



# ANDHRA KESARI UNIVERSITY :: ONGOLE

## Department of BOTANY AND MICROBIOLOGY

Ph.D. Part –I Examination

**BOTANY Course structure**

With effect from Academic Year 2024-2025

### COURSESTRUCTURE

Papers	Paper Code	Title of the paper	Marks	Credits
Paper -I	BoT1.0	Research Methodology(common Paper)	100	4
Paper -II	BOT2.0	Advances in Plant Biology	100	4
Paper – III	A	BOT3.1 Cytogenetic, Molecular Genetics, Biotechnology and Plant Breeding	100	4
	B	BOT3.2 Biosystematics	100	4
	C	Ecology		
	D	BOT3.3 Plant physiology	100	4
	E	BOT3.4 Environmental Microbiology	100	4
Paper - IV	BOT4.0	Seminar	100	2

1. In paper III chose any one of the specialization
2. A candidate to have passed if he/she gets a minimum of 40% marks in each paper and 50% aggregate in one attempt. Paper wise pass (supplementary) candidates should get a minimum of 50 marks in each paper.



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### Ph.D. Part –I Examination

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### Botany Syllabus

#### Paper-I: RESEARCH METHODOLOGY (COMMON PAPER)

#### UNIT-I Advances in Microscopy and staining methods

- Working principles, magnification and resolution of SEM, TEM fluorescence and phase contrast microscopes.
- Cytochemical staining of DNA, RNA and proteins, Gram staining of Bacteria.
- Chromosome banding techniques-types, mechanism and applications.

#### UNIT-II Electrophoretic, spectrophotometric and autoradiographic techniques.

- **Electrophoresis:** Principles involved in disc and slab types. Agarose and polyacrylamide mechanism of staining of enzyme gels. Isometric focusing.
- Colorimetric and spectrophotometric techniques. Principles of Lambert Beers Law, types of techniques and applications.
- **Autoradiography:** General principles and applications.

#### UNIT-III Tissue and recombinant DNA techniques.

- Sterilization and preparation of media, Establishment of cell culture and plating efficiency. Isolation of protoplasts, induction of protoplast fusion and selection systems for somatic hybrids
- Principles and applications of RELP, Blotting techniques, PCR and DNA finger printing techniques.

#### UNIT-IV Elementary statistics and Research methods in plant pathology and plant ecology

- Mean, Mode, Median, Standard deviation, Standard Error, Analysis of Variance, Chi-square test, Student's "t" test, correlation and regression, Randomized and Latin Square Designs.
- Collection, preservation and isolation of plant pathogens, inoculation methods and plant disease indexing, methods of studying plant populations: Quadrates and transects for analysis.



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### Ph.D. Part –I Examination

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### Botany Syllabus

#### **Paper-II: ADVANCES IN PLANT BIOLOGY (COMMON PAPER)**

##### **UNIT-I**

Concept of Genomics. Overview of the techniques used in genomic studies, microarray technique and its application, next generation sequencing, progress in genome sequencing genome analysis and annotation.

Molecular markers with special emphasis to Methylation-sensitive amplified polymorphism (MSAP) & Amplified fragment length polymorphism (AFLP), microRNA & siRNA technologies and their applications in stress biology.

DNA barcoding, SNP concept and its applications, comparative genomics and its applications

##### **UNIT-II**

Concept of Proteomics. Protein sample preparation and separation techniques - 2D - Gel Electrophoresis, Differential Gel Electrophoresis (DIGE), Liquid Chromatography and Mass spectrometry (LC-MS).

Protein sequencing and protein micro arrays. Analysis of protein interactions and protein Complexes by Yeast Two hybrid, Immunoprecipitation, Co-immunoprecipitation and Pull down assays.

Applications of proteomics in plant science.

##### **UNIT-III**

Bioinformatics definition, introduction, scope and applications. Databases - CBI Gen Bank, PDB, OMIM, EMBL.

Literature Data banks -- Pub Med, Med line. Sequence Alignment based on Matrices (BLOSUM and PAM), Tools for sequence alignment -BLAST, FASTA. Pair wise and Multiple sequence alignment and phylogenetic analysis.

The biological databases and types; Sequence databases; Structural databases; Prediction of genes and gene function. Translation of gene into protein; Protein secondary structure prediction; Prediction of domains, motifs and profiles of proteins.

##### **UNIT-IV**

Ethical conflicts in biological sciences-interference with nature. Genetically engineered food, environmental risk, labelling and public opinion. Sharing benefits and protecting future generations.

Protection of environment and biodiversity. Recommended biosafety levels for specific microorganisms. Biosafety guidelines for industrial operations with GMOs and Field trial of GM crops.



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#### Paper – III (a): Cytogenetics, Molecular Genetics, Biotechnology and Plant Breeding

##### UNIT-I Cytogenetic

- Chromosome: Chemistry, Structure, Organisation and morphology of Eukaryotic chromosome. Molecular event of cell cycle.
- **Karyotype:** Concept and its use in plant systematic.
- **Chromosomal structural alterations:** Identification, Mitotic behaviour genetic and evolutionary significance of deficiencies, duplications, inversions and translocations.
- **Aneuploids:** Types, Sources, meiotic behaviour, mode of transmission and uses.
- **Allopolyploidy:** Auto and allosyndetic pairing, Amphidiploids and their in use in crop improvement. Production of Alien addition and substitution lines.

##### UNIT-II Molecular genetic

- **Recombinant DNA technology:** Restriction enzymes, methods of obtaining R-DNA molecules, procedure and methods of gene cloning vectors in gene cloning.
- Genomic library and r-DNA library. Identification of gene from genomic library.
- Applications of PCR technology. RFLPs as markers for genomic analysis.

##### UNIT-III Plant biotechnology

- Concept, Scope and Commercial potential of Biotechnology.
- Plant genetic engineering: Methods of gene transfer in plants. Transgenic plants and achievements in crop plants.
- **Anther culture:** Methods of anther culture, raising haploids and their use in plant breeding
- In vitro culture methods for production of Biochemicals.

##### UNIT-IV Plant breeding

- **Male sterility:** Study of genetic, cytoplasmic and genic- cytoplasmic male sterile lines. Applications of male sterility for hybrid seed production in crop plants.
- **Apomixis:** Terminology, Mechanism and significance.
- **Spontaneous and Induced mutations:** Mutation breeding techniques, application and achievements.



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### BOTANY Syllabus

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### Paper-III (B): BIOSYSTEMATICS

#### UNIT-I

- **Biosystematics:** Definition, history, scope, importance and objectives. Role of biosystematics in understanding evolution.
- **Biosystematics:** Categories- phenotype, genotype and biotype, neotype ecotype, subspecies-ecospecies, coenospecies, comparium and infra specific variations.
- **Plant taxonomy;** Static and Dynamic concepts: Alpha and omega Taxonomy – Scope and significance.

#### UNIT-II

- Concept of population, Ecotype- nature, origin and their significance: Genotypes and phenoecotypes. Plasticity of phenotypes, factors affecting phenotypes variations, interactions of factors.
- **Breeding systems:** Role in sexual and asexual population differentiation, concept of hybridization and stabilization of hybrids.
- **Concept of characters:** Methods of sampling and processing of data concept of species.

#### UNIT-III

- Experimental Taxonomy: Sources of taxonomic characters
  - a) External morphology
  - b) Microscopic morphology and anatomy
  - c) Embryology
  - d) Palynology
  - e) Phytochemistry and serology
  - f) Cytology and Genetics
  - g) Molecular taxonomy: Semantides, Isozymes, allozymes and DNA markers.
  - h) Breeding systems.

#### UNIT-IV

- Taximetrics: Adansonian principles, Application of computers in plat systematic, summarizing the data, Cladistic analysis, construction of taxonomic groups. Merits and demerits of numerical taxonomy.
- Species concept: Dynamic and mechanism of speciation, abrupt speciation, biological species concept, classification of species ( taxonomic species, biological species, semi-species, successional species and evolutionary species).
- Germplasm accession, characterization and preservation.



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### Ph.D. Part –I Examination

### BOTANY Syllabus

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### Paper-III (C) - ECOLOGY

#### UNIT-I

Nature, scope and principles of Ecology; Concept, structure and function of ecosystem; Concept of productivity and measurement of primary productivity. Ecological energetic: Transformation and transfer of energy. Degradation of quantity and upgradation of energy quality.

#### UNIT-II

**Biogeochemical cycles:** Maintenance of air, cycling of nitrogen, phosphorus and sulphur and Hydrological cycle. Leigig's law of minimum and shelford' law of tolerance. Comprehensive account of the impactic, edaphic and biotic factors on plants and animals. Concept of ecological Niche, Microclimate. Ecological indicators.

#### UNIT-III

Population Ecology. Groups aaiributes of popuations, population growth, regulation and the carrying capacity. Interactions.

- Community Ecology: Nature of communities; concept of a biotic community; Classification of communities; characteristics of communities. Ecological succession, general trends in ecological succession; concept of climax.

#### UNIT-IV

- **Phytogeography:** Dynamics of phytogeography and continental drift.
- Biodiversity: Concept, Components and levels of assessment of Bio diversity. Threats to biodiversity and conservation.
- Pollution: Types of pollution; air pollution; water pollution and soil pollution prevention and control measures; Phytoremediation.



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Ph.D. Part –I Examination

**BOTANY Syllabus**

With effect from Academic Year 2024-2025

## **Paper-III (D) –PLANT PHYSIOLOGY**

### **UNIT-I Photosynthesis and crop productivity**

Current knowledge on the mechanism of photochemical reaction, molecular organization and functions of photo system I& II modes of photosynthetic electron flow, photophorylation and mechanism of ATP synthesis. Regulation of the functions of the two photo systems: protein phosphorylation and energy spillover mechanism. Photosynthetic carbon fixation and assimilation: leaf anatomy in relation to carbon assimilation path ways, CO<sub>2</sub> fixation and assimilation pathway in C<sub>3</sub>,C<sub>4</sub>, -C<sub>3</sub> intermediates, and CAM plants, ecological significance of C<sub>4</sub> and CAM patterns, partitioning of photo synthetically fixed carbon between starch and sucrose synthesis, light control of photosynthetic enzymes, photorespiration and its significance. Morphological characters in relation to yielding ability and photosynthetic rate.

### **UNIT-II PLANT GROWTH AND DEVELOPMENT**

Pattern plant growth and development: Growth kinetics, chemistry and physiology of cell wall growth , Plant growth regulators: mechanism of action and physiological affects of plant growth regulators; Role of growth regulators in plant tissue culture and weed control. **Photomorphogenesis**: Physical and chemical properties of phytochrome,role of phytochrome in photomorphogenesis.

### **UNIT-III Physiology of flowering**

Effect of temperature and day length on initiation of flower primordial and flowering stimulus; endogenous clock and its regulation; molecular mechanism of flowering.

### **UNIT-IV Stress Physiology**

Morphological,anatomical and biochemical changes in plant in response to water, salinity, heavy metals and nutrients. Mechanism of stress tolerance. Biotic stress and plant responses. Role of heat shock proteins in stress tolerance.



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### BOTANY Syllabus

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### Paper-III (E) - Environmental Microbiology

#### UNIT-I

- Soil environment. Components soil
- Diversity and abundance of soil microorganism
- Methods for the enumeration of microbes in soil
- Transformation of carbon, phosphorus, sulphur and iron in soil
- Transformation of nitrogenous compounds in soil – ammonification, nitrification, denitrification and nitrogen fixation

#### UNIT-II

- Interactions among soil microorganisms
- Rhizosphere- microorganisms in rhizosphere soil, rhizosphere effect, alteration of rhizosphere microflora
- Nature, extent and influence of root exudates on microbes
- Plant growth promoting rhizobacteria
- Symbiotic and free-living nitrogen microbes and mechanism of nitrogen fixation

#### UNIT-III

- Types of mycorrhiza
- Ecto-endo and ecto-ecto- mycorrhiza
- VAM- distribution, fungi involved, VAM propagation, effect of VAM on crop plant
- Phosphate solubilising bacteria
- Degradation of hydrocarbons and pesticides by microflora
- Microbial leaching of minerals- leaching processes of copper, uranium and gold
- biofuels
- Role of microbes in the production of biogas

#### UNIT-IV

- Aerial environment, kinds of micropropogules in air
- Seasonal and diurnal periodicities of air- spore
- Methods of detecting air - spora
- Aquatic environment, microbes in water bodies, detection and enumeration of microbes in water.
- Coli form test for water quality
- Treatment of water for drinking purpose sewage treatment



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### Ph.D. Part –I Examination

### BOTANY Syllabus

With effect from Academic Year 2024-2025

### Paper I – RESEARCH METHODOLOGY

### Modal Question Paper

Time: 3 hours

Max. Marks: 100

Answer **ONE** question from each unit

All question carry equal marks

#### UNIT-I

Q1. a) Essay question.

**OR**

b) Write short essay on any two of the following

- i)
- ii)
- iii)

#### UNIT-II

Q2. a) Essay question.

**OR**

b) Write short essay on any two of the following

- i)
- ii)
- iii)

#### UNIT-III

Q3. a) Essay question.

**OR**

b) Write short essay on any two of the following

- i)
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- iii)

#### UNIT-IV

Q4. a) Essay question.

**OR**

b) Write short essay on any two of the following

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Ph.D. Part –I Examination

**BOTANY Syllabus**

With effect from Academic Year 2024-2025

**Paper II – Advances in Plant Biology**

**Modal Question Paper**

Time: 3 hours

Max. Marks: 100

Answer **ONE** question from each unit

All question carry equal marks

### UNIT-I

Q1. a) Essay question.

**OR**

b) Write short essay on any two of the following

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### UNIT-II

Q2. a) Essay question.

**OR**

b) Write short essay on any two of the following

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### UNIT-III

Q3. a) Essay question.

**OR**

b) Write short essay on any two of the following

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Q4. a) Essay question.

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### Paper- III (A) – Cytogenetic, Molecular Genetics, Biotechnology & Plant Breeding Modal Question Paper

Time: 3 hours

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#### UNIT-I

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### Modal Question Paper

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### Paper-III (C) – ECOLOGY

### Modal Question Paper

Time: 3 hours

Max. Marks: 100

Answer ONE question from each unit

All question carry equal marks

#### UNIT-I

Q1. a) Essay question.

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### Paper-III (D) –PLANT PHYSIOLOGY

### Modal Question Paper

Time: 3 hours

Max. Marks: 100

Answer ONE question from each unit

All question carry equal marks

#### UNIT-I

Q1. a) Essay question.

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#### UNIT-III

Q3. a) Essay question.

**OR**

b) Write short essay on any two of the following

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ii)

iii)

#### UNIT-IV

Q4. a) Essay question.

**OR**

b) Write short essay on any two of the following

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### Paper-III (E) - Environmental Microbiology

### Modal Question Paper

Time: 3 hours

Max. Marks: 100

Answer ONE question from each unit

All question carry equal marks

#### UNIT-I

Q1. a) Essay question.

**OR**

b) Write short essay on any two of the following

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