

SUBJECT: BOTANY

UNIT-I: DIVERSITY IN THE LIVING WORLD:

The living world: What is living?, Diversity in the living world; Taxonomic categories and taxonomical aids.

Biological Classification: Five kingdom classification - Monera, Protista, Fungi, Plantae and Animalia, Three domains of life (Six kingdom classification), Viruses, Viroids, Prions & Lichens.

Science of plants– Botany: Origin, Development, Scope of Botany and Branches of Botany.

Plant Kingdom: Salient features, Classification and alternation of generations of the plants of the following groups - Algae, Bryophytes, Pteridophytes, Gymnosperms, Angiosperms,

UNIT-II: STRUCTURAL ORGANISATION IN PLANTS- MORPHOLOGY:

Morphology of flowering Plants: *Vegetative:* Parts of a typical Angiospermic plant; Vegetative morphology and modifications - Root, Stem and Leaf- types; Venation, Phyllotaxy. *Reproductive:* Inflorescence - Racemose, Cymose and special types (in brief). **Flower:** Parts of a flower and their detailed description; Aestivation, Placentation, **Fruits:** Types – True, False and Parthenocarpic fruits, **Seeds** (in brief).

UNIT-III: REPRODUCTION IN PLANTS:

Modes of Reproduction: Asexual reproduction, Binary fission, Sporulation, budding, fragmentation, vegetative propagation in plants, Sexual reproduction in brief, Overview of angiosperm life cycle.

Sexual Reproduction in Flowering Plants: Stamen, microsporangium, pollen grain; Pistil, megasporangium (ovule) and embryo sac; Development of male and female gametophytes; Pollination - Types, agents, Out breeding devices and Pollen - Pistil interaction; Double Fertilization; Post fertilization events: Development of endosperm and embryo; development of seed, Structure of Dicotyledonous and Monocotyledonous seeds, Significance of fruit and seed. Special modes - Apomixis, parthenocarpy, polyembryony.

UNIT-IV: PLANT SYSTEMATICS:

Taxonomy of angiosperms: Introduction, Types of Systems of classification (In brief). Semi-Technical description of a typical flowering plant; Description of Families: Fabaceae, Solanaceae and Liliaceae.

UNIT-V: CELL STRUCTURE AND FUNCTION:

Cell- The Unit of Life: Cell- Cell theory and cell as the basic unit of life- overview of the cell; Prokaryotic and Eukaryotic cells, Ultra Structure of Plant cell (structure in detail and functions in brief), Cell membrane, Cell wall, Cell organelles: Endoplasmic reticulum, Mitochondria, Plastids, Ribosomes, Golgi bodies, Vacuoles, Lysosomes, Microbodies, Centrosome and Centriole, Cilia, Flagella, Cytoskeleton and Nucleus. Chromosomes: Number, structural organization, Nucleosome.

Biomolecules: How to analyse chemical composition; primary and secondary metabolites, Biomacromolecules, Proteins, Polysaccharides, Nucleic acids, Structure of Proteins, Nature

of bond linking monomers in a polymer, Dynamic state of body constituents-concept of metabolism, Metabolic basis for living, the living state.

Cell cycle and Cell Division: Cell cycle, Mitosis, Meiosis - significance.

UNIT-VI: INTERNAL ORGANISATION OF PLANTS:

Histology and Anatomy of Flowering Plants: Tissues – Types, structure and functions; Meristematic: Permanent tissues – Simple and Complex tissues. Tissue systems – Types, structure and function: Epidermal, Ground and Vascular tissue systems, Anatomy of Dicotyledonous and Monocotyledonous plants - Root, Stem and Leaf, Secondary growth in Dicot stem and Dicot root.

UNIT-VII: PLANT ECOLOGY:

Ecological Adaptations, Succession and Ecological Services: Introduction. Plant communities and Ecological adaptations: Hydrophytes, Mesophytes and Xerophytes. Plant succession. Ecological services- Pollination, Carbon fixation, Oxygen release and how to sustain ecological functions.

UNIT-VIII: PLANT PHYSIOLOGY:

Transport in Plants: Means of Transport- Diffusion, Facilitated Diffusion, Passive symports and antiports, Active Transport, Comparison of Different Transport Processes, Plant-Water Relations- Water Potential, Osmosis, Plasmolysis, Imbibition, Long Distance Transport of Water- Water Movement up a Plant, Root Pressure, Transpiration pull, Transpiration- Opening and Closing of Stomata, Transpiration and Photosynthesis - a compromise; Uptake and Transport of Mineral Nutrients- Uptake of Mineral Ions, Translocation of Mineral Ions, Phloem transport: Flow from Source to Sink-The Pressure Flow or Mass Flow Hypothesis.

Mineral Nutrition: Methods to study the Mineral Requirements of Plants, Essential Mineral Elements – Criteria for Essentiality, Macronutrients, Micronutrients, Role of Macro – and Micro – nutrients, Deficiency Symptoms of Essential Elements, Toxicity of Micronutrients, Mechanism of Absorption of Elements, Translocation of Solutes, Soil as Reservoir of Essential Elements, Metabolism of Nitrogen – Nitrogen Cycle, Biological Nitrogen Fixation, Symbiotic nitrogen fixation, Nodule Formation.

Enzymes: Chemical Reactions, Enzymatic Conversions, Nature of Enzyme Action, Factors Affecting Enzyme Activity, Temperature and pH, Concentration of Substrate, Classification and Nomenclature of Enzymes, Co-factors.

Photosynthesis in Higher Plants: Early Experiments, Site of Photosynthesis, Pigments Involved in Photosynthesis, Light Reaction, The Electron Transport-Splitting of Water, Cyclic and Noncyclic Photo-phosphorylation, Chemiosmotic Hypothesis, Biosynthetic phase- The Primary Acceptor of CO₂, The Calvin Cycle, The C₄ Pathway, Photorespiration, Factors affecting Photosynthesis.

Respiration of Plants: Cellular respiration, Glycolysis, Fermentation, Aerobic Respiration - Tricarboxylic Acid Cycle, Electron Transport System (ETS) and Oxidative Phosphorylation, The Respiratory Balance Sheet, Amphibolic Pathway, Respiratory Quotient.

Plant Growth and Development: Plant Growth, Phases of Growth, Growth Rates, Conditions for Growth, Differentiation, Dedifferentiation and Redifferentiation, Development, Plant Growth, Regulators - Physiological Effects of Plant Growth Regulators, Auxins, Gibberellins, Cytokinins, Ethylene, Absciscic acid; Seed Dormancy, Photoperiodism, Vernalisation.

UNIT-IX: MICROBIOLOGY:

Bacteria: Morphology of Bacteria, Bacterial cell structure - Nutrition, Reproduction-Sexual Reproduction, Conjugation, Transformation, Transduction, The importance of Bacteria to Humans.

Viruses: Discovery, Classification of Viruses, structure of Viruses, Multiplication of Bacteriophages – the Lytic cycle, The Lysogenic Cycle, Viral diseases in Plants, Viral diseases in Humans.

UNIT- X: GENETICS:

Principles of Inheritance and Variation: Mendel's Experiments, Inheritance of one gene (Monohybrid Cross)-Back cross and Test cross, Law of Dominance, Law of Segregation or Law of purity of gametes, Deviations from Mendelian concept of dominance - Incomplete Dominance, Co-dominance, Explanation of the concept of dominance, Inheritance of two genes- Law of Independent Assortment, Chromosomal Theory of Inheritance, Linkage and Recombination, Mutations, Significance of mutations.

UNIT- XI: MOLECULAR BIOLOGY:

Molecular Basis of inheritance: The DNA- Structure of Polynucleotide Chain, Packaging of DNA-Helix. The Search for Genetic Material, Transforming Principle, Biochemical Characterisation of Transforming Principle, The Genetic Material is DNA, Properties of Genetic Material (DNA versus RNA), RNA World, Replication - The Experimental Proof, The Machinery and the Enzymes, Transcription-Transcription Unit, Transcription Unit and the Gene, Types of RNA and the process of Transcription, Genetic Code-Mutations and Genetic Code, tRNA- the Adapter Molecule, Translation, Regulation of Gene Expression-The Lac operon.

UNIT-XII: BIOTECHNOLOGY:

Principles and processes of Biotechnology: Principles of Biotechnology-Construction of the first artificial recombinant DNA molecule, Tools of Recombinant DNA Technology-Restriction Enzymes, Cloning Vectors, Competent Host (For Transformation with Recombinant DNA), Processes of Recombinant DNA Technology- Isolation of the Genetic Material (DNA), Cutting of DNA at Specific Locations, Separation and isolation of DNA fragments, Insertion of isolated gene into a suitable vector, Amplification of Gene of Interest using PCR, Insertion of Recombinant DNA into the Host, Cell/Organism, Selection of Transformed host cells, Obtaining the Foreign Gene Product, Downstream Processing.

Biotechnology and its applications: Biotechnological Applications in Agriculture-Bt Cotton, Pest Resistant Plants, Other applications of Biotechnology - Insulin, Gene therapy, Molecular Diagnosis, ELISA, DNA fingerprinting, Transgenic plants, Bio-safety and Ethical issues- Biopiracy.

UNIT-XIII: PLANTS, MICROBES & HUMAN WELFARE:

Strategies for enhancement in food production: Plant Breeding- What is Plant Breeding? Wheat and Rice, Sugarcane, Millets. Plant Breeding for Disease Resistance, Methods of breeding for disease resistance, Mutation, Plant Breeding for Developing Resistance to Insect Pests, Plant Breeding for improved Food Quality, Single Cell Protein (SCP), Tissue Culture.

Microbes in Human Welfare: Microbes in Household Products, Microbes in Industrial Products-

Fermented Beverages, Antibiotics, Chemicals, Enzymes and other Bioactive Molecules, Microbes in Sewage Treatment, Primary treatment, Secondary treatment or Biological treatment, Microbes in Production of Biogas, Microbes as Biocontrol Agents, Biological control of pests and diseases, Microbes as Biofertilisers, Challenges posed by Microbes.