

Syllabus for Ph.D. Entrance Test (PET) 2026

Department of Botany

Part A: Research Methodology

S. No.	Subject Area	Number of questions
I	Principles and uses of Flame Photometry, Spectrophotometry (UV/Vis, Fluorescence and Atomic absorption), Isolation, separation and analysis of biological macromolecules (DNA, RNA, proteins, carbohydrates and lipids); Paper and Thin layer chromatography (TLC), Gas Liquid chromatography (GLC), Column chromatography, Ion exchange chromatography, Gel exclusion chromatography, High Performance Liquid chromatography (HPLC), Affinity chromatography, Centrifugation (Ultracentrifugation and Density gradient centrifugation), Electrophoresis, Microbial techniques – Media preparation and sterilization, Inoculation and growth monitoring, Use of fermentations, Microbial assays, Microscopy–Electron microscope. Methods of tissue culture.	20
II	Field and Herbarium techniques: Plant Collection and Documentation: Methods of collecting plants; Herbarium Specimens' preparations, Methods in determining dose effects: determination of LD50 and RD50, Phenotyping of Mutants: Phenotypic evaluation of quantitative and qualitative traits in M ₁ and M ₂ generations, Molecular techniques and methods for mutation detection and screening in plants, TILLING, Molecular analysis of genes: Southern blotting, Northern blotting, DNA sequencing, PCR, RT-PCR and DNA microarray technology, <i>In situ</i> hybridization techniques: FISH, GISH, CRISPR Cas 9 technology, Tools for analyzing gene expression: Antisense technology, analysis of DNA protein interactions – EMSA, ChIP, DNase I foot printing, analysis of protein-protein interactions– Pull down assay, yeast two hybrid assay, Coimmunoprecipitation assay, FRET, Methods of study of fossils and carbon dating technique.	20
III	Sampling techniques, Measures of central tendency (i.e. Mean, Median and Mode), Standard deviation, Standard error, Mean deviation, Analysis of variance (ANNOVA), null hypothesis, Correlation and regression, t-test, F-test, Chi-square (χ^2) test.	10

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Part B: Botany


S. No.	Subject Area	Number of questions
I	General characteristics, life cycle and classification of Cyanophyta, Chlorophyta and Xanthophyta. Prochlorophyta, Charophyta, Euglenophyta, Pyrrophyta, Bacillariophyta and Cryptophyta. Diversity in Bryophytes: Habit and Habitat; Developmental morphology and- organization of gametophyte and sporophyte bodies, Comparative study of morphology, anatomy, life history, classification and phylogeny of the Calobryales, Sphaerocarpaceae, Marchantiales, Anthocerotales, Andreaeales and Bryales	5
II	General characteristics, life cycle and classification of Myxomycetes, Plasmodiophoromycetes, Chytridiomycetes, Oomycetes, Zygomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes, Heterokaryosis, Parasexuality, Heterothallism in fungi, Mycorrhizae: Types and significance, Brief history of plant viruses and their origin, Mode of infection and replication of plant viruses, Basic control measures and production of virus-free plants, general description of viroids, virusoids, satellite viruses and Prions	5
III	Classification and origin of Pteridophytes; The vegetative sporophyte; Microphylls and megaphylls; Stelar theory; Telome theory; The fertile sporophyte: sporangia; position, ontogeny. Types, structure. Heterospory, general description of Pteridospermales, Glossopteridales, Caytoniales, Cycadales Bennettitales, Ginkgoales, Coniferales and Gnetales. Fossil history of Bryophytes, Pteridophytes and Gymnosperms	5
IV	Bacterial photosynthesis, Bacterial fermentative pathways: lactic acid, propionic acid, mixed and butanol fermentation, Genetic analysis of bacteria: Conjugation: molecular mechanism of gene transfer and regulation. Conjugation mapping, Plasmids: types, function and application. Transformation: molecular mechanism of transformation. Transduction: Generalized and specialized transduction-T4, T7 and lambda phages. Lysogenic phages: genome organization and its regulation, Nitrogen metabolism, <i>Nif</i> genes: functions and regulation, Antibiotics and their mode of action. Basic principles of immunology, vaccines and antibodies.	5
V	Basic concepts of Molecular Systematics, Botanical nomenclature: International code of nomenclature (ICN); Principles: rules and recommendations, Field and Herbarium techniques: Plant Collection and Documentation: Methods of collecting plants; Herbarium Specimens' preparations; Role of Botanic Gardens in conservation of biodiversity, economic importance of	5

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	Monocotyledons and Dicotyledons.	
VI	Phylogeny of Angiosperms; Morphology of flower; Morphology of carpel and ontogeny of inferior Ovary, Fertilization: double fertilization, self-incompatibility mechanisms, somatic embryogenesis; apomixis, polyembryony and its induction, Induced Parthenocarpy, Primary meristem organization of shoot and root apices, Development of organs: organ identity, key regulatory mechanisms in development of size and shape of specific organs, Cambium and its derivative tissues, differentiation of secondary xylem and secondary phloem, Cork cambium and its derivatives, Anatomy of floral organs	5
VII	Plant cell wall: structure and function. Cell membrane: structure and function. Solute transport across the membrane: passive transport, primary active and secondary active transport. Membrane transport systems: ion channels and its types, aquaporins, P-type, V-type, F-type ATPases, ABC transporters, endomembrane system. Vesicular trafficking. Plasmodesmata. Nucleus and nuclear pore complex (NPC), Cytoskeleton, Cell signaling, G-protein, GPCRs, second messengers, membrane derived messengers, serine/threonine kinases and receptor tyrosine kinases (RTKs), Ca ²⁺ - calmodulin-dependent protein kinases (CaM kinases), MAPK cascade, cell cycle, apoptosis, programmed cell death in plants, Concept of gene, allele, multiple allele, pseudoallele, complementation test, extensions of Mendelian principles, Quantitative inheritance, QTL mapping, population genetics, Hardy-Weinberg equilibrium (HWE), genetic drift, speciation, and adaptive radiation, Chemical properties of soil, Endemism, Indian endemic flora; Exotics and Alien flora. Hotspots and hottest hotspots of biodiversity	5
VIII	Composition, Structure and functions of carbohydrates, lipids and proteins, Enzymes: regulatory and active sites, activation energy, isozymes, Principles of catalysis, kinetics of enzymatic catalysis, Michaelis-Menten equation, its derivation and significance, Bioenergetics: Laws of thermodynamics and its application in biological systems, concept of entropy and enthalpy, concept of free energy, energy rich bonds and high energy compounds, energetic coupling. Substrate level phosphorylation,	5
IX	Photochemistry and Photosynthesis (C3, C4 and CAM pathways), Soil and plant water relationship, Mechanism of phloem loading and unloading, Stomatal physiology, Respiration in plants, Phytohormones (auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, jasmonates, salicylic acid and strigolactones), photoperiodism, Molecular mechanism of flowering in long day plant (<i>Arabidopsis thaliana</i>) and short day plant (rice: <i>Oryza sativa</i>), Sensory Photobiology, photochemical properties and	5

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	photophysiology of light induced responses by the photoreceptors: phytochromes, cryptochromes, phototropins, UVR-8 and zeitlupe (ZTL), Population Ecology, Community Ecology, Ecosystem Ecology	
X	Structure and form of DNA, Circular DNA in bacteria and chloroplast, packaging of DNA, C-value and C-value paradox, DNA replication in prokaryotes and eukaryotes, mechanisms of mutagenesis, DNA damage and repair mechanism, Mechanism of transcription and translation in prokaryotes and eukaryotes, Medicinal plants, Drugs and narcotics, Spices and flavoring materials, Vegetables, Gum and dye yielding plants, Latex yielding plants, teal coffee, rubber and Insecticide yielding plants, Principles of conservation; In situ conservation and <i>Ex-situ</i> conservation, Structural Changes in Chromosomes: Deletion, duplication, inversion (paracentric and pericentric), and translocation, Cytoplasmic male sterility, Experimental designs in plant breeding: randomized block design (RBD), completely randomized designs (CRD), latin square design (LSD), split plot design (SPD), lattice design (LD), and augmented design (AD)	5

 28/1/26
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