

**DEPARTMENT OF BOTANY  
DISTANCE EDUCATION –M.PHIL SYLLABUS  
SRI KRISHNADEVARAYA UNIVERSITY**

# **Syllabus**

**PAPER I: RESEARCH METHODOLOGY (COMMON  
PAPER)**

**PAPER II: SPECIAL PAPER (BROAD AREAS)**

**HEAD & CHAIRMAN**

**DEPARTMENT OF BOTANY**  
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**Paper I: RESEARCH METHODOLOGY (COMMON PAPER) FOR M.Phil/Pre-Ph.D**

1. Principles of experimental design-tabular, graphical and diagrammatic representation of data. Statistical applications in biological research: Averages, standard deviation, standard error, analysis of variance, regression coefficient, chi-square test, student's t' test.
2. Chromatography: Principles; Techniques and applications of Paper chromatography, Thin-Layer Chromatography, Ion-exchange and Gas-Liquid Chromatography, High-Performance Liquid Chromatography.
3. Electrophoresis: Principles, types, techniques and applications.
4. Spectrophotometry: Principles-Lambert-Beer's law; types, techniques and applications.
5. Plant Tissue culture and Plant Micro techniques:  
Principles and applications of plant tissue culture; fixatives, methods of fixation; methods of dehydration, embedding, sectioning and staining.
6. Herbarium Methodology: Collection, poisoning, drying and preservation of herbarium specimens; Important National and International herbaria.
7. Principles of Light microscopy, Phase contrast microscopy, Fluorescent microscopy, Electron microscopy – SEM and TEM, Cytophotometry.
8. Computers – Basic Principles and applications in plant sciences.

## Model Question Paper

Time: 3hr.

Max. Marks 100

*Write any FIVE questions.*

*All questions carry equal marks*

**Eight questions will be given selecting one from each chapter**

**Note: Special paper syllabus will be given by the concerned research supervisor within the following frame work. Research student can opt suitable option related his research field.**

- A. PLANT TISSUE CULTURE AND BIOTECHNOLOGY**
- B. ENVIRONMENTAL PLANT PHYSIOLOGY**
- C. MOLECULAR PLANT PHYSIOLOGY AND GENETIC ENGINEERING**
- D. ECOLOGY AND BIODIVERSITY CONSERVATION**
- E. PLANT SYSTEMATICS**
- F. ETHNOBOTANY, PHYTOMEDICINE AND PHARMACOGNSY**

### **PAPER IIA: PLANT TISSUE CULTURE AND BIOTECHNOLOGY**

1. History and scope of plant tissue culture, concept of Cellular differentiation De-differentiation, re-differentiation , totipotency . Laboratory organization , media composition, preparation and sterilization, Equipments.
2. Organogenesis and adventive embryogenesis:  
Fundamental aspects of morphogenesis , somatic embryogenesis and androgenesis, mechanisms, techniques and utility.
3. Vegetative part cultures:  
Root, Stem, leaf, meristem culture, Reproductive part.
4. Production of Haploids: Techniques Development of Androgenic haploids, Factors affecting anther culture, pollen culture, Gynogenesis. Applications of Haploids.
5. Ovary, Ovule and Nucellus culture, Embryo culture, Endosperm culture  
Somatic Hybridization: Protoplast isolation, fusion and culture, hybrid selection and regeneration, possibilities, achievements and limitations of protoplast research  
Application.

6. Application of Plant Tissue Culture: Clonal propagation , artificial seed, production of hybrids and somaclones.

7. Production of secondary metabolites/natural products;

8. Cryopreservation and germplasm storage.

## **SPECIAL PAPER II B: ENVIRONMENTAL PLANT PHYSIOLOGY**

### **1. PLANT WATER RELATIONS**

Thermodynamic concept of plant cell and water relations. Water potential, Osmotic potential and Pressure potential. Dynamics of soil-plant-atmosphere continuum (SPAC).

### **2. PHOTOSYNTHESIS**

Current knowledge on the mechanism of photosynthesis-light harvesting complexes, photochemical reactions, electron transport in chloroplasts. Oxygen evolution and photophosphorylation.

### **3. CARBON METABOLISM**

Carbon fixation pathways-Reductive Pentose Phosphate pathway and its regulation by light and metabolites; C4 pathway; CAM pathway; C3-C4 intermediates. Photosynthesis versus plant productivity. Photorespiration-Glycolate pathway, significance of photorespiration.

### **4. PLANT NUTRITION**

Ion uptake and transport in plants. Physiological and functions of mineral elements in plants. Micro, macro and beneficiary elements.

### **5. WATER STRESS**

Development of water deficits in plants. Drought avoidance and tolerance mechanisms in plants. Osmotic adjustment and limitations to adjustment. Compatible solutes: Proline and Glycine betaines. Anti-transpirants and their role in control of water loss. Physiological, biochemical and molecular responses of plants to water stress. Changes in stress gene expression and protein synthesis.

### **6. SALT STRESS**

Causes and development of salinity. Classification and properties of saline and alkaline soils. Physiological and biochemical responses of mesophytic plants to salt stress. Methods of reclamation of saline soils. Salt responsive proteins and genes.

### **7. HEAVY METAL STRESS**

Heavy metal pollution, toxicity and tolerance in plants. Mechanism of heavy metal tolerance in plants. Indicator plants and their role in mineral exploration. Reclamation methods of metal contaminated soils. Physiological and biochemical responses of plants to heavy metals. Metal detoxification mechanisms in plants. Metalloenzymes. Phytochelatins

### **8. TEMPERATURE STRESS**

Responses of plants to high and low temperatures stress. Responses and adaptation of photosynthesis to high temperature stress. Adaptation of kinetic properties of enzymes to temperature variability. Heat shock proteins and their function.

## **SPECIAL PAPER II C: MOLECULAR PLANT PHYSIOLOGY AND GENETIC ENGINEERING**

### **1. PHYSIOLOGICAL AND MOLECULAR ASPECTS OF PHOTOSYNTHESIS AND PRODUCTIVITY**

Photosynthesis, its significance in crop productivity. Physiological and biochemical aspects; photosynthetic carbon reduction, supplementary carbon fixation pathway in C<sub>4</sub> and CAM plants, their ecological significance, photorespiration and its significance; significance of WUE, carbon isotope discrimination concept; prospects of improving photosynthetic rate and productivity, potential traits of photosynthesis.

### **2. ABIOTIC STRESSES AND DROUGHT RESPONSE OF PLANTS**

Abiotic stresses affecting plant productivity; Drought, characteristic features, water potential in the soil, plant air continuum; development of water deficits, physiological processes affected by drought.

3. Drought resistance mechanisms; escape dehydration postponement (Drought avoidance), dehydration tolerance, and characteristics of resurrection plants; osmotic adjustment osmorprotectants, stress proteins; WUE – a drought resistance trait.

### **4. MOLECULAR ASPECTS OF DROUGHT STRESS TOLERANCE**

Molecular responses to water deficit; stress perception, expression of regulatory and functional genes and significance of gene products; stress and hormones, ABA as a signaling molecule, cytokinin as a negative signal; Stress responsive transcription factors, DREB, EREBP, and NAC family. Oxidative stress; reactive oxygen species (ROS); role of scavenging systems (SOD, Catalase etc).

### **5. PHYSIOLOGICAL AND MOLECULAR ASPECTS OF SALINITY AND TEMPERATURE STRESSES**

Salinity, species variation in salt tolerance; salinity effects at cellular and whole plant level, tolerance mechanisms; salt tolerance in glycophytes and halophytes. High temperature stress; tolerance mechanisms; role of membrane lipids in high temperature tolerance; functions of HSP's.

### **6. GENETIC ENGINEERING OF PLANTS**

Basic principles and methods; mode of action and uses of restriction endonucleases and other enzymes; electrophoretic techniques; Cloning-Phage and plasmid vectors, cosmids, shuttle vectors, yeast vectors, artificial chromosomes.

7. Genomic and cDNA libraries; Subtractive, suppression and colony hybridization; Differential display. Southern blot, northern blot and western blot; Dot and slot blots; Methods of preparing probes.

8. Transformation, selection and expression of cloned DNA; Sequencing of DNA. Synthesis of oligonucleotides; Site-directed mutagenesis; Polymerase chain reaction; DNA foot printing; RAPD, RFLP and AFLP; Application of r-DNA technology in agriculture.

## **SPECIAL PAPER II. D.: ECOLOGY AND BIODIVERSITY CONSERVATION**

## 1. PLANT COMMUNITIES

Plant communities- analytic and synthetic characters; phytosociological methods of study-minimum size and minimum number of quadrats for a community; determination of quantitative characters, importance value index and species diversity indices.

## 2. POPULATIONS AND INDIVIDUALS

Characteristics of plant populations-density, dispersion, natality, mortality and survival, age structure and biotic potential; ecophenes and ecotypes.

## 3. ENVIRONMENTAL POLLUTION

Sources and control of air, water and land pollution; impacts of pollution on global environment-global warming and ozone layer depletion; phytoremediation.

## 4. BIODIVERSITY AND ITS UTILIZATION

Nature of biodiversity-genetic, species and ecosystem diversity; values of biodiversity; global biodiversity hotspots; India, a mega diversity center; non-timber forest produce and medicinal plant resources and marketing in Andhra Pradesh; weed ecology-agrestals and its importance.

## 5. BIODIVERSITY CONSERVATION

Principles of conservation; key threats to biodiversity; IUCN threat categories-red data book; threatened plants of India; *in situ* conservation of biodiversity- wild life sanctuaries and sacred groves in Andhra Pradesh; *ex situ* conservation-botanical gardens and gene banks.

## 6. FLORA AND VEGETATION OF ANDHRA PRADESH

Topography, climate and vegetation types of Andhra Pradesh; a general account on the flora of Andhra Pradesh; endemic and threatened plant taxa.

7. REMOTE SENSING AND BIODIVERSITY CONSERVATION: Principles of remote sensing- aerial photography and satellite remote sensing; applications of remote sensing technology in forestry and ecology-forest resources mapping. Brief account on Geographical Information Systems (GIS) and Global Positioning System (GPS).

## 8. MANAGEMENT OF BIODIVERSITY RESOURCES

Intellectual Property Rights (IPR) and patents; Biodiversity Registers; Environmental Impact Assessment (EIA); Sustainable development.

## **SPECIAL PAPER - II E: PLANT SYSTEMATICS**

### 1. PLANT CLASSIFICATIONS

Natural and phylogenetic classifications-salient features and classifications of Bentham and Hooker and Cronquist.

### 2. PLANT COLLECTION AND IDENTIFICATION

Herbarium methodology-collection, processing and preservation of plant specimens; important world and Indian herbaria; SKU Herbarium; taxonomic keys- preparation of keys; indented and bracketed keys.

### 3. PLANT NOMENCLATURE AND TAXONOMIC LITERATURE

International Code of Botanical Nomenclature-principles, rules and recommendations-ranks of taxa, rule of priority, typification, concept of names; describing a new species. taxonomic literature-floras and journals; computer databases.

### 4. PHYTOGEOGRAPHY

Principles of Phytogeography; endemic and threatened plants of Andhra Pradesh and India; floristic richness and vegetation types of Andhra Pradesh.

## 5. BIOSYSTEMATICS-I

History and importance of biosystematics; ecotypes and ecophenes; different types of characters - analytic vs synthetic, qualitative vs quantitative, consistent vs variable, etc.

## 6. BIOSYSTEMATICS-II

External morphology, Anatomy, Embryology, Palynology in relation to taxonomy ; biochemical and molecular systematics: Secondary metabolites, chemical markers, Chemotypes, Semantides, Isozymes, Allozymes and Immunosystematics; Principles of Numerical taxonomy.

## 7. DIVERSITY IN BRYOPHYTES

General characteristics and classification of bryophytes; salient features and classification of Marchantiales, Jungermanniales, Anthocerotales and Polytrichales; diversity of bryophytes in Andhra Pradesh.

## 8. FLORISTIC STUDIES IN ANDHRA PRADESH

Plant explorations in Andhra Pradesh- a historical account; explorations by Botanical Survey of India; explorations by state universities; contribution to flora of Andhra Pradesh by S.K.University Taxonomists.

## **SPECIAL PAPER-II F: ETHNOBOTANY, PHYTOMEDICINE AND PHARMACOGNOSY**

1. History of Plant classification and principles of classification. Current systems of plant classifications: A comparative account on different systems of classifications.
2. Techniques involved in Processing and preparation of Herbarium, adopted in the preservation of plant diversity. Role of herbarium in teaching and research.
3. Taxonomic Keys: Types, Role of Keys in identification of higher plants.
4. Ethnobotany; Ethnology of tribes, inhabited in the forests of Andhra Pradesh, ethno- botanical studies by South Indian scientists.
5. Ethnomedicobotany: Common ailments among the tribes of Eastern Ghats of Andhra Pradesh. The folklore information on therapeutic properties of different crude drugs available in the area.
6. Alternative/Complementary medicine; Traditional medicine, Phytomedicine. Indian medicine: Ayurveda, Siddha and Unani systems of medicine.
7. Phytochemistry: Preliminary screening studies; secondary metabolites and their significance in phytotherapy.
8. Ethnopharmacology, antimicrobial screening, minimum inhibitory concentration (MIC) and minimum bacterial concentration (MBC).