycle (various phases); Mitosis; Meiosis.

2.4 Biomolecules – Structure and function of Carbohydrates, Proteins, Lipids, and Nucleic acids.

2.5 Enzymes – Chemical nature, types, properties and mechanism of action.

3: Genetics and Evolution

3.1 Mendelian inheritance; Chromosome theory of inheritance; Gene interaction; Incomplete dominance; Co-dominance; Complementary genes; Multiple alleles;

3.2 Linkage and Crossing over; Inheritance patterns of hemophilia and blood groups in humans.

3.3 DNA – its organization and replication; Transcription and Translation;

3.4 Gene expression and regulation; DNA fingerprinting.

3.5 Theories and evidences of evolution, including modern Darwinism.

4: Structure and Function – Plants

4.1 Morphology of a flowering plant; Tissues and tissue systems in plants; Anatomy and function of root, stem (including modifications), leaf, inflorescence, flower (including position and arrangement of different whorls, placentation), fruit and seed; Types of fruit; Secondary growth;

4.2 Absorption and movement of water (including diffusion, osmosis and water relations of cell) and of nutrients; Translocation of food; Transpiration and gaseous exchange; Mechanism of stomatal movement.

4.3 Mineral nutrition – Macro- and micro-nutrients in plants including deficiency disorders; Biological nitrogen fixation mechanism.

4.4 Photosynthesis – Light reaction, cyclic and non-cyclic photophosphorylation; various pathways of carbon dioxide fixation; Photorespiration; Limiting factors.

4.5 Respiration – Anaerobic, Fermentation, Aerobic; Glycolysis, TCA cycle; Electron transport system; Energy relations.

5: Structure and Function - Animals

5.1 Human Physiology – Digestive system – organs, digestion and absorption; Respiratory system – organs, breathing and exchange and transport of gases.

5.2 Body fluids and circulation – Blood, lymph, double circulation, regulation of cardiac activity; Hypertension, Coronary artery diseases.

5.3 Excretion system – Urine formation, regulation of kidney function

5.4 Locomotion and movement – Skeletal system, joints, muscles, types of movement.

5.5 Control and co-ordination – Central and peripheral nervous systems, structure and function of neuron, reflex action and sensory reception; Role of various types of endocrine glands; Mechanism of hormone action.

6: Reproduction, Growth and Movement in Plants

6.1 Asexual methods of reproduction;

6.2 Sexual Reproduction – Development of male and female gametophytes; Pollination (Types and agents); Fertilization; Development of embryo, endosperm, seed and fruit (including parthenocarpy and elminth).

6.3 Growth and Movement – Growth phases; Types of growth regulators and their role in seed dormancy, germination and movement;
6.4 Apical dominance; Senescence; Abscission; Photo-periodism; Vernalisation;
6.5 Various types of movements.

7: Reproduction and Development in Humans
7.1 Male and female reproductive systems;
7.2 Menstrual cycle; Gamete production; Fertilisation; Implantation;
7.3 Embryo development;
7.4 Pregnancy and parturition;
7.5 Birth control and contraception.

8: Ecology and Environment
8.1 Meaning of ecology, environment, habitat and niche.
8.2 Ecological levels of organization (organism to biosphere); Characteristics of Species, Population, Biotic Community and Ecosystem; Succession and Climax. Ecosystem – Biotic and abiotic components; Ecological pyramids; Food chain and Food web;
8.3 Energy flow; Major types of ecosystems including agroecosystem.
8.4 Ecological adaptations – Structural and physiological features in plants and animals of aquatic and desert habitats.
8.5 Biodiversity and Environmental Issues – Meaning, types and conservation strategies (Biosphere reserves, National parks and Sanctuaries), Air and Water Pollution (sources and major pollutants); Global warming and Climate change; Ozone depletion; Noise pollution; Radioactive pollution; Methods of pollution control (including an idea of bioremediation); Deforestation; Extinction of species (Hot Spots).

9: Biology and Human Welfare
9.1 Animal husbandry – Livestock, Poultry, Fisheries; Major animal diseases and their control. Pathogens of major communicable diseases of humans caused by fungi, bacteria, viruses, protozoans and elminthes, and their control.
9.2 Cancer; AIDS.
9.3 Adolescence and drug/alcohol abuse;
9.4 Basic concepts of immunology.
9.5 Plant Breeding and Tissue Culture in crop improvement.

10: Biotechnology and its Applications
10.1 Microbes as ideal system for biotechnology;
10.2 Microbial technology in food processing, industrial production (alcohol, acids, enzymes, antibiotics), sewage treatment and energy generation.
10.3 Steps in recombinant DNA technology – restriction enzymes, NA insertion by vectors and other methods, regeneration of recombinants
10.4 Applications of R-DNA technology in human health – Production of Insulin, Vaccines and Growth hormones, Organ transplant, Gene therapy.
10.5 Applications in Industry and Agriculture – Production of expensive enzymes, strain improvement to scale up bioprocesses, GM crops by transfer of genes for nitrogen fixation, herbicide-resistance and pest-resistance including Bt crops.