# 3. SYLLUBUS

# B.Sc., BOTANY

### First Year, I-Semester Paper-I

# Microbial Diversity and Lower Plants

DSC - 1A (4 hrs./week)

Credits- 4

Theory Syllabus

(60 hours)

UNIT-I

- (15 hours)
- Bacteria: Structure, nutrition, reproduction and economic importance. Brief account of Archaebacteria, Actinomycetes and Mycoplasma with reference to little leaf of Brinjal and Papaya leaf curl
- Viruses: Structure, replication and transmission; plant diseases caused by viruses and their control with reference to Tobacco Mosaic and Rice Tungro.
- An outline of plant diseases of important crop plants caused by bacteria and their control with reference to Angular leaf spot of cotton and Bacterial blight of Rice.

UNIT-II

(15 hours)

- 1) General characters, structure, reproduction and classification of algae (Fritsch)
- Cyanobacteria: General characters, cell structure their significance as biofertilizers with special reference to Oscillatoria, Nostoc and Anabaena.
- Structure and reproduction of the following: Chlorophyceae- Volvox, Oedogonium and Chara. Phaeophyceae- Ectocarpus Rhodophyceae- Polysiphonia.

UNIT-III

(15 hours)

- 1) General characters and classification of fungi (Ainsworth).
- 2) Structure and reproduction of the following:
  - (a) Mastigimycotina- Albugo
  - (b) Zygomycotina- Mucor
  - (c) Ascomycotina- Saccharomyces and Penicillium.
  - (d) Basidiomycotina- Puccinia
  - (e) Deuteromycotina- Cercospora.
- 3) Economic importance of lichens

UNIT-IV

(15 hours)

- Bryophytes: Structure, reproduction, life cycle and systematic position of Marchantia, Anthoceros and Polytrichum, Evolution of Sporophyte in Bryophytes.
- Pteridophytes: Structure, reproduction, life cycle and systematic position of Rhynia, Lycopodium, Equisetum and Marsilea.
- 3) Stelar evolution, heterospory and seed habit in Pteridophytes.

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(45 hours)

- Study of viruses and bacteria using electron micrographs (photographs). 2. Gram staining of Bacteria.
- Study of symptoms of plant diseases caused by viruses, bacteria, Mycoplasma and fungi:

Bacteria: Angular leaf spot of cotton and Rice tungro.

Mycoplasma: Little leaf of Brinjal and Leaf curl of papaya

Fungi: White rust on Crucifers, Rust on wheat & Tikka disease of Groundnut.

4. Vegetative and reproductive structures of the following taxa:

Algae: Oscillatoria, Nostoc, Volvox, Oedogonium, Chara, Ectocarpus and Polysiphonia.

Fungi: Albugo, Mucor, Saccharomyces, Penicillium, Puccinia and Cercospora

- 5. Section cutting of diseased material infected by Fungi and identification of pathogens as per theory syllabus. White rust of Crucifers, Rust on wheat & Tikka disease of Groundnut.
- 6. Lichens: Different types of thalli and their external morphology
- 7. Examination of important microbial, fungal and algał products: Biofertilizers, protein capsules, antibiotics, mushrooms, Agar-agar etc.
- 8. Field visits to places of algal / microbial / fungal interest (e.g. Mushroom cultivation,
- 9. Study of Morphology (vegetative and reproductive structures) and anatomy of the following Bryophytes: Marchantia, Anthoceros and Polytrichum.
- 10. Study of Morphology (vegetative and reproductive structures) and anatomy of the following Pteridophytes: Lycopodium, Equisetum and Marsilea.
- 11. Study of Anatomical features of Lycopodium stem, Equisetum stem and Marsilea petiole & rhizome by preparing double stained permanent mounts.

Practical Model Paper	Max. Marks: 25
1. Identify the given components 'A'&'B' in the algal mixture.	Time: 3 hrs
Describe with neat labeled diagrams & give reasons for the classifications.  2. Classify the given bacterial culture 'D' using Gram – staining technique.	2 X 2 = 4M
<ol> <li>Take a thin transverse section of given diseased material 'E'.</li> <li>Identify &amp; describe the symptoms caused by the pathogen.</li> </ol>	3М
4. Identify the given specimens 'F', 'G' & 'H' by giving reasons (Fungal-!, Bacteria-! & Viral-!)	4M
5. Comment on the given slides 'I' & 'J' (Algae, 1 Fungi 1)	$3 \times 1 = 3M$
6. Identify the given specimen 'K' & slide 'L' (Bryophytes & Pteridophytes ) 7. Record	$2 \times 2 = 4M$ $2 \times 2 = 4M$
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# B.Sc., BOTANY

# First Year, II -Semester

# Paper-II Gymnosperms, Taxonomy of Angiosperms and Ecology

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DSC-1B	Credits-4

# Theory Syllabus

#### **UNIT-I**

- Gymnosperms: General characters, structure, reproduction and classification (Sporne's).
   Distribution and economic importance of Gymnosperms.
- Morphology of vegetative and reproductive parts, systematic position and life cycle of Pinus and Gnetum,
- Geological time scale Introduction to Palaeobotany, Types of fossils and fossilization, Importance of fossils.

UNIT-II (15 hours )

- Introduction: Principles of plant 4 ystematic, Types of classification: Artificial, Natural and Phylogenetic; Systems of classification: Salient features and comparative account of Bentham & Hooker and Engler & Prantl classification systems. An introduction to Angiosperm Phylogeny Group (APG).
- Current concepts in Angiosperm Taxonomy: Embryology in relation to taxonomy Cytotaxonomy, Chemotaxonomy and Numerical Taxonomy.
- Nomenclature and Taxonomic resources: An introduction to ICN, Shenzhen code a brief account. Herbarium: Concept, techniques and applications.

#### UNIT-III

(15 hours)

- Systematic study and economic importance of plants belonging to the following families:
   Polypetalae Annonaceae, Capparidaceae, Rutaceae, Fabaceae (Faboideae/Papilionoideae, Caesalpinioideae, Mimosoideae), Cucurbitaceae
- Gamopetalae: Apiaceae, Asteraceae, Asclepiadaceae, Lamiaceae, Monochalmydeae: Amaranthaceae, Euphorbiaceae
- 3) Monocotyledons: Orchidaceae, Poaceae and Zingeberaceae.

UNIT-IV

(15 hours)

- 1. Component of eco system, energy flow, food chain and food webs.
- Plants and environment, ecological adaptations of plants, Hydrophytes, Xerophytes and Mesophytes
- Plant Succession serial stages, modification of environment, climax formation with reference to Hydrosere and Xerosere.

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- 1. Study of viruses and bacteria using electron micrographs (photographs).
- 2. Gram staining of Bacteria.
- 3. Study of symptoms of plant diseases caused by viruses, bacteria, Mycoplasma and fungi:

Viruses: Tobacco mosaic

Bacteria: Angular leaf spot of cotton and Rice tungro.

Mycoplasma: Little leaf of Brinjal and Leaf curl of papaya

Fungi: White rust on Crucifers, Rust on wheat & Tikka disease of Groundnut.

4. Vegetative and reproductive structures of the following taxa:

Algae: Oscillatoria, Nostoc, Volvox, Oedogonium, Chara, Ectocarpus and Polysiphonia.

Fungi: Albugo, Mucor, Saccharomyces, Penicillium, Puccinia and Cercospora

- Section cutting of diseased material infected by Fungi and identification of pathogens as per theory syllabus. White rust of Crucifers, Rust on wheat & Tikka disease of Groundnut.
- 6. Lichens: Different types of thalli and their external morphology
- Examination of important microbial, fungal and algal products:
   Biofertilizers, protein capsules, antibiotics, mushrooms, Agar-agar etc.
- Field visits to places of algal / microbial / fungal interest (e.g. Mushroom cultivation, water bodies).
- Study of Morphology (vegetative and reproductive structures) and anatomy of the following Bryophytes: Marchantia, Anthoceros and Polytrichum.
- Study of Morphology (vegetative and reproductive structures) and anatomy of the following Pteridophytes: Lycopodium, Equisetum and Marsilea.
- 11. Study of Anatomical features of Lycopodium stem, Equisetum stem and Marsilea petiole & rhizome by preparing double stained permanent mounts.

Practical Model Paper	Max. Marks: 25
	Time: 3 hrs
1. Identify the given components 'A'&'B' in the algal mixture.	
Describe with neat labeled diagrams & give reasons for the classifications.	2 X 2 = 4M
2. Classify the given bacterial culture 'D' using Gram - staining technique.	3M
3. Take a thin transverse section of given diseased material 'E'.	
Identify & describe the symptoms caused by the pathogen.	4M
4. Identify the given specimens 'F', 'G' & 'H' by giving reasons .	
(Fungal-1, Bacteria-1 & Viral-1)	3 X 1 = 3M
5. Comment on the given slides 'I' & 'J' (Algae-1, Fungi-1)	2'X 2 = 4M
6. Identify the given specimen 'K' & slide 'L' (Bryophytes & Pteridophytes )	2 X 2 = 4M
7. Record Name of the All	3M
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# KAKATIYA UNIVERSITY - WARANGAL - TELANGANA Under Graduate Courses (Under CBCS 2020 – 2021 onwards) B.Sc. BOTANY II Year SEMESTER – III

#### PLANT ANATOMY AND EMBRYOLOGY

Theory: 4 Hours/Week; Credits: 4 Marks: 100 (Internal: 20; External: 80)

Practical: 3 Hours/Week Credits: 1 Marks: 25

#### UNIT - I

Meristems: Types, histological organization of shoot and root apices and theories.

- 1. Tissues and Tissue Systems: Simple, complex and special tissues.
- Leaf: Ontogeny, diversity of internal structure; stomata and epidermal outgrowths.

#### UNIT -II

- 4. Stem and root anatomy: Vascular cambium Formation and function.
- Anomalous secondary growth of Stem -Achyranthes, Boerhaavia, Bignonia, Dracaena; Root—Beta vulgaris.
- Wood structure: General account. Study of local timbers Teak (Tectona grandis), Rosewood, (Dalbergia latefolia), Red sanders, (Pterocarpus santalinus) Nallamaddi (Terminalia tomentosa) and Neem (Azadirachta indica).

#### UNIT-III

- 7. History and importance of Embryology.
- 8. Another structure, Microsporogenesis and development of male gametophyte.
- 9. Ovule structure and types; Megasporogenesis; types and development of female gametophyte.

#### UNIT- IV

- Pollen morphology, pollination and fertilization, Pollination Types, Pollen pistil interaction, Double fertilization.
- Seed structure appendages and dispersal mechanisms.
- Endosperm Development and types. Embryo development and types;
   Polyembryony and Apomixis -- an outline.

#### References:

- Bhattacharya et. al. 2007. A textbook of Palynology, Central, New Delhi.
- Bhojwani, S. S. and S. P. Bhatnagar. 2000. The Embryology of Angiosperms (4th Ed.), Vikas Publishing House, Delhi.
- M.R.Saxena- A textbook of Palynology.
- Vashista- A textbook of Anatomy.
- P.K.K.Nair- A textbook of Palynology.
- Esau, K. 1971. Anatomy of Seed Plants. John Wiley and Son, USA.
- Johri, B. M. 1984. Embryology of Angiosperms. Springer-Verleg, Berlin.
- Kapil, R. P. 1986. Pollination Biology. Inter India Publishers, New Delhi.
- Maheswari, P. 1971. An Introduction to Embryology of Angiosperms. McGraw Hill Book Co., London.
- Dutta A.C. 2016. Botany for Degree Students. Oxford University Press

# KAKATIYA UNIVERSITY - WARANGAL - TELANGANA Under Graduate Courses (Under CBCS 2020 – 2021 onwards) B.Sc. BOTANY II Year SEMESTER – III

# PLANT ANATOMY AND EMBRYOLOGY PRACTICAL

- 1. Demonstration of double stain technique.
- 2. Preparation of double stained Permanent slides

Primary structure: Root - Cicer, Canna; Stem - Tridax, Sorghum

Secondary structure: Root — Tridax sp.; Stem —Pongamia

Anomalous secondary structure:

Stem: Achyranthes, Boerhavia, Bignonia, Dracaena

Root: Beta vulgaris

- 3. Stomatal types using epidermal peels (Dicots).
- 4. Structure of anther and microsporogenesis using permanent slides.
- 5. Structure of pollen grains using whole mounts Hibiscus, Acacia and Grass).
- 6. Pollen viability test using Evans Blue Hibiscus
- 7. Study of ovule types and developmental stages of embryo sac.
- Structure of endosperm (nuclear and cellular); Developmental stages of dicot and monocot embryos using permanent slides.
- 9. Isolation and mounting of embryo (using Cymopsis / Senna / Crotalaria)

Under Graduate Courses (Under CBCS 2020–2021 onwards)

# B.Sc. BOTANY II Year SEMESTER – IV

#### CELL BIOLOGY AND PLANT PHYSIOLOGY

Theory: 4 Hours/Week Credits: 4 Marks: 100 (Internal: 20; External: 80)

Practical: 3 Hours/Week Credits: 1 Marks: 25

UNIT I: Plant cell envelops: Ultra structure of cell wall, molecular organization of cell membranes.

- Models of membrane structure, Functions, fluidity and Selective permeability of the membranes.
- 2. Cell Organelles: Structure and semiautonomous nature of Mitochondria and Chloroplast.
- Structure and role of endoplamic reticulum, ribosomes, golgi complex, lysosomes, peroxisomes and glyoxisomes.

#### UNIT-II

Nucleus: Ultra structure, types and functions of DNA & RNA.

- Chromosomes: Morphology, organization of DNA in a chromosome, Euchromatin and Heterochromatin, Karyotype. Special types of chromosomes: Lampbrush and Polytene chromosomes.
- 5. Extra nuclear genome: Mitochondrial DNA and Plastid DNA.. Plasmids.
- 8. Cell division: Cell and its regulation; mitosis, meiosis and their significance

#### UNIT- III

- Plant -Water Relations: Physical properties of water, diffusion, imbibitions, osmosis; osmotic and pressure Potential, absorption and transport of water.
- Mineral Nutrition: Essential macro and micro mineral nutrients, and symptoms of mineral deficiency.
- 11.Transpiration; Stomatal structure and movement. Mechanism of phloem transport. Mechanism of phloem transport.
- 12. Enzymes: Nomenclature, Characteristics, Classification and factors regulating enzyme activity.

## UNIT- IV

- Photosynthesis: Photosynthetic pigments, Mechanism of photosynthetic electron transport and evolution of oxygen, Photophosphorylation. Carbon assimilation pathways: C3, C4 and CAM.
- Respiration: Aerobic and Anaerobic; Glycolysis, Krebs cycle and electron transport system.
- 15. Nitrogen Metabolism: Biological nitrogen fixation
- Physiological effects of Phytohormones: Auxins, gibberellins, cytokinins, ABA, ethylene and Brassinosteroids

Under Graduate Courses (Under CBCS 2020-2021 onwards)

# B.Sc. BOTANY II Year SEMESTER – IV

## CELL BIOLOGY AND PLANT PHYSIOLOGY PRACTICAL

- Demonstration of cytochemical methods: Fixation of plant material and nuclear staining for mitotic and meiotic studies.
- 2. Study of various stages of mitosis using cytological preparation of Onion root tips.
- 3. Study of various stages of meiosis using cytological preparation of onion flower buds.
- Study of ultra structure of cell organelles using photographs. Chloroplast,
   Mitochondria, Nucleus, Ribosomes, Endoplasmic reticulum and Golgi complex.
- Study of Special types of Chromosomes (Polytene chromosome and Lampbrush chromosomes-Permanent slide) ✓
- Determination of osmotic potential of vacuolar sap by Plasmolytic method using leaves of Rheodiscolor / Tradescantia.
- 7. Determinion of rate of transpiration using Cobalt chloride method
- 8. Determination of stomatal frequency using leaf epidermal peelings / impressions
- 9. Determination of catalase activity using potato tubers by titration method
- 10. Separation of chloroplast pigments using paper chromatography technique
- 11. Estimation of protein by Biurette method
- 12. Mineral deficiency- Detail study of Micronutrients and Macro nutrients
- 13. Identification of C3,C4 and CAM plants.



# KAKATIYA UNIVERSITY - WARANGAL - TELANGANA UNDER GRADUATE COURSES (UNDER CBCS 2021 – 2022 ONWARDS) B.SC. BOTANY III YEAR SEMESTER – V

# PAPER - V: (A) BIODIVERSITY & CONSERVATION

(DSE-1: ELECTIVE)

Theory:

4 Hours/Week;

Credits: 4 Marks: 100 (Internal: 20; External: 80)

Practical 3 Hours/Week

Credits: 1 Marks: 25

# UNIT-I

 Plant diversity and its scope: Genetic diversity, Species diversity, Plant diversity at the ecosystem level, Agro biodiversity and cultivated plant taxa, wild taxa.

Values and uses of Biodiversity: Ethical and aesthetic values, Precautionary principle, Methodologies for valuation, Uses of plants, Uses of microbes.

#### UNIT-II

- Loss of Biodiversity: Loss of genetic diversity, Loss of species diversity, Loss of ecosystem diversity, Loss of agro biodiversity, Projected scenario for biodiversity loss.
- Management of Plant Biodiversity: Organizations associated with biodiversity, management- Methodology for execution-IUCN, UNEP, UNESCO, WWF, NBPGR.
- Biodiversity legislation and conservation, Biodiversity information management and communication.

## UNIT-III:

- Conservation of Biodiversity: Conservation of genetic diversity, species diversityand ecosystem Diversity
- Principles of conservation: In -situ and Ex-situ conservation. Sacred groove,
   Botanical garden, Biosphere reserves, Sanctuaries, National parks (In-situ) and
   Tissue culture, Gene / seed / pollen banks and Cryopreservation (Ex-situ).

#### UNIT-IV:

- Role of plants in relation to Human Welfare; Importance of forestry, their utilization and commercial aspects, Avenue trees, Ornamental plants of India.
- Alcoholic beverages through ages. Fruits and nuts, Important fruit crops and their commercial importance. Wood and its uses.

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# KAKATIYA UNIVERSITY - WARANGAL - TELANGANA UNDER GRADUATE COURSES (UNDER CBCS 2021 – 2022 ONWARDS) B.SC. BOTANY III YEAR SEMESTER – V

# PAPER – V:: (A) BIODIVERSITY & CONSERVATION PRACTICAL (DSE-1: ELECTIVE)

- Study on local biodiversity: Herbs, shrubs and trees; Seasonal, Annual, biennial and perennial plants.
- Study of morphological characteristics of plant communities: Hydrophytes (Eichhornia, Hydrilla, Pistia, Nymphaea, Vallisneria), Xerophytes: (Asparagus, Opuntia, Euphorbia milii, Casuarina, Calotropis).
- 3. Assessment of biodiversity
  - Avenue trees: Pongamiapinnata, Butea monosperma, Spathodea sp., Delonix regia, Jacaranda mimosifolia, Cassia fistula, Mimusopselengi, Acacia leucophloea, and Albizialebbeck.
  - ii) Ornamental Plants: Any five locally available ornamental plants.
  - iii) Timber Value: Acacianilotica, Tectonagrandisand Azardirachtaindica
  - iv) Fruits: Mangiferaindica(Mango), Ziziphusmauritiana, Psidium guajava(Guava), Annona squamosa
  - v) Nuts: Anacardiumoccidentale(Cashew), Terminalia catappa(Badam)
  - vi) Beverages: Madhucaindica, ↑ Camellia sinensis(Tea),Coffea arabica(Coffee),
    Borassusflabellifer

(Toddy palm) and Caryotaurens

- vii Medicinal value: Catharanthus roseus, Tinosporacordifolia and Phyllanthus emblica, Ocimumsp., and Azardirachta indica
- 4. Field trip: Collection of plants from the field, identification and preparation of Herbarium.

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Under Graduate Courses (Under CBCS 2021 - 2022 onwards)

## B.SC. BOTANY III YEAR SEMESTER - VI

# PAPER-2B: TISSUE CULTURE AND BIOTECHNOLOGY

(DSE-2: ELECTIVE)

Theory:

4 Hours/Week;

Credits: 4 Marks: 100 (Internal: 20; External: 80)

Practical:

3 Hours/Week

Credits: 1 Marks: 25

#### UNIT - I

- Tissue culture: Introduction, sterilization procedures, explants, culture media- composition and preparation; Nutrients and hormone requirements. Micropropagation.
- Organ culture: Totipotency, Induction of callus, Shoot, leaf culture, Anther culture, Ovule and Embryo culture.
- 3. Callus culture and isolation and fusionof protoplast culture
- 4 Organogenesis, Somatic and Zygotic embryogenesis

#### UNIT- I

- Applications of tissue culture: Production of pathogen free plants and stress resistant plants, somaclonal variants and synthetic seeds.
- Induction of hairy roots and its applications in production of secondary metabolites.
- 7. Haploidy and triploids, Cryopreservation and Germplasm Conservation.
- 8 .Somatic hybrids and Cybrid

## UNIT-III

- 9. Biotechnology: Introduction, history, scope and applications.
- rDNA technology: Basic aspect of gene cloning, Enzymes used in gene cloning. Restriction enzymes, Ligases, Polymerases.
- Gene cloning: Recombinant DNA, Bacterial Transformation and selection of recombinant clones, vectors- cloning vehicles (Plasmid, Cosmids, Bacteriophages, & Phasmids; Eukaryotic Vectors (YAC) Gene Construct; Applications of rDNA technology.

### UNIT - IV:

- Gene Libraries: construction of genomic and cDNA libraries, Polymerase Chain Reaction (PCR) and its applications.
- Methods of gene transfer-Agrobacterium mediated Direct gene transfer by Electroporation, Microinjection, Microprojectile bombardment.

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12. Application of transgenics in improvement of crop productivity and quality traits. Pest resistant transgenic crops (Bt-cotton & Bt-brinjal); herbicide resistant plants (Roundup Ready soybean); crops with quality traits (Flavr Savr tomato, Golden rice).



Under Graduate Courses (Under CBCS 2021 - 2022 onwards)

# B.SC. BOTANY III YEAR SEMESTER – VI

# PAPER-2B: TISSUE CULTURE AND BIOTECHNOLOGY PRACTICAL (DSE-2: ELECTIVE)

#### **Major Experiments**

- 1. Isolation of plant DNA (Tomato)
- 2. Production of synthetic seeds /Encapsulation of embryo
- 3. Preparation of plant tissue culture medium MS medium
- 4. Isolation of protoplasts.

### Minor Experiments

- 1. Callus induction
- 2. Demonstration of Micropropagation/multiple shoots
- 3. Anther culture
- 4. PCR Demonstration
- 5. Study of biotechnology products: Samples of antibiotics and vaccines
- 6. Photographs of Gene transfer methods.
- Instruments used in Biotechnology lab- Autoclave, Laminar air flow, Hot air oven and Incubator.
- Demonstration of in vitro sterilization and inoculation methods using leaf and nodal explants of tobacco, Datura, Brassica etc.

#### Spotting

- Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis & artificial seeds through photographs.
- Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct gene transfer by electroporation, microinjection, microprojectile bombardment.
- Study of steps of genetic engineering for production of Bt cotton, Golden rice, Flavr Savr tomato through photographs.
- 4. Restriction digestion and gel electrophoresis of plasmid DNA.

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