

Department of Botany
Punjabi University, Patiala 147002
(Established under Punjab Act No. 35 of 1961)

Syllabus for Ph. D. Entrance Test for Session 2024-25

Section-A

(Research Methodology)

1. **TECHNIQUES IN MOLECULAR BIOLOGY:** Techniques of molecular biology and recombinant DNA technology and their applications. Bioinformatics & its applications.
2. **CELL AND TISSUE CULTURE TECHNIQUES:** Requirements and Techniques for micro propagation of plants, embryo, anther and pollen culture, applications of cell and tissue culture.
3. **ANATOMICAL AND HISTOCHEMICAL TECHNIQUES:** Stains and staining techniques; Maceration; Principle of fixation, types of fixatives and their applications, Functioning and application of microtomy. Principle and methods of histochemical localization of biomolecules.
4. **CENTRIFUGATION:** Principle, functioning and applications of low speed, high speed and ultracentrifugation.
5. **SPECTROSCOPY:** Principle, functioning and applications of UV-visible spectrophotometry, spectrofluometry.
6. **ELECTROPHORESIS:** Principle, functioning and applications of simple and 2D gel electrophoresis.
7. **CHROMATOGRAPHIC TECHNIQUES:** Principle and applications of paper chromatography, column chromatography, thin layer chromatography, Ion Exchange, Gel filtration chromatography and Gas HPLC chromatography, LC-MS, NMR.
8. **MICROSCOPIC TECHNIQUES:** Principle and applications of light microscopy phase contract microscope, scanning and transmission electron microscopy.
9. **IMMUNOTECHNIQUES:** Detection of biomolecules using ELISA, RIA, western blotting, immunoprecipitation immuno-fluorescence microscopy.
10. **CHROMOSOME TECHNIQUES:** Fixation of buds for cytological studies, stains for chromosome staining, chromosome techniques, FISH and GISH.

Section-B

(Subject)

1. **DIVERSITY OF LIFE FORMS:** Principles and methods of taxonomy and outlines of latest criteria for classification of Algae, Fungi, Bacteria and Plants. Reproduction and evolutionary relationships among taxa of different groups of organisms.
2. **CELL BIOLOGY AND CYTOGENETICS:** Membrane structure and function; Structural organization and functions of intracellular organelles; Organization of genes and chromosomes; Cell division & cell cycle. Genomatic (Chromosomal aberrations, aneupoidy, polyploidy) and point mutations.
3. **FUNDAMENTAL PROCESSES:** DNA replication, repair and recombination; RNA synthesis and processing; Protein synthesis; Control of gene expression at transcription and translation level; Host parasite interaction against pathogens in plants;
4. **DEVELOPMENTAL BIOLOGY:** Microsporogenesis, Megasporeogenesis and Post fertilization development. Morphogenesis and organogenesis in plants. Programmed cell death, aging and senescence.
5. **PLANT PHYSIOLOGY:** Photosynthesis; Respiration & photorespiration; Nitrogen metabolism; Plant hormones, their mechanism of action and functions; Sensory photobiology; Solute transport & photoassimilate translocation; Secondary metabolites; Stress physiology; Signal transduction in plants.
6. **MOLECULES & THEIR INTERACTION:** Bioenergetics, coupled reaction, group transfer, biological energy transducers; Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes; Conformation of proteins (Ramachandran plot, 2^o, 3^o & 4^o structures; domains; motif and folds); Conformation of nucleic acids (A-, B-, Z-, DNA), t-RNA, micro-RNA).
7. **ECOLOGICAL PRINCIPLES:** The Environment; Habitat and niches; Population ecology; Species interactions; Community ecology; Ecological succession; Ecosystem; Environmental pollution; global environmental change; Conservation biology
8. **APPLIED BIOLOGY:** Transgenic plants, molecular approaches for diagnosis and strain identification; Genomics and its application to health and agriculture; Bioresource and uses of biodiversity; Breeding in plants, including marker – assisted selection; Bioremediation and phytoremediation; Economic importance of Algae, Fungi, Lichens and Bacteria. Plants as a source of Food, Timber, Drugs, Essential oils, Rubber, Beverages and Fiber. Metabliomics.