JAIN (Deemed-to-be University)

SYLLABUS FOR Ph.D. ENTRANCE TEST – BOTANY

PART B

Plant Anatomy and Plant Physiology: Apical meristem (Shoot and Root): Structural organization, Tunica-corpus theory, Quiescent centre concept and Promeristem concept. Plant cell wall, Leaf, stem and root Anatomy, Xylem and Phloem, Photosynthesis and Respiration, Stress physiology – Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses. Plant Growth regulators: Physiological effects of auxins and gibberellins. Seed: Dormancy and germination.

Plant Taxonomy and Evolution: Major systems of angiosperm classification (Bentham and Hooker, Engler & Prantl, Hutchinson, Takhtajan, and APG systems of Classification, use of taxonomic tools, monographs, floras, taxonomic keys, International Code of Botanical Nomenclature- aims and principles, rules and recommendations. Botanical Gardens, specimen collection and preservation, Herbarium and techniques. Mechanism of speciation - Genetic divergences and isolating mechanisms. Gene pool, allele and genotype frequency. Hardy-Weinberg law and its applications. Patterns of speciation - allopatric, sympatric, quantum and parapatric speciation, The evolutionary time scale; Eras, periods and epoch; Major events in the evolutionary time scale; Major groups of plants.

Plant Ecology and Phytogeography: Physical environment; biotic environment; biotic and abiotic interactions; Habitat and Niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement; Population Ecology: Characteristics of a population; population growth curves; population regulation; life history strategies (*r* and *K* selection); concept of metapopulation; Species Interactions: Types of interactions, interspecific competition, herbivory, pollination, symbiosis. Community Ecology: Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones. Ecological Succession: Types; mechanisms; changes involved in succession; concept of climax. Ecosystem Ecology: Ecosystem structure; ecosystem function; energy flow and mineral cycling (C,N,P); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water,

marine, eustarine). Major terrestrial biomes; theory of island biogeography; phytogeographical zones of India. Environmental pollution; global environmental change; biodiversity: status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches.

Plant conservation: Principles of conservation, major approaches to management - *In-situ* and *ex-situ* conservation, IUCN red list criteria, habitat loss and fragmentation. Indian case studies on conservation/management strategy (Biosphere reserves etc).

Cytogenetics and Plant Breeding: Cell division and Cell cycle; Eukaryotic chromosome replication; Regulation of Mitotic Phase (M Phase); Mitosis and Meiosis; Morphology of eukaryotic chromosomes; Molecular organization of Eukaryotic chromosomes; Organellar chromosomes; Plasmids, IS elements, transposons and Retroelements; Molecular mechanisms to mutation and DNA repair: Types of mutations; Molecular basis of mutations; mutagens, mechanism of DNA repair; Introduction to Plant Breeding; Heterosis and inbreeding depression:; Distance hybridization and in-vitro techniques in plant breeding.

Plant Biotechnology and Plant tissue culture: Recombinant DNA methods and technology, Transgenic plant technology. Insect resistant plants- Cry- genes of Bt., their proteins and target insects, cry genes expression in plants, insect resistance to cry proteins. Bt cotton and Bt brinjal issues in India. Plant Tissue Culture: Totipotency; Media Preparation, Cell Cultures (including Bergmann's plating technique); Applications of Plant cell, tissue and organ cultures: Clonal Propagation; Somatic Embryogenesis; Role of Tissue Culture in Germplasm conservation; Applications in agriculture: improvement of hybrids, encapsulated cells, production of disease and stress resistant plants. Applications in horticulture and Forestry.

Plants and civilization: Centres of origin, utilization, cultivation and improvement of plants of food, drug, fibre and industrial values, Unexploited plants of potential economic value, Plants as a source of renewable energy, Genetic resources and their conservation.