

**THIRUVALLUVAR UNIVERSITY
SERKKADU, VELLORE - 632 115**

**M.Phil/Ph.D Common Entrance Test Syllabus
BOTANY**

1. Viruses, Bacteria and Thallophytes

(i). Viruses

A general characters of viruses- nature and origin of viruses, classification of viruses, shape of viruses, Properties and Structure of viruses, purification by symptomatology methods, transmission and control measures of viruses - Vector relationships, multiplication, Bacterial viruses, algal viruses and mycoviruses, TMV and T₄ Bacteriophage.

(ii). Bacteria

A general characters of bacteria, Shape of bacteria, bacteria Flagellation, structure of bacteria, type of bacterial Nutrition, Respiration, Reproduction (asexual and sexual) in Bacteria, appendages, envelopes, structure and replication of nucleic acids in Bacteria plasmids and gene manipulation, classification as per Bergey Manual (1973) economic importance of bacteria, Bacterial straining (Grams stain).

(iii). Thallophytes

a. Algae - A comparative study of the range of structure, organisation, reproduction, life history and classification of algae (Bold and Wynne, 1978). Phylogeny and interrelationships among algae. Origin and evolution of sex in algae. Distribution of algae. Pigmentation of algae, Account of fossil algae. Structure, reproduction, life history and evolutionary trends in cyanophyceae, chlorophyceae, rhodophyceae and phaeophyceae. Flagellation of Algae, Algae as source of medicine, food, animal feed, hydrocarbon and biofertilizers. Algae as pollution indicators-role of algae in

bioremediation. Role of Algae in soil fertility. Freshwater and marine algal cultivation techniques.

b. Fungi - General characters, mode of nutrition and occurrence of fungi. Classification (Alexopoulos and Mims 1979). A systematic study of the range of structure, reproduction, life cycle of Myxomycotina, Eumycotina, Mastigomycotina, Plasmodiophoromycetes and Zygomycotina; Economic importance of fungi.

c. Lichens - A general account of lichens - Nature, Occurrence, Classification Structure, Vegetative and Sexual Reproduction, Nutrition and economic importance of lichens. Role in Succession and Monitoring Pollutants (pollution indicators).

2. Bryophytes, Pteridophytes and Gymnosperms

(i) **Bryophytes** - Occurrence and distribution of Bryophytes, general characters of Bryophytes, classification of Watson 1963. Study of thallus structure, reproduction and life cycle of Bryophytes, resemblances and differences of bryophytes with algae and pteridophytes. Ecology and economic importance of Bryophytes. Fossil forms of bryophytes.

(ii) **Pteridophytes** - Occurrence and distribution of Pteridophytes, Classification (Reimer's 1954) - Distribution of extinct and extant forms, evolutionary significance - Homospory and heterospory, apospory and apogamy, comparative study of morphology anatomy of sporophytes -Structure and development of gametophytes,

(iii) **Gymnosperms** - Classification of Gymnosperms (Sporne 1965) and general account of morphology, distribution and reproduction of Gymnosperms, Phylogeny and affinity, distribution of Gymnosperms in India, evolution of male and female gametophytes Economic importance of Gymnosperms.

3. Plant Pathology and Microbiology

Plant Pathology - A general account of plant disease due to fungi, bacteria and viruses Host parasite interaction, Metabolic changes during disease development, Role of enzymes and toxins during pathogenesis, Etiology, Principles and methods of disease

control – physical, chemical and biological methods - Legislation and Quarantine measures. Verification of Koch's postulates.

Study of the disease dissemination and its control measures of Blast of Paddy; Blight of rice; Red rot of Sugar cane; Tikka disease of ground nut; Damping off of seedlings; Leaf spot of Turmeric, Leaf spot in Cotton ; Blight of Paddy ; Citrus canker ; Tobacco Mosaic and Little leaf of Brinjal.

(ii) **Microbiology**- Brief outline of microbial diversity, Microbial taxonomy, Soil microbiology, Soil microbes N₂ fixation and Bio-geochemical cycles, Food and Water microbiology, influence of environmental factors like pH, light, organic matter, moisture and temperature. Role of microbes in cycles of nitrogen, carbon and phosphorus. Microbial control—methods of physical control (heat, cold, desiccation, radiation and sound waves). Role of microbes in waste water treatment, General design and application of biofermentor. Microbes in food spoilage and food poisoning. Food preservation – Micro organisms as food— Probiotics. Genetically modified food. Industrial products of micro organisms. Microbes used as biofertilizers, Application of fungal enzymes in different industries—immobilization of enzymes – biofuel, ethanol, biogas and biodiesel production.

4. Morphology, Angiosperms Taxonomy and Economic Botany

(i) **Morphology**: The plant body, the root system, Modification of Roots, Modification of Stem, The leaf – Structure of a Leaf, Stipules, Phyllotaxy, Leaf shape, leaf margin, leaf apex, leaf surface, leaf texture, leaf venation, types of leaves, modification of leaves. Buds. Prefoliation, Vernation, Types of inflorescence, Flower parts, symmetry, form, position of the ovary, perianth, calyx, corolla, forms of corolla, Aestivation. Androecium – attachment of anthers, dehiscence of anthers, union of Stamens, length of stamens, nature of Stamens and Pollen, pollination and fertilization, the fruit and the seed morphology, dispersal of fruits and seeds, vegetative reproduction and Germination.

(ii) **Taxonomy**: Historical account on classification of angiosperms (classification of Linnaeus, Bentham and Hooker, Engler and Prantl Takhtajan and

Arthur Cronquist. A detailed account of APG3 classification. Biosystematics and Modern Taxonomy, Chemotaxonomy and Numerical taxonomy. International code of Botanical nomenclature, Herbarium techniques.

Principles of ICBN--Typification, Principles of priority and their limitations Citation, key for identification of plants, General indexes, Monographs, Periodicals, Floras and Manuals, Data banks, Use of molecular tools in taxonomy, Use of Cladistics methodology in Taxonomy.

(iii) **Economic Botany**: cultivation and utilization Food crops, Cereals, millets, legumes, Spices, oil, nuts and tropical fruits, sugar yielding crops, Timbers and pulp yielding plants, Commercial crops—Sugar cane, Rubber, Tea, Fibers- Cotton, Jute; Drug yielding plant, Adulterant

5. Cell Biology and Genetics

(i) **Cell Biology** – General account of Prokaryotic and Eukaryotic Cell, Cell wall, plasmamembrane. Ultra structure and molecular organization of cell, cell wall, plasma membrane, Endoplasmic reticulum, Mitochondria, Lysosomes and other cell organelle. Role of nucleus in cell cycle. Structure and functions of Nucleolus—importance of nucleolus in cell division. Kinetochore, chromomeres, statellite, Euchromatin and Heterochromatin- special types of chromosomes – lamp brush chromosome, polytene chromosome, B- Chromosomes. Karyotype analysis – Importance of Cytotaxonomy. The Cell cycle : cell reproduction, events of the eukaryotic cell cycle, variations in cell-cycle organization, cell cycle control system. Plastids – Classification, morphology, structure – functions Cytoplasm – Physical and Chemical properties. Cell division – Mitosis, meiosis and their significance

(ii) **Genetics** - Mendelian and non-mendelian inheritance – linkage and crossing over. Population genetics, gene concept- molecular basis of heredity. Algal, Fungal, bacterial and viral genetics. Fungal mitochondrial genomes, gene mapping in bacteria and virus. types of nucleic acids – replication of DNA – methods and models in DNA repair mechanism – enzymes – split genes – jumping and mobilic genes – concepts of gene – cistron – muton-recon. Mutation – Classification of Mutations, Mutagenic agents

– structural and chemical basis of mutations in plants cytoplasmic inheritance, Male sterility in plants – Sex determination in plants – sex linked inheritance. Chromosomal aberrations. Genetic disorders in human.

6. Anatomy and Embryology

(i) **Anatomy** – Classification of Meristems - Growth Patterns – Apical Meristem- Theories of Apical Meristem – organization of Apical Meristem - Promeristem Shoot Apex and Root Apex. Origin, Structure, and types of Vascular Cambium. Cambial activity Normal and anomalous secondary thickening in dicot and monocot plants. Primary and Secondary structures of Xylem and Phloem and their elements. Structure and development of Periderm , protective tissue in monocots, Wound healing and grafting, tyloses and Lenticels. Growth rings—heart and sap wood, porous and non-porous wood. Physical , Chemical and Mechanical properties of wood, Unilacunar, trilacunar and multilacunar nodes and their phylogenetic relationships, internal and external Secretory structures, Types of stomata, Ontogeny and histogenesis of unifacial and bifacial leaf-kranz anatomy

(ii) **Embryology** - Morphology, cytology, development and formation of microspores and structure of micro-sporangium, role of tapetum, pollen wall morphogenesis. Pollen sterility and fertility and role of palynology. Types and structure of ovules, Organisation of the embryo sac, types of embryo sac, role of synergids and antipodal haustoria, nutrition of embryo sac. Fertilization, control of fertilization and current concept of fertilization heterospermy, polyspermy and heterofertilization, classification and endosperm types, Endosperm haustoria, Polyembryony and Apomixis - diplospory , apospory, parthenogenesis and parthenocarpy.

7. Plant Physiology

Plant Physiology: Physical and chemical properties of water, water absorption by roots- ascent of sap, Mechanisms of active and passive absorption of water, structure and function of stomata, mechanism of stomatal opening and closing, essential macro and micro nutrients and their deficiencies symptoms and plant disorders. Structure and function of photosynthetic pigments, biosynthesis of chlorophyll—Van Neil Hills

reaction, Red drop phenomenon and Emerson enhancement effect, mechanism of electron transport – photophosphorylation (PS-I & PS-II), proton transport –Z- scheme – pseudocyclic electron flow and ATP synthesis. C₃, C₄ and CAM pathways and their distinguishing features - photorespiration and its significance, RuBISCO.

overview of plant respiration – glycolysis – TCA cycle – electron transport and ATP synthesis –pentose phosphate pathway – glyoxylate cycle – electron transport and ATP synthesis at the inner mitochondrial membrane – respiration and its significance in crop improvement. Nitrogen Metabolism: Nitrate and Ammonium assimilation, Amino acid biosynthesis. Definition of growth, growth dynamics and growth analysis, auxin, gibberellins, cytokinins, abscisic acid, ethylene,– commercial application of growth promoters, photoperiodism, theories related to flowering, fruit ripening and their biochemical mechanism, phototropism - geotropism – hydro and chemotropism.

8. Plant Breeding and Tissue culture

(i) **Plant Breeding** - Methods of improvement of crops. Scope and importance of plant breeding, Heterosis, Polyploidy, Mutation breeding. Importance of male sterility and haploid plants in plant breeding, Methods of plant breeding in self and cross pollinated crops. Pure line selection – mass selection – recurrent selection and clonal selection for breeding. Intervarietal, interspecific and intergeneric hybridization, haploids, aneuploids, secondary polyploids, euploids, auto and allopolyploids.

(ii) **Tissue culture** – Totipotency, Aseptic techniques. Culture media, preparation and composition, Methods of sterilization, Dynamics of callus growth, —Morphogenesis in callus culture, Organogenesis-rhizogenesis, caulogenesis - Hardening. Root culture – Cell suspension cultures. Isolation, purification and culture of protoplasts, Anther and pollen culture, pollen dimorphism, gynogenesis, differentiation and redifferentiation, Application of tissue culture in plant pathology, medicine and biosynthesis of secondary metabolites, Production of secondary metabolites and single cell proteins by cell culture.

9. Ecology and Plant Geography

(i) **Ecology** - Importance of ecology, Ecological factors- Biotic and abiotic components. Concept, structure and function, producer, consumers, decomposers, Energy flow. Food chain, food web and ecological pyramids, Biogeochemical cycling of the water, Carbon, Phosphorous and Nitrogen. Autecology and Synecology, species interaction, types and Population of Ecology and its characteristics, Quadrat, migration, ecesis and aggregation. concepts of climax and stability of ecosystem, Plant indicators. Types and Conservation of Natural Resources, Deforestation its role in Global warming and Climate change. El Nino—its role in climate change

(ii) **Plant Geography** - Principles of Plant Geography Dispersal and migration – Types – Age and Area hypothesis, Endemism – types– endemic plants of the World. Wegner's theory of continental drift and plant distribution.

10. Palaeo Botany

Gondwana flora of India. Contribution of Birbal Sahni to Paleaobotany. Study of fossils in undersatanding evolution. Types of fossils and different methods of fossilization. Economic importance of fossils – fossil fuels and industrial raw materials, fossil forms in algae, bryophytes, pteriodophytes and Gymnosperms.