Department of Botany

Osmania University

M.Sc. Botany Syllabus

SEMESTER - III & IV

For University, Constituent and Affiliated Colleges

With effect from
2018 – 2019

SEMESTER - III

Subject Code	Subject / Paper	Theory / Practical	Instruction Hrs /Week	Credits	Evaluation		Duration of External Examination
			Th./ Pr.		Internal	External	
MBOT.CC.T.2.301	Cell Biology, Genetics and Biostatistics	Theory (Paper-I)	4	4	20	80	3
MBOT.CC.T.2.302	Environmental Pollution & Protection	Theory (Paper-II)	4	4	20	80	3
MBOT.EC.T.2.303	Specialization - (A/B/C/D/E)	Theory (Paper-III)	4	4	20	80	3
MBOT.EC.T.2.304	Specialization - (A/B/C/D/E)	Theory (Paper-IV)	4	4	20	80	3
MBOT.CC.P.2.305	Practical Lab - I	Practical (Paper-I)	4	2	-	50	4
MBOT.CC.P.2.306	Practical Lab - II	Practical (Paper-II)	4	2	-	50	4
MBOT.EC.P.2.307	Practical Lab - III	Practical (Paper-III)	4	2	-	50	4
MBOT.EC.P.2.308	Practical Lab - IV	Practical (Paper-IV)	4	2	-	50	4
			32	24	**600**		

SEMESTER - IV

Subject Code	Subject / Paper	Theory / Practical	Instruction Hrs /Week	Credits	Evaluation		Duration of External Examination
			Th./ Pr.		Internal	External	
MBOT.CC.T.2.401	Ecology & Phytogeography	Theory (Paper-I)	4	4	20	80	3
MBOT.CC.T.2.402	Horticulture & Plant Breeding	Theory (Paper-II)	4	4	20	80	3
MBOT.EC.T.2.403	Specialization - (A/B/C/D/E)	Theory (Paper-III)	4	4	20	80	3
MBOT.EC.T.2.404	Specialization - (A/B/C/D/E) / Project*	Theory (Paper-IV) / Project*	4	4	20	80	3
MBOT.CC.P.2.405	Practical Lab - I	Practical (Paper-I)	4	2	-	50	4
MBOT.CC.P.2.406	Practical Lab - II	Practical (Paper-II)	4	2	-	50	4
MBOT.EC.P.2.407	Practical Lab - III	Practical (Paper-III)	4	2	-	50	4
MBOT.EC.P.2.408	Practical Lab – IV / Project*	Practical (Paper-IV) / Project*	4	2	-	50	4
			32	24	**600**		
* Project work / Dissertation in place of one elective course and one practical that accounts to 6 Credits.							

Total number of Credits for the 2-year M.Sc. Botany Programme: 96

Note: Specializations (A/B/C/D/E): Given in next page

SEMESTER - III

MBOT.CC.T.2.301: Paper-I: Cell Biology, Genetics and Biostatistics
MBOT.CC.T.2.302: Paper-II: Environmental Pollution & Protection

A= Specialization -A: Applied Mycology and Molecular Plant Pathology
MBOT.EC.T.2.303 / A: Paper-III: Principles of Plant Pathology
MBOT.EC.T.2.304 / A: Paper-IV: Applied Mycology

B= Specialization B: Applied Plant Physiology and Molecular Biology
MBOT.EC.T.2.303 / B: Paper-III: Carbon and Nitrogen assimilation and Crop Productivity
MBOT.EC.T.2.304 / B: Paper-IV: Stress Physiology

C= Specialization C: Biodiversity of Angiosperms and Pharmacognosy of Medicinal Plants
MBOT.EC.T.2.303 / C: Paper-III: Biodiversity of Angiosperms
MBOT.EC.T.2.304 / C: Paper-IV: Cultivation and Post-harvest technology of Medicinal Plants

D= Specialization D: Cytogenetics, Molecular Genetics and Biotechnology
MBOT.EC.T.2.303 / D: Paper-III: Cytogenetics
MBOT.EC.T.2.304 / D: Paper-IV: Genetics

E= Specialization E: Applied Palynology, Palaeophytology
MBOT.EC.T.2.303 / E: Paper-III: Actuopalynology
MBOT.EC.T.2.304 / E: Paper-IV: Applied palynology

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M.Sc. Botany III Semester CBCS

Common paper

MBOT.CC.T.2.301 (CORE) 4 Hrs/week 4 Credits

Paper-I: Cell Biology, Genetics and Biostatistics

UNIT -I

1. Principles of microscopy, Light microscopy and Electron microscopy, (SEM,TEM), Fluorescent microscopy
2. Brief account of DNA replication and transcription in Prokaryotes, Eukaryotes (Introns and exons).
3. Brief study of regulation of gene expression in prokaryotes (Lac-operon) and eukaryotes (promoters, transcription factors and enhancers).
4. Overview of cell cycle: Mitosis, Meiosis and significance.
5. Cell cycle Control: Role of cyclins and cyclin-dependent kinases. Apoptosis and Programmed cell death.

UNIT -II

6. Mutations: Gene mutations (substitutions and frame-shift mutations), Chromosomal aberrations (structural & numerical),Site-directed mutagenesis.
7. Brief study of DNA damage and repair mechanisms
8. Brief account of Proto-oncogenes, oncogenes and tumor suppressor genes.
9. Mendelian inheritance. Gene interaction (12:3:1; 9:3:4; 9:7 ratios).
10. Linkage and chromosome mapping in Eukaryotes

UNIT -III

11. Inherited human diseases: Haemophilia and Sickle cell Anaemia. Gene therapy
12. Extra nuclear inheritance: Cytoplasmic male sterility
13. Brief account of Plant tissue culture, Micropropagation and Transgenic plants.
14. Overview of recombinant DNA technology. Gene cloning, , Restriction enzyme, Vectors Genomic / cDNA libraries.
15. Blotting methods, Polymerase chain reaction and DNA fingerprinting.

UNIT -IV

16. Basic concepts of gene sequencing (Sanger's Method)
17. Genomics, Proteomics and Bioinformatics.
18. Hardy-Weinberg Law. Gene pool, Gene frequency and genotype frequency
19. Mean, Variance, Standard deviation and Standard error.
20. Chi-square and Student's "t" test. Probability distribution (Binomial, Poisson and Normal).

MBOT.CC.P.2.305 Practicals (Labs) 4 Hrs/ week 2 Credits

Practical Paper-I (Common)

1. Cytological Squash preparation of onion root tips to study mitosis.
2. Problems in Genetics:
   Mendelian inheritance and gene interaction.
   Chromosome mapping in eukaryotes
   Population Genetics.
3. Problems in Biostatistics:
   Mean, Variance, Standard Deviation and Standard Error.
   Chi-square and Student's "t" test
   Problems on Probability.
4. Demonstration of plant tissue culture methods.
5. Maintenance of Practical Record.

List of books recommended

1. A. K. Sharma and A. Sharma. 1990. Chromosome techniques. Butterworths. 1990 Ed.
2. Lodish, 8 th Ed. Cell and Molecular Biology.
3. E.D.P. De Robertis and E. M. F. De Robertis. 1987. Cell and Molecular biology8th Ed(Indian 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 & Gelbert1999 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.
13. 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.
19. Watson, Gilman, Wittkowsky and Zoller. 1992. Recombinant DNA.
20. Shaw, G. M. 1988. Plant Molecular Biology. A practical approach. Ed.
21. Twyman. 1998. Advanced Molecular Biology.
22. Turner, Mclennon, Bates and White. 1999. Instant notes in Molecular Biology.
23. Primrose. 1999. Molecular Biotechnology.
24. Prathibha Devi. Principles & Methods in Plant Molecular Biology,Genetics& Biochemistry,,Agrobios.
25. Purohit. S. S. 1999. Agricultural Biotechnology.
26. Stansfield. 1996. Theory & Problems in Genetics. Schaum's Series. McGraw & Hill.
27. Khan, I. A. and A. Khanum. 1994. Fundamentals of Biostatistics
28. B. N. Mishra and K. K. Mishra. Naya Prakash. 1983. Introductory practical Biostatistics
29. Jain, v. k. Computers for beginners. PustakMahal.
30. Cynthia Gibas. O'Reilly & Assoc.2000. Developing Bioinformatics Computer skills.
31. Balasubramainan. Ed. Concepts in Biotechnology.Universities Press.1996.
32. Deepak Bharihoke.2000. Fundamentals of Information technology.

M.Sc. BOTANY
III Semester
Common paper

MBOT.CC.T.2.302: (Core) 4 Hrs/week 4 Credits

Paper-II: Environmental pollution and protection

UNIT I

1. Kinds of pollution, Air pollution-Sources of air pollution,
2. Major air pollutants, Primary and Secondary Pollutants stationary and mobile sources.
3. Effects of air pollutants on plants, human beings and materials, control of air pollution.
4. Noise pollution- sources, effects and control measures.
5. Acid rain- causes and effects on terrestrial and aquatic systems.

UNIT II

6. Water pollution- Sources, Effects and control of water pollution.
7. BOD, COD, Hardness of water, criteria of water quality.
8. Primary treatment (Industrial wastewater) - Segregation, equalization, neutralization, sedimentation, flotation and oil separation.
9. Secondary treatment (Biological treatment)- Principles of biological treatment
10. Waste stabilization ponds, Aerated lagoons-Activated sludge process, Trickling filters.

UNIT III

11. Soil pollution – Sources, effects and control measures.
12. Bioremediation- Insitu and Ex-situ bioremediation
13. Bioremediation of toxic metals.
14. Concept of Phytoremediation

UNIT IV

15. Classification of solid wastes, types and sources. Disposal methods,
16. Management of Muncipal waste,
17. Hazardous and Biomedical waste.
18. Environmental (protection) Act-1986

MBOT.CC.P.2.306 Practicals (Labs) 4 Hrs/ week 2 Credits

Practicals *Common paper*

1. Estimation of the following in water:
    a. Total hardness
    b. Calcium
    c. Organic matter
    d. BOD
2. Estimation of noise.
3. Qualitative estimation of the following:
    a. Solid waste
    b. Coal
    c. Fly ash
    d. Sugarcane bagasse
    e. Wood
    f. Cow dung

REFERENCE BOOKS

1. MN Rao, McGrace Hill 1993 – Air pollution
2. C.S.Rao- Environmental Engineering and technology
3. S.P. Misra and Pandey- Essential Environmental Studies
4. Y.Anjaneyulu- Introduction to Environmental Science.
5. P.D.Sharma- Ecology and Environment
6. P.C.Santra- Environmental Science

III SEMESTER

Specialisation: A:

Applied Mycology & Molecular Plant Pathology

M.Sc. BOTANY- III SEMESTER

MBOT.EC.T.2.303 /A **4 Hrs/week 4 Credits**

Specialisation: Applied Mycology & Molecular Plant Pathology

Paper III - Principles of Plant Pathology

UNIT- I

1. **Introduction:** Terminology, Disease concept. Pathogenectiy and Koch's postulates; disease quantification, Traditional and image analysis.
2. **Parasitism and Disease Development:** Host range of pathogens, disease development, disease cycle, penetration (chemical and physical), colonization and dissemination of pathogens.
3. **Host pathogen interaction:** Chemical Weapons of pathogens (Enzymes, Toxins and Growth regulators).

UNIT- II

4. **Changes in Host physiological functions due to pathogenesis:**

   Photosynthesis, Translocation of water and nutrients, Respiration and Permeability of membrane.

5. **Nutrition and Physiology of plant pathogenic fungi:**
   - Carbon, Nitrogen, phosphorous and trace elements.
   - Physiology of spore dormancy and spore germination.

UNIT- III

6. **Host defense mechanisms:** Structural defense, Hypersensitivity, Physical barriers, Metabolic or Biochemical defense, Phenols, Phytoalexins and induced enzymes.
7. **Effect of Environment on Disease Development:** Effect of Moisture, Temperature, Wind, Soil, pH and Host-plant nutrition.
8. **Plant disease Epidemiology:** Elements of epidemics, Measurement of Plant diseases, Patterns of epidemics and pathogens factors. Computer simulation of epidemics, Disease Forecasting.

UNIT- IV

Principles of Plant Disease Management

9. Quarantine
10. Cultural practices
11. Biological Methods
12. Physical Methods
13. Chemical Methods:-
    a. Classification of fungicides
    b. Chemical nature, mode of action and methods of application of the following: Sulphur fungicides, Copper fungicides, Mercurial compounds, Quinones, Heterocyclic compounds, Oxanthins. & Benzimidazoles and Miscellaneous fungicides.
14. Integrated Disease management- General account (importance and basic principles).

MBOT.EC.P.2.307/A Practicals (Labs) 4 Hrs/ week 2 Credits

Practical Lab (Special)

1. Techniques of isolation of fungi: Dilution method, soil plate method, agar plate method and single spore isolation.
2. Collection, isolation and identification and of fungi from soil, water, air, leaf, root and seed.
3. Calculation of spore count using Haemocytometer.
4. Isolation and identification of AM Fungi and estimation of root colonization.
5. Mushroom cultivation.
6. Demonstration of antagonistic fungi
   a) Antibiosis b) Competition c) Mycoparasitism.
7. Record

Reference Books:

1. Agrios, G.N. 1999. Plant Pathology. Academic Press
2. Annual Review of Phytopathology, 1999. Vol. 37, APS Press
3. Cairney, J.W.G. & Chambers, S.M. 1999. Ectomycorrhizal Fungi. Springer Publishers
4. Chandanwala, K. 1986. Introduction to Plant Pathology. Ammol Publishers and Distributors
6. Cheet,I. 1993. Biotechnology in Plant Disease Control. Wilen-Liss, Inc.
7. Dennis Allsopp and Seal, K.J. 1986. Introduction to Biodeterioration. E Edward Arnold Ltd.
8. Frisvad, J.C. Bridge, P.D. Arora, D.K. 1998. Chemical fungal taxonomy Marcel and Dekker Inc.
9. Horsfall, J.G. & Cowelling. 1978. Plant Diseases – An Advance Treatise Vol. II& IV Acad Press
10. Ignacimuthu, S.J. 1996. Applied Plant Biotechnology. Tata Megrew –Hill Publ Company Ltd.
11. Mahadevan, A. 1991. Post infectional defense mechanisms. Today and Tomorrow's Printers and publishers
12. Mehrotra, R.S. 1991. Plant Pathology. Tata Mcgraw – Hill Publishing Company Ltd.
13. Miles, P.G. and Chang, S.T. 1997. Mushroom Biology. World Scientific Publ. Company
14. Natish, S. Chopra, V.L. & Ramachandra, S. 1994. Biotechnology in Agriculture. Oxford and IBH Publishing Company
15. Rajak, R.c?. 2000. Microbial Biotechnology for sustainable development and productivity. Scientific publishers (India) Jodhpur
16. Roberts, S. Fritz & Elien. I. Simms. 1992. Plant Resistance to Herbivors and Pathogens (Ecology, Evolutin and Genetics), University of Chicago Press.
17. Rudra P. Singh, Uma S. Singh & Keiisuke Kohmoto (eds.) 1995. Pathogenesis and host specificity in plant diseases. Vol. III Pergamon Press.
18. Scheffer, R.P. 199. The nature of disease in plants. Cambridge University Press.
19. Tarr, S.A.J . 1987. Principles of Plant Pathology. Academic Press
20. Verma, A & Hock, B. 1999. Mycorrhizae. Springer Publishers

M.Sc. BOTANY- III SEMESTER

Specialization: Applied Mycology and Molecular Plant Pathology

MBOT.EC.T.2.304 / A 4 Hrs/week 4 Credits

Paper IV - Applied Mycology

UNIT- I

Diversity of Fungi

1. Diversity of Fungi - General account
2. Fungi in diversified habitats- soil, water and air.
3. Fungi on plant surfaces- Phyllosphere, Rhizosphere and Spermosphere
4. Keratinophilic fungi- Distribution, Isolation and economic importance
5. Biology of some important fungi: *Saccharomyces*, *Aspergillus and Neurospora.*
6. Isolation, identification, selection and strain improvement of some useful fungi.

UNIT - II-

Biofertilizers and Mushrooms

7. Glomeromycota- Recent trends in -mycorrhizal taxonomy
8. Isolation and multiplication of mycorrhizae; role in crop productivity and forestry.
9. Phosphate solubilizing fungi (PSF)
10. General account of Oyster, white button, paddy straw, Morels, Truffles & Poisonous mushrooms.
11. Cultivation and economics of *Agaricus bisporus*, *Pleurotus* and *Volvoriella*
12. Medicinal and nutritional value of edible and poisonous mushrooms
13. Effect of environmental, nutritional and chemical factors on mushroom cultivation (intensive and extensive cultivation methods).
14. General techniques and their application in improving mushroom production (protoplast fusion, Dimon matings and sporeless mutants, breeding of high performing strains and germplasm conservation).

UNIT- Ill

Fungi as biopesticides

15. Entomogenous fungi
16. Nematophagous fungi
17. Mycoherbicides
18. Fungi in plant disease control
19. Selection, production and formulation of fungal biopesticides and commercial use of biocontrol agents
20. Exploitation of biocontrol agents by genetic manipulation.
21. Gene source from *Trichoderma* for GM crops.

UNIT – IV

Fungal Biotechnology

22. Fermentation methods and biomass production of fungi, growth kinetics, fermenter systems scale up, fermentation processes.
23. Yeast genome - genetic analysis of yeast; Baker's yeast, food and feed yeasts, Glycerol and adhesive, bio-polymer from yeasts.

24. General account of production and application of Industrial fungal enzymes (amylases, cellulases, pectinases and chitinases).
25. General account of production and application of primary metabolites (vitamins and proteins).
26. General account of production and application of secondary metabolites (antibiotics, mycotoxins, pigments and alkaloids).
27. Environmental and regulatory aspects of using genetically-modified microbes in the field.

MBOT.EC.P.2.308 / A Practicals (Labs) 4 Hrs/ week 2 Credits

Practical Lab- (Special)

1. Estimation of organic acids in fungal culture filtrates.
2. Estimation of enzymes: Cellulases, Pectinases, Chitinases and Amylases.
3. Estimation of sugars, proteins and amino acids in fungal mycelium and culture filtrate.
4. Record.

Reference Books:

1. Agrios, G.N. 1999. Plant Pathology. Academic Press
2. Annual Review of Phytopathology, 1999. Vol. 37, APS Press
3. Cairney, J.W.G. & Chambers, S.M. 1999. Ectomycorrhizal Fungi. Springer Publishers
4. Chandanwala, K. 1986. Introduction to Plant Pathology. Ammol Publishers and Distributors
6. Cheet,I. 1993. Biotechnology in Plant Disease Control. Wilen-Liss, Inc.
7. Dennis Allsopp and Seal, K.J. 1986. Introduction to Biodeterioration. E Edward Arnold Ltd.
8. Frisvad, J.C. Bridge, P.D. Arora, D.K. 1998. Chemical fungal taxonomy Marcel and Dekker Inc.
9. Horsfall, J.G. & Cowelling. 1978. Plant Diseases – An Advance Treatise Vol. II& IV Acad Press
10. Ignacimuthu, S.J. 1996. Applied Plant Biotechnology. Tata Megrew –Hill Publ Company Ltd.
11. Mahadevan, A. 1991. Post infectional defense mechanisms. Today and Tomorrow's Printers publ
12. Mehrotra, R.S. 1991. Plant Pathology. Tata Mcgraw – Hill Publishing Company Ltd.
13. Miles, P.G. and Chang, S.T. 1997. Mushroom Biology. World Scientific Publ. Company
14. Natish, S. Chopra, V.L. & Ramachandra, S. 1994. Biotechnology in Agriculture. Oxford and IBH
15. Rajak, R. 2000. Microbial Biotechnology for sustainable development and productivity. Scientific pub
16. Roberts, S. Fritz & Elien. I. Simms. 1992. Plant Resistance to Herbivors and Pathogens (Ecology, Evolutin and Genetics), University of Chicago Press.
17. Rudra P. Singh, Uma S. Singh & Keiisuke Kohmoto (eds.) 1995. Pathogenesis and host specificity in plant diseases. Vol. III Pergamon Press.
18. Scheffer, R.P. 199. The nature of disease in plants. Cambridge University Press.
19. Tarr, S.A.J . 1987. Principles of Plant Pathology. Academic Press
20. Verma, A & Hock, B. 1999. Mycorrhizae. Springer Publishers

III SEMESTER

Specialisation: B:

Applied Plant Physiology & Molecular Biology

M.Sc. BOTANY- III SEMESTER

Specialisation: Applied Plant Physiology & Molecular Biology

MBOT.EC.T.2.303 /B **4 Hrs/week 4 Credits**

Paper III Carbon and Nitrogen assimilation and crop productivity

UNIT-I

1. CO_2 metabolism in C_3 plants
- a) Factors affecting photosynthesis
- b) C_3 pathway
- c) Rubisco-structure, activation and catalysis.

2. CO_2 metabolism in C_4 plants and CAM plants
- a) C_4 plants
- b) Biochemical schemes for C_4 pathway: aspirtate and malate forms
- c) CAM pathway
- d) Mechanism and significance of photorespiration

UNIT-II

3. Starch metabolism and assimilate Partitioning
- a) Starch sucrose metabolisms and assimilate partitioning
- b) Source-sink relationship and yield
- c) Manipulation of starch metabolism
- d) Cyclodextrins and fructans

4. Efficiency of C3, C_4 and CAM pathways and productivity

UNIT-III

5. Nitrogen fixing organisms
- a) Nitrogen fixing bacteria and Cyanobacteria
- b) Actinorhizal and non-leguminous bacteria
- c) Rhizosphere fixation in grasses

6. Physiology and Biochemistry of Nitrogen fixation:
- a) Physiology of Legume – Rhizobial symbiosis
- b) Molecular communication and Nodulation
- c) Molecular mechanisms of nitrogen fixation
- d) Energetics of nitrogen fixation
- e) nif genes in Rhizobium, Nod genes and Nod factors:

UNIT-IV

7. Nitrogen dependent agricultural productivity - BNF and nitrogen fertilizers in agriculture

8. Biotechnology of nitrogen fixation

9. Fertilizer production and consumption scenario in India

MBOT.EC.P.2.307 /B Practicals (Labs) 4 Hrs/ week 2 Credits

Practical Lab- (Special)

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 dinitrosalicyclic acid reagent (DNS)
5. Estimation of protein content by Lowry's Bradford's method
6. Separation of Amino Acids by TLC
7. Study of Bacterioids.
8. Maintenance of Practical Record.

REFERENCES

1. Plant Physiology: by F.B. Salisbury and Cleon W. Ross. 4th edition 1992.
2. Words worth publishing company. Belmont California
3. Photosynthesis and crop productivity in different ensvironments. J. Cooper, Cambridge
4. Plant Physiology, biochemistry and molecular biology. Ed. David. T. Dennis and David H. Turnip (1990). Longman scientific technical
5. Photosynthesis: A comprehensivie treatise (1998) Ed. A.S. Raghavendra Cambridge University Press,
6. Introduction to Plant Physiology by W.G. Hopkins 2nd Ed. John Wiley, NY.
7. Photosynthesis-Physiological, Biochemical and Molecular aspects.????
8. Advances in Plant Physiology. Vol.2. A. Hemantarajan.
9. J.R. Gallow and A.E. Chaplin (1987) An introduction to Nitrogen fixation. Cassel Education Limited.
10. F.O' GARA; S. MNNIANA, J.J.DREEVON (eds.) (1988) Physiological limitations and Genetic improvement of symbiotic Nitrogen fixation. Kluwer Academic Pub.
11. Hothe, H; de Bruijn, F.J. and Newton, W.E. (eds.) (1988) Nitrogen fixation; Hundred years after.
12. J.R. Postgate (1982)The fundamentals of nitrogen fixation, Cambridge Univ Press, Cambridge, U.K.
13. A.B. Prasad and A. Vaishampayan (1994) Biology and application of nitrogen fixing organisms – Problems and prospects. Scientific Publications, Jodhpur, India.
14. P.S. Verma and N. Brisson (1987) Molecular Genetics of plant – Microbe interactions.
15. Burris, R.H. and Roberts. G.P. (1993). Biological Nitrogen fixation, Annu. Rev. Nutr. 13: 317-335
16. N. S. Subba Rao (1998): Biofertilizers for agriculture and agroforesty: Oxford & IBH Publ. New Delhi.
17. K.V. B.R. Tilak: (1993): Bacterial fertilizers, ICAR Publication, New Delhi.
18. Plant Physiological Ecology. Hans Lambers, S. Stuart Champin III, Thijs L. Pons. Springer.

M.Sc. BOTANY- III SEMESTER

Specialisation: Applied Plant Physiology & Molecular Biology

MBOT.EC.T.2.304 / B **4 Hrs/week 4 Credits**

Paper – IV: 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. Osmotic adjustment
   e. Mechanism of drought tolerance
2. **Flooding stress**
   a. Flooding injury
   b. Metabolic damage
   c. Hormonal imbalance
   d. Soil toxins
   e. Tolerance mechanisms

UNIT –II

3. **Low temperature stress**
   a. Chilling and freezing effects on germination
   b. Physiological and molecular mechanism of low temperature tolerance
   c. Effect of low temperature on plant productivity
4. **Heat stress**
   a. Cellular responses to high temperature: enzyme activities, photosynthesis, ultra structural effects
   b. Molecular responses to high temperature. Heat shock proteins.
   c. 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
   b. Phytochelations
   c. Differential plant tolerance to heavy metals
6. **Allelochemicals**
   a. Chemical nature of allelochemicals
   b. Mode of release of allelochemicals
   c. Regulation of allelochemical production and release
   d. 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 exclusion, salt elimination, salt succulency
    c. Mechanism of salt resistance and tolerance

8. **Ultra violet – B (UV-B radiation):**
    a. Plant response to UV 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 ZPhysiology Ecology 1983. Springer Verlag Berlin
3. Plant Physiology. L. Taiz and E. Zeiger. 1999. Sinava Associates Inc. Publishers Sunderland MA
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. Words worth Publication Co,. Belmont.California
6. Stress Physiology. D.P. Singh
7. Plant Physiological Ecology. Hans Lambers, F. Stuart Champin II, Thijs J, Pons
8. Advances in Plant Physiology. A Hemantarajan

MBOT.EC.P.2.308 Practicals (Labs) 4 Hrs/ week 2 Credits

Practical Lab- (Special)

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

III SEMESTER

Specialization: C:

Biodiversity of Angiosperms and Pharmacognosy of Medicinal Plants

M.Sc. BOTANY- III SEMESTER

Specialization : Biodiversity of Angiosperms and Pharmacognosy of Medicinal Plants

MBOT.EC.T.2.303 /C **4 Hrs/week 4 Credits**

Paper-III: Biodiversity of Angiosperms

UNIT –I

1. Concept of Biodiversity, its origin and development
   a) Definition b) Past history c) Ranks recognized in Biodiversity studies, taxonomy and others d) Keystone taxa.

2. Aims and objectives of Biodiversity

3. Characterization of Biodivieirsity
   a) Levels of Biodiversity b) Measurement of Genetic diversity, species diversity and community diversity.

UNIT –II

4. Magnitude and Distribution of Biodiversity
   a) Current magnitude of Global Biodiversity
   b) Botanical regions and Hot spots
   c) Distribution of Biodiversity
   d) Endemism and Biodiversity

5. Degeneration Maintenance and Loss of Biodiversity
   a) Diversification of species
   b) Ecological extinctions
   c) Proximate causes

UNIT –III

6. Inventorying, Monitoring and Assessment of resource base for Biodiversity
   a) Inventorying: Definition, purpose, orientation, completeness and intensity. Indicator selection for Biodiversity inventory.
      Monitoring of Biodiversity at different biological levels: Genetics, Population level and Species level; Species turnover in Ecosystems-Landscape levels.
   b) Monitoring: Definition, purpose, orientation, completeness and intensity
      Monitoring in marine environment and freshwater ecosystems. Long-term monitoring of ecosystems
   c) Inventorying and monitoring for conservation: RAMSAR convention, sites, Red data (books and lists).

7. Biotechnology and Biodiversity
   a) Assessment and use of molecular DNA data on Biodiversity
   b) Application of Biotechnology for the utilization of Biodiversity

UNIT –IV

8. Economic value and utilization of Biodiversity with reference to the following taking five examples for each: a) Food b) Fodder c) Fibre d) Oils e) Drugs f) Timber g) Rubber h) Spices I) Essential oils j) Gums and Resins k) Insecticides and Pesticides l) Ornamentation

9. A brief account of origin of cultivated plants
10. Biodiversity convention: a) Initiative from UN b) Rio Conference c) Recent efforts

11.Conservation of Biodiversity
  a) in-situ conservation
  b) ex-situ conservation

MBOT.EC.P.2.307/C Practicals (Labs) 4 Hrs/ week 2 Credits

Practical Lab- (Special)

1. Interpretation of Biodiversity and vegetation based on the data provided
2. Comparison of floristic elements of Biodiversity in published Floras:
  a) Comparison of ten dominant families in different Floras
  b) Genetic diversity (number of Genera)
  c) Ten dominant Genera
3. Comparative study of species diversity of different Genera from published Floras (Jaccard index Coefficient). The student should be provided data on specific Genera represented in the relevant Floras.
4. Field study – Record and Field Note Book.

Reference

1. Global Biodiversity assessment Heywood, V.H. and Watson, RT Ed. 1995.
2. Biodiversity measurement and estimtioin.Ed. Hawksworth. Chapman & Hall, 1995.
3. Biodiveirsity and eecosystem function.Ed.B7 Schulze, ED and Mooney,
4. Functional roles of Biodidversity: A Global Perspective. Mooney, HA, Cushman, JH, Miduo, E, Sale, OE and Schulze, ED. 1995.
5. Biodiversity prospecting: Using Genetic resources for suitable development. Reid et al. WRI, USA, 1993.
6. Conserving Biodiversity for suitable development, Ramakrishnan, AK.Das and Saxena INSA, N.Delhi. 1995.
7. Biodiversity and Forest Genetic Resources. D.N. Tewari. International Book Distrib. Dehradun
8. Biodiversity and its conservation in India S.S. Negri. 1996.
9. Biodiversity in Managed landscapes. Theory and practice. R.C. Szatro and D.W. Johnston. Oxford University Press. 1996.
10. General Ecology. HD. Kumar. Vikass Publ. House Pvt. Ltd. 1995.
11. Global Biodiversity. Trivedi.
12. Biodiversity. Agarwal – K.C.
13. Kumar, U – Biodiversity
14. Navadanya – The Biodiversity convention to its impact on III World.

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 se) 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

MBOT.EC.P.2.308/C Practicals (Labs) 4 Hrs/ week 2 Credits

Practical Lab- (Special)

1. Germination studies and nursery management of medicinal and aromatic plants.
2. Organoleptic and Microscopic analysis, identification and adulteration check of the following crude drugs.

a)	Leaf drugs	*Cassia augustifolia*
b)	Root drugs	*Rauwolfia serpentina vs. R. tetraphyla*
c)	Bark drugs	*Hollahrena pubiscente vs Wrightia tinctoria*
d)	Flower drugs	Saffron-vs Safflower
e)	Whole plant drugs	*Catharanthus roseus*

3. Histochemical identification of the following chemical substances: a) Carbohydrates b)Proteins, c)Amino acids d)Starch e)Tannins f)Enzymes
4. Histological identification of tissue systems and deposits
   a) Epidermis, b)Parenchyma, c)Collenchyma, d)Phloem, e)Xylem, f)Crystals etc.
5. Estimation of oil content in aromatic crops (Clevenger apparatus) and GSC analysis of oil samples for identification of major compounds.

1. Record

III SEMESTER

Specialization: D:

Cytogenetics, Molecular Genetics and Biotechnology

M.Sc. BOTANY- III SEMESTER

Specialization: Cytogenetics, Molecular Genetics and Biotechnology

MBOT.EC.T.2.303 /D 4 Hrs/week 4 Credits

Paper-III: Cytogenetics

UNIT -I

1. Introduction to Cytogenetics. Cytological methods, pretreatment, fixation, chemical, fixatives, stains and mechanism of staining.
2. The architecture of bacterial and eukaryotic chromosomes. Structural organization of Eukaryotic chromosomes. Nucleosome concept. Importance of Telomeres and Telomerase.
3. Euchromatin, Heterochromatin. X Chromosome inactivation, Xistrna, Chromosome banding and chromosome painting. Genomic imprinting
4. Different forms of chromosomes: Somatic metaphase (Salivary gland Chromosomes), Meiotic prophase, (Lampbrush), B chromosomes or super numerary chromosomes.

UNIT -II

5. Karyotype, evolution of karyotype, changes in the basic number.
6. Mechanism of cell division. Mitotic cycle. Cell cycle, G1, S phases and cell cycle regulation. Cyclin dependent kinases (CDKs) and cyclins. MPF activity, anaphase promoting complex (APC).
7. DNA damage check point controlled by P 53 protein. Ras and Map (mitogen activated protein kinases).Programmed cell death.
8. Meiotic prophase. Synaptinemal complex, organization, structure, role of synaptinemal complex in meiotic cross over.

UNIT -III

9. Recombination models. Homologous Recombination, Holliday model I and II. Heteroduplex, mismatch repair.
10. Genetic systems of *Oenothera*. Genome of *Arabidopsis thaliana.*
11. Position effects of heterochromatin: Variegated eye in drosophila. Red & white colonies of yeast, a & alpha type gamete type formation in yeast. Ac/Ds system in maize.
12. Cytological effects of chromosomal aberrations, deletions, duplications, inversions, bridge breakage fusion cycle, translocations alternate, adjacent 1&2 disjunctions. Robertsonian translocations. Centric fusion & fission.

UNIT -IV

13. Variations involving chromosomal numbers. Aneuploidy, trisomics, (primary, secondary, tertiary) Monosomics, nullisomics, meiotic behaviour of trisomics, (primary, secondary & tertiary). Aneuploidy of sex chromosomes.
14. Euploidy, Haploidy,Autopolyploidy, Allopolyploids. Haploidy in crop improvement. Chromosome elimination (bulbosum technique).
15. Transitions & Transversions, repair & mis repair mechanisms.
16. Recombinase type of repair mechanism SOS response in *E. coli.*

MBOT.EC.P.2.307 Practicals (Labs) 4 Hrs/ week 2 Credits

Practical Lab- (Special)

Section-A

1. Preparation of fixatives (3:1 and 6:3:1).
2. Preparation of stains Acetoorcein, Acetocarmine and Feulgen.
3. Squash and smear preparations to study mitiosis sand meiosis: Mitosis in onion root tips and meiosis in maize and onion flower buds.
4. Demonstration of salivary gland chromosome preparations in Drosophila larvae.
5. G-banding of chromosomes (demonstration).
6. Squashes of onion root tip to study Karyotype and preparation of Idiograms
7. Smear of *Rhoeodiscolor* flower buds to study metaphase plate
8. Record

List of books recommended

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 Molecularbiology. 8th Ed.. (Indian Edition is also available..Varghese Company).
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 Geneticanalysis.
10. Winter, Hicky and Fletcher . 1999. Instant notes in Genetics. Ed.
11. I. Vasil. 1995. Plant tissue culture. Vol. 1 to 4. Ed.
12. Watson, Gilman, Wittkowsky and Zoller. 1992. Recombinant DNA.
13. Davis, L, Kuehl and Battey. 1994.Basic methods in Molecular Biology.
14. Twyman. 1998. Advanced Molecular Biology.
15. Turner, Mclennon, Bates and White. 1999. Instant notes in Molecular Biology.
16. Primrose. 1999. Molecular Biotechnology.
18. Stansfield 1996 III Ed Theory & Problems in Genetics. Schaum's Series McGraw &Hill.
19. Cynthia Gibas. O'Reilly & Assoc.2000. Developing Bioinfor Computer skills.
20. Rastogi, Sharma and Tandon 1994. Concepts in Molecular Biology.
21. P.K. Gupta. 1990. Genetics.
22. U. Sinha and S. Sinha. 1994. Cytogenetics, Plant Breeding & Evolution.
23. A.V.S.S. Sambamurthy. 1999. Genetics.
24. Ahluwalia. 1993Genetics.
25. Khan, I. A. and A. Khanum. 1994Fundamentals of Biostatistics
26. N. Mishra and K. K. Mishra. Naya Prakash. 1983. Introductory practical Biostatistics.
19. Cell and molecular biology by Lodish.
20. Cytogenetics by Swanson
21. Molecular biology by Robert F.Weaver.
22. DNA science I and II

M.Sc. BOTANY- III SEMESTER

Specialization: Cytogenetics, Molecular Genetics and Biotechnology

MBOT.EC.T.2.304 / D **4 Hrs/week 4 Credits**

Paper-IV Genetics

UNIT -I

1. Classical and modern concept of the gene.
2. Experiments including DNA and RNA as the genetic material.
3. Detailed study of DNA double helical structure and different forms of DNA, A,B,Z and their physical properties. Central Dogma of Molecular Biology.
4. Cot curves and their significance.

UNIT -II

5. DNA replication, semi conservative mode of replication, Differences in prokaryotic & eukaryotic replication.
6. Enzymes involved in DNA replication. DNA polymerase in prokaryotes (I, II, III) & eukaryotic DNA polymerases (α, € and $), Ligases. Primosome and Replisome.
7. General features of transcription Eukaryotic & Prokaryotic transcriptional factors and Promoters. RNA processing in Eukaryotes (splicing, capping and polyadenylation).
8. Regulation of transcription by noncoding RNA, RNA editing, DNA methylation.

UNIT -III

9. Salient features of Genetic Code. Codon assignment. Genetic code of mitochondria. Structure of t-RNA, Translation.
10. Regulation of gene expression by Lambda phage virus. Repressible system of gene regulation with reference to Trp operon.
11. Fine structure of gene rII locus. Mapping of viral chromosome by complementation, deletion & recombination.

UNIT -IV

12. Eukaryotic mapping by 3 point test cross, mapping by tetrad analysis.
13. Brief account of Quantitative inheritance with special reference to kernel colour in wheat.
14. Sex linked inheritance with reference to X and Y chromosomes.
15. Extra nuclear inheritance (cytoplasmic male sterility)

List of books recommended

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 Molecularbiology. 8th 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 toGenetic analysis.
10. Winter, Hicky and Fletcher . 1999. Instant notes in Genetics. Ed.
11. I. Vasil. 1995. Plant tissue culture. Vol. 1 to 4. Ed.
12. Watson, Gilman, Wittkowsky and Zoller. 1992. Recombinant DNA.
13. Davis, L, Kuehl and Battey. 1994.Basic methods in Molecular Biology.

14. Twyman. 1998. Advanced Molecular Biology.
15. Turner, Mclennon, Bates and White. 1999. Instant notes in MolecularBiology.
16. Primrose. 1999. Molecular Biotechnology.
17. Hughes, M. A. 1992. Plant Molecular Genetics.
18. Stansfield. 1996. III Ed. Theory & Problems in Genetics. Schaum's Series.McGraw & Hill.
19. Cell and molecular biology by Lodish.
20. Plant breeding by B D Singh.
21. Cytogenetics by Swanson
22. Molecular biology by Robert F.Weaver.
23. DNA Science I and II

MBOT.EC.P.2.308 /D Practicals (Labs) 4 Hrs/ week 2 Credits

Practical Lab- (Special)

1. Estimation of RNA by Orcinol method.
2. Study of C mitosis by Colchicine treatment
3. Problems on tetrad analysis.
4. Problems on chromosome mapping in viruses by deletion and complementation
5. Problems on bacterial chromosome mapping by conjugation and transformation.
6. Problems on quantitative genetics. Heritability genetic advance genotypic and phenotypic variance.
7. Problems on sex linked inheritance.
8. Record

III **SEMESTER**

Specialization: E:

Applied Palynology and Palaeophytology

M.Sc. BOTANY- III SEMESTER

Specialization: Applied Palynology and Palaeophytology

MBOT.EC.T.2.303 / E **4 Hrs/week 4 Credits**

Paper-III Actuopalynology

UNIT - I

1. Aspects, prospects and perspectives of palynology.
2. Spore and pollen morphology-

Spore morphology; triletes, monoletes and aletes. Size, shape and symmetry of spores; spore wall structure and sculpture.

Pollen morphology; size, shape and symmetry of pollen; saccate and non-saccate pollen; apertural types, function of apertures, harmomegathy number, position and character of apertures, simple and composite apertures.

3. Pollen wall detailed structure, sporoderm stratification; Faegri & Iverson and Erdtman's views regarding fine structure of pollen wall; sculpture of pollen wall and chemical composition. Evolutionary trends in exine.

UNIT – II

4. Taxonomic significance of Palynology, Eurypalyny and Stenopalyny in Angiosperms.
5. Pollen morphology of the following angiosperm families: A comparative account.

i). Malvaceae ii). Rutaceae iii). Combretaceae iv). Myrtaceae
v). Asteraceae vi).Arecaceae.

6. Palynological description and identification of the pollen types of the following genera;-

i).*Hibiscus ii). Citrus iii).Eucalyptus iv) Terminalia v) Tridax vi).Cocos*
vii) Borassus.

UNIT – III

7. Development and ontogeny of pollen wall.
8. Pollen Kitt, Ubisch bodies and their biological functions.
9. The method of pollen germination and pollen tube growth. The factors involved in Pollen germination in in vitro and in vivo.
10. Pollen viability; pollen preservation and the controlling factors- cryopreservation: Pollen banks and their role in agriculture and plant breeding.

UNIT- IV

11. Pollen expressed and pollen specific genes.
12. A brief account on pollen culture and pollen embryoids.
13. Pollen productivity: Pollen dispersal
14. Relevance of spores and pollen and their application to oil exploration

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MBOT.EC.P.2.307 Practicals (Labs) 4 Hrs/ week 2 Credits

Practical Lab- (Special)

1. Wodehouse technique and preparation of temporary pollen slides.
2. Acetolysis technique and Preparation of Permanent pollen slides.
3. Study of acetolysed pollen preparation of the following pollen types

i). Hibiscus ii). Gossypium iii). Brassica iv). Eucalyptus v). Psidium vi). Sesamum vii). Citrus viii). Tridax ix). Vernonia x). Boerhaavia xi). Cocos xii). Borassus, x) Prosopis.

4. Assessment of pollen productivity by using haemocytometer
5. intended key preparation with pollen morphology
6. Preparation of glycerin jelly

References:

1. Maheshwari P. 1950. An introduction to the embryology of Angiosperms.
2. Bojwani and Bhatnagar. 1995. The embryology of Angiosperms.
3. Erdtman G. 1952. Pollen morphology and Taxonomy of Angiosperms.
4. Heslop-Harisson J. 1971. Pollen development and Physiology.
5. Shivanna KR. 2003. Pollen biology and Biotechnology
6. Erdtman, G. 1952. Pollen morphology and Taxonomy of Angiosperms
7. T.S. Nayar. 1990 Pollen flora of Maharashtra state, India.
8. G.Thanikaimoni. 1970 Mangrove Palynology
9. P.K.K.Nair. 1970 Pollen morphology of Angiosperms.
10. Shripad N. Agashe, 2006. Palynology and its applications
11. Kashinath Bhattacharya, 2006., A Text book of palynology

M.Sc. BOTANY- III SEMESTER

Specialization: Applied Palynology and Palaeophytology

MBOT.EC.T.2.304 /E **4 Hrs/week 4 Credits**

Paper: IV Applied palynology

UNIT – I

1. Aerobiology – Allergenic spores and pollen in atmosphere and types of allergic reactions, Symptoms of pollen allergy in human beings: Pollenosis, conjunctivitis and Rhinitis.
2. Mould spores provoking allergy- Systemic mycosis, Aspergilosis,Mucomycosis**.**
3. Incidence and monitoring of airborne pollen by various types of Aeroscopes. (Gravimetric and Volumetric). Air samplers: Rotorod sampler, Burkard volumetric sampler, Tilak air sampler, Lakhanpal and Nair sampler.
4. Diagnosis of pollen or spore allergy: Skin Prick test, ELISA; Treatment of pollen allergy.
5. Preparation of pollen calender.- Pollen calender of Hyderabad metropolitan complex.

UNIT– II

6. Melissopalynology and Bee botany, Application of Melissopalynology.
7. Honey bee colony, bee Apiculture Forage pattern, behaviour and honey producing potential of various honey bee species in India viz., indigenous *Apis dorsata*, *A. florea*, *A. cerana* and the recently introduced European honey bee *A. mellifera*.
8. Honey bee products – Honey, Bee wax, Pollen, Propollis, Royal jelly, Bee venom and their marketing.
9. Strategies for enhanced honey production. Role of Apiculture in rural development and social forestry.

UNIT– III

10. Forensic Palynology – Definition, scope and importance.
11. Methodology in Forensic study: potential pollen/spore forensic sample collections-Collection of Pollen from Soil, Mud, Hair, Animal Human and illicit drugs.
12. Forensic Palynology as an aid to criminology case studies.
13. Palaeopalynology – Diverse types of palynomorphs, their preservation in various lithic entities. Recovery and concentration of spores and pollen by suitable maceration techniques and heavy liquid treatment.

UNIT – IV

14. Pollen assemblages of the coal bearing deposits (Permian –Lower Gondwana) of India and their stratigraphic importance.
15. Upper Gondwana palynology with reference to Pranhita-Godavari basin- the Stratigraphic, floristic and climatic significance of pollenflora
16. Palynology of Tertiary deposits of southern India-Neogene of Cauvery basin-the stratigraphic floristic and climatic significance of pollen floras.

MBOT.EC.P.2.308 /E Practicals (Labs) 4 Hrs/ week 2 Credits

Practical Lab- (Special)

Practicals:

1. Recovery of pollen from clay or mud samples
2. Identification of some geographically important pollen and spores.
3. Recovery of pollen from clothes, honey samples and hair.
4. Pollen viability test by using Acetocarmine and Evans blue
5. In-vitro germination of pollen grains
6. Study of pollen tube on stigmatic surface
7. Study of various developmental pathways in pollen culture.
8. Qualitative and quantitative study of airborne pollen
9. Prick test for confirmation of pollen allergy
10. Study of pollen calendar of Hyderabad
11. Morphological study of some important allergic pollen
12. Study of some phenograms of allergenic plants
13. Study of pollen loads
14. pollen analysis of honey samples
15. study of moisture content of honey by using refract meter
16. Study of hive architecture of various bees.

References:

1. Faegri and Iversen 1989. Text book of pollen analysis. John wiley and sons. New York.
2. Mildenhall DC. 1992. Forensic socus 11: 1-4
3. Bryant VM. 1989. Pollen: natures fingerprints.
4. Erdtman G. 1969. Handbook of Palynology hafner publishing Co., New yark.
5. Havinga AJ. 1984. Pollen et spores, 26:541-558.
6. Stanley EA. 1991. Forensic aspects of trace evidence.
7. Maheshwari P. 1950. An introduction to the embryology of Angiosperms.
8. Bojwani and Bhatnagar. 1995. The embryology of Angiosperms.
9. S.T.Tilak. 1989 Air borne pollen and fungal spores. Vaijayanti Prakasam, Aurangabad.
10. S.T.Tilak 1987 Air monitoring. Vaijayanti Prakasam, Aurangabad.
11. S.T.Tilak. 1982 Aerobiology. Vaijayanti Prakasam, Aurangabad.
12. Hjemoors M. 1992. Aerobiolgia. 8: 231-236.
13. Gell PGH 1963. Clinical aspects of immunology. 1963. Oxford.
14. Shripad N. Agashe, 2006. Palynology and its applications
15. Kashinath Bhattacharya, 2006., A Text book of palynology
16. Bee keeping in India. - Sardar singh. 1962 *ICAR*, New Delhi.
17. Bee keeping. - L.R. Varma. 1990. *Oxford and IBH publishing Co. Pvt. Ltd.* New Delhi.
18. Nectary biology. - Bir bahadur (Ed.) 1998 Dattsons, J.L. Nehrumarg, Sardar, Nagpur.
19. A book of Honey. - Eva Crane. 1980 *Charles Scribner's sons* New York.
20. Bee keeping in integrated mountain development. – L.R. Varma. 1990. Oxford and IBH Publishing Co. Pvt. Ltd., new Delhi
21. Guide to Bees and Honeys. Ted and Hooper. 1976. Blandford press, U.K.
22. The dancing bees – Karl. V. Frisch. 1966. Methueu and Co. Ltd. U.K.
23. Honey – a comprehensive survey. Eva Crane. 1979. Heinemann, London
24. The hive and honey bee. A Grout (Ed.) 1954. Adant & sons, Hamstsar.
25. Shripad N. Agashe, 2006. Palynology and its applications
26. Kashinath Bhattacharya, 2006., A Text book of palynology

SEMESTER - IV

MBOT.CC.T.2.401: Paper-I: Ecology and Phytogeography
MBOT.CC.T.2.402: Paper-II: Horticulture and Plant Breeding

A= Specialization A: Applied Mycology and Molecular Plant Pathology
MBOT.EC.T.2.403 / A: Paper-III: Molecular Plant Pathology
MBOT.EC.T.2.404 / A: Paper-IV: Plant Diseases

B= Specialization B: Applied Plant Physiology and Molecular Biology
MBOT.EC.T.2.403 / B: Paper-III: Phytohormones in Plant Development
MBOT.EC.T.2.404 / B: Paper-IV: Plant Molecular Biology & Biotechnology

C= Specialization C: Biodiversity of Angiosperms and Pharmacognosy of Medicinal Plants
MBOT.EC.T.2.403 / C: Paper-III: Taxonomy of Angiosperms and Ethnobotany
MBOT.EC.T.2.404 / C: Paper-IV: Pharmacognosy

D= Specialization D: Cytogenetics, Molecular Genetics and Biotechnology
MBOT.EC.T.2.403 / D: Paper-III: Molecular Genetics & Recombinant DNA Technology
MBOT.EC.T.2.404 / D: Paper-IV: Plant Biotechnology and Crop improvement

E= Specialization E: Applied Palynology, Palaeophytology
MBOT.EC.T.2.403 / E: Paper-III: Plant fossils and Floristics of Gondwana system
MBOT.EC.T.2.404 / E: Paper-IV: Antiquity of Angiosperms and Tertiary flora of South India

M.Sc. BOTANY- IV SEMESTER

MBOT.CC.T.2.401 (CORE) 4 Hrs/week 4 Credits

Paper-I: Ecology and Phytogeography (common paper)

UNIT I

1. **The Environment:** Physical environment; biotic and abiotic interactions.
2. **Habitat and Niche:** Concept of habitat and niche; Niche width and overlap; Fundamental and realized niche; Resource partitioning; Character displacement- Allopatric and Sympatric.
3. **Ecosystem Ecology**: Ecosystem structure and function; Food Chain, Food Web, Energy flow and Mineral cycling (C,N); Primary production and Methods of measurement of primary productivity;

UNIT II

4. **Population Ecology**: Characteristics of a population (Density ,Natality, Mortality ,Dispersion Population size, Age structure , Life tables); Population growth curves; Population regulation; life history strategies (r and K selection);
5. **Species Interactions:** Types of Interactions,Positive interactions- Mutualism,Symbiosis, commensalism, Protocooperation.
6. Negative interactions – Exploitation, Herbivors, Carnivors, antibiosis, competition.

UNIT III

7. **Community Ecology:** Characteristics of communities Analytical Quantitative – Frequency, density, Abundance, Cover and Basal area. Qualitative – Physiognomy, Phenology,Stratification, sociability, vitality and Life form and Synthetic - Prensence and constance, Fidelity Dominance.); Raunkiaer concept ; Levels of species diversity and its measurement; Ecotones. Biodiversity:
   Monitoring; Hotspots (with reference to India), Major drivers of biodiversity change;
8. **Ecological Succession:** Types; mechanisms; Changes involved in succession;
9. Concept of climax- Monoclimax and Polyclimax theories.

UNIT IV

10. **Biogeography**: Plant distribution , Theory on plant distribution(Age and area theory, Theory of tolerance), Major terrestrial biomes; Biogeographical zones of India. Classification of climate – Koppens and Thornthwaites classification.
11. **Applied Ecology**: Pollution -Global environmental change -Atmosphere composition and structure ,Green house gases , Global warming, Ozone depletion.
12. **Conservation Biology**: Principles of conservation In situ - Protected areas, National parks, Wildlife sanctuaries, Biosphere reserves and Project tiger. Ex situ - Botanical gardens, Zoological parks and cryopreservation.

MBOT.CC.P.2.405 Practicals (Labs) 4 Hrs/ week 2 Credits

Practical Lab-I (Common)

1. Determination of quantitative characters by random quadrat method -Abundance, Density ,Frequency ,IVI and Dominance : Similarity And Dissimilarity Index
2. Estimation of Carbonates ,Bicarbonates , Chlorides and Dissolved Oxygen

3. Morphology And Anatomy of Hydrophytes and Xerophytes And their Adaptations
4. Maintenance of Practical records

Reference books

1. E.P. Odum 1996 Fundamentals of ecology
2. E.J Koromondy .1996 Concept of Ecology
3. P.D Sharma . 1996 Ecology and environment
4. S.P. Misra .S.N. 2010 Pandey Essentail Enviromental studies
5. N.S Subrahmanyam and Sambamurty 2000 Ecology

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 andBt-brinjal,Herbicide resistant crops and Golden rice.
10. PCR based zygosity analysis and ELISA.

MBOT.CC.P.2.406 Practicals (Labs) 4 Hrs/ week 2 Credits

Practicals (common)

1. Identification of Horticultural tools & implements and their use.
2. Study of containers, preparation of potting mixture, potting, de-potting and repotting.
3. Estimation of moisture content in soils. Determination of pH, electrical conductivity, sodium adsorption ratio and exchangeable sodium percentage of soils.
4. Propagation through seeds, methods to overcome the seed dormancy - a) Mechanical scarification b) Soaking the seeds in water c) Acid scarification d) Startification
5. Rapid tissue test, seed dormancy, seed viability by tetrazolium test.
6. Vegetative propagation by corms, bulbs, rhizomes etc.

7. Propagation methods like cutting, layering, budding and grafting.
8. Micropropagation.
9. Identification and description of important fruit varieties: Mango, Guava and Citrus, Grape, Sapota, Banana and Papaya; Commercial flower varieties: Roses, Chrysanthemums, Dahlias, Orchids etc.
10. Study of plant breeding techniques.
11. Estimation of leaf area index, growth analysis parameters including harvest index.
12. Identification of synthetic plant hormones and growth retardants, preparations of hormonal solution and induction of rooting in cuttings, ripening of fruits and control of flower and fruit drop.

References:

1. Plant propagation (Principles and practices) Hortman, Kester, Fred T Davies, Robert Genene
2. Floriculture in India – T.K. Bose
3. Principles of horticultural science – Janick
4. Beautiful shrubs – Prathibha P. Trivedi
5. Commercial flowers Vol. I & II- T.K. Bose,Yadav, P. Pal, P.Das, V.A. Parthasarathy.
6. Floriculture in India – Randhawa and Mukhopadhyaya Allied Publishers.
7. Biotechnology and its application in horticulture S.P. Ghosh- Narosa Publishers.
8. Agricultural dairy- published by Agriculture Department A.P.
9. Horticulture dairy- Horticulture Department A.P.
10. Field Crops research. By Poehlman.
11. Genetics by Sambamurthy.
12. Plant breeding by Allard.
13. Plant breeding by Randhawa
14. Plant Tissue Culture-Protocols in Plant Biotechnology by MC Gayathri& R.Kavyashree-Narosa Publ.

IV **SEMESTER**

Specialization: A:

Applied Mycology and Molecular Plant Pathology

M.Sc. BOTANY- IV SEMESTER

Specialization Applied Mycology and Molecular Plant Pathology

MBOT.EC.T.2.403/ A **4 Hrs/week** **4 Credits**

Paper III - Molecular Plant Pathology

UNIT- I

Introduction Techniques and Information Technology

1. Introduction to Molecular Plant Pathology
2. Molecular techniques in plant pathology, RFLPs, RAPDs, polymerase chain reaction (PCR, RTPCR) - Analysis of PCR products and serological techniques based on immunofluorescence, chromosome karyotyping.
3. Fungal protoplasts and Vegetative compatibility groupings.
4. Information Technology in Plant Pathology: Plant disease clinics; use of database and application of Bioinformatics in plant pathology- a general account.

UNIT- II

Plant Pathogen Interactions

5. Recognition: Early events, Adhesion, spore eclosion, adhesion of germ tubes and hyphae factors affecting adhesion, hydrophobins.
6. Elicitiors: Distribution, production and nature, fungal wall elicitors (carbohydrates and glycoprotein elicitors) elicitors from plant cell walls, microbial enzyme elicitors, mode of action and diverse plant defense mechanisms.
7. Signal Transduction: Intracellular signals, short distance intercellular signals and systemic signals.
8. Second Messengers: Calcium ion and Calcium dependent enzymes, cyclic AMP, Proteins, H_2O_2 and Ethylene.
9. Systemic Signal Molecules: Oligogalacturonides, Salicylic acid, Systemin, Jasmonic acid and Lypoxygenases.

UNIT- III

Genetics of Plant Pathogen Interactions

1. Genetics of Plant Disease:
2. Basic features of sexual reproduction; Fungal nucleus; Gene organization
3. Genes and disease; Variability of organisms (Mutation, Heterokaryosis and Parasexuality).
4. Physiological Specialization, origin of races, concept of biological forms.
5. Molecular variability of fungal pathogens.

15. Genetics of virulence in pathogens: Genes involved in pathogenesis; Virulence by pathogens; brief account on plant pathogenic genes in fungi, bacteria and viruses.
16. Types of plant resistance to pathogens:
    i) Non-host resistance, True resistance (Vertical and Horizontal resistance).
    ii) Apparent resistance, Gene-for-gene concept, Flor's concept, Breeding resistant varieties.

UNIT- IV

Pathogen Ingress and Plant Resistance

17. Plant defense responses: Generation of signals Local and systemic responses, fungal resistance genes in plants, defense genes and fungal avirulence genes.
18. Plant lmmunizaiton: Systemically acquired resistance (SAR) Chemical inducers of plant resistance and Pathogenesis related proteins (PRPs) .
19. Strategies for cloning plant resistance genes: Vector mediated transformation, Alternative

transformation methods and ldentificaiton of transformants.

20. Engineering resistance against fungal and viral pathogens: Coat protein mediated resistance (CPMR) and antisense genes and gene silencing.
21. Antifungaland antibacterial strategies: Candidate genes to combat microbial pathogens (Chitinase,Thionine, Permatins, Lysozymes and Lectins) and antifungal proteins (Ribosome inactivating proteins-RIPs).

MBOT.EC.P.2.407 /A Practicals (Labs) 4 Hrs/ week 2 Credits

Practical Lab- (Special)- A

1. Isolation and separation of fungal nucleic acids and proteins by gel electrophoresis.
2. RFLPs of fungal nucleic acids and RAPDs of fungal DNA.
3. Amplificaiton of Fungal DNA by PCR.
4. Fungal Protoplast isolation.
5. Elaboration of phytoalexins byTLC methods.
6. Record and Herbarium of diseased plants.

Reference Books:

1) Agrios, G.N. 1999, Plant Pathology. Academic press.
2) Alexander, N. Glazer & Hiroshi Nikaido, 1995. Microbial Biotechnology, W.H. Freeman and Company.
3) Bau, A.N. & Giri, B.K. 1993. The essential of viruses, vectors and plant diseases. Wiley Eastern Limited.
4) Bernard R. Glick & Jack J. Pasternak. 1996, Molecular Biotechnology, Panima Publishing Company.
5) Bridge, P., Jeffriens, P. and Morse, D.R., 1998, Information technology, plant Pathology and Biodiversity, CAB international Publications.
6) Bridge, P.D. 1995, Molecular Variability of Fungal Pathogens, CABI Publ.
7) Bridge, P.D., Arora, D.K., Reddy, C.A. & Elander, R.P. 1998. Applications of PCR in Mycology,
8) Callow, J.A. 1983. John Wiley & Sons, Biochemical Plant pathology.
9) Chandanwala, K. 1986 Introduction of Plant pathology Anmol Publications Pvt. Ltd. New Delhi.
10) Dubey, R.C. 1995. A Text Book of Biotechnology, S. Chand & Company Ltd.
11) Greg J. Boland & Kuykendall, L.D. 1998. Plant Microbe Interactions and Biological Control. Marcel Dekker Inc.
12) Gurr, S.J. & Mc. Pherson, M.J. & Bowles, D.J. 1992. Molecular Plant Pathology, Vol. I & II Oxford
13) Horst w. Doelle, 1994, Microbia Process Development, World Scientific
14) Marshall, G. & Walters, D. 1994 Molecular Biology in Crop Protection, Chapman & Hall.
15) Mehrotra, R.S. 1991 Plant pathology, Tata Megrew – Hill Publishing Comp Ltd.
16) Natish, S. Chopra, V.L. & Ramachandran, S. 1994. Biotechnology in Agriculture Oxford and IBH Publishing Company.
17) Natish, S., Chopra, V.L. & Ramachandran, S. 1994 Biotechnology Agriculture Oxford and IBH Publishing Company.

M.Sc. BOTANY- IV SEMESTER

Specialization Applied Mycology and Molecular Plant Pathology

MBOT.EC.T.2.404 /A 4 Hrs/week 4 Credits

PaperIV -Plant Diseases

UNIT- I

1. Introduction and History of Plant Pathology
2. Classification of plant diseases: Symptomology of Fungal, Bacterial, Viral and Phytoplasmal diseases
3. Plant diseases caused by Phanerogamic plant parasites- *Loranthus, Orobanche, Striga and Cuscuta.*
4. Nematode disease - Root knot of tomato caused by *Meloidogyne*
5. General account of post-harvest fungal diseases of food crops, fruits and vegetables and their management.

UNIT- II

Plant diseases caused by Bacteria, Viruses, Viroids, Phytoplasma and Spiroplasmas

6. Plant diseases caused by Bacteria:

a) Wildfire of Tobacco
b) Angular leaf spot of Cotton
c) Leaf spot of Mango
d) Wilt of Potato
e) Wilt of Tomato
f) Soft rot and Scab of Potato

7. Plant diseases caused by Viruses & Viroids:

a) Bhendi vein clearing
b) Papaya leaf curl
c) Bunchy top of Banana
d) Rice Tungro
e) Bud necrosis of Groundnut
f) Bean common mosaic
g) Potato spindle tuber

8. Plant diseases caused by Phytoplasmas and Spiroplasmas:

a) Grassy shoot of Sugarcane b) Little leaf of Brinjal c) Sandalwood spike
d) Sesamum phyllody

UNIT- III

Fungal Diseases of Cereals, Plantation crops, Pulses and Oil Seeds

9. Cereals:

a) Bakanae disease of Rice
b) Sheath blight disease of Rice
c) Loose smut of Wheat
d) Karnal bunt of Wheat
e) Grain smut of Sorghum
f) Loose smut of Sorghum
g) Downy mildew of Bajra
h) Common smut of Maize

10. Plantation crops:

a. Coffee Rust
b. Blister blight of Tea
c. Stem rot of Rubber

11. Pulses and Oil Seeds:

a) Pigeon pea Wilt **b)** Chick pea Blight

UNIT- IV

Fungal Diseases of Fruits, Vegetables and Cash crops 12. Fruits:

a) Downy mildew of Grapes
b) Powdery mildew of grapes
c) Mango Anthracnose
d) Citrus Gummosis

13. Vegetables:

a) Powdery mildew of Cucurbits
b) Leaf spot of Tomato
c) Leaf spot of Brinjal
d) Club root of Crucifers
e) Chilli Die-back

14. Cash crops:

a) Whip smut of Sugarcane
b) Cotton Wilt
c) Damping off of Tobacco
d) Black Shank of Tobacco
e) Turmeric Leaf spot

MBOT.EC.P.2.408/A **Practicals (Labs)/Project*** **4 Hrs/ week 2 Credits**

Practical Lab- (Special)- A

1. Diagnosis of plant diseases and proof of pathogenicity according to Koch's postulates.
2. Measurement of plant diseases- Disease scoring.
3. Plant disease diagnosis by studying symptoms in the field.
4. Preparation of semi-permanent slides of diseased material, eg. Leaf spots, blights, mildews, rots, wilts, rusts and smuts.
5. Micrometry and standardization of microscope.
6. Measurement of fungal spores and mycelium and camera Iucida drawings
7. Record and Herbarium of diseased plants.

*Project: Individual project along with submission of dissertation (Subject related Project) which carries 2 credits. It is optional to choose Practical paper or Project by the Department/College.

IV SEMESTER

Specialization: B:

Applied Plant Physiology and Molecular Biology

M.Sc. BOTANY- IV SEMESTER

Specialization Applied Plant Physiology and Molecular Biology

MBOT.EC.T.2.403 / B **4 Hrs/week** **4 Credits**

Paper – III Phytohormones and Plant Development

UNIT-I

1. **Phytohormones**: Biosynthesis, physiological role and molecular mechanism of action 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 substance on flowering and fruiting:**
   a) Flower initiation and sex expression
   b) Fruit set, development and ripening

UNIT-III

5. **Senescence:**
   a) Programmed cell death
   b) Physiological and biochemical changes during senescence: loss of chlorophylls, nucleic acid metabolism, respiration and photosynthesis.
   c) 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

UNIT-IV

7. Physiological and molecular mechanisms of disease resistance in plants:
- a) Hypersensitive reaction
- b) Elicitors
- c) Phytoalexins
- d) Physiology of disease resistance.
- e) System acquired resistance (SAR)

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.

MBOT.EC.P.2.407/B Practicals (Labs) 4 Hrs/ week 2 Credits

Practical Lab- (Special)- B

1. Estimation of Indole Acetic Acid.
2. Estimation of Amylase enzyme
3. Radish cotyledonary bioassay for Cytokinins.
4. Action of Abscisic acid on stomatal movement.
5. Maintenance of Practical Record.

References

1. Phytohormones and related compounds: a comprehensive treatise Vol I and II 1978 Elsevier/North Holland, Biomedical Press, Amsterdam.
2. Plant Growth Substances Principles and application. / Richard N. Arteca. 1996 Chapman and Hall Inc. NY (Ind Ed. Cbs. Publ and Dist, New Delhi 1997)
3. Physiololgy 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 Sins 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.

M.Sc. BOTANY- IV SEMESTER

Specialization Applied Plant Physiology and Molecular Biology

MBOT.EC.T.2.404 / B **4 Hrs/week4 Credits**

Paper-IV. Plant Molecular Biology and Biotechnology

UNIT -I

1. Overview of Plant Molecular Biology and Biotechnology.
2. Plant tissue culture, culture media and culture techniques. Totipotency and cyto-differentiation.
3. Micropropagation, Somatic embryos, Synthetic seeds and Somaclonal variation. *In vitro* production of secondary metabolites.
4. Brief account of anther culture and haploidy. Isolation and fusion of protoplasts.

UNIT -II

5. Recombinant DNA technology. Biosafety measures. Intellectual property rights and Patents.
6. Vectors, Restriction endonucleases and DNA ligases. Gene cloning, genomic and cDNA libraries. Detection and isolation of a gene within a library by immuno-detection of proteins and nucleic acid (colony) hybridization.
7. Southern, northern and western blotting. Restriction fragment length polymorphisms (RFLPs) and DNA Fingerprinting. RNAi technology, Gene knockout technology. Genome editing (CRISPR-Cas9).

UNIT -III

8. Genetic engineering for production of transgenic plants: *Agrobacterium* and microprojectile gun mediated methods of gene transfer, Genetic transformation of chloroplasts. Hairy root cultures. Status of transgenic plants in India.
9. Sanger's method of DNA sequencing. Human genome project. Brief account of chemical synthesis of genes.
10. Importance of cryopreservation and germplasm storage.

UNIT -IV

12. Polymerase Chain reaction. Brief account of molecular markers: Randomly Amplified Polymorphic DNA (RAPD), Amplified length fragment polymorphism (AFLP), Simple Sequence Repeats (SSR) and Expressed sequence tags (ESTs).
13. Mapping of quantitative trait loci (QTLs) and marker-assisted selection.
14. Applications of Biofertilizers, Biopesticides, Single cell protein and Biodiesel.
15. Microbial production of vitamins, organic acids and alcohols.

MBOT.EC.P.2.408 /B Practicals (Labs)/Project* 4 Hrs/ week 2 Credits

Practical Lab- (Special)- B

1. Preparation of stock solutions and tissue culture medium (MS medium).
2. Plant tissue culture for callus induction, somatic embryogenesis, shoot regeneration and rooting.
3. Preparation of synthetic seeds with somatic embryos.
4. Enzymatic isolation of protoplasts from leaves.
5. Estimation of RNA by Orcinol method.
6. Scoring of RFLP maps.
7. Study of Biofertilizers and Biopesticides
8. Problems on restriction mapping.
9. Maintenance of Practical Record.

*Project: Individual project along with submission of dissertation (Subject related Project) which carries 2 credits. It is optional to choose Practical paper or Project by the Department/College.

References

1. Y.P.S. Bajaj. Biotechnology in Agriculture and Forestry. Vol. 1 to 16. 1986-1990.
2. I. Vasil. Plant tissue culture. Vol. 1 to 4. Ed. I. Vasil. 1993.Ed.
3. Balasubramainan. Concepts in Biotechnology.. Universities Press. 1996. Ed.
4. Prathibha Devi. Principles and methods in Plant Molecular Biology, Genetics and Biochemistry. Agrobios Publ. 2000. Ed.
5. S.S. Purohit . Agricultural Biotechnology.. 1999.Ed.
6. H. D. Kumar . Biotechnology..1992.Ed.
7. Trehan. Biotechnology. 1994.Ed.
8. K. K. De Plant tissue culture.. 1992.Ed.
9. Narayanaswamy. Plant tissue culture. 1994.Ed.
10. Smith,R.H.2000 Plant Tissue Culture:Techniques & Experiments Acad PressN.Y.
11. Snustad and Simmons. 1997. Principles of Genetics. Wiley.
12. Watson, Hopkins, Roberts, Steitz & Weiner1987. Molecular Biology of the gene.
13. Watson, Gilman, Wittkowsky and Zoller. 1992. Recombinant DNA.
14. Benjamin Lewis. 1999. Genes VII.
15. Cooper, G.M. 1999. The Cell and Molecular approach. ASM Press.
16. G. M. Shaw.1988.Ed Plant Molecular Biology. A practical approach.
17. Sambrook, J., Fritsch, E. F., and Maniatis, T. 1989.&2000. Eds. Molecular Cloning : A lab manual. 2nd ed. 3 Vols. Cold Spring Harbor Lab, N.Y.
18. Davis, L, Kuehl and Battey. 1994. Basic methods in Molecular Biology.
19. Twyman, 2000. Advanced Molecular Biology.
20. Turner, Mclennon, Bates and White. 1999. Instant notes in Molecular Biology.
21. Friefelder. Molecular Biology. 1990. Ed.
22. M. A. Hughes Plant Molecular Genetics..
23. Primrose.Molecular Biotechnology. 2nd Ed. 1999.Ed.
24. P.K. Gupta. Biotechnology. 1996. Ed.
25. Glick, B.R. and Thompson, J.E. Methods in Plant Molecular Biology and Biotechnology. 1993. CRC Press, Boca Raton, Florida.

IV SEMESTER

Specialization : C:

Biodiversity of Angiosperms and Pharmacognosy of Medicinal Plants

M.Sc. BOTANY- IV SEMESTER

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

MBOT.EC.T.2.403 /C 4 Hrs/week 4 Credits

Paper-III: Taxonomy of Angiosperms and Ethnobotany

UNIT -I

1. Method to describe a new Taxon with reference to Genus and species
2. Contribution of the following to the growth of Taxonomy a) R.M.T. Dahlgren b)R.F. Thorne c) Kubtizki
3. Plant identification – taxonomic keys

UNIT -II

4. Role of the following institutions in the growth of Taxonomy a)Botanical Survey of India, India
   b) Kew Gardens, London, UK
   c) Smithsonian, Institutions, Washington, D.C., USA
5. Floral diversity in a) Annonacease b)Malvaceae c)Apocynaceae d) Asclepiadaceae e) Hydrocharitaceae f) Lemnaceae

UNIT -III

6. Taxonomy of the following significant families
   a) Nymphaceae (*Sensu stricto and Sensu lato*)
   b) Euphorbiaceae with emphasis on its role in modern economy
   c) Podostemaceae
   d) Musaceae
   e) Arecacae
7. Seed Morphology: external features
   a) Embryo, Endosperm, Seed coat anatomy
   b) Corner's classification and its role in taxonomy

UNIT -IV

8. Ethnobotany: Concept, scope and objectives
9. Ethnobotany as an inter-disciplinary science. The relevance of Ethnobotany in the present context. Methodology of ethnobotanical studies a) Field work b) Herbarium c)Ancient literature d)Archaeological findings e)Temples and sacred groves
10. Plants Vs. Tribal Life: a)Food plants and Food cycles b)Intoxicants and Beverages c)Ropes and Bindings materials d)Resins and oils e)Poisons as baits
11. Role of ethnobotany in modern medicine with special examples

MBOT.EC.P.2.407 /C Practicals (Labs) 4 Hrs/ week 2 Credits

Practical Lab- (Special)- C

1. Study of the following locally available taxa (living sand herbarium) belonging to:
a)*Cleome b)Cassia c)Sida d)Indigofera e)Euphorbia f)Corchorus g)Tephrosia h)Phyllanthus i)Brachiaria j)Ipomoea*

2. Identification of key characters of species of above genera and construction of keys
3. Study of the seed morphology of the following:
a) Cleome b)Gossypium c)Calotropis d)Annona e)Cyperus f)Oryza g)Castor / Croton h)Portulaca i)Tecoma j)Glinus / Mullugo k)Pulses
4. Identification of selected families based on their Androecium and Gynoecium given in the mixture
a)Malyaceae b)Meliaceae c)Fabaceae d)Umbelliferae e)Cucurbiataceae f)Compositsae g)Euphorbaceae h)Lamiaceae\
5.Students are required to maintain field note book and record of the taxa occurring in the areas visited

6. Students are required to prepare herbarium of plants collected during field trips
7. Record.

Reference

1. Wills, J.C. Dictionary of Flowering plants, 1971
2. Santapau, H and A.N. Henry. Dictionary of Flowering plants in India, CSIR, 1973
3. D.J. Mabberly, Plant Book (2nd Edi.) 1997. Cambridge Univ. Press
4. Hubbard, C.E. Grasses, 1954. Penguin Books, London
5. Henry and chandrabose. An Aid to International code of Botanical Nomenclature
6. Hutchinson, J. The families of Flowering plants (3rd Edi.) b1973.
7. Lawrence, G.H. Taxonomy of Vascular plants. 1951
8. Sivarajan, V.V. (Ed. Robson) Introduction to Principles of Plant Taxonomy
9. V.N. Naik. Taxonomy of angiosperms
10. Cronquist. A. The Evolution and classification of flowering plants. 1988
11. Takhtajan. A. Outline of classification of flowering plants. Botanical Rev. 1980.
12. Davis P.H. and Heywood, V.H. Principles of Angiosperm Taxonomy
13. Jain S.K. and Rao R.R. A Handbook of field and herbarium methods
14. International code of Botanical nomenclature – 1998 (IAPT) Pub.)
15. Flowering plants / origin sand dispersal (Trans by C. Jeffrey). Takhtajan, 1969
16. Seed Anatomy Vol. I and II Cornner
17. Seed identification Manual by A. Martin and Willim Barkley 1961. Oxford and IBH publications. Calcutta.

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 tradional drugs and their market adulteration of Punarnava, Shankhapuspi (Clitoria), Indian goose-berry, Tulasi, Commiphora, Kalmegh

UNIT -II

4. Types of Plant drug and their Pharmacognostic study
   a) Root drugs; *Glycyrrhiza and Ipecac, Raulvolfia, 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

MBOT.EC.P.2.408 /C **Practicals (Labs)** **4 Hrs/ week 2 Credits**

Practical Lab- (Special)- C

1. Histochemical analysis of the following chemical compounds:
   a) Alkaloids b) Steroids c) Quinones d) Resins e) Glucosides
   f) Pigments g) Volatile oils

2. Organoleptic evaluation of the following:
   a) *Glycyrrhiza* (Root) b) Ginger (Rhizome) c) Eucalyptus (leaf)
   d) *Terminalia arjuna* (Bark) f) *Strychnos nuxvomica* (seed)

3. Powder analysis. a) Curcuma b) Cloves c) Senna d) Fennel
   e) Cinnamon : Market drugs: a) Turmeric b)Chillies c)Coriander
   d) Wheat and Jowar

4. Qualitative and Quantitative tests for
   a)Alkaloids b)Carbohydrates c) Anthroquinones d) Tannins
   e) Steroids f) Terpenoids

5.Growing chosen Medicinal plants in an experimental plot and
   preparation of Crude Drug for commercial market – Project

6. Collection of crude drugs from the market and studying their characteristics

7. Preparation of exhibits
8. Record and Herbarium of diseased plants.

IV SEMESTER

Specialization:D:

Cytogenetics, Molecular Genetics and Biotechnology

M.Sc. BOTANY- IV SEMESTER

Specialization: Cytogenetics, Molecular Genetics and Biotechnology

MBOT.EC.T.2.403 /D 4 Hrs/week 4 Credits

Paper-III: Molecular Genetics & Recombinant DNA Technology

UNIT -1:

1. General concept of genetic engineering & recombinant DNA technology. Biosafety measures.
2. Restriction endonucleases: type I, II, III, DNA ligases, reverse transcriptase, alkaline phosphatases, S1 nucleases and DNA polymerases.
3. Gene cloning. Restriction mapping, Vectors used in gene cloning: Plasmids, Cosmids, Phagemids, YAC, BAC, Ti and Ri plasmids. Preparation of genomic & cDNA libraries.
4. Southern, Northern, Western blotting, DNA finger printing, single locus & multi locus. Paternity tests & forensic applications.

UNIT -II:

5. DNA sequencing: Sangers method, Pyro sequencing.
6. Gene knockout techniques, DNA foot printing, RNA i technology (mi-RNA, Si RNA).
7. Molecular markers: Randomly Amplified Polymorphic DNA (RAPD), Amplified Length Fragment Polymorphism (AFLP), Simple Sequence Repeats (SSR). Expressed Sequence Tags (ESTs) for gene discovery. SNPs.

UNIT -III:

8. Brief overview of plant genome mapping. BACs (large-insert libraries) for map-based cloning of candidate genes and physical mapping. Mapping of quantitative trait loci (QTLs). Marker-assisted selection (MAS).
9. Gene amplification by PCR, RT PCR, Real Time PCR. Molecular diagnosis of human diseases: Sickle cell anaemia & cystic fibrosis, Production of monoclonal antibodies, synthetic vaccines.
10. Brief account and recent developments in stem cell research and cloning, Gene Therapy

UNIT -IV:

11. Genomics, functional genomics, proteomics. DNA chips, Microarrays.
12. Bioinformatics: Introduction, sequence databases, pair-wise alignment using BLAST,multiple sequence alignment with CLUSTAL.
13. Analysis of variance (ANOVA) one factor & two factor analysis.
14. Correlation coefficient positive & negative correlation

MBOT.EC.P.2.407/D Practicals (Labs) 4 Hrs/ week 2 Credits

Practical Lab- (Special)- D

1. Extraction of DNA from plants.
2. Restriction analysis of Bacteriophage Lambda DNA.
3. Problems on RFLP
4. Problems on restriction mapping
5. Problems on DNA sequencing
6. Problems on correlation coefficient.
7. Problems on ANOVA
8. Record

List of books recommended

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 Molecularbiology. 8th Ed.. (Indian Edition is also available..Varghese Company).
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 Geneticanalysis.
10. Winter, Hicky and Fletcher . 1999. Instant notes in Genetics. Ed.
11. I. Vasil. 1995. Plant tissue culture. Vol. 1 to 4. Ed.
12. Watson, Gilman, Wittkowsky and Zoller. 1992. Recombinant DNA.
13. Davis, L, Kuehl and Battey. 1994.Basic methods in Molecular Biology.
14. Twyman. 1998. Advanced Molecular Biology.
15. Turner, Mclennon, Bates and White. 1999. Instant notes in Molecular Biology.
16. Primrose. 1999. Molecular Biotechnology.
17. Hughes, M. A. 1992. Plant Molecular Genetics.
18. Stansfield 1996 III Ed Theory & Problems in Genetics. Schaum's Series 19. Cynthia Gibas. O'Reilly & Assoc.2000. Developing Bioinfor Computer skills.
20. Rastogi, Sharma and Tandon 1994. Concepts in Molecular Biology.
21. P.K. Gupta. 1990. Genetics.
22. U. Sinha and S. Sinha. 1994. Cytogenetics, Plant Breeding & Evolution.
23. A.V.S.S. Sambamurthy. 1999. Genetics.
24. Ahluwalia. 1993Genetics.
25. Khan, I. A. and A. Khanum. 1994Fundamentals of Biostatistics
26. N. Mishra and K. K. Mishra.. 1983. Introductory practical Biostatistics.
27. Cell and molecular biology by Lodish.
28. Plant breeding by B D Singh.
29. Cytogenetics by Swanson
30. Molecular biology by Robert F.Weaver.
31. DNA Science I and II

M.Sc. BOTANY- IV SEMESTER

Specialization: Cytogenetics, Molecular Genetics and Biotechnology

MBOT.EC.T.2.404 /D **4 Hrs/week** **4 Credits**

Paper IV Plant Biotechnology and Crop improvement

UNIT -I:

1. Introduction to plant tissue culture. Totipotency and cyto differentiation.
2. Establishment of tissue culture lab, preparation of culture media and culture techniques. Cell suspension, callus, meristem and organ culture.
3. Somatic embryogenesis and synthetic seeds. Morphogenesis. Shoot regeneration, rooting and establishment of plantlets. Somaclonal variations.

UNIT -II:

4. Micropropagation and its application in horticulture & forestry. Cryopreservation and germplasm storage.
5. Anther and pollen culture and their importance.
6. Isolation, culture and fusion of protoplasts. Somatic hybridization &cybrids.
7. *In vitro* production of secondary metabolites from medicinal plants, hairy root cultures.

UNIT -III:

8. Genetic engineering for production of transgenic plants: (1) *Agrobacterium*-mediated gene transfer method and (2) microprojectile bombardment method.
9. Current status of transgenic plants in the world. Transgenics resistant to herbicides, pests, diseases (viral, fungal and bacterial) and with nutritional benefits (Golden rice).
10. Role of QTLs in crop improvement.

UNIT -IV:

11. Conventional method of crop improvement. Principles of plant breeding. Selective selfing & crossing techniques. Introduction, pure line selection, mass selection, clonal selection, hybrdisation, pedigree method, back cross method of production of synthetic varieties.
12. Germplasm banks (National & International).
13. Alien addition & substitution .Wheat homologous &homeologous chromosomal pairing.role of 5B chromosomes in wheat. Evolution of wheat & cotton.

List of books recommended

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 Molecularbiology. 8th Ed.. (Indian Edition is also available..Varghese Company).
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.
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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. I. Vasil. 1995. Plant tissue culture. Vol. 1 to 4. Ed.
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13. Davis, L, Kuehl and Battey. 1994.Basic methods in Molecular Biology.
14. Twyman. 1998. Advanced Molecular Biology.
15. Turner, Mclennon, Bates and White. 1999. Instant notes in Molecular Biology.
16. Primrose. 1999. Molecular Biotechnology.
17. Hughes, M. A. 1992. Plant Molecular Genetics.
18. Stansfield. 1996. III Ed. Theory & Problems in Genetics. Schaum's Series. 19. Cynthia Gibas. O'Reilly & Assoc.2000. Developing Bioinfor Computer skills.
20. Rastogi, Sharma and Tandon 1994. Concepts in Molecular Biology.
21. P.K. Gupta. 1990. Genetics.
22. U. Sinha and S. Sinha. 1994. Cytogenetics, Plant Breeding & Evolution.
23. A.V.S.S. Sambamurthy. 1999. Genetics.
24. Ahluwalia. 1993Genetics.
25. Khan, I. A. and A. Khanum. 1994Fundamentals of Biostatistics
26. N. Mishra and K. K. Mishra. Naya Prakash. 1983. Introductory practical Biostatistics.
27. Cell and molecular biology by Lodish.
28. Plant breeding by B D Singh.
29. Cytogenetics by Swanson
30. Molecular biology by Robert F.Weaver.
31. DNA Science I and II

MBOT.EC.P.2.408 /D Practicals (Labs)/Project* 4 Hrs/ week 2 Credits

Practical Lab- (Special)- D

1. Preparation of stock solutions and tissue culture medium (MS medium).
2. Plant tissue culture for callus induction, somatic embryogenesis, shoot regeneration and rooting.
3. Preparation of synthetic seeds with somatic embryos.
4. Enzymatic isolation of protoplasts from leaves.
5. Record

*Project: Individual project along with submission of dissertation (Subject related Project) which carries 2 credits. It is optional to choose Practical paper or Project by the Department/College.

IV SEMESTER

Specialization:E:

Applied Palynology and Palaeophytology.

M.Sc. BOTANY- IV SEMESTER

Specialization: Applied Palynology and Palaeophytology.

MBOT.EC.T.2.403 /E 4 Hrs/week 4 Credits

IV SEMESTER

Specialization:E:

Applied Palynology and Palaeophytology.

M.Sc. BOTANY- IV SEMESTER

Specialization: Applied Palynology and Palaeophytology.

MBOT.EC.T.2.403 /E 4 Hrs/week 4 Credits

Paper- III Plant fossils and Floristics of Gondwana system.

UNIT - I

1. Basic principles of Palaeobotany – conditions of fossilization; different types of sedimentary rocks bearing fossils.
1. Modes of fossilization- kinds of fossils- Techniques involved in the study of plant fossils, Palaeobotanical nomenclature.
3. Standard stratigraphic column and highlights of Indian stratigraphy.
4. Principles of stratigraphy- Lithostratigraphy, Biostratigraphy and Chronostratigraphy.

UNIT – II

5. Geology in relation to Palaeobotany and impact of different geological phenomena on preservation of plants as fossils.
6. Application of plant fossils in correlation and geological dating of sedimentary deposits: Index fossils, significance of FAD and LAD.
7. Relevance of plant fossils in understanding of the evolution of plant kingdom.
8. Stromatolites, their geological and modern occurrence, Palaeoecological significance.

UNIT -III

9. Permocarboniferous floristics of the world- their floristic and climatic significance.
10. Indian Gondwana stratigraphy- classification, Gondwana flora- megafloristic divisions of Indian Gondwanas (Lower, Middle and Upper Gondwanas).
11. Gymnosperms in India – in time and space.
12. Mio-pliocene Himalayan upheavel; the origin of modern coniferous flora of India.

UNIT – IV

13. Theory of continental drift and plate tectonics; relevance of plant fossils and floral distribution with reference to India.
14. Xylotomy of Fossil Gymnosperms.
15. The record of gymnospermous woods from Indian Gondwanas (Lower and Upper).
16. Wood Anatomy of the following:-
    i). *Podocarpoxylon*
    ii).*Taxaceoxylon*
    iii). *Cupressinioxylon*
    iv). *Araucarioxylon*
    v*). Barakaroxylon*.

MBOT.EC.P.2.407 /E Practicals (Labs) 4 Hrs/ week 2 Credits

Practical Lab- (Special)- E

1. Study of different types of plant fossils (impressions, compressions, petrifications, casts, moulds and mummified fossils).
2. Techniques in the study of petrified Mezozoic and Tertiary fossils and preparation of slides
3. Study of stromatolites and some Precambrian microbiota

References:

1. Palaeobotany and Evolution of plants – W.N. Steward 1993. *Cambridge UNIT . Press*
2. Studies in Palaeobotany – H.N. Andrews Jr. 1961. *John Wiley & Sons, New Yark*
3. Geology of India, Burma and Ceylon. M.S. Krishnan 1960. *Higgin Bothms, madras*
4. Geology of India – D.N. Wadia, 1981. *Tata Macgrow Hill.*
5. Principles of Strastigraphy. Vol. I and II. A.W. Grabau 1960. *Devan Pub. New Yark.*
6. Aspects and appraisal of Indian Palaeobotany – K.R. Surange, R.N. Lakhanpal and D.C. Bharadwaj 1974. *BSIP Lucknow*.
7. Essentials of Palaeobotany – Ashok C. et al. 1975. *Vikas Publication*
8. Plants of the past, their evolution, palaeoenvsironmental application in exploration of fossil fuels – S. N. Agashe 1995. *Oxford and IBH Pub. & Co.*
9. Indian fossil Pteridophytes – K.R. Surange. 1966. *CSIR, New Delhi*
10. Symposium on Origin and Phytogeography of Angiosperms 1974. *BSIP Publication*
11. Geological Time – Don L. Eicher. 1968. *Prentice Hall Inc.*
12. Principles of Stratigraphy – A.W. Grabau 1960. *Dover Pub. New Yark*
13. Fossil plants and spores – T.P. Jones and N.P. Rowe. 1999. *Geol. Soc. London*
14. Palynological techniques- C.A. Brown, 1967. *Stanford Avenue*

M.Sc. BOTANY- IV SEMESTER

Specialization: Applied Palynology and Palaeophytology.

MBOT.EC.T.2.404 / E 4 Hrs/week 4 Credits

Paper: IV Antiquity of Angiosperms and Tertiary flora of South India.

UNIT I

1. Origin and antiquity and early evolution of Angiosperms in the light of Palaeobotanical and Palynological evidences.
2. Recent studies on fossil Angiosperm flowers.
3. Antiquity of some Indian common plants viz., ***Artocarpus, Cinnamomum. Cocos, Dipterocarpus, Mangifera, Musa,*** and ***Syzygium***- as evidenced from the fossil records.

UNIT II

4. Radiometric dating and its applications.

5. Deccan Intertrappean flora their stratigraphic and Climatic importance.

6. Study and identification of the following Intertrappean fossils.
i). ***Tricoccites*** ii). ***Enigmocarpan*** iii). ***Cyclanthodendran*** iv***).***
Sonneratioxylon v***). Azolla.***

UNIT -III

7. Highlights of Wood Anatomy of Dicotyledonous Angiosperms, utilized in the Identification of their fossil woods.

8. Xylotomy of the following fossil woods :
i) Shoreoxylon **ii)** ***Cynometroxylon***
iii) ***Terminalioxylon*** **iv)** ***Putranjivoxylon***
v) ***Palmoxylon*** **vi)** ***Barringtonioxylon***.

1. Cuddalore sandstones – Flora of Cuddalore sandstone series – its floristic, stratigraphic and climatic significance.

UNIT IV

2. Archaeobotany of Cereals, Millets and Pulses.
3. History of Palaeobotany in India. Centers of Palaeobotanical Research in India.
12. Birbal Sahni Institute of Palaeobotany and thrust areas of Palaeobotanical research.
13. Birbal Sahni`s contribution to Indian Palaeobotany.

Reference

1. Aspects and Appraisal of Indian Palaeobotany. K.R. Surange, R.N. Lakhanpal & D.C. Bharadwaj 1974. BSIP Lucknow.
2. Indian Woods Vol. I and II. A.K. Chowdhury & SS Ghosh 1960. *FRI Dehradun*
3. I.A.W.A,. List of microscopic features for hard wood identification B.A. Wheeler et al. 1989. *IAWA Bulletin*
4. Revision of Indian fossil plants Part-III Monocotyledons. B. Sahni 1964. BSIP *Lucknow*
5. History of Botanical Researches in India, Burma and Ceylon Pt. III. Palaeobotanhy A.R. Rao 1968. *Inn. Bot. Soc.*
6. Extinct plant evolution and earth's history 1991. Vol. 61. *Current Science spl. Issue*
7. Anatomy of the dicotyledons Vol. I and II. Metcalf, C.R. and Chalk, L. 1950. *Oxford London*
8. Commercial Timbers of India. Vol. I and II. Pearson, R.S. a nd Brown, H.P. 1932. *Govt. of India Pub.*
9. Tertiary angiosperm woods in Hungary. Pal Greguss. 1960./ *Akademiai Budapest*
10. The Biology and evolution of fossil plants. T.N. Taylor and E.L. Taylor 1993. *Ohio State University*
11. Palaeobotany and Evolution of Plants. W.N. Steward. 1993. *Prentice Hall Cambridge Univ. London.*

MBOT.EC.P.2.408 /E Practicals (Labs)/Project* 4 Hrs/ week 2 Credits

Practical Lab- (Special)- E

1. Xylotomical study and identification of the following fossil woods
   i) Shoreaxylon ii) Cynometraxylon iii) Terminalioxylon iv) Palmaxylon
2. Identification of carbonized woods from lignites of Southern India
3. Maceration techniques in the study of mummified / compressed leaf fossils and the recovery of cuticles