

BOTANY OPTIONAL SYLLABUS FOR UPSC CSE MAINS PDF DOWNLOAD

UPSC Botany Optional Syllabus

The UPSC Botany optional syllabus consists of 2 papers. Each paper in the Botany syllabus for UPSC will comprise 250 marks, totalling 500 marks. The time allotted to complete each UPSC Biology paper will be 3 hours. Each paper will contain objective answer-type questions. There is no negative marking.

Overview of UPSC Botany Syllabus

Sl. No.	UPSC IAS Mains Papers	Subject	Mark
1	Paper VI	Optional Subject Paper-I	250
2	Paper VII	Optional Subject Paper-II	250
Total			500
Time Duration			3 hours

UPSC Botany Optional Syllabus: Paper 1

Some of the significant and fundamental topics that have been included in the Botany UPSC syllabus of optional paper 1 include:

- Cell Biology focuses on the structural and functional features of plant cells, including the cell division cycle.
- Genetics covers the principles of inheritance, gene interactions, and mutations.
- Molecular Biology examines the mechanisms of DNA replication, transcription, and translation, as well as the regulatory mechanisms that control gene expression.
- Microbiology and Plant Pathology address the structures and reproduction of microbes, immunology, and the diseases affecting plants.
- Plant Morphology and Anatomy provides a comparative study of the roots, stems, leaves, and reproductive parts of various plants, establishing a foundational understanding of Botany for students.

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UPSC Botany Optional Syllabus for Paper 1

Topics	Sub-Topics
Microbiology and Plant Pathology	<p>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; Prions and the Prion hypothesis.</p> <p>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.</p>
Cryptogams	<p>Algae, fungi, lichens, bryophytes, pteridophytes—structure and reproduction from an evolutionary viewpoint; Distribution of Cryptogams in India and their ecological and economic importance.</p>
Phanerogams	<p>Gymnosperms: Concept of Progymnosperms. Classification and distribution of gymnosperms. Salient features of Cycadales, Ginkgoales, Coniferales and Gnetales, their structure and reproduction.</p> <p>A general account of Cycadofilicales, Bennettitales and Cordaitales; Geological time scale; Types of fossils and their study techniques.</p> <p>Angiosperms: Systematics, anatomy, embryology, palynology and phylogeny. Taxonomic hierarchy; International Code of Botanical Nomenclature; Numerical taxonomy and chemotaxonomy; Evidence from anatomy, embryology and palynology.</p>

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Topics	Sub-Topics
 Plant Resource Development	<p>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.</p> <p>Stomata and their types; Glandular and non-glandular trichomes; Unusual secondary growth; Anatomy of C3 and C4 plants; Xylem and phloem differentiation; Wood anatomy.</p> <p>Development of male and female gametophytes, pollination, fertilisation; Endosperm—its development and function. Patterns of embryo development; Polyembryony, apomixis; Applications of palynology; Experimental embryology, including pollen storage and test-tube fertilisation.</p> <p>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 the Indian context; Energy plantations; Botanical Gardens and Herbaria.</p>
	<p>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.</p>

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UPSC Botany Optional Syllabus: Paper 2

The UPSC Botany Optional Syllabus Paper 2 also addresses specialised issues.

- Study of ecology, focusing on important physiological processes of plants such as photosynthesis, respiration, growth regulators, and their responses to environmental stress conditions.
- The ecology section includes discussions on ecosystems, biogeochemical cycles, conservation of biodiversity, and ecological principles that aid in understanding patterns and processes in environmental interactions.
- Economic Botany covers the origin of cultivated plants, emphasises sustainable agriculture, and highlights the industrial importance of various plants.
- Cell Biotechnology, which includes topics like plant tissue culture, genetic engineering, and the biotechnological applications of these techniques in agriculture and related fields.

UPSC Botany Optional Syllabus for Paper 2

Topics	Sub-Topics
Cell Biology	<p>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.</p> <p>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.</p> <p>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 organisation and packaging of the genome.</p> <p>Polytene chromosomes; B-chromosomes—structure, behaviour, and significance.</p>

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Topics	Sub-Topics
Genetics, Molecular Biology and Evolution	<p>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, including molecular maps.</p> <p>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).</p> <p>Structure and synthesis of nucleic acids and proteins; Genetic code and regulation of gene expression; Gene silencing; Multigene families; Organic evolution—evidence, mechanism, and theories.</p> <p>Role of RNA in origin and evolution.</p>
Plant Breeding, Biotechnology and Biostatistics	<p>Methods of plant breeding—introduction, selection, and hybridisation (pedigree, backcross, mass selection, bulk method); Mutation, polyploidy, male sterility and heterosis breeding.</p> <p>Use of apomixis in plant breeding; DNA sequencing; Genetic engineering—methods of transfer of genes; Transgenic crops and biosafety aspects.</p> <p>Development and use of molecular markers in plant breeding; Tools and techniques—probe, Southern blotting, DNA fingerprinting, PCR and FISH.</p> <p>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.</p>

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Topics	Sub-Topics
Physiology and Biochemistry	<p>Water relations, mineral nutrition and ion transport, mineral deficiencies.</p> <p>Photosynthesis—photochemical reactions, photophosphorylation and carbon fixation pathways; C₃, C₄ and CAM pathways.</p> <p>Mechanism of phloem transport, Respiration (anaerobic and aerobic, including fermentation)—electron transport chain and oxidative phosphorylation; Photorespiration; Chemiosmotic theory and ATP synthesis.</p> <p>Lipid metabolism; Nitrogen fixation and nitrogen metabolism. Enzymes, coenzymes; Energy transfer and energy conservation. Importance of secondary metabolites.</p> <p>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.</p> <p>Stress physiology (heat, water, salinity, metal); Fruit and seed physiology. Dormancy, storage, and germination of seed. Fruit ripening—its molecular basis and manipulation.</p>
Ecology and Plant Geography	<p>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.</p>

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Topics	Sub-Topics
	<p>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.</p> <p>Protected Area Network; Convention on Biological Diversity, Farmers' Rights; Intellectual Property Rights. Concept of Sustainable Development. Biogeochemical cycles.</p> <p>Global warming and climatic change; Invasive species; Environmental Impact Assessment; Phytogeographical regions of India.</p>



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