

# BOTANY

## PAPER-I

### 1. Microbiology and Plant Pathology :

Structure and reproduction/multiplication of viruses, viroids, bacteria, fungi and mycoplasma; Applications of microbiology in agriculture, industry, medicine and in control of soil and water pollution; Prion and Prion hypothesis.

Important crop diseases caused by viruses, bacteria, mycoplasma, fungi and nematodes; Modes 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.

### 2. Cryptogams :

Algae, fungi, lichens, bryophytes, pteridophytes—their structure and reproduction from evolutionary viewpoint; Distribution of Cryptogams in India and their ecological and economic importance

### 3. Phanerogams :

- Gymnosperms: Concept of Progymnosperms. Classification and distribution of gymnosperms. Salient features, Cycadales, Ginkgoales, Coniferales and Gnetales, their structure and reproduction. General account of Cycadofilices, Bennettitales and Cordaitales; Geological time scale; Type of fossils and their study techniques.
- Angiosperms: Systematics, anatomy, embryology, palynology and physiology.
- Taxonomic hierarchy; International Code of Botanical Nomenclature; Numerical taxonomy and chemotaxonomy; Evidence from anatomy, embryology and palynology.
- Origin and evolution of angiosperms; Comparative account of various systems of classification of angiosperms; Study of angiosperm families—Magnoliaceae, Ranunculaceae, Brassicaceae, Rosaceae, Fabaceae, Euphorbiaceae, Malvaceae, Dipterocarpaceae, Apiaceae, Asclepiadaceae, Verbenaceae, Solanaceae, Rubiaceae, Cucurbitaceae, Asteraceae, Poaceae, Arecaceae, Liliaceae, Musaceae and Orchidaceae.
- Stomata and their types; Glandular and non-glandular trichomes; Unusual secondary growth; Anatomy of C<sub>3</sub> and C<sub>4</sub> plants; Xylem and phloem differentiation; Wood anatomy.
- Development of male and female gametophytes, pollination, fertilization; Endosperm—its development and function. Patterns of embryo development

Development; Polyembryony; apomixes; Applications of palynology; Experimental embryology including pollen storage and test-tube fertilization.

#### 4. Plant Resource Development:

- Domestication and introduction of plants; Origin of cultivated plants, Vavilov's centres of origin.
- Plants as sources for food, fodder, fibres, spices, beverages, edible oils, drugs, narcotics, insecticides, timber, gums, resins and dyes; latex, cellulose, starch and its products; Perfumery; Importance of Ethnobotany in Indian context; Energy plantations; Botanical Gardens and Herbaria.

#### 5. Morphogenesis:

- Totipotency, polarity, symmetry and differentiation; Cell, tissue, organ and protoplast culture.
- Somatic hybrids and Cybrids; Micropropagation; Somaclonal variation and its applications; Pollen haploids, embryo rescue methods and their applications.

### PAPER-II

#### 1. Cell Biology:

- Techniques of cell biology. Prokaryotic and eukaryotic cells—structural and ultrastructural details; Structure and function of extracellular matrix (cell wall) and membranes—cell adhesion, membrane transport and vesicular transport; Structure and function of cell organelles (chloroplasts, mitochondria, ER, dictyosomes ribosomes, endosomes, lysosomes, peroxisomes; Cytoskeleton and microtubules; Nucleus, nucleolus, nuclear pore complex; Chromatin and nucleosome).
- Cell signalling and cell receptors; Signal transduction; Mitosis and meiosis; molecular basis of cell cycle.
- Numerical and structural variations in chromosomes and their significance; Chromatin organization and packaging of genome; Polytene chromosomes; B-chromosomes—structure, behaviour and significance.

#### 2. Genetics, Molecular Biology and Evolution:

- Development of genetics, and gene versus allele concepts (Pseudoalleles); Quantitative genetics and multiple factors; Incomplete dominance, polygenic inheritance, multiple alleles.
- Linkage and crossing over of gene mapping including molecular maps (idea of mapping, function); Sex chromosomes and sex-linked inheritance; sex determination and molecular basis of sex differentiation; Mutations (biochemical and molecular basis); Cytoplasmic inheritance and cytoplasmic genes (including genetics of male sterility).

- Structure and synthesis of nucleic acids and proteins; Genetic code and regulation of gene expression; Gene silencing; Multigene families; Organic evolution—evidences, mechanism and theories.
- Role of RNA in origin and evolution.

### 3. Plant Breeding, Biotechnology and Biostatistics:

- Methods of plant breeding—introduction, selection and hybridization (pedigree, backcross, mass selection, bulk method); Mutation, polyploidy, male sterility and heterosis breeding.
- Use of apomixes in plant breeding; DNA sequencing; Genetic engineering—methods of transfer of genes; Transgenic crops and biosafety aspects; Development and use of molecular markers in plant breeding; Tools and techniques—probe, southern blotting, DNA fingerprinting, PCR and FISH.
- Standard deviation and coefficient of variation (CV). Tests of significance (Z-test, t-test and chi-square tests). Probability and distributions (normal, binomial and Poisson). Correlation and regression.

### 4. Physiology and Biochemistry:

- Water relations, mineral nutrition and ion transport, mineral deficiencies.
- Photosynthesis—photochemical reactions, photophosphorylation and carbon fixation pathways; C<sub>3</sub>, C<sub>4</sub> and CAM pathways; Mechanism of phloem transport; Respiration (aerobic and anaerobic, including fermentation)—electron transport chain and oxidative phosphorylation; Photorespiration; Chemiosmotic theory and ATP synthesis; Lipid metabolism; Nitrogen fixation and nitrogen metabolism.
- Enzymes, coenzymes; Energy transfer and energy conservation. Importance of secondary metabolites.
- Pigments as photoreceptors (plastidial pigments and phytochrome).
- Plant movements; Photoperiodism and flowering, vernalization, senescence; Growth substances—their chemical nature, role and applications in agri-horticulture; growth indices, growth movements.
- Stress physiology (heat, water, salinity, metal); Fruit and seed physiology. Dormancy, storage and germination of seed. Fruit ripening—its molecular basis and manipulation.

### 5. Ecology and Plant Geography:

- Concept of ecosystem; Ecological factors. Concepts and dynamics of community; Plant succession.
- Concepts of biosphere; Ecosystems; Conservation; Pollution and its control (including phytoremediation); Plant indicators; Environment (Protection) Act.
- Forest types of India—Ecological and economic importance of forests, afforestation, deforestation and social forestry; Endangered plants, endemism IUCN categories, Red Data Books; Biodiversity and its conservation; Protected Area Network.