

UPSC CSE Botany Syllabus 2024

The UPSC CSE Botany syllabus 2024 covers plant diversity, physiology, genetics, biochemistry, ecology, and related domains. Aspirants have to study plant taxonomy, cell biology, plant breeding, morphology, and other topics for this paper. The botany syllabus evaluates conceptual knowledge and applied skills relevant for civil services roles involving agriculture, environment conservation, and rural development.

UPSC CSE Botany Syllabus 2024 Paper 1

1. Microbiology and Plant Pathology:

- Structure and reproduction/multiplication of viruses, viroids, bacteria, fungi, and mycoplasma.
- Applications of microbiology in agriculture, industry, medicine, and 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/defense.
- 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 an 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—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 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 centers of origin.
- Plants as sources for food, fodder, fibers, spices, beverages, edible oils, drugs, narcotics, insecticides, timber, gums, resins, and dyes.
- Latex, cellulose, starch, and its products.
- Perfumery.
- Importance of Ethnobotany in the 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.

UPSC CSE Botany Syllabus 2024 Paper 2

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.
- Cytoskeleton and microtubules.
- Nucleus, nucleolus, nuclear pore complex.
- Chromatin and nucleosome.
- Cell signaling and cell receptors.
- Signal transduction.
- Mitosis and meiosis; molecular basis of the cell cycle.
- Numerical and structural variations in chromosomes; significance of chromatin organization.
- Polytene chromosomes.
- B-chromosomes—structure, behavior, and significance.

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

- Development of genetics; gene versus allele concepts (Pseudoalleles).
- Quantitative genetics and multiple factors.
- Incomplete dominance, polygenic inheritance, multiple alleles.
- Linkage and crossing over of gene mapping; molecular maps.
- Sex chromosomes and sex-linked inheritance; sex determination.
- 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.
- Mutation, polyploidy, male sterility, and heterosis breeding.
- Use of apomixis in plant breeding.
- DNA sequencing.

- Genetic engineering—methods of gene transfer.
- 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.
- 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 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.
- 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.

