

UNIVERSITY OF JAMMU
DEPARTMENT OF BOTANY
SYLLABUS FOR ENTRANCE TEST FOR Ph.D. IN BOTANY [2026-2027]

UNIT-1

1.1 Cell Biology

Plasma membrane - structure & functions

Chloroplasts & Mitochondria - structure, function and organization. Endoplasmic reticulum and Golgi apparatus - structure & function

1.2 Molecular Biology

DNA and RNA - structure, types and functions, Replication, Transcription, Splicing and Translation.

Protein trafficking - cotranslational and post-translational

Cell cycle and apoptosis – role of cyclins and CDKs, control mechanisms

1.3 Cytology, Genetics and Cytogenetics

Molecular organization of centromere and telomere

Recombination - site specific and generalized, molecular mechanism, Holliday model Somatic cell genetics.

DNA damage and repair; Transposons in pro- and eukaryotes

Transfer of whole genome, individual chromosomes and chromosome segments

UNIT-2

2.1 Microbiology

General characteristics, ultrastructure, reproduction and economic importance of Eubacteria, Archaeobacteria, Phytoplasmata, Plant viruses and Fungi

2.2 Biology of Lower Plants

Life cycle patterns among algae, bryophytes and pteridophytes, alternation of generations and its significance

Diversity in plant organization, sporophytic diversity among bryophytes and pteridophytes

Economic importance of algae, bryophytes and pteridophytes

2.3 Gymnosperms

General characters of gymnosperms; their distribution in India

Structure and reproduction in Cycadales, Ginkgoales, Ephedrales, Welwitschiales and Gnetales

Concept of progymnosperms; economic importance of gymnosperms

UNIT-3

3.1 Taxonomy of Angiosperms

Concept of artificial, natural and phylogenetic system of classifications

Taxonomic hierarchies, Taxonomic tools, Basic knowledge of ICBN

Endemism *vis-a-vis* hotspots with respect to Indian flora

3.2 Plant Development

Seed – dormancy and seed germination; seedling development

Organization of RAM and SAM: secretory ducts and laticifers

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3.3 Plant Reproduction

Flower development - MADS box concept, Male sterility-phenomenon and implications
Self-incompatibility: types and genetics. Embryo and endosperm development
Apomixis; Fruit development and ripening. Seed structure and function

UNIT-4

4.1 Plant Physiology and Metabolism

Concept of water potential, structure and functions of ATP, passive and active solute transport, physiological effects and mechanism of action of growth regulators: concept & role of photoperiodism and vernalization

Electron and proton transport, C₃, C₄ and CAM pathways in photosynthesis, photorespiration, structure and function of lipids, fatty acid synthesis, Biological nitrogen fixation, sulphate transport and assimilation

4.2 Genetic Engineering

Gene cloning technique, restriction endonucleases, plasmids and phages as vectors
Gene transfer methods in plants, transgenic plants for herbicide tolerance and insect resistance
Artificial chromosomes (BAC and YAC), Aims, objectives and major achievements of Human Genome Project

4.3 Plant Tissue Culture

Concept and application of somatic embryogenesis and synthetic seed production, disadvantages of long term cultures

Protoplast isolation, culture, fusion, hybrid selection and regeneration, genetic consequences of protoplast fusion, hybrids versus cybrids, applications of protoplast research

Applications and limitations of micropropagation. Origin, prospects and achievements of somaclonal variation

UNIT-5

5.1 Ecology

Nature and concept of biotic communities; life forms and biological spectrum; succession-mechanism & models

Concept of ecosystems, energy flow; Biogeochemical cycles; Pollution – sources, types and control

Environmental impact assessment; sustainable development, ecological management

5.2 Plant Resource Utilization

Origin of agriculture; centers of origin of crop plants; cereals and legumes as sources of food; medicinal plants of Jammu and Kashmir

Timber and forage plants; alcoholic beverages; green revolution; sustainable utilization of plant resources

5.3 Plant Resource Conservation

Biodiversity-concept and concerns; concept of rare, threatened and endangered plants; priorities for conservation; *in situ* and *ex situ* conservation-methods and limitations

Role of markets, educational institutions, governments and religious beliefs in conservation; activities and role of IUCN, WWF, ICAR and NBPGR in plant conservation