

Unit 1: Diversity & Structural Organisation

What is living? Biodiversity; Need for classification; Three domains of life; Taxonomy & Systematics; Concept of species and taxonomical hierarchy; Binomial nomenclature; Tools for study of Taxonomy – Museums, Zoos, Herbaria, Botanical gardens.

Five kingdom classification: Salient features and classification of Monera; Protista and Fungi into major groups; Lichens; Viruses and Viroids, Salient features and classification of plants into major groups-Algae, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms; Angiosperms- classification up to class, characteristic features and examples, Salient features and classification of animals-nonchordate up to phyla level and chordate up to classes level.

Structural Organisation in Animals and Plants: Morphology and modifications; Tissues; Anatomy and functions of different parts of flowering plants: Root, stem, leaf, inflorescence- cymose and recemose, flower, fruit and seed, Animal tissues; Morphology, anatomy and functions of different systems (digestive, circulatory, respiratory, nervous and reproductive) of an insect (cockroach).

Cell Structure and Function: Cell theory and cell as the basic Unit of life; Structure of prokaryotic and eukaryotic cell; Plant cell and animal cell; Cell envelope, cell membrane, cell wall; Cell organelles-structure and function; Endomembrane system-endoplasmic reticulum, Golgi bodies, lysosomes, vacuoles; mitochondria, ribosomes, plastids, micro bodies; Cytoskeleton, cilia, flagella, centrioles (ultra structure and function); Nucleus-nuclear membrane, chromatin, nucleolus. Chemical constituents of living cells: Biomolecules-structure and function of proteins, carbohydrates, lipids, nucleic acids; Enzymes-types, properties, enzyme action;

Cell division: Cell cycle, mitosis, meiosis and their significance.

Unit 2: Plant Physiology

Transport in plants: Movement of water, gases and nutrients; Cell to cell transport-Diffusion, facilitated diffusion, active transport; Plant – water relations – Imbibition, water potential, osmosis, plasmolysis; Long distance transport of water – Absorption, apoplast, symplast, transpiration pull, root pressure and guttation; Transpiration-Opening and closing of stomata; Uptake and translocation of mineral nutrients- Transport of food, Phloem transport, Mass flow hypothesis; Diffusion of gases.

Mineral nutrition: Essential minerals, macro and micronutrients and their role; Deficiency symptoms; Mineral toxicity; Elementary idea of Hydroponics as a method to study mineral nutrition; Nitrogen metabolism-Nitrogen cycle, Biological Nitrogen fixation.

Photosynthesis: Photosynthesis as a means of Autotrophic nutrition; Site of photosynthesis take place; pigments involved in Photosynthesis (Elementary idea); Photochemical and biosynthetic phases of photosynthesis; Cyclic and non cyclic and photophosphorylation; Chemiosmotic hypothesis; Photorespiration C3 and C4 pathways; Factors affecting photosynthesis.

Respiration: Exchange gases; Cellular respiration- glycolysis, fermentation (anaerobic), TCA cycle and electron transport system (aerobic); Energy relations- Number of ATP molecules generated; Amphibolic pathways; Respiratory quotient.

Plant growth and development: Seed germination; Phases of Plant growth and plant growth rate; Conditions of growth; Plant growth and development: Seed germination; Conditions of growth; Differentiation, dedifferentiation and redifferentiation; Sequence of developmental process in a plant cell; Growth regulators-auxin, gibberellin, cytokinin, ethylene, ABA; Seed dormancy; Vernalisation; Photoperiodism.

Unit 3: Human Physiology

Digestion and absorption: Alimentary canal and digestive glands; Role of digestive enzymes and gastrointestinal hormones; Peristalsis, digestion, absorption and assimilation of proteins, carbohydrates and fats; Caloric value of proteins, carbohydrates and fats; Egestion; Nutritional and digestive disorders – PEM, indigestion, constipation, vomiting, jaundice, diarrhea.

Breathing and Respiration: Respiratory organs in animals; Respiratory system in humans; Mechanism of breathing and its regulation in humans- Exchange of gases, transport of gases and regulation of respiration Respiratory volumes; Disorders related to respiration-Asthma, Emphysema, Occupational respiratory disorders.

Body fluids and circulation: Composition of blood, blood groups, coagulation of blood; Composition of lymph and its function; Human circulatory system- Structure of human heart and blood vessels; Cardiac cycle, cardiac output, ECG, Double circulation; Regulation of cardiac activity; Disorders of circulatory system-Hypertension, Coronary artery disease, Angina pectoris, Heart failure.

Excretory products and their elimination: Modes of excretion- Ammonotelism, ureotelism, uricotelism; Human excretory system-structure and function; Urine formation, Osmoregulation; Regulation of kidney function-Renin- angiotensin, Atrial Natriuretic Factor, ADH and Diabetes insipidus; Role of other organs in excretion; Disorders; Uraemia, Renal failure, Renal calculi, Nephritis; Dialysis and artificial kidney.

Locomotion and Movement: Types of movement- ciliary, flagellar, muscular; Skeletal muscle- contractile proteins and muscle contraction; Skeletal system and its functions; Joints; Disorders of muscular and skeletal system-Myasthenia gravis, Tetany, Muscular dystrophy, Arthritis, Osteoporosis, Gout.

Neural control and coordination: Neuron and nerves; Nervous system in humans- central nervous system, peripheral nervous system and visceral nervous system; Generation and conduction of nerve impulse; Reflex action; Sense organs; Elementary structure and function of eye and ear.

Chemical coordination and regulation: Endocrine glands and hormones; Human endocrine system-Hypothalamus, Pituitary, Pineal, Thyroid, Parathyroid, Adrenal, Pancreas, Gonads; Mechanism of hormone action; Role of hormones as messengers and regulators, Hypo-and hyperactivity and related disorders (Common disorders e.g. Dwarfism, Acromegaly, Cretinism, goiter, exophthalmicgoiter, diabetes, Addison's disease).

Unit 4: Reproduction, Genetics and Evolution

Reproduction in organisms: Reproduction, a characteristic feature of all organisms for continuation of species; Modes of reproduction – Asexual and sexual; Asexual reproduction; Modes-Binary fission, sporulation, budding, gemmule, fragmentation; vegetative propagation in plants.

Sexual reproduction in flowering plants: Flower structure; Development of male and female gametophytes; Pollination- types, agencies and examples; Outbreeding devices; Pollen- Pistil interaction; Double fertilization; Post fertilization events- Development of endosperm and embryo, Development of seed and formation of fruit; Special modes-apomixis, parthenocarpy, polyembryony; Significance of seed and fruit formation.

Human Reproduction: Male and female reproductive systems; Microscopic anatomy of testis and ovary; Gametogenesis- spermatogenesis & oogenesis; Menstrual cycle; Fertilisation, embryo development upto blastocyst formation, implantation; Pregnancy and placenta formation; Parturition; Lactation.

Reproductive health: Need for reproductive health and prevention of sexually transmitted diseases (STD); Birth control-Need and Methods, Contraception and Medical Termination of Pregnancy (MTP); Amniocentesis; Infertility and assisted reproductive technologies – IVF, ZIFT, GIFT.

Genetics and Evolution: Heredity and variation: Mendelian Inheritance; Deviations from Mendelism- Incomplete dominance, Co-dominance, Multiple alleles and Inheritance of blood groups, Pleiotropy; Elementary idea of polygenic inheritance; Chromosome theory of inheritance; Chromosomes and genes; Sex determination-In humans, birds, honey bee; Linkage and crossing over; Sex linked inheritance-Haemophilia, Colour blindness; Mendelian disorders in humans- Thalassaemia; Chromosomal disorders in humans; Down's syndrome, Turner's and Klinefelter's syndromes.

Molecular basis of Inheritance: Search for genetic material and DNA as genetic material; Structure of DNA and RNA; DNA packaging; DNA replication; Central dogma; Transcription, genetic code, translation; Gene expression and regulation- Lac Operon; Genome and human genome project; DNA finger printing.

Evolution: Origin of life; Biological evolution and evidences for biological evolution from Paleontology, comparative anatomy, embryology and molecular evidence; Darwin's contribution, Modern Synthetic theory of Evolution; Mechanism of evolution-Variation (Mutation and Recombination) and Natural Selection with examples, types of natural selection; Gene flow and genetic drift; Hardy-Weinberg's principle; Adaptive Radiation; Human evolution.

Unit 5: Biology, Biotechnology and Human Welfare

Health and Disease: Pathogens; parasites causing human diseases (Malaria, Filariasis, Ascariasis Typhoid, Pneumonia, common cold, amoebiasis, ring worm); Basic concepts of immunology-vaccines; Cancer, HIV and AIDS; Adolescence, drug and alcohol abuse.

Improvement in food production: Plant breeding, tissue culture, single cell protein, Biofortification; Apiculture and Animal husbandry.

Microbes in human welfare: In household food processing, industrial production, sewage treatment, energy generation and as biocontrol agents and biofertilizers.

Biotechnology and its Applications: Principles and process of Biotechnology; Genetic engineering (Recombinant DNA technology).

Application of Biotechnology in health and agriculture: Human insulin and vaccine production, gene therapy; Genetically modified organisms-Bt crops; Transgenic Animals; Biosafety issues-Biopiracy and patents.

Unit 6: Ecology and environment

Organisms and environment: Habitat and niche; Population and ecological adaptations; Population interactions- mutualism, competition, predation, parasitism; Population attributes-growth, birth rate and death rate, age distribution.

Ecosystem: Patterns, components; productivity and decomposition; Energy flow; Pyramids of number, biomass, energy; Nutrient cycling (carbon and phosphorous); Ecological succession; Ecological Services-Carbon fixation, pollination, oxygen release.

Biodiversity and its conservation: Concept of Biodiversity; Patterns of Biodiversity; Importance of Biodiversity; Loss of Biodiversity; Biodiversity conservation; Hotspots, endangered organisms, extinction, Red Data Book, biosphere reserves, National parks and sanctuaries.

Environmental issues: Air pollution and its control; Water pollution and its control; Agrochemicals and their effects; Solid waste management; Radioactive waste management; Greenhouse effect and global warning; Ozone depletion; Deforestation; Any three case studies as success stories addressing environmental issues.