




Department of Botany
University College of Science
Mahatma Gandhi University
Nalgonda, T.S

Revised Syllabus for M.Sc, Botany

w.e.f. 2023-24

(Semester I & II)


13/10/23
Dr. K. Madhuri
Chairperson - Board of Studies
Biotechnology & Botany
Assistant Professor
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SEMESTER-I

Sl.No	Subject Paper	Credits	Instruction Hrs/week	Evaluation		Total
				Internal/ Assignment + seminar	External	
1	BOT101T. Phycology and Lichenology	4	4	20 +10	70	100
2	BOT102T. Bryology, Pteridology and Paleobotany	4	4	20 +10	70	100
3	BOT103T. Taxonomy of Angiosperms and Economic Botany	4	4	20 +10	70	100
4	BOT104T. Plant Biochemistry	4	4	20 +10	70	100
5	BOT105P. (P-1 & 2)	3	6 (+ 6*)	-	75	75
6	BOT106P. (P- 3 & 4)	3	6 (+ 6*)	-	75	75
	Total	22	28 (+ 12*)	120	430	550

Note: \$ Workload without ID paper and Project; * Batches are made for practical's if students more than 20; # if two optional (Electives) opted by different students; @ 1 hr/week workload for handling of project (individual/group).

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SEMESTER-II

Sl.No	Subjects	Credits	Instruction Hrs/week	Evaluation		Total
				Internal/ Assignment + seminar	External	
1	BOT201T Mycology and Virology	4	4	20 +10	70	100
2	BOT202T Gymnosperms and Anatomy	4	4	20 +10	70	100
3	BOT203T Embryology, Palynology and Biostatistics	4	4	20 +10	70	100
4	BOT204T Plant Physiology	4	4	20 +10	70	100
5	BOT205P. (P-1 & 2)	3	6 (+ 6*)	-	75	75
6	BOT206P. (P- 3 & 4)	3	6 (+ 6*)	-	75	75
	Add On Paper: Economic Botany and Medicinal Botany	2	2	10+5	35	50
	Total	24	30 (+ 12*)	135	465	600

Note: \$ Workload without ID paper and Project; * Batches are made for practical's if students more than 20; # if two optional (Electives) opted by different students; @ 1 hr/week workload for handling of project (individual/group).

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M.Sc Botany Semester –I
Theory syllabus

MBOT.101.T (CORE)

4Hrs / week 4 credits

Paper -1 PHYCOLOGY AND LICHENOLOGY

UNIT-I:

1. Classification of Algae a) General characters and comparative study of important systems of Classification of Algae - Fritsch and Parker systems of classification
2. Criteria used in the primary classification of Algae: a) Pigments b) Reserve food materials c) Flagella
3. Algae on diverse habitats - a) Terrestrial, b) Freshwater, c) Marine algae
4. Reproduction in algae - a) Vegetative, b) Asexual - different types of spores and c) Sexual - Zygotic Sporic and Gametic with suitable examples.
5. Economic importance of Algae: a) Biofertilizers b) Food and feed c) Role in industry (Alginic acid , Agar, Carrageenan)

UNIT - II:

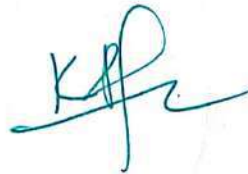
6. General characters - a) Morphology, b) Life history c) Classification of the following groups of algae.
 - a) Cyanophyceae : *Microcystis, Lyngbya* and *Aulosira*
 - b) Chlorophyceae : *Eudorina, Pediastrum, Hydrodictyon, Pithophora, Ulva*.
Stigeoclonium, Draparnaldiopsis, Cosmarium, Closterium and *Bryopsis*
 - c) Charophyceae : *Nitella*
 - e) Algal blooms and Toxic Algae

UNIT - III:

7. 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 - IV:

8. General characters of Lichens a) Habitat, b) Nature association of Lichens
9. Classification of lichens a) Structure of thallus - External structure, Internal structure and specialised structure.
10. Symbiotic organism ,
11. Reproduction
12. Importance of lichens



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. Pandey, B. P. 2001. College Botany, Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd, New Delhi.
7. Sambamurthy, A. V. S. S. 2006. A Textbook of Algae. I. K. International Pvt. Ltd., New Delhi.
8. Dutta A.C. 2016. Botany for Degree Students. Oxford University Press.



PAPER – II: Bryology, Pteridology and Paleobotany**UNIT - I**

1. General characters and systems of classification of Bryophytes
2. Distribution, structure and reproduction of the following groups:
 - a) Marchantiales- *Targionia*, *Plagiochasma*
 - b) *Sphaerocarpaceae* - *Sphaerocarpos*
 - c) Jungermanniales- *Porella*, *Pellia*
 - d) Anthocerotales- *Notothylas*
 - e) Polytrichales-*Polytrichum*
 - f) Sphagnales – *Sphagnum*

UNIT - II

3. Structure and evolution of gametophyte and sporophyte in Bryophytes
4. Economic importance of Bryophytes
5. Pteridophytes – General characters and systems of classification
6. Distribution, vegetative structure and reproduction of the following groups:
 - a. Psilotales- *Psilotum*
 - b. Filicales – *Ophioglossum*, *Adiantum*, *Salvinia*, *Azolla*

UNIT - III

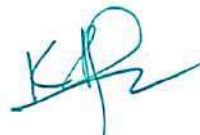
7. Distribution, vegetative structure and reproduction of the following groups:
 - a) Lycopodiales- *Lycopodium*, *Phylloglossum*
 - b) Selaginellales-*Selagenella*
 - c) Isoetales- *Isoetes*,
 - d) Equisetales-*Equisetum*
8. Telome theory & its application
9. Stellar evolution in Pteridophytes. Heterospory & seed habit
10. Origin and evolution of early vascular plants

UNIT- IV

11. Paleobotany- Scope and objectives, Birbal Sahni institute and its contributions in Paleobotany.
12. Fossil types Techniques, Fossilization.
13. Fossil Bryophytes.
14. General characters of Lepidodendrales, Calamitales and Sphenophyllales.
15. Geological time scale

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.
7. S S Sambamurty: A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany"



Paper-III: Taxonomy of Angiosperms and Economic Botany**UNIT -I**

1. Systems of classification: Phenetic and Phylogenetic systems.
2. Taxonomic hierarchy, species, genus, family and other categories.
3. Critical account of the systems of classifications of a) Hutchinson b) Cronquist and c) Takhtajan d) APG
4. Biosystematics: a) Concept b) Categories c) Species concept

UNIT -II

5. Nomenclature: a) Concept of ICBN b) Salient features of Botanical Nomenclature c) Ranks and Nomenclature of taxa d) Typification e) Rules of Priority f) Effective and valid Publication g) Author citations
6. Taxonomic evidence and techniques used there in a) Morphology b) Epidermology c) Anatomy d) Embryology e) Palynology f) Cytology g) Phytochemistry h) Nucleic acid hybridization
7. Herbarium, Botanical gardens, Floras, Manuals, Monographs, e-flora
8. Cladistics- A brief introduction, Apomorphy and Synapomorphy

UNIT -III

9. A comparative study of the following pairs of families and their treatment in recent Systems-I:
 - a) Magnoliaceae & Winteraceae
 - b) Malvaceae & Sterculiaceae
 - c) Rutaceae & Meliaceae
 - d) Apocynaceae & Asclepiadaceae
10. A comparative study of the following pairs of families and their treatment in recent Systems-II
 - a) Verbenaceae & Lamiaceae
 - b) Amaranthaceae & Chenopodiaceae
 - c) Cyperaceae & Poaceae
11. Origin of angiosperms, with reference to recent findings.
12. Flora of Telangana: Salient features of vegetational aspects.

UNIT -IV

13. Cereals: Wheat, Maize, Barley, Oats, Sorghum, Rye and Rice
14. Major Millets: Finger millet, Pearl millet and Proso millet
15. Minor millets: Foxtail millet, Barnyard millet, Kodo millet, Little millet (Sama), Browntop millet
16. Pulses: Red gram, Green gram, Black gram, Bengal gram and Lentils.

Reference Books

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. Takhtajan, K. Outline of classification of flowering plants. Botanical Rev. 46:225-359), 1980
8. Flowering plants. Origin and Dispersal (Trans. By Jeffry), 1969



Paper-IV: Plant Biochemistry**UNIT -I**

1. a) **Concept of thermodynamics:** Principles of thermodynamics, Entropy and disorder, Gibbs free energy, Enthalpy, Redox potential.
b) **Bioenergetics:** Conservation of energy, energy currencies (ATP, NAD, NADP), ATP structure and reactions, biological energy transducers.
2. **Enzymes:** Properties of enzymes, Classification and nomenclature, Co-factors, allosteric mechanism, Regulation and active sites, Isozymes,
3. **Principles of catalysis:** Mechanism of enzyme action. regulation of enzyme action, enzyme kinetics, Michaelis –Menten equation and its significance, pH and temperature optima of enzymes.

UNIT -II

4. **Carbohydrates:** Basic concepts of Carbohydrates, Classification, structure and function of carbohydrates
a) monosaccharides b) oligosaccharides c) polysaccharides, storage polysaccharides, structural polysaccharides, glycoproteins.
5. **Lipids:** Basic concepts of Lipids, Structure and function of lipids, Classification of lipids – simple lipids, compound lipids, sterols and terpenoids
6. **Lipid Metabolism:** Biosynthesis of fatty acids, oxidation of fats, α -oxidation, β -oxidation lipoproteins, Synthesis of membrane lipids, Structure and Storage of lipids and their catabolism.

UNIT -III

7. **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.
8. **Proteins:** General introduction, biological functions proteins a) Classification of proteins, b) Structure of proteins and Ramachandran plot
9. **Nucleic acids:** a) Structure of DNA and types – B, A and Z forms and DNA
b) Structure of RNA – m-RNA, t-RNA, r-RNA

UNIT -IV

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

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. William 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



Practical syllabus

Phycology and Lichenology

1. Identification of the genera mentioned in Cyanophyceae and Chlorophyceae.
2. Collecton and identification of algae occurring in and around university college/campus.
3. Identification of the genera mentioned in *Bacillariophyceae*, *Euglenophyceae*, *Phaeophyceae* and *Rhodophyceae*.
4. Identification of bloom forming algae.
6. Identification of toxic algae.
10. Lichens : different types of thallus and their external morphology

Bryology, Pteridology and Paleobotany

1. Bryology: Morphological and structural study using whole mount of
 - a. *Plagiochasma / Fimbraria*
 - b. *Targionia*
 - c. *Notothylas*
 - d. *Sphagnum / Fumaria*
 - e. *Porella*
 - f. *Pellia*
2. Pteridology: Morphology and anatomy of vegetative and reproductive organs using cleared whole mount sections. Macerations and permanent preparation of
 - a. *Psilotum*,
 - b. *Isoetes*,
 - c. *Lycopodium*
 - d. *Ophioglossum*,
 - e. *Equisetum*
 - f. *Selaginella*
 - g. *Adiantum*,
 - h. *Salvinia*,
 - i. *Azolla*.
3. Paleobotany: *Glossopteris*, *Leginopteris*, *Pentaxylon*, *Medullosa*, and *Ptilophyllum*

Taxonomy of Angiosperms and Economic Botany

Study of wild taxa representing different families and identification up to species level, worked out for technical description and identification up to the species using Gamble and Fischer's Flora of the Madras Presidency as per Bentham and Hooker's Classification

Annonaceae: *Annona squamosa*, *Polyalthia longifolia*

Capparaceae: *Cleome viscosa*

Malvaceae: *Abutilon indicum* or *Sida acuta*

Menispermaceae: *Tinospora cordifolia*

Meliaceae: *Azadirachta indica* or *Melia azadirachta*

Nymphaeaceae: *Nelumbo nucifera* or *Nymphaea pubescens*

Rutaceae: *Murraya koenigii* or *Murraya paniculata* (*M. exotica*)

Leguminosae: **Papilionoideae:** *Butea monosperma* or *Tephrosia* spp.

Caesalpinioideae: *Senna* spp. or *Bauhinia* spp.

Mimosoideae: *Acacia nilotica*

Combretaceae: *Combretum indicum* (*Quisqualis indica*) or *Terminalia* spp.

Cucurbitaceae: *Coccinia indica* or *Diplocyclos pamatus*.

Rubiaceae: *Oldenlandia umbellata*

Asteraceae: *Blumia* spp. or *Eclipta prostrata*

Apocynaceae: *Catharanthus pusillus* or *Catharanthus roseus*

Convolvulaceae: *Evolvulus alisinooides* or *Ipomoea aquatica*

Solanaceae: *Datura* spp. or *Solanum* spp.

Acanthaceae: *Barleria prionotis*, *B. cristata*

Verbenaceae: *Vitex negundo* or *Lantana camara*

Lamiaceae: *Ocimum* spp.

Amaranthaceae: *Achyranthus aspera* or *Amaranthus* spp.

Euphorbiaceae/Phyllanthaceae: *Phyllanthus amarus* or *Jatropha* spp.

Scitamineae: **Cannaceae:** *Canna indica*

Economic Botany specimens: **Cereals:** Wheat, Maize Sorghum and Rice; **Milletts:** Finger millet, Pearl millet, and Proso millet; **Little millets:** Foxtail millet, Barnyard millet, Kodo millet, Little millet (Sama), Browntop millet; **Pulses:** Red gram, Green gram, Black gram, Bengal gram and Lentils.

- Students should submit 75 herbarium specimens of common wild plant taxa.
- Students should submit field visit note book
- Study of flora of University/College campus
- Construction of taxonomic keys and Nomenclatural exercise

ant Biochemistry

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

KP

SEMESTER-I
MODEL QUESTION PAPER (PRACTICAL)
BOT105 P: Practical-I: Phycology and lichenology (and) Bryology, Pteridology and
Paleobotany

Time: 3 hours

Max.Marks: 75

- I. Identify the given components 'A' & 'B' in the algal mixture. Describe with neat labeled diagram give reasons for the classifications. 5x2=10M
(From Cyanophyceae, Chlorophyceae, Charophyceae)
- I. Identify the given components 'C' & 'D' in the algal mixture. Describe with neat labeled diagram give reasons for the classifications. 5x2=10M
(From Bacillariophyceae, Rhodophyceae, Phaeophyceae,)
- II. Take a thin section and describe the structure with well labeled diagram of the given plant material Bryophyta (E) by making a temporary/ by preparing double stained permanent slide. 13 M
- III. Take a thin section and describe the structure with well labeled diagram of the given plant material Pteridophyta (F) by making a temporary/ by preparing double stained permanent slide. 10 M
- IV. Identify the following slides by suitable reasons (G, H, I). 3 x 2 = 06 M
- G = Algae
H = Lichen
I = Bryophyta /Pteridophyta
- V. Identify the following specimens by suitable reasons (J, K, L). 3 x 2 = 06M
- J = Algae/Lichen
K = Specimen of Bryophyta/Pteridophyta
L = Specimen of Paleobotany
- VI. Algal collection (Min 10) 05M
- VII. Record 5+5=10M
- VIII. Viva-Voce 05M
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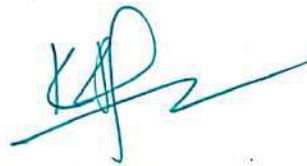


BOT106P: Practical-II: Taxonomy of Angiosperms and Economic Botany (and) Plant Biochemistry

Time: 3 hours

Max.Marks: 75

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- | | | |
|-------|--|-------------|
| I. | Describe the technical terms, draw the floral diagram and write floral formula of the given plant material (A) | 10M |
| II. | Identify to the level of species using the flora for the given plant material (B) | 05M |
| III. | Construct a key for the given 2 twigs (C) | 05M |
| IV. | Give the procedure for the experiment (D) (Major) conduct the experiment and give result and conclusions (From Plant Biochemistry) | 12M |
| V. | Give the procedure for the experiment (E) (Minor) record the data and give the inference (From Plant Biochemistry) | 10M |
| VI. | Write critical note on Economic Botany specimens of the following
-F = Cereals
G = Millets / Little millets
H = Pulses | 3 x 2 = 06M |
| VII. | Comment on I, J, K & L (From Plant Biochemistry) | 4x2=08M |
| VIII. | Herbarium and Field note book | 04M |
| IX. | Record | 5+5=10M |
| X. | Viva-Voce | 05M |
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M.Sc Botany - II Semester

Theory Syllabus

MBOT.202.T. (CORE)

4Hrs / week 4 credits

Paper -1: MYCOLOGY AND VIROLOGY

UNIT - I

1. Introduction to Mycology - General characters, structure of fungi like organisms; a) Hypha ultrastructure; b) Fungal wall and septa; c) Main growth forms of fungi; d) Mode of nutrition in fungi.
2. General characteristics of fungal spores; asexual and sexual reproduction in different groups of fungi.
3. Fungal cytology and genetics: a) Heterokaryosis, b) Parasexual cycle; c) Sex Pheromones (hormones) in fungi;
4. Outlines of nomenclature, a) ICN, b) phylogeny and recent taxonomic criteria; c) Classification of Fungi (Alexopoulos and Mims, 1996 and Hibbett et. al., 2007).

UNIT -II

5. Morphology life cycle (Alexopoulos and C. W. Mims : 1996) of the following types.
 - a) Microsporidia : General account
 - b) Chytridiomycota : *Synchytrium*
 - c) Neocallimastigomycota: General account
 - d) Blastocladiomycota: *Allomyces, Pilobolus*
 - e) Ascomycota - *Taphrina, Neurospora*
 - f) Basidiomycota - *Melampsora, Phallus,*
 - g) Oomycota - *Peronospora*

UNIT - III

6. Applications of Fungi: a) Fungi in Industry: Production of alcohol and organic acids.
 - b) Fungi in Medicine: production of antibiotics.
 - c) Fungi in Agriculture and Forestry:
 - d) Fungi as Biopesticides: mycofungicides, weedicides, and insecticides.
7. Fungi as food: Mushrooms: Types of mushrooms, biology and growth of mushrooms, nutritional and medicinal value of edible mushrooms;

Unit - IV

Bacteria

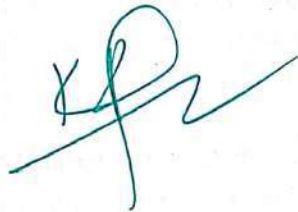
8. General account of Archaeobacteria and Eubacteria; General characters of Plant Pathogenic Bacteria.
9. Bacteria- Ultra structure of bacterial cell, biochemistry of cell wall, nutritional and growth factors of bacteria. Plasmids - significance of plasmids; molecular events in genetic transfer (conjugation transformation and transduction) in Bacteria

Viruses:

10. Characteristics and ultrastructure of virions; isolation, purification, detection and characterization of viruses.
11. Viruses; Symptomatology and Transmission of plant viruses; Importance of the viruses. Structure and replication of plant viruses a) TMV, b) Cauliflower mosaic virus.

Reference books

1. John Webster and Roland W.S. Weber - Introduction to Fungi
2. Alexopoulos C.J., C.W. Mims and M. Blackwell – Introductory Mycology
3. Mehrotra R.S. and K.R. Aneja – An Introduction to Mycology
4. Smith, J.E. - The Filamentous Fungi
5. Change. S.T. and P.G. Miles - Edible mushrooms and their cultivation
6. Mosses, B.V.A. – Mycorrhizae
7. Powel, C and D. J. Bagyaraj - V.A. Mycorrhizae
8. Berry, R. - Industrial mycology (Vol. I)
9. Dubey, S.C. - Biotechnology.
10. Jeffrey C. Pommerville - Alcamo's Fundamentals of Microbiology
11. Arora D.R. and B. Arora - Text book of Microbiology.
12. Pandey, B. P. 2001. College Botany, Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd, New Delhi.
13. Sambamurthy, A. V. S. S. 2006. A Textbook of Plant Pathology. I. K. International Pvt. Ltd., New Delhi.
14. Sambamurthy, A. V. S. S. 2006. A Textbook of Algae. I. K. International Pvt. Ltd., New Delhi.
15. Thakur, A. K. and S. K. Bassi. 2008. A Textbook of Botany: Diversity of Microbes and Cryptogams. S.Chand & Company Ltd, New Delhi.
16. Vashishta, B. R., A. K. Sinha and V. P. Singh. 2008. Botany for Degree Students: Algae. S. Chand&Company Ltd, New Delhi.
17. Vashishta, B. R. 1990. Botany for Degree Students: Fungi, S. Chand & Company Ltd, New Delhi.
18. Dutta A.C. 2016. Botany for Degree Students. Oxford University Press.



Paper – II Gymnosperms and Anatomy

UNIT – I

1. Gymnosperms: General Characters, Distribution of Gymnosperms - Past and present.
2. Classification of Gymnosperms – Proposed by Sporne and Pant.
3. 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*)
4. a. Economic importance of Gymnosperms
 - b. General Account of Pteridospermales, Pantoxylales and Cordaitales.

UNIT -II

5. Plant Anatomy: Introduction and importance
6. Shoot Development:
 - a) Recent views on organization of shoot Apical Meristem and types of vegetative shoot apex in Gymnosperms and Angiosperms.
 - b) Cytological zonation – Anneun initial and Meristem
 - d) Sub-apical differentiation of tissues.
7. Root Development:
 - a) Organization of root apex and significance of Quiscent center
 - b) Recent experimental studies on differentiation of tissues.
8. Leaf: Structure with reference to C₃ and C₄ plants – Kranz and CAM Syndrome.

UNIT -III

9. Epidermology:
 - a) Structural composition of Epidermal cells, Stomata and Trichomes
 - b) Epidermal cell complex – Structure, orientation and arrangement
10. Stomatal complex–Basic structure with reference to subsidiaries and ultra structure of guard cells. Ontogeny of Paracytic, diacytic, and anisocytic stomata.
11. Transfer cells: Structure, distribution, ontogeny and function.

UNIT -IV

12. Secondary Growth
 - a) Secondary growth with reference to Dicot stem:
 - b) Anomalous secondary growth with reference to: *Boerhavia*, *Nyctanthes*, *Amaranthus*,
 - c). Morphology and arrangement of Vessels, Axial Parenchyma, Fibres & Ray parenchyma and their value in wood identification.
13. Salient features of the following woods.
 - a) *Tectona grandis*
 - b) *Terminalia tomentosa*
 - c) *Shorea robusta*
 - d) *Pongamia pinnata*



Reference Books

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. Fañn, A. Plant Anatomy (4th Ed.), 1990.
7. Easu, K. Anatomy of Seed Plants.
8. Easu, K. Plant Anatomy, 2nd Ed. Wiley N.Y. 1965.
9. Cutter, E.G. Plant Anatomy, Part I and II Edward Arnold; London, 1971 and 1978
10. Metcalf and Chalk. Anatomy of dicots (2nd Edition) (1983). Clarendon Press, Oxford.
11. Metcalf (1982-87) Anatomy of Dicots Vol. I to III



Paper: III Embryology, Palynology and Biostatistics**UNIT – I**

1. Microsporangium and male gametophyte: Anther structure, development of male gametophyte.
2. Megasporangium and female gametophyte: Structure and types of ovules, Megasporogenesis-development of embryo sac (monosporic, bisporic and tetrasporic), a special account of mature embryo sac.

UNIT-II

3. Pollen – pistil interaction and fertilization; Double fertilization, Self-incompatibility (cytological, biochemical and molecular aspects)), *In vitro* fertilization, embryo culture.
4. Endosperm: Development and types of endosperm.
5. Embryogeny of dicots, A general account of Apomixis and Polyembryony, Parthenocarpy.
6. Embryology in relation to Taxonomy.

UNIT – III**9. Palynology:**

- a) Introduction and scope of palynological science.
 - b) Morphology of pollen – Polarity, symmetry, size and shape, apertural pattern, exine stratification and ornamentation of pollen wall.
10. Aero-palynology – principles, dissemination, distribution of aerospora and meteorological factors. Pollen and spore allergy and clinical treatment.
 11. Importance of melitto palynology
 12. Role of Palynology in Taxonomy

UNIT – IV

13. Measures of central tendency, Range, Variance, Standard deviation and Standard error.
14. Chi-square and Student's "t" test. Probability distribution (Binomial, Poisson and Normal).
15. Introduction to computers. Use of Word and PowerPoint in the preparation and presentation of documents.
16. Use of Internet and World Wide Web in research.

Reference books

1. P.K.K. Nair. Pollen Morphology of angiosperms.
2. P.K.K. Nair: Essentials of Palynology
3. Moor & Moor: Pollen analysis
4. R.B. Knox, Pollen allergy
5. Khan, I. A. and A. Khanum. 1994 Fundamentals of Biostatistics
6. B. N. Mishra and K. K. Mishra. Naya Prakash. 1983. Introductory practical Biostatistics
7. Cynthia Gibas. O'Reilly & Assoc. 2000. Developing Bioinformatics Computer skills.
8. Balasubramanian. Ed. Concepts in Biotechnology. Universities Press. 1996.



Paper-IV: Plant Physiology**UNIT -I****1. Water relations:**

- a. Water potential
- b. Absorption of Water
- c. Transpiration - Stomatal regulation of transpiration
- d. SPAC concept

2. Mineral nutrition: Macro and Micro essential elements

- a. Mechanism of ion uptake
- b. Uptake of solutes and macromolecules from soil
- c. Ion channels
- d. ATP ase carrier,
- e. Aquaporins

3. Assimilation of Nutrients:

- a. Translocation and Distribution of Photo-assimilates: Sources and Sinks
- b. Mechanism of Translocation in the Phloem
- c. Physiology and biochemistry of nitrogen fixation
- d. 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
 - i). Difference between C3 and C4 photosynthesis
 - ii). 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.
- d. Glyoxylate cycle, alternative oxidase system, gluconeogenesis.

UNIT -IV**6. Hormonal control of growth and development:**

- a. General role of auxins, gibberellins, cytokinins, ethylene and abscisic acid , brassinosteroids
jasmonic acid and salicylic acid
- b. Mechanism of hormonal regulation-hormone receptors, secondary messengers,
- c. Amplification of kinases.
- d. Structure and functions of calmodulin

8. Physiology of flowering

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

9. Floral Induction and Development:

- a. Genetic and molecular analysis
- b. Role of vernalization



Physiology and biochemistry of seed dormancy and germination:
Causes of dormancy and methods of breaking dormancy
Biochemical changes accompanying seed germination

References

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



Practical syllabus

Mycology and Virology

1. Introduction to basic Mycological Techniques and Lab. Safety; Methods of sterilization, media preparation and culturing.
2. 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.
3. Identification of fungal cultures, slides and specimens of *Synchytrium*, *Allomyces*, *Glomus*, *Emericella*, *Neurospora*, *Morchella*, *Fusarium*, *Colletotrichum*, *Melampsora*, *Phallus*, *Ustilago*, *Peronospora*, and *Stemonitis*.
4. Identification of fungal cultures, slides and specimens of *Rhizopus/Mucor*, *Aspergillus*, *Penicillium*, *Yeast*, *Fusarium*, *Alternaria*, *Cercospora*, *Pythium*, *Sphaecelotheca*, VAM fungi, *Trichoderma*, *Beauveria*.
5. Study of Mycorrhizal colonization in roots of Parthenium and Tagetes.
6. Herbarium of diseased plants (fungal, bacterial, viral & mycoplasma diseases available locally - at least 2-3 specimens of each to be submitted).
7. Staining of Gram + ve and Gram - ve Bacteria
8. Study of viruses and bacteria using electron microscope (slides)
9. Study of symptoms plant diseases caused by bacteria and viruses, mycoplasma and fungi.
 - A) Viruses : tobacco mosaic
 - B) Bacteria : angular leaf spot of cotton
 - C) Mycoplasma : little leaf of brinjal and leaf curl of papaya
 - D) Fungi : white rust on crucifers, rust on wheat & tikka disease of groundnut

Gymnosperms and Anatomy

1. Gymnosperms: Comparative study of the vegetative, reproductive parts and Anatomy of the following: *Zamia*, *Araucaria*, *Cedrus*, *Thuja*, *Ginkgo* and *Taxus*.
2. Histochemical tests for identification of the following:
 - a) Cellulose
 - b) Lignin
 - c) Pectin
 - d) Starch
 - e) Suberin
 - f) Silica bodies in the leaf of grasses and sledges.

- Estimation of stomata frequency and stomata index in the materials studied.
4. 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*.
 5. Maceration of wood and identification of various elements in *Michelia*, *Bombax*, *Tectona*, *Terminalia* and *Azadiracta*
 6. Study of wood structure with the help of T.S., R.L.S. in the following: *Tectona*, *Bombax*, *Michelia*, *Pongamia* and *Azadiracta*
 7. Study of shoot apex in suitable locally available materials to understand cyto histological zonation (*Coleus*, *Kalanchoe*)
 8. 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*)

Embryology, Palynology and Biostatistics

- 1) Pollen germination by using Hanging drop technique.
- 2) Estimation of pollen fertility; Acetolysis of pollen grains
- 3) Problems in Biostatistics:
 - a. Graphic representation of data: Histogram.
 - b. Mean, Medan, Mode, Variance, Standard Deviation and Standard Error.
 - c. Chi-square and Student's "t" test.
 - d. Problems on Probability.

Spotters

- A. T.S. of anther.
- B. Pollen grains
 - i. *Hibiscus*,
 - ii. *Tribulus*,
 - iii. *Ocimum*
 - iv. *Grass*.
- C. Ovule types
- D. Globular embryo
- E. Mature embryo (Dicot & Monocot)
- F. Polyembryony

Plant Physiology

1. Determination of water potential by Shardolo's methods.
2. Determination of total and titrable acidity.
3. Separation of chloroplast pigments by solvent method
4. Determination of chlorophyll a, chlorophyll b and total chlorophylls in C3 and C4 plants.
5. Estimation of reducing sugars in fruits.
6. Determination of iodine number.

SEMESTER-II

MODEL QUESTION PAPER (PRACTICAL)

BOT205 P: Practical-I: Mycology and Virology (and) Gymnosperms and Anatomy

Time: 3 hours

Max.Marks: 75

- I. Take a thin transverse section of given diseased plant material 'A' identify and describe the symptoms caused by the pathogen. 12M
- II. Classify the given bacterial culture 'B' by using Gram – staining technique. 10M
- III. Take a thin section and describe the structure with well labeled diagram of the given plant material Gymnosperm (C) by preparing double stained permanent slide. 10M
- IV. Experiment (From Anatomy) – D 10M
- V. Identify the following slides by suitable reasons (E, F, G, H, I). 5 x 2 = 10M

E= Fungi

F = Fungi

G = Bacteria/ Viruses

H = Gymnosperms

I= Anatomy

- VI. Identify the following specimens by suitable reasons (J, K, L, M). 4 x 2 = 08M

J = Fungi

K = Fungi

L = Specimen of Gymnosperm

M = Specimen of Anatomy

- VII. Record 10M

- VIII. Viva-Voce 05M

BOT206P: Practical-II: Embryology, Palynology and Biostatistics (And) Plant Physiology

Time: 3 hours

Max.Marks: 75

- I. Perform the given experiment (A) and interpret the results (from Embryology & Palynology) 10M
- II. Solve the given problem (B) (From Biostatistics) 08M
- III. Solve the given problem (C) (From Biostatistics) 06M
- IV. Give the procedure for the experiment (Major) conduct the experiment and give result and conclusions (From Plant Physiology) 12M
- V. Give the procedure for the experiment (Minor) record the data and give the inference (From Plant Physiology) 10M
- VI. Write critical note on Specimens/Slides of the following 4 x 3 = 12 M
- E = Embryology
F = Embryology
G = Palynology
- VII. Comment on H, I, J & K (From Plant Physiology) 4x2=08 M
- VIII. Record 5+5=10 M
- IX. Viva-Voce 05 M
- I. _____

