

Department of Botany
Osmania University

M.Sc. Botany Syllabus

For University, Constituent and Affiliated Colleges

With effect from
2018 – 2019

DEPARTMENT OF BOTANY,
OSMANIA UNIVERSITY
M.Sc. BOTANY (CBCS)
(Effective from Academic Year 2018-2019)

Semester-I

Subject Code	Subject / Paper	Theory / Practical	Instruction	Credits	Evaluation		Duration of External Examination
			Hrs /Week Th./ Pr.		Internal	External	
MBOT.CC.T.1.101	Phycology and Mycology	Theory (Paper-I)	4	4	20	80	3
MBOT.CC.T.1.102	Bryophyta & Pteridophyta	Theory (Paper-II)	4	4	20	80	3
MBOT.CC.T.1.103	Taxonomy of Angiosperms and Medicinal Botany	Theory (Paper-III)	4	4	20	80	3
MBOT.CC.T.1.104	Plant Biochemistry	Theory (Paper-IV)	4	4	20	80	3
MBOT.CC.P.1.105	Practical Lab - I	Practical (Paper-I)	4	2	-	50	4
MBOT.CC.P.1.106	Practical Lab - II	Practical (Paper-II)	4	2	-	50	4
MBOT.CC.P.1.107	Practical Lab-III	Practical (Paper-III)	4	2	-	50	4
MBOT.CC.P.1.108	Practical Lab-IV	Practical (Paper-IV)	4	2	-	50	4
			32	24	600		

Semester-II

Subject Code	Subject / Paper	Theory / Practical	Instruction Hrs /Week	Credits	Evaluation		Duration of External
			Th./ Pr.		Internal	External	Examination
MBOT.CC.T.1.201	Applied Phycology and Mycology	Theory (Paper-I)	4	4	20	80	3
MBOT.CC.T.1.202	Gymnosperms and Embryology	Theory (Paper-II)	4	4	20	80	3
MBOT.CC.T.1.203	Plant Anatomy and Palynology	Theory (Paper-III)	4	4	20	80	3
MBOT.CC.T.1.204	Plant Physiology	Theory (Paper-IV)	4	4	20	80	3
MBOT.CC.P.1.205	Practical Lab - I	Practical (Paper-I)	4	2	-	50	4
MBOT.CC.P.1.206	Practical Lab - II	Practical (Paper-II)	4	2	-	50	4
MBOT.CC.P.1.207	Practical Lab - III	Practical (Paper-III)	4	2	-	50	4
MBOT.CC.P.1.208	Practical Lab - IV	Practical (Paper-IV)	4	2	-	50	4
			32	24	600		

SEMESTER - III

Subject Code	Subject / Paper	Theory / Practical	Instruction Hrs /Week	Credits	Evaluation		Duration of External
			Th./ Pr.		Internal	External	Examination
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 and Palynotaxonomy

MBOT.EC.T.2.304 / E: Paper-IV: Forensic Palynology and Pollen Biotechnology

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: Aeropalynology and Melissopalynology

MBOT.EC.T.2.404 / E: Paper-IV: Palaeophytology

M.Sc Botany I Semester

MBOT.CC.T.1.101

(CORE)

4 Hrs/week 4 Credits

Paper I: Phycology and Mycology

UNIT - I

1. General characters and comparative study of important systems of classification of algae – Fritsch and Parker systems of classifications.
2. Criteria used in the primary classification of algae: a). Pigments b). Reserve food materials c). flagella d). cell wall e). gross cell structure.
3. Algae of diverse habitats – a). Terrestrial. b). Freshwater algae and c). Marine algae
4. Reproduction of algae – a). Vegetative b). Asexual – Different types of spores. Sexual – Zygotic, Sporic and Gametic with suitable examples.

UNIT - II

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

UNIT -III

6. Introduction to Mycology - General characters of true fungi and fungi-like organisms; Hyphal ultrastructure; fungal wall and septa; main growth forms of fungi; mode of nutrition in fungi.
7. General characteristics of fungal spores; asexual and sexual reproduction in different groups of fungi.
8. Fungal cytology and genetics: Heterokaryosis, Parasexual cycle; Sex Pheromones (hormones) in fungi; Mechanism of nuclear inheritance; Mechanism of extra-nuclear inheritance.
9. Outlines of nomenclature, ICN, phylogeny and recent taxonomic criteria; Classification of Fungi (Alexopoulos and Mims, 1996 and Hibbett et. al., 2007)

UNIT -IV

10. Systematic position, lifecycle (Hibbett et. al., 2007) and brief account of the following types:
 - Microsporidia - General account
 - Chytridiomycota - *Synchytrium*
 - Blastocladiomycota - *Allomyces*, *Pilobolus*
 - Neocallimastigomycota - General account

 - Ascomycota - *Taphrina*, *Emericella*, *Neurospora*, *Gibberella*, *Glomerella*, *Morchella*
 - Basidiomycota - *Melampsora*, *Phallus*, *Ustilago*
 - Oomycota - *Peronospora*
 - Fungi-like organisms - *Stemonitis*

Practical lab -I

1. Identification of the genera mentioned in Cyanophyceae and Chlorophyceae.
2. Collecton and identification of algae occurring in and around university college/campus.
3. Introduction to basic Mycological Techniques and Lab. Safety; Methods of sterilization, media preparation and culturing.
4. Identification of fungal cultures, slides and specimens of *Synchytrium*, *Allomyces*, *Glomus*, *Emericella*, *Neurospora*, *Morchella*, *Fusarium*, *Colletotrichum*, *Melampsora*, *Phallus*, *Ustilago*, *Peronospora*, and *Stemonitis*.
5. Study of Symptomology of the following fungal diseases by taking sections and slide preparation: Downy mildews, Tikka disease, *Melampsora* rust, Wheat rust and White rust.

Reference books

1. Fritsch, F.E. The structure and reproduction of algae volume 1 and 2
2. Robin South,G and Alan Whittick: Introduction to Phycology
3. Morris,I: An Introduction to Algae
4. Bold, H.C. and Wynne, M.D.: Introduction to the Algae structure and reproduction
5. H.D.Kumar: Introductory Phycology
6. John Webster and Roland W.S. Weber - Introduction to Fungi
7. Alexopoulos C.J., C.W. Mims and M. Blackwell – Introductory Mycology
8. Mehrotra R.S. and K.R. Aneja – An Introduction to Mycology
9. Smith, J.E. - The Filamentous Fungi

M.Sc. BOTANY- I SEMESTER

MBOT.CC.T.1.102

(CORE)

4 Hrs/week 4 Credits

PAPER – II: Bryophyta and Pteridophyta

UNIT - I

1. Classification systems of Bryophytes
2. Distribution, structure and reproduction of the following groups:
 - a) Marchantiales; Marchantiaceae-*Marchantia*, *Targionia*
 - b) Jungarmanniales- *Porella*
 - c) Anthocerotales- *Anthoceros*, *Notothylas*
 - d) Sphagnales – *Sphagnum*
 - e) Polytrichales- *Polytrichum*.

UNIT - II

3. Structure and evolution of gametophyte in Bryophytes
4. Structure and evolution of sporophytes in Bryophytes
5. Economic importance of Bryophytes
6. Fossil & Fossilization, types of plant fossils
7. Fossil Bryophytes.

UNIT - III

8. Classification systems of Pteridophytes
9. Distribution, structure and reproduction of the following groups:
 - Psilotales- *Psilotum*
 - Azolla* Lycopodiales- *Lycopodium*, *Phylloglossum*
 - Selaginellales-*Selaginella*
 - Isoetales- *Isoetes*,
 - Equisetales-*Equisetum*
 - Filicales – *hioglossum* *Adiantum*, *Salvinia*Stelar evolution in Pteridophytes.

UNIT- IV

10. Telome theory & its application
11. Heterospory & seed habit
12. Geological time scale
13. Techniques employed in the types of fossils
14. Origin & evolution of early vascular plants
15. General characters of Lepidodendrales, Calamitales and Sphenophyllales.

Practical Lab-II

1. Bryophytes: Morphological and structural study using whole mount
 - a) *Plagiochasma / Fimbrania*
 - b) *Targionia*
 - c) *Notothalas*
 - d) *Sphagnum / Funaria*.

2. Pteridophyta, Morphology and anatomy of vegetative and reproductive organs using cleared whole mount sections. Macerations and permanent preparation of *Psilotum, Isoetes, Ophioglossum, Adiantum, Salvinia, Azolla*.

Reference books

1. Smith, G.M. Cryptogomic Botany. Vol.II
2. Parihar, N.S.: Bryophyta
3. Parihar, N.S.1976: Biology and Morphology of Pteridophytes
4. Sporne, K.R. Pteridophyta
5. Rashid: Introduction to Pteridophyta
6. Cavers, F. Inter-relations of Bryophytes.

M.Sc. BOTANY- I SEMESTER

MBOT.CC.T.1.103

(CORE)

4 Hrs/week 4 Credits

Paper-III: Taxonomy of Angiosperms and Medicinal Botany

UNIT –I

1. Taxonomy: Definition, Principles, Scope and historical development.
2. Taxonomic tools: Herbarium, floras, Botanical gardens, GPS, GIS.
3. Plant nomenclature: Salient features of International Code of Nomenclature for algae, fungi, and plants (ICN), brief account of The Shenzhen Code 2018.
4. ICN Articles and Recommendations about Ranks and Nomenclature, Typification, Author citation, Effective and valid publication.
5. Web resources for proper nomenclature– BHL, IPNI, Species 2000 and The Plant List.
6. Biosystematics – Introduction, Principles and Methods.

Unit-II

7. Synthetic approach to the systematics of Angiosperms: - Palynology, Phytochemistry.
8. Classification of angiosperms: Natural, Artificial, Phylogenetic system of classification
9. Systems of angiosperm classification : Phenetic verses Phylogenetic system; cladistics in taxonomy;
10. Relative merits and demerits of major systems of classifications- Bentham &Hooker; Takhtajan and Cronquist; Introduction to APG system of classification.-

UNIT -III

11. Study of following families with particular reference to systematic position, phylogeny, evolutionary trends and economic importance. Dicot families; Magnoliaceae, Meliaceae, Fabaceae, Cucurbitaceae, Apiaceae, Lamiaceae, Verbenaceae, Euphorbiaceae.
12. Study of following families with particular reference to systematic position, phylogeny, Evolutionary trends and economic importance, Monocot families- Zingiberaceae, Cyperaceae, Poaceae.

UNIT -IV

13. Medicinal Botany:
 - a. Role of plants in medicine, its origin and development
 - b. Morphology, active principles and medicinal value of the following:
 - i. *Andrographis paniculata*
 - ii. *Asparagus racemosus*
 - iii. *Clitoria ternata*
 - iv. *Phyllanthus emblica*
 - v. *Gymnema sylvestre*
14. Flora of Telangana State: Salient features of vegetational aspects.

Practical Lab-III

1. Study of the locally available plants and recording of the intraspecific variation.
2. Description and identification at family, genus and species levels using Floras.
3. Identification of key characters in a group of species of a genus and construction of keys.
4. Construction of indented keys for the given material
5. Simple Nomenclatural problems
6. Identification of families studied based on flowers or essential parts of the flowers
7. Knowledge of Herbarium techniques
8. Study of medicinal plants
9. Record and Herbarium

References:

1. Lawrence: Taxonomy of Vascular Plants
2. Sivarajan, V.V. (Ed. Robson). Introduction to Principles of Plant Taxonomy
3. Heywood, V.H. Plant Taxonomy
4. Naik, V.N. Taxonomy of Angiosperms (1988)
5. Stace, C.R. Plant Taxonomy and biosystematics (2nd Ed.)
6. Hutchinson, J. The families of flowering plants (3rd Ed.), 1973
7. Cronquist, R. The Evolution and classification of flowering plants (1988)
8. Cronquist 1981. An integrated system of classification of flowering plants
9. Takhtajan, K. Outline of classification of flowering plants. Botanical Rev. 46:225-359, 1980
10. Flowering plants. Origin and Dispersal (Trans. By Jeffrey), 1969
11. Jones, S.B. & Luchsinger, A.E. Plant systematics, 1988
12. Davis, P.H. & V.H. Heywood. Principles of Angiosperm Taxonomy
13. Henry & Chandrase. An aid to International Code of Botanical Nomenclature
14. Bennet. Plant Nomenclature
15. Dunn, C. and B.S. Veritt. An introduction to Numerical Taxonomy
16. R. Jain, S.K. & Rao, .R. A Handbook of Field and Herbarium Methods.
17. Herborne, J.B. & B.L. Turner. Plant Chaemosystematics
18. International code of Botanical Nomenclature – 2000. (Int. Association of Plant Taxonomist Pub.) Utrecht.
19. Takhtajan 1997. Diversity and Classification of flowering plants. Columbia Univ. Press, New York.
20. Nordenstam B., El/Gazalay and Kasas M. 2000. Plant Systematics for 21st Century. Portland Press Ltd., London.
21. Woodland DW 1991, Contemporary Plant systematics, Prentice Hall, New Jersey.

M.Sc. BOTANY- I SEMESTER

MBOT.CC.T.1.104

(CORE)

4 Hrs/week 4 Credits

Paper-IV: Plant Biochemistry

UNIT -I

1. **Bioenergetics:** Metabolic pathways and oxidation–reduction process with reference to Photophosphorylation and Glycolysis, Energy Currency –ATP structure and reactions; other energy rich compounds
2. **Thermodynamic Principles applicable to bioenergetics:** Conservation of Energy, Entropy, Disorder, Gibb's free Energy and energy coupled reactions.
- 3.
3. **Enzymes:** Properties of enzymes, Co-factors, Isozymes, enzyme kinetics, Michaelis – Menten equation, mechanism of enzyme action, regulation of enzyme action.

UNIT -II

4. **Carbohydrates:** Classification, structure and function of carbohydrates a) monosaccharides b) oligosaccharides c) polysaccharides, storage polysaccharides, structural polysaccharides, glycoproteins.
5. **Lipids:** Classification of lipids – simple lipids, compound lipids, sterols and terpenoids, biosynthesis of fatty acids, polyunsaturated fatty acids, lipoproteins, oxidation of fats, α -oxidation, β -oxidation, glyoxylate cycle, gluconeogenesis.

UNIT -III

6. **Amino acids:** a) General properties b) Classification and characteristics c) non protein amino acids d) peptide bonds e) Biosynthesis of amino acids with reference to GS and GOGAT.
7. **Proteins:** a) Classification of proteins, b) Structure of proteins and Ramachandran plot
8. **Nucleic acids:** a) Structure of DNA and types – B, A and Z forms and DNA Structure of RNA – m-RNA, t-RNA, r-RNA

UNIT -IV

9. **Structure and function of membranes:** a) Chemical composition b) Membrane models c) Functions of Membranes d) Membrane proteins e) Membrane lipids
10. **Biochemistry of plant cell wall:** cellulose, hemicelluloses, lignin, pectin, suberin and cutin.
11. **Secondary metabolites:** introduction, classification, distribution and functions.

Practical Lab-IV

1. Determination of amylase activity
2. Estimation of fructose by resorcinol method
3. Estimation of protein by Biuret method
4. Estimation of reducing sugars in fruits.
5. Determination of iodine number.
6. Extraction and estimation of alkaloids from tea leaves/coffee seeds

References:

1. Plant Physiology, biochemistry and molecular biology. David, T: Dennis and Davis Turnip. Longman. Scientific and technical U.K. 1990.
2. Plant Biochemistry Voet, D and Voet J.G. International
3. Outlines of biochemistry. 5th edition Con E.E. and Stump P.K. 1995. Willey
4. Principles of biochemistry, Lehninger, A.L. 1982 CBS Publication
5. Biochemistry, Strayer W.H. 1976. Foreman Company.
6. Introduction to Plant Physiology. Willium G. Hopkins and Norman P. A. Huner
7. Plant Physiology. Lincoln Taiz and Eduardo Zeiger. International Edition
8. Plant Biochemistry. P.M. Dey and J.B. Harborne
9. Plant Biochemistry. Hans-Walter Heldt
10. Physicochemical and Environmental Plant Physiology. Park S. Nobel

M.Sc. BOTANY- II SEMESTER

MBOT.CC.T.1.201 (CORE)

4 Hrs/week 4 Credits

Paper-I Applied Phycology and Mycology

UNIT-I

1. General characters and morphology, life history of the following groups of algae.
 - a. Bacillariophyceae – *Cyclotella*, *Cymbella*, *Gomphonema*.
 - b. Euglenophyceae - *Euglena*, *Phacus*
 - c. Phaeophyceae - *Laminaria* , *Padina*
 - d. Rhodophyceae - *Porphyra*, *Gracillaria*, *Corallina*.

UNIT-II

2. Algal blooms and Toxic algae
3. Algal biofertilizers.
4. Algae as Food and Feed.
5. Role of algae in industry(Alginic acid, Agar, Carrageenan)
6. Fossil Algae (A brief account only)

UNIT-III

7. Fungi in Industry: Production of alcohol and organic acids.
8. Fungi in Medicine: Types of metabolites used in medicine and production of antibiotics.
9. Fungi in Agriculture and Forestry:
 - a) Fungi as plant parasites (Wilts, Leafspots, Root rots, Smuts and Rusts).
 - b) Fungi as bio-fertilizers: Ecto and Endomycorrhizae.
 - c) Fungi as biopesticides: mycofungicides, weedicides, and insecticides.
10. Fungi as human and animal parasites (medical mycology)
11. Fungi as food: Mushrooms: Types of mushrooms, biology and growth of mushrooms, nutritional and medicinal value of edible mushrooms; Fungal protein (Yeast and *Fusarium*).

UNIT-IV

12. General account of Archaeobacteria and Eubacteria; General characters of Plant Pathogenic Bacteria - Ultra structure of bacterial cell, biochemistry of cell wall, nutritional and growth factors of bacteria. Plasmids - significance of plasmids; molecular events in genetic transfer(conjugation, transformation and transduction) in bacteria.
13. Viruses: Characteristics and ultrastructure of virions; isolation, purification, detection and characterization of viruses; Classification (ICTV) of viruses; Symptomatology and Transmission of plant viruses; Importance of the viruses.
14. Mollicutes: General characters, transmission and diseases caused by Spiroplasmas and Phytoplasmas.

Practical Lab-I

1. Identification of the genera mentioned in Bacillariophyceae, Euglenophyceae, Phaeophyceae and Rhodophyceae.
2. Identification of bloom forming algae.
3. Identification of Algal biofertilizers.
4. Identification of toxic algae.
5. Identification of fungal cultures, slides and specimens of *Rhizopus/Mucor*, *Aspergillus*, *Penicillium*, Yeast, *Fusarium*, *Alternaria*, *Cercospora*, *Pythium*, *Sphacelotheca*, VAM fungi, *Trichoderma*, *Beauveria*.
6. Study of Mycorrhizal colonization in roots of *Parthenium* and *Tagetes*.
7. Study of Mushroom specimens
8. Staining of Gram + ve and Gram - ve Bacteria
9. Herbarium of diseased plants (fungal, bacterial, viral & mycoplasma diseases available locally - at least 2-3 specimens of each to be submitted).

Reference books

1. Fritsch, F.E. The structure and reproduction of algae volume I and II
2. Robin South, G and Alan Whittick: Introduction to Phycology
3. Morris, I: An Introduction to Algae
4. Bold, H.C. and Wynne, M.D.: Introduction to the Algae structure and reproduction
5. H.D.Kumar: Introductory Phycology.
6. Change. S.T. and P.G. Miles - Edible mushrooms and their cultivation
7. Mosses, B.V.A. - Mycorrhizae
8. Powel, C and D. J. Bagyaraj - V.A. Mycorrhizae
9. Berry, R. - Industrial mycology (Vol. I)
10. Dubey, S.C. - Biotechnology.
11. Jeffrey C. Pommerville - Alcamo's Fundamentals of Microbiology
12. Arora D.R. and B. Arora - Text book of Microbiology

M.Sc. BOTANY- II SEMESTER

MBOT.CC.T.1.202 (CORE)

4Hrs/week 4 Credits

Paper – II Gymnosperms and Embryology

UNIT – I

1. Distribution of Gymnosperms - Past and present.
2. Classification of Gymnosperms – Proposed by Sporne and Pant.
3. Economic importance of Gymnosperms
4. Wood anatomy of Conifers

UNIT – II

5. A general account of Gymnosperms with reference to their vegetative morphology and anatomy and male and female cones of the following taxa
 - a). Cycadales (*Cycas*, *Zamia*)
 - b). Ginkgoales (*Ginkgo*)
 - c). Coniferales (*Araucaria*, *Podocarpus*, *Cupressus* and *Cedrus*)
 - d) Taxales (*Taxus*)
 - e). Gnetales (*Ephedra*, *Welwitschia*)

UNIT – III

6. Development and trends of evolution of male gametophyte in Gymnosperms
7. Structure of Ovule and development of female gametophyte.
8. Embryogeny in Gymnosperms
9. General Account of Pteridospermales, Pantoxyloales and Cordaitales.

UNIT IV

10. Microsporangium: Anther, sporogenous tissue, formation of pollen wall, vegetative and generative nucleus.
11. Megasporangium: Ovule, types of ovule, Nucellus, Megasporogenesis, embryosac types, a special account of mature embryosac.
12. Fertilization: Double fertilization, self-incompatibility, barriers of fertilization.
13. Endosperm: Development and types of endosperms. Embryogeny of dicots. A general account of Apomixis and Parthenocarpy.
14. Embryology in relation to Taxonomy.

MBOT.CC.P.1.206 Practicals (Labs)

4 Hrs/ week 2 Credits

Practical Lab-II

1. Gymnosperms: Comparative study of the vegetative, reproductive parts and Anatomy of the following: *Zamia*, *Araucaria*, *Cedrus*, *Thuja*, *Ginkgo* and *Taxus*.
2. Palaeobotany: *Lyginopteris*, *Medullosa*, *Ptilophyllum* and *Glossopteris*.
3. Embryology: Study of embryology by specimens and slides.
 - a) T.S. of anther.
 - b) Study of ovules by hand section.
 - c) Globular embryo
 - d) Mature embryo
 - e) Polyembryony
 - f) Pollen viability.

References

1. Chamberlain, C.J. Gymnosperms: Structure and evolution
2. Sporne K. R: The Morphology of Gymnosperms.
3. Vashistha, P.C. 1978: Gymnosperms.
4. Foster & Gifford. Comparative Morphology of Vascular Plants
5. Delevoryas, T.1963. Morphology and evolution of Fossil Plants
6. Arnold C.W. introduction to Paleobotany
7. Shukla & Mishra: Essentials of Paleobotany
8. Steward, W.N. 1988: Paleobotany & Evolution of plants
9. Sergeiv, Moyen: Fundamentlis of Paleobotany – 1098
10. Taylor, T.N. 1981. Introduction to Fossils

M.Sc. BOTANY- II SEMESTER

MBOT.CC.T.1.203 (CORE)

4 Hrs/week 4 Credits

Paper: III Plant Anatomy and Palynology

UNIT -I

1. Introduction, importance and relationships of Plant Anatomy
2. Shoot Development:
 - a) Recent views on organization of shoot Apical Meristem and types of vegetative shoot apex in Gymnosperms and Angiosperms.
 - b) Cytological zonation – Anneau initial and Meristem :c) d' attente
 - d) Sub-apical differentiation of tissues.
3. Root Development:
 - a) Organization of root apex and significance of Quiscent center
 - b) Recent experimental studies on differentiation of tissues.
4. Leaf: Structure with reference to C3 and C4 plants – Kranz and CAM Syndrome.

UNIT -II

5. Epidermology:
 - a) Structural composition of Epidermal cells, stomata and trichomes
 - b). Epidermal cell complex – Structure, orientation and arrangement
 - c). Stomatal complex–Basic structure with reference to subsidiaries and ultrastructure of guard cells. Ontogeny of Paracyctic, diacytic, and anisocytic stomata.
 - d) Trichome complex-Basic structure with reference to foot and body. Classification of trichomes.
6. Transfer cells: Structure, distribution, ontogeny and function.

UNIT -III

7. a). Secondary growth with reference to Dicot stem:
 - b) Significance of Dicots wood anatomy.
 - c). Morphology and arrangement of Vessels, Axial Parenchyma Fibres and Ray parenchyma and their value in wood identification.
8. Salient features of the following woods.
 - a). *Tectona grandis*
 - b). *Terminalia tomentosa*
 - c). *Shorea robusta*
 - d) *Pongamia pinnata*

UNIT – IV

9. Palynology: Definition, Scope and importance.
 - i). Methods in Palynology: Acetolysis.
 - ii). Morphology of pollen – Polarity, symmetry, size and shape, apertural pattern (NPC Classification), exine stratification and ornamentation of pollen wall.
10. Aeropalynology –Allergenic spores and pollen in atmosphere and types of allergic reactions, Symptoms of pollen allergy in human beings, diagnosis (ELISA) and clinical treatment.
11. Melissopalynology– quantitative methods in Melissopalynology. Applications of melissopalynology in codification of honeys.
12. Role of Palynology in Taxonomy and Forensic science.

Practical Lab-III

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

REFERENCES

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

M.Sc. BOTANY- II SEMESTER

MBOT.CC.T.1.204 (CORE)

4 Hrs/week 4 Credits

Paper-IV: Plant Physiology

UNIT –I

1. Water relations:

- a. Water potential
- b. SPAC concept

2. Mineral nutrition: Mechanism of ion uptake

- a. Electrochemical potential
- b. Uptake of solutes and macromolecules from soil
- c. Ion channels
- d. ATPase carrier
- e. Aquaporins

3. Assimilation of Nutrients:

- a. Physiology and biochemistry of nitrogen fixation
- b. Sulphate reduction and assimilation

UNIT –II

4. Photosynthesis:

- a. Properties of light and absorption of light by photosynthetic pigments
- b. Composition and characterization of photo systems I and II
- c. Photophosphorylation
- d. Path of carbon
 - Differences between C3 and C4 photosynthesis
 - CAM pathway and its regulation
- e. Photorespiration, biosynthesis of glycolate and regulation of photorespiration.

UNIT –III

5. Respiration:

- a. Glycolysis, fermentation, tricarboxylic acid cycle, Regulation of TCA cycle.
- b. electron transport and oxidative phosphorylation, Coupling oxidative phosphorylation to electron transport, chemiosmotic hypothesis.
- c. Hexose monophosphate shunt and its significance, Cyanide – resistant respiration.

UNIT –IV

6. Hormonal control of growth and development

- a. General role of auxins, Gibberellins, Cytokinins, Ethylene and Abscissic acid
- b. Mechanism of hormonal regulation-hormone receptors, secondary messengers,
- c. Amplification of kinases.
- d. Structure and functions of Calmodulin

7. Physiology of flowering

- a. Photoperiodism
- b. Phytochrome – structure and function

8. Physiology and biochemistry of seed dormancy and germination:

- c. Causes of dormancy and methods of breaking dormancy
- d. Biochemical changes accompanying seed germination.

Practical Lab-IV

1. Determination of water potential by Shardolo's methods.
2. Determination of total and titrable acidity.
3. Separation of chloroplast pigments by solvent method
4. Determination of chlorophyll a, chlorophyll b and total chlorophylls in C₃ and C₄ plants.
5. Determination of Anthocyanin Pigments.
6. Estimation of I.A.A

References

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