

## BIOLOGY (BOTANY AND ZOOLOGY)

### **Unit 1 : Diversity in Living World**

Biology – its meaning and relevance to mankind

What is living; Taxonomic categories and aids (Botanical gardens, herbaria, museums, zoological parks); Systematics and Binomial system of nomenclature.

Introductory classification of living organisms (Two-kingdom system, Five-kingdom system);

Major groups of each kingdom alongwith their salient features (Monera, including Archaeobacteria and Cyanobacteria, Protista, Fungi, Plantae, Animalia); Viruses; Lichens

Plant kingdom – Salient features of major groups (Algae to Angiosperms);

Animal kingdom – Salient features of Nonchordates up to phylum, and Chordates up to class level.

### **Unit 2 : Cell : The Unit of Life ; Structure and Function**

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.

### **Unit 3 : Genetics and Evolution**

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

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

DNA –its organization and replication; Transcription and Translation; Gene expression and regulation; DNA fingerprinting.

Theories and evidences of evolution, including modern Darwinism.

#### **Unit 4 : Structure and Function – Plants**

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 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; Biological nitrogen fixation mechanism.

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

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

#### **Unit : 5 Structure and Function - Animals**

Tissues;

Elementary knowledge of morphology, anatomy and functions of different systems of earthworm, cockroach and frog.

Human Physiology – Digestive system - organs, digestion and absorption; Respiratory system – organs, breathing and exchange and transport of gases. Body fluids and circulation – Blood, lymph, double circulation, regulation of cardiac activity; Hypertension, Coronary artery diseases.

Excretion system – Urine formation, regulation of kidney function

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

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.

## **Unit : 6 Reproduction, Growth and Movement in Plants**

Asexual methods of reproduction; Sexual Reproduction - Development of male and female gametophytes; Pollination (Types and agents); Fertilization; Development of embryo, endosperm, seed and fruit (including parthenocarpy and apomixis).

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

## **Unit 7 : Reproduction and Development in Humans**

Male and female reproductive systems; Menstrual cycle; Gamete production; Fertilisation; Implantation; Embryo development; Pregnancy and parturition; Birth control and contraception.

## **Unit 8 : Ecology and Environment**

Meaning of ecology, environment, habitat and niche.

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; Energy flow; Major types of ecosystems including agroecosystem.

Ecological adaptations – Structural and physiological features in plants and animals of aquatic and desert habitats.

Biodiversity – Meaning, types and conservation strategies (Biosphere reserves, National parks and Sanctuaries)

Environmental Issues – 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).

## **Unit 9 : Biology and Human Welfare**

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 helminths, and their control.

Cancer; AIDS.

Adolescence and drug/alcohol abuse;

Basic concepts of immunology.

Plant Breeding and Tissue Culture in crop improvement.

Biofertilisers (green manure, symbiotic and free-living nitrogen-fixing microbes, mycorrhizae);

Biopesticides (micro-organisms as biocontrol agents for pests and pathogens); Bioherbicides;

Microorganisms as pathogens of plant diseases with special reference to rust and smut of wheat, bacterial leaf blight of rice, late blight of potato, bean mosaic, and root - knot of vegetables.

Bioenergy – Hydrocarbon - rich plants as substitute of fossil fuels.

### **Unit 10 : Biotechnology and its Applications**

Microbes as ideal system for biotechnology;

Microbial technology in food processing, industrial production (alcohol, acids, enzymes, antibiotics), sewage treatment and energy generation.

Steps in recombinant DNA technology – restriction enzymes, DNA insertion by vectors and other methods, regeneration of recombinants.

Applications of R-DNA technology. In human health –Production of Insulin, Vaccines and Growth hormones, Organ transplant, Gene therapy. In Industry – Production of expensive enzymes, strain improvement to scale up bioprocesses. In Agriculture – GM crops by transfer of genes for nitrogen fixation, herbicide-resistance and pest-resistance including Bt crops.