**JAIN (Deemed-to-be University)**

**SYLLABUS FOR Ph.D. ENTRANCE TEST 2023-24 – 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.