

**BOTANY -Syllabus-UPHESC-Assistant-Professor**  
**U.P. HIGHER EDUCATION SERVICES COMMISSION,**  
**PRAYAGRAJ**  
**\_(Subject Code-71)**

1. **Cell Biology:** Cell as structural and functional unit of life, Prokaryotic and eukaryotic cells- structural and ultra structural details; Structure and function of extracellular matrix (cell wall), membranes-cell adhesion, membrane transport and vesicular transport; Structure and function of cell organelles (chloroplasts, mitochondria, FR, dictyosomes ribosomes, endosomes, lysosomes, peroxisomes); Cytoskeleton and microtubules; Nucleus, nucleus, nuclear pore complex; Chromatin and nucleosome; Cell signaling 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 -structural, behaviour and significance.
2. **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 disease resistance/defence mechanisms. PR proteins, Control measures; Mycotoxins.
3. **Cryptogams:** Algae, fungi, lichens, bryophytes, pteridophytes- structure and reproduction from evolutionary viewpoint; Distribution of Cryptogams in India and their ecological and economic importance.
4. **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. International Code of Botanical Nomenclature; Numerical taxonomy and chemotaxonomy; Evidence from, embryology and palynology.

Comparative account of various systems of classification of angiosperms; Study of angiospermic families Magnoliaceae, Ranunculaceae, Cappparidaceae, Cucurbitaceae, Apiaceae, Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Acanthaceae, Lamiaceae, Verbenaceae, Arecaceae, Liliaceae, Musaceae, Orchidaceae, Poaceae.

Unusual secondary growth; Development of male and female gametophytes, fertilization; Endosperm- its development and function; patterns of embryo development; Polyembryony and apomixis; Applications of palynology; Experimental embryology including anther culture, embryo culture and test-tube fertilization.

5. **Plant Resource Development:** Domestication and introduction of plants; Plants as sources for food, fodder, fibre, 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.
6. **Morphogenesis:** Totipotency, polarity, symmetry and differentiation; Cell, tissue, organ and protoplast culture; Somatic hybrids and Cybrids; Micropropagation; Somaclonal variation and its applications.
7. **Genetics & Evaluation:** Gene versus allele concepts (Pseudoalleles); Quantitative genetics and multiple factors; incomplete dominance, polygenic inheritance, multiples; Linkage and crossing over; Methods 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 Back cross).

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.

8. **Biotechnology, Molecular Biology and Biostatistics:** Use of apomixis 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.

DNA gene manipulating enzymes: Endonuclease, exonuclease, Ligase, Polymerase, Phosphatase, Transcriptases, transfarases

DNA damage and repair, Gene cloning

Standard deviation and coefficient of variation (CV); Tests of significance (Z-test, t-test and chi-square test); Probability and distributions (normal, binomial and Poisson); Correlation and regression.

- 9. Physiology and Biochemistry:** Water relations, mineral nutrition and ion transport, mineral deficiencies; Photosynthesis photochemical relations; 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.
- 10. Ecology and Plant Geography:** Concept of ecosystem; Ecological factors; Concept and dynamics of community; Plant succession; Concept 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, Hot spots, IUCN categories, Red Data Books; Biodiversity and its conservation; Protected Area Network; Convention on 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.