

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-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 of Cycadales, Ginkgoales, Coniferales and Gnetales, their structure and reproduction. General account of Cycadofilicales, Bennettitales and Cordaitales;
 - Geological time scale;
 - Type of fossils and their study techniques.
- **Angiosperms** : Systematics, anatomy, embryology, palynology and phylogeny.
- 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 angiospermic families—Mangnoliaceae, 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 C3 and C4 plants; Xylem and phloem differentiation; Wood anatomy.
- Development of male and female gametophytes, pollination, fertilization;
- **Endosperm**—its development and function. Patterns of embryo 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, Government strives to have a workforce which reflects gender balance and women candidates are encouraged to apply. 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. Government strives to have a workforce which reflects gender balance and women candidates are encouraged to apply. Photosynthesis—photochemical reactions, photophosphorylation and carbon fixation pathways; C₃, C₄ and CAM pathways;
- Mechanism of phloem transport, Respiration (anaerobic and aerobic, 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 agriculture; 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;
- Convention of Biological Diversity, Farmers' Rights; and Intellectual Property Rights;
- Concept of Sustainable Development;
- Biogeochemical cycles. Global warming and climatic change; Invasive species;
- Environmental Impact Assessment; Phytogeographical regions of India.