

Ph.D. Entrance Test - SYLLABUS  
OF  
**BOTANY**

**PART- 1**  
**RESEARCH METHODOLOGY (50%)**

1. **Research Methodology** : Introduction and definition of research, Selecting research problem, Steps of research, Hypothesis, Sampling, Experimental Research Methods, Errors in sampling, Variables in research, Different research designs, Review literature, Software's used in Research-SPSS,SAS, PAST etc. References.
2. **Analytical Methods in Biology : Microscopy and Autoradiography** : Tissue fixation and staining techniques, Principles of TEM & SEM, Phase Contrast, Fluorescence Microscopy, Autoradiography. Basic principles of Spectroscopy, UV-VIS, NMR, ESR, Principle of GC-MS, LC – MS Ion Exchange Chromatography, gel permeation, HPLC and FPLC. Principle and applications of Centrifugation techniques, principles of Electrophoresis, Agarose gel, native and SDS-PAGE, Isoelectric focusing, 2D-PAGE and their uses in protein research, Fractionation and Blotting Techniques, Antigen Antibody, Structure of Ig, Ig Classes & Biological Activities, Antigen-Antibody Interactions: ELISA Test, Agglutination, Precipitation, Immunofluorescence.
3. **Biostatistics & Computer Applications**: Significance tests: Student's 't' test: Hypotheses, acceptance and rejections, significance levels. Analysis of Variance: General principles, completely randomized and random-block design ANOVA. Regression and correlation – bivariate analysis. Chi-Square and its applications. Use of different software packages. Data Analysis, Graphics, PowerPoint Presentations.
4. **Methods in Cell & Molecular Biology, Genetics & Biochemistry**: Ultrastructure and role of Mitochondria, Chloroplasts, Lysosomes, Golgi Apparatus Peroxisomes & Glyoxisomes and other cellular organelles. Cytoskeleton, Ultrastructure and functions of Microtubules, microfilaments, Apoptosis: Mechanism and significance. Principles of Mendelian genetics, DNA Structure, Genetic Code, Loci, alleles, and Gene structure, spontaneous and induced mutations, Carbohydrates, Lipids and Fatty Acid metabolism, Protein Structure and Function, Principles and mechanism of enzymes catalysis, Coenzymes and cofactors, laws of thermodynamics, Glycolysis and Citric Acid Cycle,
5. **Methods in Biodiversity & Environmental Science**: Concepts of Biodiversity, Genetic, species and ecological diversity, Terrestrial, Marine Biodiversity, Eco-tourism and Biodiversity. Conservation and Sustainable use of Biodiversity. Ecosystem monitoring and Rehabilitation. Definition, principles and Scope of Environmental science. Threats to Biological Diversity: Habitat Destruction, Invasive species, Disease, Over-exploitation, Pollution, Climate change and Biodiversity. Structure and functions, abiotic and Biotic components, food chains, food web, ecological pyramids, population & community ecology and parasitism, prey-predator relationships, Air, Water and Soil pollution. Global Environmental problems: Ozone depletion, global warming and climatic change, clean development mechanism. EIA. Remote sensing and its applications of environmental sciences, Application of GIS in Environmental management.

**PART- 2**  
**CORE SUBJECT (BOTANY) (50%)**

**Taxonomy and diversity of plants:** Concept of species, Qualitative and quantitative methods in plant taxonomy, Biological nomenclature, Different classification systems, Rare and endangered species, conservation strategies, Cryptogams plants and their life cycles- Algae, fungi, Bryophytes, Pteridophytes, Angiosperm diversity, Gymnosperms diversity

**Anatomy & Morphogenesis:** Meristematic and permanent tissues of plants, Shoot and root apex organization Special and secretory tissues of plants, Types of tissue systems, Anatomical features of dicotyledonous and monocotyledonous plants, Secondary and anomalous growth in plants, Evolution of morphogenetic pattern, Organogenesis of root, stem and leaf, Organogenesis of bud, flower and inflorescence, Morphogenesis: light, temperature and precipitation affecting on morphogenesis

**Embryology:** Micro and Mega sporangium, Female and Male gametophyte, Fertilization, Endosperm Types Embryogenesis and types of embryo, Apomix, Polyembryony, Embryology in relation to taxonomy, Experimental Embryology

**Structure of Plant Communities:** Concept of community and continuum, Community analysis analytical character, Community analysis synthetic characters, Physiognomic characters, growth forms and sampling methods

**Community Metabolism and Dynamics:** Primary production, productivity and methods of measurement

Energy dynamics (energy flow pathways), Litter production and decomposition, Community change (ecological succession)

**Population dynamics and Autecology:** Population growth, carrying capacity and population regulation, Species interaction: competition, allelopathy, Concept of ecological niche, Ecotype formation and classification, Plant indicators

**Soil and Desert:** Soil structure, Soil processes, nitrogen mineralization, Desertification: causes and control

Fire: effect on grasslands and forests

**Agricultural Products of India:** History, origin and distribution of crop plants, Major staple crops: rice, wheat, maize, Minor staple crops: millets, ragi, rye, barley, Major pulses: oil seeds, fibre crops

**Forest and Forestry:** Classification of Indian Forests, Afforestation, Forms and growth of forest trees, Silviculture, Silviculture systems, Forest Menustration and Protection, Major and minor forest products of India

**Grassland and Fodder Resources:** Major grassland area of India and its classification, Importance of fodder grasses, forbs and legumes, Grassland management

**Intellectual Property Right:** Overview of Intellectual Property Plant variety protection, Farmer's and Breeder's rights, Biodiversity act, Protection of traditional knowledge

**Growth and Development:** Plant growth processes, Physiology of flowering: vernalization and photoperiodism, Seed viability and germination, Seed and bud dormancy, Senescence and Abscission

**Mineral Nutrition:** Essential elements and their role in plant growth and development, Translocation phenomena in plants, Assimilation of inorganic nutrients, Plant - Water relations, Transpiration and stomatal movement

**Physiology and phytochemistry:** Photosynthetic pigments and light harvest complexes , Photo oxidation of water , Mechanisms of electron and proton transport, Carbon assimilation the Calvin cycle, photorespiration and its significance, The C4 cycle, the CAM pathway, physiological and ecological considerations, Respiration

**Plant growth regulators:** Physiological effects and mechanism of action of auxins, gibberellins and cytokines, Physiological role of abscisic acid and ethylene, Minor group of phytohormones: brassinosteroids, polyamines, jasmonic acid, salicylic acid and their role in plant growth and development.

**Cell, Molecular Biology and Plant tissue culture:**Structure of eukaryotic and prokaryotic cell, Lipid bilayer, DNA and RNA, Types of DNA, Types of RNA, Structure of Chromosome, Replication, Protein synthesis process and elements, Control of gene expression, Cell cycle – Mitosis, Meiosis and their regulation, Plant tissue culture process, Callus, Different cultures, Secondary metabolites, Transgenic plants, Cancer, Protein sequencing methods, detection of post translation modification of proteins. DNA sequencing methods, strategies for genome sequencing, Isolation, separation and analysis of carbohydrate and lipid molecules RFLP, RAPD and AFLP techniques