

**DEPARTMENT OF BOTANY**

**Courses having focus on Employability/Entrepreneurship/Skill Development**

**The following Courses having focus on Employability / Entrepreneurship / Skill Development:**

**Courses:**

Biodiversity & Conservation , Tissue culture & Biotechnology, Genetics, Taxonomy, Algal Biofertilizers, Cultivation and post harvest technology of medicinal plants, Pharmacognosy , Horticulture & Plant Breeding , Soil Testing , Advance paper - Horticulture /SEC- Industrial Microbiology / SEC-Nursery & Gardening .

**Attachment:**

Attached Syllabus copy of the above mentioned courses.



Sign of the Head, Dept.

## DSE-1A

## Theory Syllabus

### Unit - I:

(15h)

- ## Unit-II:

(15h)

- ### Unit-III:

(15h)

- #### Unit-IV:

(15h)

- ### References:

- [illegible]

**B.Sc. BOTANY**  
**III Year: Semester-V**  
**Paper-1B: Tissue Culture and Biotechnology**

**DSE-1B**

**Credits-4**

**Theory Syllabus**

**(60 hours)**

**UNIT – I:**

**(15 hours)**

1. Tissue culture: Introduction, sterilization procedures, explants, culture media - composition and preparation; Nutrient and hormone requirements, Micropropagation.
2. Organ culture: Totipotency, Vegetative Organs-Root, Shoot, Leaf culture  
Reproductive Organs-Anther, Ovule, Embryo culture
3. Callus culture and isolation and fusion of protoplast culture
4. Organogenesis, Embryogenesis (somatic and zygotic).

**UNIT- II:**

**(15 hours)**

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

**UNIT- III:**

**(15 hours)**

9. Biotechnology: Introduction, history, scope and applications.
10. rDNA technology: Basic aspect of gene cloning, Enzymes used in gene cloning-Restriction enzymes, Ligases, Polymerases.
11. 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:**

**(15 hours)**

12. Gene Libraries: construction of genomic and cDNA libraries, colony hybridization; Probes-oligonucleotide, Polymerase Chain Reaction (PCR) and its applications.
13. Methods of gene transfer- Agrobacterium-mediated, Direct gene transfer by Electroporation, Microinjection, Microprojectile bombardment; Selection of transgenics-selectable marker and reporter genes.
14. 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).

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**B.Sc. BOTANY**  
**II YEAR: Semester-IV**

**Paper IV: Cell Biology, Genetics and Plant Physiology**

**DSC-1D**

**Credits-4**

**Theory Syllabus**

**(60 hours)**

**UNIT I:**

**(15h)**

1. Plant cell envelopes: Ultra structure of cell wall, Models of membrane structure, structure and functions of Semi permeable Plasma membrane.
2. Cell Organelles: Structure and semiautonomous nature of Mitochondria and Chloroplast.
3. Nucleus: Ultra structure, types and functions of DNA & RNA. Mitochondrial DNA & Plastid DNA and Plasmids.
4. Chromosomes: Morphology, organization of DNA in a chromosome, Euchromatin and Heterochromatin, Karyotype. Special types of chromosomes: Lampbrush and Polytene chromosomes.
5. Cell division: Cell and its regulation; mitosis, meiosis and their significance

**UNIT – II:**

**(15 hours)**

6. Mendelism: History, Principles of inheritance, Chromosome theory of inheritance, Autosomes and sex chromosomes, Incomplete dominance and Co-dominance. Multiple alleles, Lethal alleles, Epistasis, Recessive and Dominant traits, Polygenic inheritance.
7. Linkage and crossing over, Recombination frequency, two factor and three factor crosses; Interference and coincidence. Numericals based on gene mapping; Sex Linkage.
8. Variation in chromosome number and structure: Deletion, Duplication, Inversion, Translocation, Position effect, Euploidy and Aneuploidy
9. Gene mutations: Types of mutations; Molecular basis of Mutations; Mutagens-physical and chemical (Base analogs, deaminating, alkylating and intercalating agents);

**Unit-III**

**(15h)**

10. Plant -water Relations: Water potential, osmosis, osmotic and pressure potential, absorption and transport of water.
11. Mineral Nutrition: Essential micro & macro nutrients and symptoms of mineral deficiency.
12. Transpiration: Stomatal structure and movement.
13. Mechanism of phloem transport.
14. Enzymes: Nomenclature, properties, Classification and factors regulating enzyme activity.

**UNIT- IV**

**(15h)**

15. Photosynthesis: Photosynthetic pigments, Cyclic and Non-cyclic Photophosphorylation. Carbon assimilation pathways: C3, C4 and CAM.
16. Respiration: Aerobic and Anaerobic; Glycolysis, Krebs cycle and oxidative phosphorylation.
17. Nitrogen Metabolism: Biological nitrogen fixation.
18. Physiological role of Phytohormones: Auxins, gibberellins, cytokinins, ABA, ethylene and Brassinosteroids

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Sushama Kumar  
B. Kishore  
M. Gupta  
B. Kishore  
Jana

# **B.Sc., BOTANY**

## **First Year, II -Semester**

### **Paper-II**

#### **Gymnosperms, Taxonomy of Angiosperms and Ecology**

**DSC-1B**

**Credits-4**

#### **Theory Syllabus**

**(60 hours)**

#### **UNIT-I**

**(15 hours )**

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

#### **UNIT-II**

**(15 hours )**

- 1) Introduction: Principles of plant systematics, 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).
- 2) Current concepts in Angiosperm Taxonomy: Embryology in relation to taxonomy Cytotaxonomy, Chemotaxonomy and Numerical Taxonomy.
- 3) Nomenclature and Taxonomic resources: An introduction to ICN, Shenzhen code – a brief account. Herbarium: Concept, techniques and applications.

#### **UNIT-III**

**(15 hours )**

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

#### **UNIT-IV**

**(15 hours )**

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

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**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)**

- 1) **Bacteria:** Structure, nutrition, reproduction and economic importance. Brief account of Archaeobacteria, Actinomycetes and Mycoplasma with reference to little leaf of Brinjal and Papaya leaf curl
- 2) **Viruses:** Structure, replication and transmission; plant diseases caused by viruses and their control with reference to Tobacco Mosaic and Rice Tungro.
- 3) 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)
- 2) **Cyanobacteria:** General characters, cell structure their significance as biofertilizers with special reference to Oscillatoria, Nostoc and Anabaena.
- 3) 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) Mastigomycotina- Albugo
  - (b) Zygomycotina- Mucor
  - (c) Ascomycotina- Saccharomyces and Penicillium.
  - (d) Basidiomycotina- Puccinia
  - (e) Deuteromycotina- Cercospora.
- 3) Economic importance of lichens

**UNIT-IV**

**(15 hours )**

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





B.Sc. BOTANY  
III YEAR: Semester-V  
Generic Elective (GE)

GE-1

(Credits: 4)

**Industrial Microbiology**

Lectures: 60

**Unit I**

(15h)

1. Scope of microbes in industry and environment
2. Bioreactors/Fermenters and fermentation processes
3. Solid-state and liquid-state (stationary and submerged) fermentations; Batch and continuous fermentations.
4. Components of a typical bioreactor, Types of bioreactors-laboratory, pilot scale and production fermenters.

**Unit II**

(15h)

5. Constantly stirred tank fermenter, tower fermenter, fixed bed and fluidized bed bioreactors and air-lift fermenter. A visit to any educational institute/ industry to see an industrial fermenter, and other downstream processing operations.
6. Microbial production of industrial products: Microorganisms involved, media, fermentation conditions, downstream processing and uses;
7. Filtration, centrifugation, cell disruption, solvent extraction, precipitation and ultrafiltration, lyophilization, spray drying.
8. Hands on microbial fermentations for the production and estimation (qualitative and quantitative) of Enzyme: amylase or lipase activity, Organic acid (citric acid or glutamic acid), alcohol (Ethanol) and antibiotic (Penicillin).

**Unit III**

(15h)

9. Microbial enzymes of industrial interest and enzyme immobilization
10. Microorganisms for industrial applications and hands on screening microorganisms for casein hydrolysis; starch hydrolysis; cellulose hydrolysis.
11. Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acetylase).
12. Microbes and quality of environment. Distribution of microbes in air; Isolation of microorganisms from soil, air and water.

**Unit IV:**

(15h)

13. Microbial flora of water. Water pollution, role of microbes in sewage and domestic waste water treatment systems.
14. Determination of BOD, COD, TDS and TOC of water samples; Microorganisms as indicators of water quality, check coliform and fecal coliform in water samples.
15. Microbes in agriculture and remediation of contaminated soils.
16. Biological fixation; Mycorrhizae; Bioremediation of contaminated soils. Isolation of root nodulating bacteria, arbuscular mycorrhizal colonization in plant roots.

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**B.Sc. Botany**  
**II Year: Semester-III**  
**Skill Enhancement Course**

**SEC-1**

**(Credits - 2)**

**Nursery and Gardening**

**Lectures: 30**

**Unit-I**

**(15h)**

1. Nursery: definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities - Planting - direct seeding and transplants.
2. Seed: Structure and types - Seed dormancy; causes and methods of breaking dormancy - Seed storage: Seed banks, factors affecting seed viability, genetic erosion - Seed production technology - seed testing and certification.
3. Vegetative propagation: air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants - green house - mist chamber, shed root, shade house and glass house.

**Unit-II**

**(15h)**

4. Gardening: definition, objectives and scope - different types of gardening - landscape and home gardening - parks and its components - plant materials and design - computer applications in landscaping - Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting.
5. Sowing/raising of seeds and seedlings - Transplanting of seedlings - Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomatoes, and carrots - Storage and marketing procedures.
6. Features of a garden: Garden wall, Fencing, biofencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden. Some Famous gardens of India. Cultivation of Important cut flowers: Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolous, Marigold, Rose, Lilium, Orchids.

\* Field trip is essential.

**Suggested Readings**

1. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
4. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
5. Agrawal, P.K. 1993, Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.
6. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco, USA.

S.NO	CONTENTS	PG.NO.
1	INTRODUCTION SOIL HEALTH MANAGEMENT IMPORTANCE AND OBJECTIVES	
2	IMPORTANCE OF SOIL TESTING	
3	SOIL SAMPLING METHODS AND PROCEDURES	
4	SOIL PARAMETERES	
5	DETERMINATION OF SOIL COLOUR AND TEXTURE BY <del>FIELD</del> METHOD FEEL	
6	DETERMINATION OF SOIL REACTION	
7	DETERMINATION OF <del>ELECTONIC</del> CONDUCTIVITY ELECTRICAL	
8	DETERMINATION OF ORGANIC CARBON	
9	DETERMINATION OF AVAILABLE NITROGEN	
10	DETERMINATION OF AVAILABLE PHOSPHORUS	
11	DETERMINATION OF AVAILABLE POTASSIUM	
12	DETERMINATION OF BORON	
13	DETERMINATION OF SULPHUR	
14	DETERMINATION OF MICRO NUTRIENTS	
15	INTERPRETATION OF SOIL TEST <sup>DATA</sup> : Ranges & Reclamations	

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**M.Sc. BOTANY**

**IV Semester**

***Common paper***

**MBOT.CC.T.2.402 :**

***Core***

**4 Hrs/week 4 Credits**

**Paper-II: Horticulture and Plant breeding**

**Unit-I**

1. Importance and propagation of horticultural plants:
  - a. Propagation through seeds.
  - b. Propagation through cuttings i.e., leaf, stem and roots.
  - c. Grafting- normal and special grafting procedures.
2. Nutrient management: General account of chemical fertilizers and biofertilizers. Symptoms of deficiencies of macro and micro nutrients.

**Unit-II**

3. Disease and pest management of horticultural plants:
  - a. Identification/Symptoms
  - b. Remedies/Control measures
  - c. IPM (Integrated Pest Management)
4. Mass production of horticultural plants and plantation crop plants through tissue culture and micropropagation.

**Unit-III**

5. Plant breeding objectives. Traits of interest for field crops, fruits and vegetable crops (yield, duration, adaptability and tolerance / Resistance to Biotic and Abiotic stresses.
6. Selection. Back cross breeding and usefulness of marker-assisted selection.
7. Development of inbred cultivars and commercial hybrids. Heterosis, Combining ability and Heritability.

**Unit-IV**

8. Mutation breeding. Induced polyploidy in plant breeding. Importance of haploids and dihaploids.
9. Transgenic technology and its acceptance. Bt-cotton and Bt-brinjal, Herbicide resistant crops and Golden rice.
10. PCR based zygosity analysis and ELISA.

## **M.Sc. BOTANY- IV SEMESTER**

*Specialization : Specialization : Biodiversity of Angiosperms and Pharmacognosy of Medicinal Plants*

**MBOT.EC.T.2.404 / C**

**4 Hrs/week**

**4 Credits**

### **Paper-IV: Pharmacognosy**

#### **UNIT-I**

1. Introduction and Scope of Pharmacognosy: Pharmacognosy and modern medicine
2. Crude plant drugs
  - a) Sources: Geographical, Biological, Cell Culture and Sea
  - b) Classification: Morphological (Organized and unorganized), Taxonomical, Chemical, Pharmacological and alphabetical
3. Indigenous traditional drugs and their market adulteration of Punarnava, Shankhpuspi (Clitoria), Indian goose-berry, Tulasi, Commiphora, Kalmegh

#### **UNIT-II**

4. Types of Plant drug and their Pharmacognostic study
  - a) Root drugs: *Glycyrrhiza* and *Ipecac*, *Rauvolfia*, *Satavari*, *Colcus*, *Withania*
  - b) Rhizome drugs, Ginger
  - c) Leaf drugs, *Andrographis*, *Clitoria*, *Senna*
  - d) Bark drugs: *Terminalia arjuna*, *Holorrhena*
  - e) Flower drugs: Saffron
  - f) Seed drugs: *Piper longum*, *Mucuna*
  - g) Fruit drugs: Cumin, Amla, Senna pods
  - h) Whole plant drugs: *Catheranthus roseus*

#### **UNIT-III**

5. Evaluation of the drugs; Organoleptic, Microscopic, Physical Chemical and Biological methods of evaluation
6. A brief account of various drug constituents: Carbohydrates, Cardiac glycosides, alkaloids, volatile oils, resins quinines and steroids with particular reference to Accacia gum, amla, Coleus, Satavari, *Rauvolfia*

#### **UNIT-IV**

7. Medicinal Principles and powder analysis of *Curcuma*, Cloves, Senna, Fennel and Cinnamon
8. Large scale Industrial preparation of Crude Drugs
  - a) Types of reactors used and extraction methods
  - b) Active principles and non-active principle of drugs
  - c) Import and Export potentials of Crude Drugs
  - d) Preparation of crude drugs in indigenous system of medicine
  - e) Quality control test – contamination, Adulteration



## **M.Sc. BOTANY- III SEMESTER**

*Specialization : Biodiversity of Angiosperms and Pharmacognosy of Medicinal Plants*

**MBOT.EC.T.2. 304/C**

**4 Hrs/week 4 Credits**

### **Paper-IV: Cultivation and Post-harvest technology of Medicinal Plants**

#### **UNIT -I**

1. Introduction: Origin, development and evolution of Medicinal Botany
2. Importance of active principles and uses of medicinal plants in different traditional systems of medicine and Allopathy

#### **UNIT -II**

3. Origin, Historical background. Active principles uses and cultivation practices of the following medicinal plants  
a) *Andrographis paniculata* b) *Asparagus racemosus* c) *Bacopa monnieri* d) *Coleus forskohlii*  
e) *Rauwolfia serpentina* f) *Withania somnifera*
4. Origin, Historical background, Active principles uses and cultivation practices (including organic farming) of the following aromatic plants: a) Lemon grass (*Cymbopogon flexuosus*) b) Citronella c) Palmarosa d) *Eucalyptus citriodora*

#### **UNIT -III**

5. Post-harvest Management of Medicinal plants: Drying / Distillation, grading, packing and storage
6. Distillation of aromatic plants: a) Description of distillation UNIT s b) Principles of distillation c) Methods of distillation d) Maintenance and precautions for distillation UNIT s e) Yields and recoveries of different aromatic plants

#### **UNIT -IV**

7. Conservation of Medicinal Plants; Threatened and endangered Medicinal Plants – in-situ and ex-situ conservation
8. Preparation of Crude drugs in different systems of medicine
9. Financial aspects of medicinal plants: a) Loans b) Subsidies
10. IPR – Patents

#### **Reference**

1. Cultivation of medicinal and aromatic crops by Farooqui and Sreeramulu..Univ. Press
2. Textbook of Pharmacognosy by Young Ken – Heber W and Young Ken
3. Pharmacognosy of indigenous drugs by K. Raghunathan and Roma Mitra
4. Pharmacognosy- Kokate et al
5. Pharmacognosy- Mohammed Ali
6. Pharmacognosy- Wallis
7. Pharmacognosy- Trease & Evans-1996
8. Pharmacognosy- Shaw and Quadri
9. Pharmacognosy- Tyler, Brady and Robbins
10. Cultivation of Medicinal plants-Purohit & Vyas CBS, 2006
11. Introduction to Medicinal Chemistry (12996). Aler Gingauz. Wiley publications.
12. Medicinal Chemistry (2001). Graham L. Patrick. Oxford University Press