

## SYLLABUS FOR Ph.D. ENTRANCE TEST

**Note: There will be 100 questions of multiple choices covering the entire syllabus. All the questions will be compulsory. The paper carries 200 marks. Seventy percent (70%) questions of the entrance test will be set from subject specific section 1 and thirty percent (30%) questions from the section 2 of research methodology.**

### SECTION 1: SUBJECT SPECIFIC

General characters of fungi, their significance to human. Organization of thallus, structure of fungal cell wall composition, nutrition reproduction, kinds of spores.

Heterokaryosis, Heterothallism, Parasexuality, Mycorrhizae, Predaceous fungi.

Role of fungi in industry (Alcohol), Medicine (Antibiotics and steroids), food (edible mushrooms).

Lichens: structure, reproduction and economic importance.

Structure, nutrition, reproduction & economic importance of bacteria; Structure & replication of viruses and bacteriophage

Cyanobacteria: Salient features and Biological Importance;

Thallus organization in algae; Reproductive pattern in algae.

Algal Biofertilizers

General characteristics features and classification of bryophytes, pteridophytes and gymnosperms.

Medicinal uses of bryophytes, Ecological importance of bryophytes

Apogamy, apospory, significance and experimental induction,

Heterospory and Origin of seed habit in pteridophytes,

Economic importance of gymnosperms

Salient features of the International Code of Botanical Nomenclature.

Systems of classifications of angiosperms Bentham & Hooker; Engler & Prantl;

Experimental Embryology: *in vitro* fertilization, anther, pollen and embryo culture,

Anatomy in relation to taxonomy, Anomalous secondary structure

Cell wall composition and architecture.

Cell Membranes – Structural models; Composition and dynamics; Nucleic Acids – DNA and RNA- structure and classes; repeated DNA, DNA Replication: Semi-conservative, bidirectional, replication origins, replication machinery.

Genetic code: Deciphering the genetic code, characteristics. Regulation of gene expression in prokaryotes: Operon concept, lac operon regulation by positive and negative mechanism, trp operon, regulation by negative and attenuation.

Regulation of gene expression in eukaryotes. Transcriptional level: Regulatory sequences, nucleosome positioning, chromatin remodeling

Recombinant DNA technology-enzymes and vectors (plasmids, cosmids, lambda, artificial chromosomes).

Plant Cell and Tissue Culture: concept of cellular differentiation Totipotency, organogenesis and adventive embryogenesis; Fundamental aspects of morphogenesis, somatic embryogenesis and androgenesis-mechanisms, techniques and utility.

Transgenic plants- transgenic for insect resistance, herbicide resistance, abiotic stress resistance, disease resistance, long shelf of fruits and flowers, male sterile lines, cryopreservation.

Structure, metabolism, transport, significance and mechanism of action of Auxins, Gibberellins, Cytokinins, Ethylene and Abscisic acid. Germination and Dormancy of seeds; factors affecting dormancy and its regulation by plant growth regulators and environmental factors.

Chlorophyll and pigments of Cyanobacteria and Bacteria: their role in photosynthesis. Carotenoids and other accessory pigments.

Photosynthesis: General concepts, absorption of light and light harvesting complex, cyclic and non- cyclic photophosphorylation. The sequence of reactions in photosynthesis, the path of carbon assimilation ( $C_3$  and  $C_4$  cycles, CAM pathway), chemosynthesis.

Respiration: Overview of plant respiration, significance, mechanism of respiration Fermentation, glycolysis, krebs cycle, electron transport chain and ATP synthesis, pentose phosphate pathway, glyoxylate cycle, alternate oxidase system, general account of photorespiration.

Nitrogen Metabolism: Biochemistry of nitrogen fixation, the enzyme nitrogenase, nitrogen fixation in legumes and free living systems, nitrate reduction, amination, transamination, biosynthesis of amino acids,

Population ecology: Concept, characteristics, population growth and regulation, species interactions,

Ecosystem organization: structure and functions; primary production (global pattern and controlling factors); energy dynamics—trophic levels, energy flow pathways and ecological efficiencies; decomposition (mechanism, substrate quality and climatic factors); global biogeochemical cycles of C, N, P, & S, ecosystem stability (resistance and resilience).

Global climate change stratospheric ozone layer and ozone hole; climate change impacts, acid rain, forest types of India, forest resources of India

*In situ* conservation of biodiversity: Protected area in India: sanctuaries, national parks, biosphere reserves.

Conservation of biodiversity of wetlands, mangroves and coral reefs.

*Ex situ* biodiversity conservation: principles and practices, field gene banks and seed banks

## **SECTION 2: RESEARCH METHODOLOGY**

Isolation of microorganisms from soil by the serial agar plating method.

Isolation of fungi by Warcup and Wakesman method.

Isolation of VAM fungi, inoculums production and mass culturing of microorganisms.

Preparation of basic solid media, selective media etc., sub-culturing techniques, streak plate, pour plate, spread plate methods.

Demonstration of Koch's postulate for fungal pathogens.

Isolation of plant pathogens.

Methods of plant metabolite extraction: Chlorophyll and carotenoids, Amino acids and organic acids, starch and sugars, methods of estimation of total proteins spectrophotometry.

Principles and applications: UV, Visible spectrophotometry and Atomic absorption spectrophotometry

Media preparation and types of media for plant tissue culture: Sterilization techniques for medium, glassware and explants.

Inoculation techniques

Techniques for isolation and culture of protoplasts.

Microscopy: Fixation, types of fixatives, sectioning, types of microtomes, biological stains, staining techniques

Principles, types of microscopy (Phase-Contrast, fluorescence, TEM and SEM.)

Electrophoresis : types (paper, TLC, GLC and HPLC) & their applications

Principle and types: partition, adsorption, affinity, ion exchange, gas chromatography, gel filtration, HPLC.

Methods of vegetation analysis, plant functions traits (PFTs), estimation plant biomass, and productivity.

Methods of analysis of carbon sequestration, nitrogen mineralization and immobilization.

Application for data analysis & practical, use of basic computer software: M.S. office, SPSS.