

## **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. Structural differences between prokaryotic and eukaryotic, and between plant and animal cells. Cell cycle (various phases); Mitosis; Meiosis. Biomolecules – Structure and function of Carbohydrates, Proteins, Lipids, and Nucleic acids. Enzymes – Chemical nature, types, properties and mechanism of action.
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### **3: Genetics and Evolution**

- 4.1 Mendelian inheritance; Chromosome theory of inheritance; Gene interaction; Incomplete dominance; Co-dominance; Complementary genes; Multiple alleles;
- 5.2 Linkage and Crossing over; Inheritance patterns of hemophilia and blood groups in humans.

3. DNA –its organization and replication; Transcription and Translation;
- 3 Gene expression and regulation; DNA fingerprinting.
3. 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; Absorption and
- 4.2 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. Mineral nutrition – Macro- and micro-nutrients in plants including deficiency disorders;
- 4.3 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. Energy flow; Major types of ecosystems including agroecosystem. 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 helminthes, 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.