

# DEPARTMENT OF BOTANY

TELANGANA UNIVERSITY

Dichpally, Nizamabad-503322

(A State University Established under the Act No.28 of 2006, A.P.

Recognized by UGC under 2(f) and 12 (B) of UGC Act 1956)

Accredited by NAAC 'B' grade, CGPA: 2.61



## M.Sc. BOTANY COURSE STRUCTURE AND SYLLABUS

w.e.f. 2016-2017

**Dr. Ahmed Abdul Haleem Khan**

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**Dr. M. Aruna**

Head, Dept. of Botany,  
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M.Sc. Botany (Previous)

Course Structure

w.e.f. 2013-2014

Modified Course Structure – w.e.f. 2015-2016

Code No.	Paper Title	No. of Instruction Hours	Maximum Marks	No. of Credits
<b>Semester – I: Theory</b>				
Bot 101	Phycology	4	70 UE + 30 IE	4
Bot 102	Mycology	4	70 UE + 30 IE	4
Bot 103	Bryology, Pteridology and Paleontology	4	70 UE + 30 IE	4
Bot 104	Plant Biochemistry and Intermediary Metabolism	4	70 UE + 30 IE	4
<b>Semester – I: Practicals</b>				
Bot 151	Phycology	4	50 UE	2
Bot 152	Mycology	4	50 UE	2
Bot 153	Bryology, Pteridology and Paleontology	4	50 UE	2
Bot 154	Plant Biochemistry and Intermediary Metabolism	4	50 UE	2
<b>Semester – II: Theory</b>				
Bot 105	Taxonomy of Angiosperms, Medicinal Botany & Ethnobotany	4	70 UE + 30 IE	4
Bot 106	Gymnosperms and Embryology	4	70 UE + 30 IE	4
Bot 107	Developmental Anatomy and Palynology	4	70 UE + 30 IE	4
Bot 108	Plant Physiology	4	70 UE + 30 IE	4
<b>Semester – II: Practicals</b>				
Bot 155	Taxonomy of Angiosperms, Medicinal Botany & Ethnobotany	4	50 UE	2
Bot 156	Gymnosperms and Embryology	4	50 UE	2
Bot 157	Developmental Anatomy and Palynology	4	50 UE	2
Bot 158	Plant Physiology	4	50 UE	2

Approved by the Board of Studies

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**M.Sc. Botany I Semester**  
**BOT 101, Paper-I: Phycology**

**Unit-I**

1. General characters and comparative study of important systems of classification of algae (Fritsch, Round and Parker).
2. Criteria used in the primary classification of Algae: a) Gross cell structure b) Cell wall c) Flagella d) Pigments e) Reserve food materials
3. Algae of diverse habitats: a) Terrestrial algae b) Freshwater algae c) Marine algae
4. Reproduction of Algae: a) Vegetative b) Asexual c) Sexual

**Unit-II**

1. General characters, classification, morphology, life history of the following groups of algae:
  - a. Chlorophyceae: *Eudorina, Pediastrum, Hydrodictyon, Ulva, Cladophora, Stigeoclonium, Draparnaldiopsis, Closterium, Cosmarium* and *Nitella*
  - b. Cyanophyceae: *Microcystis, Lyngbya*

**Unit-III**

1. General characters, classification, morphology, and life history of the following:
  - a. Xanthophyceae: *Botrydium*
  - b. Phaeophyceae: *Laminaria, Sargassum, and Padina*
  - c. Rhodophyceae: *Porphyra, Gracillaria*
  - d. Bacillariophyceae: *Cyclotella, Pinnularia, Navicula* and *Synedra*

**Unit-IV**

1. General account of the following
  - a. Algal blooms and toxic algae
  - b. Algal Biofertilizers
  - c. Algae as food and feed
  - d. Economic importance of algae
  - e. Fossil algae

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2. Robin South, G and Alan Whittick: Introduction to Phycology
3. Morris, I: An Introduction to Algae
4. Round, F.E.: The Biology of Algae
5. Bold, H.c. and Wynne, M.D.: Introduction to the Algae structure and reproduction
6. H.D.Kumar: Introductory Phycology
7. Peter Pay: The Blue greens
8. M.G. Carr and S.A. Whitton: The biology of the Cyanobacteria
9. Trainer, F.R.: Introductory Phycology
10. Smith, G.M.: Manual of Phycology
11. Dawaon, Y.: Marine Botany
12. Dickson: Biology of the Rhodophyta
13. Cole, K.M. and Robert G. Sheet: Biology of the red algae

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**M.Sc. Botany I Semester**  
**BOT 102, Paper-II: Mycology**

**Unit-I**

1. General characters of fungi:
2. Recent trends in the classification of fungi; Evolution and Phylogeny of the fungi
3. Substrates of fungi, Nutrition (Saprophytic, Parasitic and symbiotic)
4. Reproduction in fungi (Sexual and Asexual).
5. Fungal cytology and genetics; Heterothallism: Heterokaryosis, Parasexuality, Physiological specialization of races

**Unit-II**

1. Comparative study of the following sub-divisions (brief account of the types)
  - a) Myxomycotina - *Stemonitis*
  - b) Mastigomycotina - *Peronospora, Pythium*
  - c) Zygomycotina - *Pilobolus*
  - d) Ascomycotina - *Emericella, Chaetomium, Erysiphe*
  - e) Basidiomycotina - *Melampsora, Polyporus, Uromyces*
  - f) Deuteromycotina - *Drechslera, Phoma, Fusarium*

**Unit-III**

1. Fungi in Industry: Production of alcohol, organic acids and antibiotics
2. Fungi in Agriculture and Forestry
  - a) Fungi as plant parasite (Wilts, leafspot, root rots, smuts and rusts)
  - b) Fungi as bio-fertilizers: Mycorrhizae: Ecto and Endomycorrhizae
3. Fungi as human and animal parasites (medical mycology)
4. Fungi as food: Mushrooms: Types of mushrooms, biology and growth of mushrooms, nutritional and medicinal value of edible mushrooms.

**Unit-IV**

1. Bacteria:
  - a) General account, ultrastructure, nutrition (autotrophy, heterotrophy and symbiosis) reproduction in bacteria and Economic importance
2. Viruses:
  - a) Characteristics and ultra-structure of virions, isolation and purification of virion
  - b) Chemical properties of plant viruses (TMV, bacteriophages)
  - c) Transmission of viruses
  - d) Economic importance of the viruses
3. Mycoplasma:
  - a) General account and systematic position of the mycoplasma
  - b) Economic importance of the mycoplasma

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4. Smith, J.E. The Filamentous Fungi
5. Berry, R., Industrial mycology (Vol. I)
6. Bio-synthesis and metabolism ( Vol II)
7. Dubey, S.C. Biotechnology.
8. Ainsworth, G.C. and Sussmann, A.S. The Fungi
9. Bennett, J.H. Fundamentals of Mycology
10. Voyles B.A. The Biology of viruses
11. Salle, A.J., Fundamentals of Bacteriology
12. Prescott-Harley and Klein-Microbiology
13. Ingram, J.L.-Microbial World
14. Holt, J.M. and Krig, N.R. (eds.)-Bergey's Manual of Systematic Bacteriology
15. Prof. A. Mani, -Microbiology

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**M.Sc. Botany I Semester**  
**BOT 103, Paper-III: Bryology, Pteridology and Paleontology**

**Unit-I**

1. Introduction, origin, distribution, classification and economic importance of Bryophytes with reference to:
  - a) Marchantiales
  - b) Jungermanniales
  - c) Anthocerotales
  - d) Sphagnales
  - e) Funariales
  - f) Polytrichales.
2. Evolution of
  - a. Gametophytes
  - b. Sporophytes
3. Ecology of Bryophytes
4. Fossil history of Bryophytes

**Unit-II**

1. Origin and evolution of early vascular plants
2. Telome concept and its applications
3. Evolution of Stele in pteridophytes
4. Heterospory and seed habit.

**Unit-III**

1. A general account of vegetation, morphology, reproductions and evolutionary trends in:
  - a. Psilotales,
  - b. Lycopodiales,
  - c. Selaginellales,
  - d. Isoetales,
  - e. Equisetales,
  - f. Filicales

**Unit-IV**

1. Paleobotany – Scope and objectives
2. Fossilization - fossil type, techniques for paleobotanical study
3. Brief account of Pteridospermales (Lyginopteridaceae, Medullaceae and Glossopteridaceae)
4. Birbal Sahni Institute of Paleobotany and its contributions

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3. Watson: The structure and life history of Bryophytes
4. Parihar, N.S.: Bryophyta
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6. Parihar N.S. 1976: Biology and Morphology of Pteridophytes
7. Sporne, K.R. Pteridophytes
8. Rashid: Introduction to pteridophyta
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**M.Sc. Botany I Semester**  
**BOT 104, Paper-IV - Plant Biochemistry and Intermediary Metabolism**

**Unit-I**

1. Principles of Thermodynamics
  - a) First law of thermodynamics
  - b) Second law of thermodynamics
2. Enzymes - properties, classification and nomenclature, co-factors, kinetics, mechanism of enzyme action, Isozymes, and allosteric enzymes.

**Unit-II**

1. Carbohydrates: Classification, structure and functions of
  - a. Monosaccharides
  - b. Oligosaccharides
  - c. Polysaccharides
2. Lipids: Classification of lipids –
  - a. Simple lipids,
  - b. Compound lipids,
  - c. Sterols
  - d. Terpenoids,
3.  $\alpha$ -oxidation,  $\beta$ -oxidation, glyoxylate cycle, gluconeogenesis.

**Unit-III**

1. Amino acids - properties, Classification, biosynthesis with reference to GOGAT and GS.
2. Proteins - Classification, Membrane models with reference to Chemical composition and Functions

**Unit-IV**

1. Respiration: Glycolysis, fermentation, tricarboxylic acid cycle and its regulation, Electron transport chain, and oxidative phosphorylation, chemiosmotic hypothesis, hexose monophosphate shunt and its significance, Cyanide – resistant respiration.

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4. Principles of biochemistry, Lehninger, A.L. 1982 CBS Publication
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## M.Sc. Botany-I Semester Practical Syllabus

### BOT 151, Paper-I: Phycology

1. Collection and identification of algae occurring in and around University Colleges / Campuses.
2. Identification of genera mentioned in Chlorophyceae, Cyanophyceae, Xanthophyceae, Phaeophyceae, Rhodophyceae and Bacillariophyceae

### BOT 152, Paper-II: Mycology

1. Introduction to Mycological techniques: i) Methods of Sterilization ii) Preparation of Media (PDA) iii) Culturing methods
2. Study of Symptomology of fungal diseases like Downy mildews, Tikka disease, Green bajra, sunflower rust, *Melampsora* rust, wheat and sorghum rusts and powdery mildews.
3. Section cutting and slide preparation of diseases mentioned above
4. Screening of Mycorrhizal fungal spores from the soil

### BOT 153, Paper-III: Bryology, Pteridology and Paleontology

1. Bryology: Morphological and structural study using whole mount of the following
  - a. *Plagiochasma / Fimbraria*
  - b. *Targionia*
  - c. *Notothylas*
  - d. *Sphagnum / Funaria*
2. Pteridology: Morphology and anatomy of vegetative as reproductive organs using cleared whole mount, sections, macerations and permanent preparations of
  - a. *Psilotum*,
  - b. *Isoetes*,
  - c. *Ophioglossum*,
  - d. *Adiantum*,
  - e. *Salvinia*,
  - f. *Azolla*
3. Paleontology – Identification of fossils preserved in the laboratory

### BOT 154, Paper-IV - Plant Biochemistry and Intermediary Metabolism

1. Determination of catalase activity
2. Determination of amylase activity
3. Estimation of fructose by resorcinol method
4. Estimation of protein by Biuret method/Lowry et.al. method
5. Estimation of phenols

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## M.Sc. Botany – II Semester

### BOT 105, Paper-I: Taxonomy of Angiosperms, Medicinal Botany and Ethnobotany

#### Unit-I

1. Systems of classification:
  - a) Hutchinson
  - b) Cronquist
  - c) Takhtajan.
2. Taxonomic Evidence and techniques used there in
  - a) Morphology
  - b) Epidermology
  - c) Cytology
  - d) Phytochemistry
  - e) Nucleic acid hybridization
3. Taxonomic Tools
  - a) Herbaria
  - b) Flora
  - c) Botanic Gardens
  - d) Arboreta

#### Unit-II

1. Nomenclature:
  - a) Concept of ICBN
  - b) Salient features of Botanical Nomenclature
  - c) Ranks and Nomenclature of taxa
  - d) Typification
  - e) Rules of Priority
  - f) Effective and valid publication
  - g) Author citations.

#### Unit-III

1. A comparative study of the following pairs of families and their treatment in recent systems:
  - a) Magnoliaceae & Winteraceae
  - b) Malvaceae & Sterculiaceae
  - c) Verbenaceae & Lamiaceae
  - d) Amaranthaceae & Chenopodiaceae
  - e) Cyperaceae & Poaceae

#### Unit-IV

1. Morphology, Active Principles and medicinal value of the following:
  - a) *Andrographis paniculata*
  - b) *Asparagus racemosus*
  - c) *Clitoria ternata*
  - d) *Phyllanthus emblica*
  - e) *Gymnema sylvestre*
2. Ethnobotany – Relevance and scope
  - a. Ethnic tribes of Andhra Pradesh and their dependence on forest produce
  - b. Podu cultivation

## References

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**M.Sc. Botany – II Semester**  
**BOT 106, Paper –II Gymnosperms and Embryology**

**Unit – I**

1. Distribution, Evolution and Classification of Gymnosperms
2. A general account of Gymnosperms with reference to their vegetative morphology and anatomy of the following taxa
  - a). Cycadales (*Zamia*)
  - b). Ginkgoales (*Ginkgo*)
  - c). Coniferales (*Podocarpus*)
  - d). Taxales (*Taxus*)
  - e). Ephedrales (*Ephedra*)

**Unit – II**

1. Development of male and female gametophyte in Gymnosperms
2. Embryogeny in Gymnosperms
3. Economic importance of Gymnosperms

**Unit- III**

1. Introduction to embryology of angiosperms
2. Microsporangium – anther wall, sporogenous tissue
3. Development of male gametophyte
  - a. Formation of vegetative and generative cells
  - b. Formation of sperms, pollen wall and abnormal features
4. Megasporangium
  - a. Types of ovules, integuments and nucellus
  - b. Special features of megasporogenesis
5. Development of female gametophyte
  - a. Types of female gametophyte
  - b. Mature embryo sac
  - c. Haustorial behavior of embryo sac
  - d. Nutrition of embryo sac

**Unit- IV**

1. Pollination:
  - a. Anther dehiscence
  - b. Pollen dehiscence
2. Fertilization
  - a. Pollen germination, Pollen tube growth
  - b. Double Fertilization
3. Sexual incompatibility
  - a. Self-incompatibility
  - b. Physiology and biochemistry of self-incompatibility
  - c. Biological significance of incompatibility
  - d. Methods to overcome incompatibility
4. Development of endosperm and function of endosperm
5. Embryology in relation to taxonomy and an account of experimental and applied embryology

## References

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**M.Sc. Botany – II Semester**  
**BOT 107, Paper: III Developmental Anatomy and Palynology**

**Unit-I**

1. Root Development:
  - a). Organization of root apex and significance of Quiescent center
  - b) Recent experimental studies on differentiation of tissues.
2. Shoot Development:
  - a) Recent views on organization of shoot Apical Meristem and types of vegetative shoot apex.
3. Leaf: Structure with reference to C3 and C4 plants – Kranz and CAM Syndrome

**Unit-II**

- 1) Structural composition of Epidermal cells, orientation and arrangement
- 2) Basic structure with reference to subsidiaries and ultra-structure of guard cells
- 3) Structure and classification of Trichomes with reference to foot and body
- 4) Ontogeny of Paracytic, diacytic, and anisocytic stomata
- 5) Ultrastructure of xylem and phloem

**UNIT-III**

1. Nature of cambium
  - a. Cambial activity-normal and abnormal (anomalous secondary growth)
2. Secondary growth with reference to stem:
  - a) Wood: Significance of study of 3-dimensional structure of wood
  - b). Morphology and arrangement of Vessels, Axial Parenchyma Fibres and Ray parenchyma and their value in wood identification
3. Salient features of the following woods.
  - a). *Tectona grandis*
  - b). *Shorea robusta*
  - c). *Pongamia pinnata*

**Unit – IV**

Palynology:

1. Introduction and scope
2. Acetolysis - Pollen preparation and pretreatment
3. Morphology of pollen –
  - a). Polarity,
  - b). Symmetry,
  - c). Apertural pattern,
  - d). Exine stratification
  - e). Ornamentation of pollen wall
4. Principles of Aeropalynology and Melittopalynology
5. Role of Palynology in Taxonomy
6. Application of palynology in oil exploration and Forensic science.

## References

1. Fahn, A. Plant Anatomy (4th Ed.), 1990.
2. Easu, K. Anatomy of Seed Plants.
3. Easu, K. Plant Anatomy, 2nd Ed. Wiley N.Y. 1965.
4. Cutter, E.G. Plant Anatomy, Part I and II Edward Arnold; London, 1971 and 1978
5. Metcalf and Chalk. Anatomy of dicots (2nd Edition) (1983). Clarendon Press, Oxford.
6. Metcalf (1982-87) Anatomy of Dicots Vol. I to III
7. meureth, J.D. 1988. Plant Anatomy. The Benjamin/Cummings Pub1.Inc., Menlo Park California.
8. Carliquist. S. (1988). Comparative wood anatomy, Springer – Berlag, Berlin.
9. Jeffrey, E.C. The Anatomy of woody plants.
10. Rao, K.R. & K.B.S. Juneja (1971) A Hand book for identification of fifty important Timbers of India.
11. Pearsom & Brown – Commercial Timbers
12. Lyndon R.F. 1990. Plant development – The cellular basis. Unwin Hyman, London.
13. Steeves T.A. & Sussex I. M., 1989, Patterns in plant development 92nd Edition) Cambridge Unity Press, Cambridge.
14. P.K.K. Nair. Pollen Morphology of angiosperms.
15. P.K.K. Nair: Essentials of Palynology
16. Moor & Moor: Pollen analysis
17. R.B. Knox, Pollen allergy
18. M.R. Suxena : Palynology

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**M.Sc. Botany – II Semester**  
**BOT 108, Paper-IV: Plant Physiology**

**Unit-I**

1. Water relations:
  - a) Transpiration - stomatal regulation of transpiration, SPAC concept
2. Mineral nutrition:
  - a) Role of micronutrients in plant nutrition
  - b) Theories of mineral salt absorption

**Unit-II**

1. Photosynthesis:
  - a. Photosynthetic apparatus
  - b. Properties of light and absorption of light by photosynthetic pigments
  - c. Composition and characterization of photo systems I and II
  - d. Photophosphorylation
  - e. C<sub>3</sub> cycle
  - f. C<sub>4</sub> cycle
  - g. CAM pathway
  - h. Regulation of C<sub>3</sub>, C<sub>4</sub> and CAM pathway
  - i. Photorespiration and its regulation

**Unit-III**

1. Hormonal Regulation of growth and development:
  - a. General role of Auxins, Gibberellins, Cytokinins, Ethylene, Abscisic acid, Salicylic acid and Brassinosteroids
2. Physiology of flowering
  - a. Photoperiodism, Phytochrome
3. Physiology and biochemistry of seed germination
4. Physiology and biochemistry of seed dormancy (Causes and methods of breaking dormancy)

**Unit-IV**

1. Nitrogen metabolism:
  - a. Protein Biosynthesis
2. Physiology and biochemistry of nitrogen fixation
  - a. Nitrate reductase
3. Sulphur Assimilation and reduction
4. Structure and Function of Protein phosphorylation in Calmodulin

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## References

1. Principles of Plant nutrition 4th Edition by Mengel K. and E.A. Kirby International Institute of Polesh Switzerland 1987.
2. Mineral nutrition of crop plants. H. Marshener academic Press 1986.
3. Plant Physiology by F.B. Salisbury and C.W. Ross. Wordsworth biology series.
4. Growth and differentiation in plants by Wareing and Phillips, Pergamon press.
5. Plants Cell structure and metabolism. J.L. Hall, Flower and Roberts, ELBS, Longman.
6. Advanced Plant Physiology by M.B. Wilkinson, ELBS, Longman
7. Introduction to Plant Physiology by G.R. Noggle and G.J. Fritz, Printice Hall Press
8. Cell Biology by C.B. Powar, Himalaya Publishing
9. Plant Physiology by R.N. Devlin and F.H. Witham, CBS 1986
10. Introduction to plant physiology W.G. Hopkins. 1999. John Wiley and sons.

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## M.Sc. Botany-II Semester Practical Syllabus

### BOT 155, Paper-I: Taxonomy of Angiosperms, Medicinal Botany and Ethnobotany

1. Study of the locally available plants
2. Description and identification at family, genus and species levels using Floras.
3. Identification of key characters in a group of species of a genus and construction of keys.
4. Construction of indented keys for the given material
5. Identification of families studied based on flowers or essential parts of the flowers
6. Knowledge of Herbarium techniques
7. Medicinal value of plants available in the University College/ campus
8. Study of ethnobotanical specimens
  - a. Ethnomedicine
  - b. Ethnic group
  - c. Ethnic food plant

### BOT 156, Paper –II Gymnosperms and Embryology

1. Comparative study of the vegetative, reproductive parts and Anatomy of the following: *Zamia*, *Araucaria*, *Thuja*, *Ginkgo*, *Taxus*.
2. Studies on section of ovules and identification of their ovaries
3. Pollen germination studies in different locally available plants and estimation of pollen fertility.
4. Study of embryos and Haustoria in locally available plants by dissection of young seeds

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## BOT 157, Paper: III Developmental Anatomy and Palynology

1. Study of angiosperm leaf epidermis in the following taxa: *Crotalaria*, *Portulaca* or *Talinium*, *Tridax*, *Petunia* or *Datura*, *Barleria*, *Rhoeo discolor* or *Commelina*, *Brassica*, *Cyperus* and Grass.
2. Estimation of stomatal frequency and stomatal index in the materials studied.
3. Maceration of wood and identification of various elements in *Michelia*, *Bombax*, *Tectona*, *Terminalia* and *Azadirachta*
4. Study of wood structure with the help of T.S., R.L.S. in the following: *Tectona*, *Bombax*, *Michelia*, *Pongamia* and *Azadirachta*
5. Histochemical tests for identification of the following: a) Callose b) Lignin c) Pectin d) Starch e) Suberin  
f) Silica bodies in the leaf of grasses and sledges.
6. Study of shoot apex in suitable locally available materials to understand cyto histological zonation (*Coleus*, *Kalanchoe*)
7. Study of roots in Monocots and Dicots. Examination of L.S. of root from a permanent preparation to understand the organization of root apical meristem and its derivatives (maize, aerial roots of banyan, *Pistia*, *Jussiaea*)
8. Study of the pollen grains of *Hibiscus*, *Tribulus*, *Ocimum* and Grass.
9. Acetolysis

## BOT 158, Paper-IV: Plant Physiology

1. Determination of water potential by Shardolo's methods.
2. Determination of total and titrable acidity.
3. Separation of chloroplast pigments by solvent method
4. Determination of chlorophyll a, chlorophyll b and total chlorophylls in C<sub>3</sub> and C<sub>4</sub> plants.
5. Estimation of reducing sugars in fruits.
6. Determination of iodine number.

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**M.Sc. Botany (Final)**  
**Course Structure**  
w.e.f. 2013-2014  
**Modified Course Structure – w.e.f. 2016-2017**

Code No.	Paper Title	No. of Instruction Hours	Maximum Marks	No. of Credits
<b>Semester – III: Theory</b>				
Bot 201	Cell Biology, Genetics, Ecology and Phytogeography	4	70 UE + 30IE	4
Bot 202	Carbon assimilation and Crop Productivity	4	70 UE + 30IE	4
Bot 203	Stress Physiology	4	70 UE + 30IE	4
Bot 204	Plant Tissue Culture and Biotechnology	4	70 UE + 30IE	4
<b>Semester – III: Practicals</b>				
Bot 251	Cell Biology, Genetics, Ecology and Phytogeography	4	50 UE	2
Bot 252	Carbon assimilation and Crop Productivity	4	50 UE	2
Bot 253	Stress Physiology	4	50 UE	2
Bot 254	Plant Tissue Culture and Biotechnology	4	50 UE	2
<b>Semester – IV: Theory</b>				
Bot 205	Molecular Genetics, Biostatistics, Ecodiversity and Conservation	4	70 UE + 30IE	4
Bot 206	Phytohormones and Plant Development	4	70 UE + 30IE	4
Bot 207	Physiology and molecular Biology of Nitrogen Fixation	4	70 UE + 30IE	4
Bot 208	Plant Molecular Biology and Genetic Engineering	4	70 UE + 30IE	4
<b>Semester – IV: Practicals</b>				
Bot 255	Molecular Genetics, Biostatistics, Ecodiversity and Conservation	4	50 UE	2
Bot 256	Phytohormones and Plant Development	4	50 UE	2
Bot 257	Physiology and molecular Biology of Nitrogen Fixation	4	50 UE	2
Bot 258	Plant Molecular Biology and Genetic Engineering	4	50 UE	2

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**Bot 201, Paper-I: Cell Biology, Genetics, Ecology and Phytogeography**  
**Section-A**

**UNIT-I**

1. Basic principles of light, phase-contrast, fluorescence and electron microscopy.  
Brief study of computer assisted karyotype analysis and in situ hybridization.
2. Brief account of DNA replication and transcription. Introns and exons.
3. Brief study of regulation of gene expression in prokaryotes (Lac-operon) and eukaryotes (promoters, transcription factors and enhancers).

**UNIT-II**

4. Overview of cell cycle and apoptosis. Control mechanisms: role of cyclins and cyclin dependent kinases, retinoblastoma and E2F proteins. Programmed cell death.
5. Brief account of gene mutations, chromosomal aberrations, site-directed mutagenesis, transposon induced mutations, DNA damage and repair. Inherited human diseases. Cancer, protooncogenes and oncogenes.
6. Brief overview of Mendelian inheritance, gene interaction, linkage and chromosome mapping in eukaryotes. Brief study of extra-nuclear inheritance.

**Section-B**

**UNIT- III**

7. Principles, concepts and levels of ecology (genes, cells, organism, individuals, population, community, ecosystems, biomass and biosphere). Homeostasis and self-regulation.
8. Community characteristics: Qualitative, quantitative, analytical and synthetic characters, Raunkier's and Braun-Blanquet's concepts. Diversity, dominance and similarity indices of plant communities.
9. Ecosystem organization: Structure and functions. Primary production (methods of measurement, global pattern, controlling factors), energy dynamics (trophic organization, energy flow pathways, ecological efficiencies), litter fall and decomposition (mechanism, substrate quality and climatic factors), global bio-geochemical cycles of C, N<sub>2</sub>, P and S, mineral cycles (pathways, processes) in terrestrial and aquatic ecosystems.

**UNIT- IV**

10. Climate, soil and vegetation pattern of the world: Climate of the world and India. Relationship between climate, vegetation and great soil types. Koppen and Thornthwaite's climatic classification. Good's principles. Endemism.
11. Environmental pollution: Sources of air pollution, causes and types (SO<sub>2</sub>, H<sub>2</sub>S, CO, NO<sub>2</sub>, Smog, biopollutants. Sources of water pollution, causes and types of eutrophication. Sources of soil pollution and effects on ecosystem. Sound and dust pollution.
12. Climate change: Greenhouse gases (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, CFCs: sources, trends and role), ozone layer and ozone hole, consequences of climate change (CO<sub>2</sub> fertilization, global warming, sea level rise, UV radiation).

## List of books recommended

### Section - A:

1. A. K. Sharma and A. Sharma. 1990. Chromosome techniques. Butterworths.1990 Ed.
2. Edward. S. Lenhoff. 1990. Tools of Biology Mc Millan Company.
3. E.D.P. De Robertis and E. M. F. De Robertis. 1987. Cell and Molecular biology. 8th Ed.. (Indian Edition is also available..Varghese Company), Ed.
4. G. M. Cooper. 1997. The Cell and Molecular approach. ASM Press. Ed.
5. Strickberger. Genetics.3rd Ed. 1990. Ed.
6. Snustad and Simmons. 1997. Principles of Genetics. Ed.
7. Benjamin Lewis. 1999. Genes VII.
8. Daniel Hartl. 1994. Basic Genetics. Ed.
9. Griffiths, Miller, Suzuki, Lewontin and Gelbert . 1999. An introduction to Genetic analysis.
10. Winter, Hicky and Fletcher . 1999. Instant notes in Genetics. Ed.
11. A.V.S.S. Sambamurthy. 1999. Genetics.
12. Ahluwalia. 1993 Genetics. 1
3. P.K. Gupta. 1990. Genetics.
14. U. Sinha and S. Sinha. 1994. Cytogenetics, Plant Breeding & Evolution. Ed.
15. K. K. De. 1992. Plant tissue culture.
16. Narayanaswamy. 1994. Plant cell & tissue culture.
17. Y.P.S. Bajaj. 1986 to 1990. Biotechnology in Agriculture and Forestry. Vol. 1 to 16. Ed..
18. I. Vasil. 1995. Plant tissue culture. Vol. 1 to 4. Ed.

### Section -B:

1. E. P. Odum. 1996. Fundamentals of Ecology.
2. E. J. Koromondy.1996. Concepts of Ecology.
3. Champion and Seth. Forests of India.
4. P. D. Sharma. 1996. Ecology and Environment.
5. B. K. Sharma. 2000.Environmental Chemistry.
6. Robert Leo Smith. 1995. Ecology and Field Biology.
7. H. N. Parket. Air Pollution.
8. S. P. Mahajan. Pollution control in process industries.
9. P. S. Welch. 1976. Limnology.
10. G. S. Puri et al. Forest Ecology.
11. Vollenreider. Productivity in freshwater Ecosystems.
12. Todev G. Kudrev. Water and plant productivity.
13. Turk and Turk. Environmental Science.
14. R. S. Ramalho. Introduction to waste water treatment process.
15. Pollution control handbook. 1986.

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**Specialization:**  
**Applied Plant Physiology and Molecular Biology**  
**M.Sc. Botany III Semester**  
**Bot 202, Paper-II: Carbon assimilation and Crop Productivity**

**UNIT-I**

**1. CO<sub>2</sub> metabolism in C<sub>3</sub> plants**

- a. C<sub>3</sub> pathway
- b. Rubisco – Structure and assembly of enzyme
- c. Mechanisms of activation, catalysis and inhibition of the enzyme

**2. CO<sub>2</sub> metabolism in C<sub>4</sub> plants**

- a. Biochemical schemes for C<sub>4</sub> pathway with reference to aspartate and malate forms
- b. Kranz leaf anatomy
- c. Regulation of C<sub>4</sub> pathway
- e. Efficiency and productivity of C<sub>4</sub> pathway

**UNIT-II**

**3. CO<sub>2</sub> metabolism in CAM plants**

- a. CAM pathway
- b. Regulation of CAM pathway

**4. Photorespiration**

- a. Mechanism of photorespiration
- b. Regulation and significance of photorespiration

**UNIT-III**

**5. Partitioning of photosynthates**

- a. Starch sucrose metabolism and assimilate partitioning
- b. Source – Sink relationship and yield

**6. Starch metabolism**

- a. Manipulation of starch metabolism
- b. Genetic manipulation of starch structure and properties
- c. Cyclodextrins and fructans

**UNIT-IV**

7. Molecular biology of photosynthesis in higher plants: plastid genome and genes encoding plastid proteins

8. Regulation of gene expression during chloroplast development. Light regulation

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## References

1. Plant Physiology: By F.B. Salisbury and Cleon W. Ross 4th Edition 1992. Wordsworth publishing company. Belmont California.
2. Photosynthesis and crop productivity in different environments. J. Cooper, Cambridge
3. Plant Physiology, biochemistry and Molecular biology. Ed. David T. Dennis and David H. Turnip (1990). Longman scientific technical
4. Photosynthesis. A comprehensive treatise (1998) Ed. A.S. Raghavendra Cambridge University Press.
5. Plant Physiology by Taiz and Zeiger
6. Plant Physiology by Hopkins
7. Genetic modification of plant carbohydrate metabolism by S C H J Turk and S C M Smeekens in: Applied biotechnology by V L Chopra, V S Malik and S R Bahl 1999.
8. Biotol Series: Crop productivity. 1992
9. Concepts in biotechnology (1996) ED. By D. Balasubramanyam, C F A Bryce K. Dharmalingam J. Green K. Jayaraman Univ. Press
10. Biochemistry in plants a comprehensive treatise De. By M D.Hatch and Broadman pg. 193-236 New York/1981.
11. Crop evolution and adaptation and yield Ed. By L T Evans 1993. Cambridge, University Press.

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**M.Sc. Botany (Final) III Semester  
Bot 203, Paper III: Stress Physiology**

**UNIT-I**

**1. Water Stress**

- a. Membranes and water stress
- b. Stomatal response to water stress-Role of ABA
- c. Photosynthesis and water stress
- d. Mechanisms of drought tolerance

**2. Flooding stress**

- a. Flooding injury
- b. Metabolic damage
- c. Hormonal imbalance
- d. Soil toxins

**UNIT-II**

**3. Temperature stress**

- a. Effect of low temperature and frost injury on plant productivity
- b. Stress effects on productivity and yield susceptibility of plants
- c. Chilling and freezing effects on carbon dioxide exchange

**4. Heat stress**

- a. Cellular responses to high temperature: enzyme activities, photosynthesis, ultra-structural effects
- b. Molecular responses to high temperature. Heat shock proteins. High temperature tolerance mechanisms in plants

**UNIT-III**

**5. Metal stress**

- a. Metal toxicity and tolerance with special reference to i) Aluminum ii) Manganese iii) Iron iv) Zinc

**6. Allelochemicals**

- a. Chemical nature of allelochemicals
- b. Mode of release and production of allelochemicals
- c. Mode of action of allelochemicals on plant physiological processes

**UNIT-IV**

**7. Salt stress**

- a. Effect of high salt concentration of plants – water stress, nutrient ion deficiency, ion toxicity
- b. Regulation of salt content – Salt elimination, salt succulency
- c. Mechanisms of salt resistance and tolerance

**8. Ultraviolet – B radiation**

- a. Plant response to UV - B radiation
- b. Effect of UV-B on chemical composition
- c. Effect of UV-B radiation on photosynthesis
- d. UV-B defense and gene expression

## References

1. Plant ecophysiology Ed. M N V Prasad. John Wiley and Sons Inc. NY (1997)
2. Encyclopedia Plant Physiology. New Series.12 ABCD Plant Physiology Ecology 1983. Springer Verlag Berlin
3. Plant Physiology L. Taiz and E. Zeiger, 1999. Sinauer Associates Inc. Publishers. Sunderland M A
4. Photosynthesis. A comprehensive treatise. 1998. Ed. A S Raghavendra, Cambridge Univ. Press.
5. Plant Physiology. Frank B. Salisbury and Cleon W. Ross 4th edition. 1992. Wordsworth Publication co. Belmont. California
6. Plant Physiology. William Hopkins. Second Edition. John Wiley and Sons. Inc. NY
7. Plant cellular and molecular responses to high salinity. P.M. Hasagewa and Ray A. Bressan. In: Annual Rev. Plant Physiology and Molecular Biology. 2000.
8. Responses of plants to environmental stress. Vol. II and I J Levitt, 1980. Academic press. New York.
9. Physiological plant ecology. Third edition. Walter Larcher 1995. Springer

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**M.Sc. Botany (Final) III Semester**  
**Bot 204, Paper-IV: Plant Tissue Culture and Biotechnology**

**UNIT-I**

1. Basic concepts of Biotechnology. Overview of Plant Biotechnology.
2. Plant tissue culture laboratory, culture media and culture techniques.
3. Totipotency and cyto-differentiation. Cell suspension and callus cultures.

**UNIT-II**

4. Morphogenesis: Caulogenesis and rhizogenesis through callus. Rooting & establishment of regenerated shoots. Somaclonal variation.
5. Embryogenesis: Embryogenic callus, somatic embryos and plant regeneration. Importance of synthetic seeds.

**UNIT-III**

6. Meristem culture, multiple shoot production and micropropagation.
7. Anther & pollen culture. Significance of haploidy.
8. Isolation, culture & fusion of protoplasts.

**UNIT-IV**

9. Cryopreservation and germplasm storage.
10. Application of micropropagation in horticulture and forestry.
11. *In vitro* production of secondary metabolites from medicinal and aromatic plants and industrial applications. Hairy root cultures.

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2. Plant tissue culture. Vol. 1 to 4. Ed. I. Vasil. 1993.Ed.
3. Concepts in Biotechnology. Ed. Balasubramanian. Universities Press. 1996. Ed.
4. Principles and methods in Plant Molecular Biology, Genetics and Biochemistry. Prathibha Devi. Agrobios Publ. 2000. Ed.
5. Agricultural Biotechnology. S.S. Purohit. 1999.Ed.
6. Biotechnology. H. D. Kumar.1992.Ed.
7. Biotechnology. Trehan. 1994.Ed.
8. Plant tissue culture. K. K. De. 1992.Ed.
9. Plant tissue culture. Narayanaswamy.1994.Ed.
10. Smith, R. H. 2000.Plant Tissue Culture: Techniques and Experiments. Academic Press, New York.

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**M.Sc. Botany III Semester**  
**Practical syllabus**  
**Bot 251, Paper-I: Cell Biology, Genetics, Ecology and Phytogeography**

**Section - A:**

1. Squash preparation of onion root tips to study mitosis.
2. Smear preparation of maize or onion flower buds to study meiosis.
3. Problems in Genetics:.
4. Mendelian inheritance and gene interaction
5. Chromosome mapping in eukaryotes
6. Maintenance of Practical Record.

**Section -B:**

1. Determination of minimum size quadrates by species area curve.
2. Determination of quantitative characters by random quadrat method. Abundance, density, basal cover, canopy cover, frequency, IVI and dominance, diversity and similarity.
3. Evaluation of life form classes of local flora. Preparation of frequency diagram of plant community by Raunkier's method and preparation of biological spectrum.
4. Morphology and anatomy of common hydrophyte and xerophyte adaptations.
5. Interpretation of environmental data and climatogram and plotting techniques with reference to life forms and vegetational types.
6. Determination of pH of soil and water samples.
7. Estimate of chlorides, carbonates and bicarbonates and dissolved oxygen in water.
8. Maintenance of Practical Record.

**Bot 252, Paper-II: Carbon assimilation and Crop Productivity**

1. Determination of leaf area
2. Estimation of total chlorophyll: Chlorophyll-a, Chlorophyll-b and ratio of Chlorophyll a /Chlorophyll b
3. Determination of stability index of chloroplast pigments
4. Estimation of reducing sugars by dinitrosalicylic acid reagent (DNS)
5. Estimation of protein content by Lowry's/Bradford's method
6. Estimation of phosphorus

**Bot 253, Paper III: Stress Physiology**

1. Estimation of proline
2. Extraction and estimation of total phenols
3. Estimation of catalase activity
4. Estimation of peroxidase activity
5. Estimation of polyphenol oxidase activity
6. Estimation of ascorbic acid oxidase activity

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**Bot 254, Paper-IV: Plant Tissue Culture and Biotechnology**

1. Preparation of stock solutions and tissue culture media viz: MS basal medium.
2. Laboratory experiments for callus induction, organogenesis, somatic embryogenesis and plantlet regeneration.
3. Preparation of synthetic seeds with somatic embryos.
4. Enzymatic isolation of protoplasts.
5. Maintenance of Practical Record.

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**M.Sc. Botany IV Semester**  
**Bot 205, Paper-I: Molecular Genetics, Biostatistics, Eco-diversity and Conservation**  
**Section--A**

**UNIT-I**

1. Brief account of plant tissue culture and micropropagation.
2. Overview of recombinant DNA technology. Basic concepts of restriction mapping, gene cloning, genomic / cDNA libraries, polymerase chain reaction, restriction fragment length polymorphism (RFLP) and DNA fingerprinting.
3. Basic concepts of gene sequencing, microarrays, functional genomics and proteomics.

**UNIT-II**

5. Mean, Variance, Standard deviation and Standard error.
6. Chi-square and Student's "t" test. Concept of Probability: Addition and multiplication rule.
7. Introduction to computers. Use of Word and PowerPoint in the preparation and presentation of documents. Use of Internet and World Wide Web in research.
8. Basic concepts of Bioinformatics.

**Section-B**

**UNIT-III**

9. Plant Biodiversity: Concept, status in India and concerns. Role of biodiversity in ecosystem functions and stability, speciation and extinction, IUCN categories of threat, hot spots and inventory.
10. Sustainable development: Basic concepts.
11. Development and evolution of ecosystem: Allopatric and sympatric speciation. Models of ecosystem development and succession.
12. Plants used as avenue trees for shade, pollution control and aesthetics.

**UNIT-IV**

13. Green revolution: Benefits and adverse consequences.
14. Principles of Conservation. Strategies for conservation: In situ conservation: International efforts and Indian initiatives, protected areas in India: sanctuaries, national parks, biosphere reserves, wetlands, mangroves and coral reefs for conservation of wild biodiversity.
15. Strategies for conservation: ex situ conservation: Principles and practices (botanical gardens, field gene banks, seed banks, in vitro repositories and cryobanks), general account of the activities of Botanical Survey of India (BSI), National Bureau of Plant Genetic Resources (NBPGR), Indian Council of Agricultural Research (ICAR), Council of Scientific and Industrial Research (CSIR), and the Department of Biotechnology (DBT) for conservation and non-formal conservation efforts.

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## List of books recommended

### Section -A

1. Watson, Gilman, Wittkowsky and Zoller. 1992. Recombinant DNA.
2. Rastogi, Sharma and Tandon 1994. Concepts in Molecular Biology.
3. Snustad, W and Simmons Wiley.1991. Principles of Genetics.
4. Shaw, G. M. 1988. Plant Molecular Biology. A practical approach. Ed.
5. Davis, L, Kuehl and Battey. 1994. Basic methods in Molecular Biology. Ed.
6. Twyman. 1998. Advanced Molecular Biology.
7. Turner, Mclennon, Bates and White. 1999. Instant notes in Molecular Biology.
8. Primrose. 1999. Molecular Biotechnology.
9. Hughes, M. A. 1992. Plant Molecular Genetics.
10. Prathibha Devi. Principles & Methods in Plant Molecular Biology, Genetics & Biochemistry, Agrobios.
11. Purohit. S. S. 1999. Agricultural Biotechnology.
12. Stansfield. 1996. III Ed. Theory & Problems in Genetics. Schaum's Series. McGraw & Hill.
13. Khan, I. A. and A. Khanum. 1994. Fundamentals of Biostatistics
14. B. N. Mishra and K. K. Mishra. Naya Prakash. 1983. Introductory practical Biostatistics.
15. Jain, v. k. Computers for beginners. Pustak Mahal.
16. Vikas Gupta, 2000. Rapidex computer course. Rapidex series.
17. Bennet Falk. 2000. The Internet road map. BPB Publications.
18. BPB Publications 2000. The ABCs of Internet..
19. Cynthia Gibas. O'Reilly & Assoc. 2000. Developing Bioinformatics Computer skills.
20. Balasubramanian. Ed. Concepts in Biotechnology. Universities Press. 1996.
21. Deepak Bharihoke. 2000. Fundamentals of Information technology. 22. Crumlish. 1999. The Internet. Ed. 23. Gralla. 2000. How the Internet works.
24. White. 2000. How computer works.

### Section B:

1. Anonymous 1997. National Gene Bank: Indian Heritage on Plant Genetic Resources (Booklet). National Bureau of Plant Genetic Resources, New Delhi.
2. Arora, R.K. and Nayar, E.R. 1984 Wild relatives of crop plants in India. NBPGR Science Monograph No. 7.
3. Baker, H.G. 1978. Plants and Civilization (3rd Ed. C.A. Wads worth, Belmont.
4. Bole, P.V. and Vaghan, Y. 1986. Field Guide to common Indian trees. Oxford Univ. Press.
5. Chandel, K.P.S. Shukla, G. and Sharma, N. 1996. Biodiversity in Medicinal & Aromatic plants in India. Conservation & Utilization. National Bureau of Plant Genetic Resources, New Delhi.

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**Specialization:**  
**Applied Plant Physiology and Molecular Biology**  
**M.Sc. Botany-IV Semester**  
**Bot 206, Paper – II: Phytohormones and Plant Development**

**Unit-I**

**1. Phytohormones:** Biosynthesis, physiological role and molecular mechanism of actions of.

- a) Auxins
- b) Gibberellins
- c) Cytokinins
- d) Abscisic acid
- e) Ethylene

**2. Naturally occurring growth substances other than principal compounds:**

- a) Polyamines
- b) Methyl Jasmonates
- c) Phenolics
- d) Brassinosteroids
- e) Tricantanol
- f) Batasins

**Unit-II**

**3. Hormonal regulation of organ development:**

- a) Root development
- b) Shoot development
- c) Leaf development

**4. Effect of plant growth substances on flowering and fruiting:**

- a) Flower initiation and sex expression
- b) Fruit set, development and ripening
- c) Genetic engineering for extended shelf life of fruits (e.g. Flavr Savr tomato)

**Unit-III**

**5. Senescence:**

- a) Physiological and biochemical changes during senescence: photosynthesis, loss of chlorophyll, nucleic acid metabolism, respiration
- b) Hormonal control of senescence: cytokinins, abscisic acid and ethylene

**6. Plant growth Regulators and weed control:**

- a) Auxin type herbicides 2,4 – D, phenoxyacetic acid
- b) Pyridines
- c) Genetic engineering for herbicide resistance in plants.

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**Unit-IV**

**7. Physiological and molecular mechanisms of disease resistance in plants:**

- a) Hypersensitive reaction
- b) Elicitors
- c) Phytoalexins
- d) Physiology of disease resistance.

**8. Agricultural uses of plant growth regulators.**

- a. Rooting and plant propagation
- b. Abscission
- c. Flowering
- d. Fruit set and development
- e. Fruit ripening
- f. Overcoming environmental stresses.

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## References

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2. Plant Growth Substances Principles and application. / Richard N. Arteca. 1996 Chapman and Hall Inc. NY ( 1st Ed. Cbs. Publ and Dist, New Delhi 1997)
3. Physiology of plant growth and development H. N. Krishnamurty, 1993, Atmaram and Sons, New Delhi.
4. Growth and Differentiation of plants. 3rd Edition. Wareing PF and Phillips IDJ Pergamon Press, Oxford.
5. Plant Growth Regulators – Agricultural Uses. L.G. Nickel, 1982. Springer – Verlag, Berlin.
6. Introduction to plant physiology, 2nd Edition. William Hopkins, 1999 John Wiley and Sons Inc. NY.
7. Plant Physiology 2nd Edition Taiz and Zeiger 1999. Sinauer Associates.Inc. Publ. Massachusetts.
8. Annual Review of Plant Physiology and Molecular Biology.
9. Senescence in plants by Kenneth V. Thimmen CRC Press. Boca Raton, Florida 1980.

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M.Sc. Botany-IV Semester

Bot 207, Paper – III: Physiology and molecular Biology of Nitrogen Fixation

Unit-I

**1. Nitrogen fixation and Nitrogen cycle**

- a) Early studies of Nitrogen fixation
- b) Nitrogen cycle.

**2. Nitrogen fixing organisms:**

- a) Nitrogen fixing bacteria and Cyanobacteria
- b) Legume – Rhizobial association
- c) Actinorrhizal and non-legume symbiosis.

Unit-II

**3. Physiology of Nitrogen fixation:**

- a) Avoidance of Oxygen by Bacteria and Cyanobacteria
- b) Legume – Rhizobial symbiosis

**4. Biotechnology of Nitrogen Fixation:**

- a) Components of Nitrogenase
- b) Molecular mechanisms of nitrogen fixation
- c) Regulation of nitrogenase

Unit-III

**5. Genetics of nitrogen fixation**

- a) nif genes in *Klebsiella pneumoniae*
- b) nif genes in *Rhizobium*
- c) Regulation of nif genes

**6. Nod genes and Nod factors:**

- a) Nod genes
- b) Structure and function of Nod factors

Unit-IV

**7. Relationship between Hydrogen metabolism and Nitrogen fixation:**

- a) Hydrogenase
- b) Molecular biology of Hydrogenase
- c) Role of Hydrogenase in Nitrogen fixation

**8. Current trends in Nitrogen fixation:**

- a) Genetic Engineering and Biotechnology of nitrogen fixation
- b) Agricultural applications of Nitrogen fixation

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1. J.R. Gallow and A.E. Chaplin (1987) An introduction to Nitrogen fixation. Cassel Education Limited.
2. F.O' GARA; S. MNNA, J.J.DREEVON (eds.) (1988) Physiological limitations and Genetic improvement of symbiotic Nitrogen fixation. Kluwer Academic Pub.
3. Hothe, H; de Bruijn, F.J. and Newton, W.E. (eds.) (1988) Nitrogen fixation; Hundred years after.
4. J.R. Postgate (1982): The fundamentals of nitrogen fixation, Cambridge University Press, Cambridge, U.K.
5. A.B. Prasad and A. Vaishampayan (1994) Biology and application of nitrogen fixing organisms – Problems and prospects. Scientific Publications, Jodhpur, India.
6. P.S. Verma and N. Brisson (1987) Molecular Genetics of plant – Microbe interactions.
7. Burris, R.H. and Roberts. G.P. (1993). Biological Nitrogen fixation, Annu. Rev. Nutr. 13: 317-335
8. N. S. Subba Rao (1998): Biofertilizers for agriculture and agroforestry: Oxford & IBH Publ. Ed. New Delhi.
9. K.V. B.R. Tilak: (1993): Bacterial fertilizers, ICAR Publication, New Delhi.

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**M.Sc. Botany-IV Semester**  
**Bot 208, Paper-IV: Plant Molecular Biology and Genetic Engineering**

**UNIT-I**

1. General concepts of Plant Molecular Biology and Genetic engineering.
2. Legal, social and ethical aspects of Recombinant DNA technology. Intellectual property rights. Biosafety measures.
3. Sequencing of genes. Maxam and Gilbert's method and Sanger's method of sequencing of genes. Human genome project.

**UNIT-II**

4. Role of Restriction endonucleases and ligases in recombinant DNA technology. Brief study of vectors used in gene cloning. Ti and Ri plasmids.
5. Gene cloning, restriction mapping, preparation of genomic / cDNA libraries and selection of transformed cells by immuno-detection of proteins and nucleic acid hybridization.
6. Southern, northern and western blotting. Restriction fragment length polymorphisms (RFLPs) and DNA Fingerprinting.

**UNIT-III**

7. Chemical synthesis of genes. Transposon mediated gene tagging.
8. Gene amplification by Polymerase Chain Reaction (PCR). Randomly amplified polymorphic DNA (RAPD) analysis.
9. Brief overview of molecular markers and maps of plant genomes. Expressed sequence tags and Mapping of quantitative trait loci (QTLs).

**UNIT-IV**

10. Plant genetic engineering: Agrobacterium and microprojectile gun mediated methods of gene transfer to plants. Role of promoters and reporter genes in genetic engineering.
11. Genetic transformation of chloroplasts.
12. Current status of Transgenic plants.

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2. Watson, Hopkins, Roberts, Steitz&Weiner. Molecular Biology of the gene. 4th Edition.
3. Watson, Gilman, Wittkowsky and Zoller. 1992. Ed. Recombinant DNA.
4. Benjamin Lewis. 1999. Genes VII.
5. G. M. Cooper. 1997. The Cell and Molecular approach. ASM Press. Ed.
6. Plant Cell Biology. B.E. S.Gunning, and M. W. Steer. Jones and Barlett Publishers.
7. Basic methods in Molecular Biology. L. Davis, Kuehl and Battey.
8. Molecular Biotechnology. 2nd Ed. Primrose. Blackwell. 1999.
9. Advanced Molecular Biology. Twyman. 1998. Ed.
10. Instant notes in Molecular Biology. Turner, McLennon, Bates and White. 1999. Ed.
11. Instant notes in Genetics Winter, Hicky and Fletcher. 1999. Ed.
12. Molecular Biology. Friefelder.
13. Plant Molecular Genetics. M. A. Hughes.
14. Applied Molecular Genetics. R. L. Miesfeld. Wiley-Liss N. York. 1999.
15. Genomics and Proteomics: Functional and Computational aspects. S.Suhai. Plenum Pub.Corp. 2000.
16. Concepts in Biotechnology. Ed. Balasubramanian. Universities Press.
17. An introduction to Genetic analysis. Griffiths, Miller, Suzuki, Lewontin and Gelbert.
18. Molecular Cloning : A laboratory manual. 2nd edition. 3 Vols. Cold Spring Harbor Laboratory, Cold Spring Harbor, New York. Sambrook, J., Fritsch, E. F., and Maniatis, T.
19. Agricultural Biotechnology. S.S. Purohit. 1999. Ed.
20. Biotechnology. B. D. Singh. Kalyani Publishers. 1998.
21. Genetics. Ahluwalia. 1993. Ed.
22. Genetics. P.K. Gupta. 1990. Ed.
23. Genetics. B.K. Jain. 1996
24. Genetics. A.V.S.S. Sambamurthy. 1999. Ed.
25. Plant Molecular Biology. A practical approach. Ed. G. M. Shaw.
26. Principles and methods in Plant Molecular Biology, Genetics and Biochemistry. Prathibha Devi. Agrobios Publ. 2000. Ed.

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**M.Sc. Botany IV Semester, Practical Syllabus**  
**Bot 255, Paper-I: Molecular Genetics, Biostatistics, Eco-diversity and Conservation**

Section -A

1. Problems in Restriction mapping of plasmids.
2. Problems in Biostatistics:
  - a. Graphic representation of data: Histogram.
  - b. Mean, Variance, Standard Deviation and Standard Error.
  - c. Chi-square and Student's "t" test.
  - d. Concept of Probability: Addition and multiplication rule.
3. Isolation of DNA.
4. Demonstration of plant tissue culture methods.
5. Maintenance of Practical Record.

Section -B

The practical course comprises (a) Field survey and (b) Scientific visits.

**a) Field survey:**

1. Survey of the campus to be undertaken (by selecting one avenue/road by individual students) to locate the planted trees on a graph paper and collect details of identification, size, canopy shape, blossoming and fruiting period and their status (healthy, diseased, infested, mutilated, misused or dying). The individual reports may be combined to prepare a larger map of the area to be available for future batches of students / civic authorities.
2. Prepare and record a short list of 10 most important sources of firewood and timber in your locality. Give their local names, scientific names and families to which they belong. Mention their properties.

**b) Scientific visits:**

The students should be taken to one of the following:

1. A national park / sanctuary.
2. A wet land
3. A mangrove.
4. National Bureau of Plant Genetic Resources, New Delhi or its field stations.
5. Head quarters of Botanical Survey of India or one of its Regional circles.
6. A CSIR laboratory doing research on plants and their utilization.
7. An ICAR Research Institute or a field station dealing with major crops.
8. A recognized Botanical garden or museum (like The Forest Research Institute, Dehra Dun, National Botanical Research Institute, Lucknow, Tropical Botanical Garden and research Institute, Trivandrum), which has rich collection of plant products.

Note: The students must prepare and submit a brief illustrated record of the field survey and scientific visits. After evaluation, the grades awarded to the students by the teachers should be added to the final assessment of the practical examination.

*(Handwritten signatures and stamps)*

*1/2/2022*

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**Bot 256, Paper-II: Phytohormones and Plant Development**

1. Estimation of Indole Acetic Acid.
2. Estimation of Amylase enzyme
3. Radish cotyledonary bioassay for Cytokinins.
4. Action of Absciscic acid on stomatal movement

**Bot 257, Paper-III: Physiology and molecular Biology of Nitrogen Fixation**

1. Estimation of Bacterioids
2. Estimation of leghaemoglobin
3. Assay of nitrogenase in Rhizobia and free-living nitrogen fixers by Acetylene reduction technique
4. Plasmid profile study using gel electrophoresis
5. Separation of Amino Acids by TLC

**Bot 258, Paper-IV: Plant Molecular Biology and Genetic Engineering**

1. Isolation of plant /chicken genomic DNA.
2. Estimation of RNA
3. Agrobacterium mediated gene transfer to plants (demonstration).
4. Scoring of RFLP maps.
5. Problems on DNA sequencing
6. Problems on restriction mapping.
7. Maintenance of Practical Record.

*1/1/16*

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