## BOTANY

- **1. Cryptogams:** Algae, Fungi, Bryophytes, Pteridophytes structure and reproduction from evolutonary viewpoint. Distribution of Cryptogams in India and their economic potential.
- 2. Phanerogams: Gymnosperms: Concept of Progymonosperms. Classification and distribution of Gymnosperms. Salient features of Cycadales, Coniferrals and Gnetales, their structures and reproduction. General account of Cycadofilicales, Bennettitales and Cordaitales.
- **3. Angiosperm:** Plants morphology, Inflorescences, Botanical Nomenclature- Salient Features of the International Code of Nomenclature (ICN), Principles, Type method, author citation, Publication of names, rejection of names. Basionym, synonym, tautonym etc. Principle of priority, limitations, conservation of names of species.

The Species concept, Taxonomic hierarchy, Species, Genus and Family Taxonomic evidence: Morphology, anatomy, palynology. Numerical, Cytology, Phytochemistry, Embryology, Evolution of Angiosperm (Phylogenetic tree). Molecular systematics: Concepts and methods.

Taxonomic Tools: Herbaria and herbarium techniques: methods plants collections and documentation; preparation and preservation of herbarium specimens, herbarium operations; virtual herbarium; major herbaria of the world and India. Functions of Herbaria, Botanical Gardens and Arboretum. Systems of angiosperm classification (Artificial, natural and phylogenetic system of classification including Angiosperm Phylogeny Group system. Numerical Taxonomy, Chemotaxonomy, Taxonomy in relation to anatomy, embryology, palynology, serology and molecular study. Dendrology, Uses of important economic species

Floristic regions of the world; Floristic Composition of India: description and composition of Himalayan, Peninsular and Desert vegetation. Biodiversity Act, Role of National Biodiversity Authority (NBA) in biodiversity management; CBD and environmental protocols.

Details of all families with special emphasis on important families : Ranunculaceae, Magnoliaceae, Berbeidaceae, Anonaceae, Capparidaceae, Pittosporaceae, Tamariaceae, Hypericaceae, Malvaceae, Sterculaceae, Tiliaceae, Linaceae. Malphiginaceae, Rutaceae, Simarubiaceae, Burseraceae, Meliaceae, Olacaceae, Ilicaceae, Celastraceae, Rhamnaceae, Sapindaceae, Sabiaceae, Anacardiaceae, Moringaceae, Fabaceae, Rosaceae, Saxifragaceae, Rhizophoraceae, Combtretaceae, Myrtaceae, Melastomaceae, Lythraceae, Samydaceae, Cactaceae, Araliaceae, Cornaceae, Caprifoliaceae, Rubiaceae, Asteraceae, Ericaceae, Plumbaginaceae,

Myrsinaceae, Sapotaceae, Ebenaceae, Styraceae, Oleaceae, Apocynaceae, Asclepiadaceae, Fagaceae, Loganiceae, Boraginaceae, Convolvulaceae, Solanceae, Bibnoniaceae, Vervenaceae, Schrophulariaceae, Achanthaceae, Labiatae, Nyctaginaceae, Amaranthaceae, Chenopodiaceae, Polygonaceae, Piperaceae, Lauraceae, Proteaceae, Thymelaeaceae, Elaegnaceae, Loranthaceae, Santalaceae, Euphorbiaceae, Myricaceae, Betulaceae, Salicaceae, Junglandaceae, Cupuliferae, Scitamineae, Dioscoreaceae, Orchidaceae, Liliaceae, Arecaceae, Typhaceae, Araceae, Cyperaceae, Gramineae; Cupressaceae, Pinaceae, Cycadaceae, Gnetaceae

**4. Plant Anatomy:** Basic structure and function of plant cells: Parenchyma, Collenchyma, Sclerenchyma;Tissue systems: Dermal, Ground, and Vascular tissues, Primary and secondary growth in plants, Structure and function of xylem and phloem;Meristematic tissues: Apical, Lateral, and Intercalary meristems; Xylem: Types of tracheary elements (tracheids, vessels), fibers, and parenchyma; Phloem: Sieve elements, companion cells, phloem parenchyma, and fibers; Vascular bundles: Arrangement in dicots and monocots (Stem, Roots and Leaves); Structure of wood: Xylem tissue, formation of growth rings, early wood and late wood, Heartwood and Sapwood; Vessels and tracheids: Role and structure, Bordered pits, Tyloses, Stomata and their types, Anomalous secondary growth, Anatomy of C 3 and C 4 plants, Dendrochronology, Fossil wood.

**Tools and Techniques in Plant Anatomy:** Light microscopy: Bright field, phase contrast, and fluorescence microscopy, Electron microscopy: Transmission and Scanning Electron Microscopy (TEM, SEM), Confocal microscopy and its application in plant tissue analysis, Preparation of plant tissues for microscopic study (fixation, embedding, sectioning), Staining methods for specific tissue identification. Microtomy: Types of microtomes and their application, Techniques for preparing thin sections of wood, leaves, roots, and stems, Maceration techniques for isolating plant cells.

**Plant Embryology:** Male and female gametophytes: Development and structure of pollen grain and ovule, Pollination mechanisms: Abiotic and biotic agents of pollination, Fertilization process: Pollen tube growth and double fertilization in angiosperms

**Embryogenesis:** Development of the zygote into the proembryo, Developmental stages of the embryo: Globular, heart-shaped, and torpedo stages, Formation of cotyledons, epicotyl, hypocotyl, and radicle, Embryonic tissue differentiation: Meristematic regions, vascular tissues; Types of endosperm: Nuclear, cellular, and helobial; Seed development and maturation; Seed coat development and role in protection, Dormancy mechanisms and factors influencing seed germination, Polyembryony, Apomixis, Application of palynology.

**5. Microbiology and Plant Pathology:** Viruses, bacteria, and plasmids-structure and reproduction. Phyto-immunology. Applications of microbiology in agriculture, industry, medicine and pollution control in air, soil and water. Important plant diseases caused by viruses, bacteria, mycoplasma, fungi and nematodes. Mode of infection and dissemination. Molecular

basis of infection and disease resistance/defence. Physiology of parasitism and control measures. Fungal toxins, Modelling and disease forecasting, Plant quarantine.

- 6. Plant Utility and Exploitation: Origin of cultivated plants, Vavilov's centres of origin. Plants as sources for timber, food, fodder, gums, resins, dyes, fibres, spices, beverages, drugs, narcotics and insecticides. Importance of Ethnobotany, Energy plantation.
- **7. Morphogenesis:** Totipotency, polarity, symmetry and differentiation. Cell, tissue, organ and protoplast culture. Somatic hybrids and Cybrids.
- 8. Cell Biology: Techniques of Cell Biology. Prokaryotic and eukaryotic cells -structural and ultrastructural details. Structure and function of extracellular matrix or ECM (cell wall) and membranes-cell adhesion, membrane and vesicular transport. Structure and function of cell organelles, Nucleus, nucleolus, nuclear pore complex. Chromatin and nucleosome. DNA and RNA. Cell signalling and cell receptors. Signal transduction (G-1 proteins, etc.). Mitosis and meisdosis; molecular basis of cell cycle. Numerical and structural variations in chromosomes and their significance. Study of polytene, lampbrush and B-chromosomes structure, behaviour and significance.
- **9.** Genetics, Molecular Biology and Evolution: Development of genetics, gene versus allele concepts (Pseudoalleles). Quantitative genetics and multiple factors. Linkage and crossing over, methods of gene mapping. Sex chromosomes and sex-linked inheritance, sex determination and molecular basis of sex differentiation. Mutation (biochemical and molecular basis). Cytoplasmic inheritance and cytoplasmic genes. Prions and prion hypothesis. Structure and synthesis of nucleic acids and protines. Genetic code and regulation of gene expression. Multigene families. Organic evolution-evidences, mechanism and theories.
- 10. Plant Breeding, Biotechnology and Biostatistics: Methods of plant breeding -- introduction, selection and hybridization (pedigree, backcross, mass selection, bulk method). Male sterility and heterosis breeding. Use of apomixis in plant breeding. Micropropagation and genetic engineering methods of transfer of genes and transgenic crops; development and use of molecular markers in plant breeding.

- 11. Physiology and Biochemistry: Water relations, Mineral nutrition and ion transport, mineral deficiencies. Photosynthesis, Respiraion. Nitrogen fixation. Enzymes, coenzymes, energy transfer and energy conservation. Importance of secondary metabolites. Pigments as photoreceptors. Photoperiodism and flowering, senescence. Growth substances-their chemical nature, growth indices, growth movements. Stress physiology. Fruit and seed physiology. Dormancy, storage and germination of seed. Fruit ripening
- 12. Ecology and Plant Geography: Ecological factors. Concepts and dynamics of community. Plant succession. Concepts of biosphere. Ecosystems and their conservation. Pollution and its control. Phytogeographical and biogeographical regions of India. Protected Areas. Forest types of India, afforestation, deforestation and social forestry. IUCN, CITES, IPCC, Threatened species, Endemism and Red Data Books. Convention of Biological Diversity (CBD), Sovereign Rights and Intellectual Property Rights. Global warming.