M.Sc. Botany – Syllabus (With effect from 2021 - 2022 admitted batches)

1<sup>st</sup> Semester - Theory.
- Core Paper 101 Biology and Diversity of Algae and Bryophytes
- Core Paper 102 Biology and Diversity of Viruses, Bacteria and Fungi
- Core Paper 103 Cell Biology
- Core Paper 104 Ethnobotany, Medicinal and Aromatic Plants

Practical
- Practical Paper - I Corresponding to Paper 101 &102
- Practical Paper - II Corresponding to Paper 103 &104

2<sup>nd</sup> Semester - Theory.
- Core Paper 201 Genetics
- Core Paper 202 Molecular Biology
- Core Paper 203 Biology and Diversity of Pteridophytes and Gymnosperms
- Core Paper 204 Plant Cell, Tissue and Organ Culture

Practical
- Practical Paper - III Corresponding to Paper 201 &202
- Practical Paper - IV Corresponding to Paper 203 &204

3<sup>rd</sup> Semester - Theory.
- Core Paper 301 Taxonomy of Angiosperms and Plant Resources Utilization and Conservation
- Core Paper 302 Plant Development and Plant Reproduction
- Core Paper 303 Plant Ecology
- Core Paper 304 Plant Physiology

Practical
- Practical Paper - V Corresponding to Paper 301 &302
- Practical Paper - VI Corresponding to Paper 303 &304

4<sup>th</sup> Semester - Theory.
- Core Paper 401 Genetic Engineering of Plants and Microbes
- Core Paper 402 Evolution and Plant Breeding
- Core Paper 403 Plant Pathology
- Core Paper 404 Crop Physiology and Biotechnology

Practical
- Practical Paper - VII Corresponding to Paper 401 &402
- Practical Paper - VIII Corresponding to Paper 403 &404
Department of Botany, Andhra University, Visakhapatnam

M.Sc. BOTANY (With effect from 2021 - 2022 admitted batches)

PROGRAMME OUTCOMES (PO)

PO 1: Understand the scope and significance of the discipline
PO 2: Develop interest in Biological Research
PO 3: Develop a thirst to preserve the Natural resources and Environment
PO 4: Make the students exposed to the diverse life forms
PO 5: Appreciate and apply ethical principles to biological science research and studies

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO 1: Understanding and Identification of the flora within field enhances basics of plants
PSO 2: Application of Botany in Agriculture is through study of Plant Pathology
PSO 3: Understanding the ultra-structure and function of cell membranes and cell communication
PSO 4: Molecular and physiological adaptations in plants in response to biotic and abiotic stress
PSO 5: Understand the classification plant taxonomy, Plant Ecology, Plant Anatomy and Plant Physiology

COURSE LEARNING OUTCOMES (LO)

LO 1: Through classroom teaching demonstration and hands on training of various tools and techniques available in the field of recombinant DNA technology
LO 2: Develop functional knowledge on differentiating diseases caused by virus, fungi and bacteria
LO 3: The students will learn about diversity of species about “Bryophytes”, “Pteridophytes” and “Gymnosperms”
LO 4: The students will be learning about various signal transduction mechanism in plants
LO 5: Students will develop ethical principles to biological science research and studies
# M.Sc. Botany Course Structure (w.e.f. 2020-2021)
(Modifications in BoS meeting held on 23-10-2020)

<table>
<thead>
<tr>
<th>S. no.</th>
<th>Paper Code</th>
<th>Paper Name</th>
<th>Internal</th>
<th>Semester end</th>
<th>Total Marks</th>
<th>Credits</th>
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<td>Biology &amp; Diversity of Bacteria, Viruses &amp; Fungi</td>
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<td>Cell Biology of Plants</td>
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<td>104</td>
<td>Ethnobotany, Medicinal &amp; Aromatic Plants</td>
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**Practicals**

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<th>Biology &amp; Diversity of Algae and Bryophytes &amp; Biology &amp; Diversity of Bacteria, Viruses &amp; Fungi</th>
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<td>Practical -II</td>
<td>Cell Biology of Plants &amp; Ethnobotany, Medicinal &amp; Aromatic Plants</td>
<td>20</td>
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**Total marks and credits for I semester**: 600  22

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<td>Plant Cell Tissue &amp; Organ Culture</td>
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**Practicals**

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<th>Genetics &amp; Molecular Biology</th>
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<td><strong>Practicals</strong></td>
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<td>Practical -I</td>
<td>Genetic Engineering of Plants and Microbes &amp; Evolution and Plant Breeding</td>
</tr>
<tr>
<td>Practical -II</td>
<td>Plant Pathology &amp; Crop Physiology and Biotechnology</td>
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<td>MOOC -II</td>
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<tr>
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<td>Value based soft skills</td>
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<tr>
<td><strong>Grand Total marks and credits for all 4 semesters (I,II,III, IV)</strong></td>
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* Credits not included in CGPA

Each paper contains 4 theory hours

Each practical contains 12 hours.
M.Sc. Botany – Semester I
Core Paper 101: BIOLOGY AND DIVERSITY OF ALGAE AND BRYOPHYTES
(With effect from 2021 - 2022 admitted batches)

Theory: semester end examination 80marks + Average midterm examinations 20marks = 100
Practical: semester end examination 80 + internal assessment 20 marks = 100.

Course Objectives:
1. To educates the student about classification, overall Thallus organization, Reproduction, and Lifecycles in Algae.
2. To educates the student about Economic importance of Algae and cultivation of important seaweeds, mass culture of microalgae and
3. To educates the student about uses in waste land reclamation, Bio-fouling and Bio-remediation through Algae.
4. To educates the student about classification, ecological and economic importance and conduction in bryophytes.
5. To educates the student about general character, Morphology, reproduction and Life history of Hepaticopsida, Anthocerotopsida and Bryopsida.

Course Learning outcomes:
1. Student can learn about Thallus organization, Reproduction, and Lifecycles in Algae.
2. Student can learn about detailed study about some algal forms belong to different classes of Algae (Chlorophyceae, Protochlorophyta, Phaeophyta, Rhodophyta and Cyanodphyta.
3. Student can learn about cultivation of important seaweeds, mass culture of microalgae and their use in waste land reclamation, Bio-fouling and Bio-remediation.
4. Student can learn about general character of Bryophytes and Conduction in bryophyte.
5. Student can learn about general characters, Morphology, reproduction and Life history of some species belong to Hepaticopsida, Anthocerotopsida and Bryopsida.

THEORY

Unit : 1 Criteria employed in classification of Algae. Classification given by Frithsch, Bold and Wynne, Thallus organization, Reproduction and Life cycles in algae and Economic importance of Algae


Unit: 5 General characters Morphology, structure, reproduction and life history of Bryopsida: Sphagnales: *Sphagnum*; Funariales: *Funaria*; Polytrichales: *Polytrichum*.

**PRACTICAL**

**Exhibit / Experiment**

1. Examination of vegetative and reproductive morphology of Chlorophyceae: *Chlamydomonas, Tetraspora, Volvox, Chlorella, Scenedesmus, Ulva, Cladophora, Fritschiella, Oedogonium, Spirogyra, Cosmarium, Caulerpa, Chara*.

2. Examination of vegetative and reproductive morphology of Bacillariophyceae: *Cyclotella, Navicula*, Phaeophyceae: *Ectocarpus, Dictyota, Padina, Laminaria, Sargassum*.

3. Examination of vegetative and reproductive morphology of Rhodophyceae: *Gelidium, Gracilaria, Polysiphonia*.


5. Field work to get acquaintance with the algae of Visakhapatnam coast and fresh water algae in and around Visakhapatnam.

6. An examination of the external features and internal structure and reproductive organs of: *Riccia, Targionia, Monoclea, Plagiochasma*.

7. An examination of the external features and internal structure and reproductive organs of the genera: *Fimbriaria, Marchantia, Pellia, Porella*.

8. An examination of the external features and internal structure and reproductive organs of: *Anthoceros, Notothylus, Andreaea, Funaria, Polytrichum*.

**REFERENCE BOOKS**

Model Question Paper
M.Sc. Botany - Semester I
Core Paper 101: BIOLOGY AND DIVERSITY OF ALGAE AND BRYOPHYTES
(With effect from 2021 - 2022 admitted batches)

Time: Three hours
Maximum marks: 80
(16 X 5 = 80)

Answer one question from each Unit.
All questions carry equal marks

Unit – I
1. a. Give a detailed classification of Algae by Fritsch
   b. Give a detailed classification of Algae by Bold and Wynne
   OR
2. a. Analyse the Economic importance of Algae
   b. critically Analyse Thallus organization and Reproduction of Algae
   Unit – II
3. a. Examine the thallus structure, reproduction, life histories of Chlorophyceae.
   b. Distinguish between Phaeophyta and Rhodophyta
   OR
4. a. Enumerate Salient features of Cyanophyta
   b. Enumerate Salient features of Xanthophyta
   Unit – III
5. a. Give a detailed account on Cultivation of economically important seaweeds
   b. Examine the Classification of Bryophytes by Smith and Campbell
   OR
6. a. Write a note on conduction in bryophytes
   b. Critically explain the process of Mass culture of micro algae, Waste land reclamation, Bio-fouling and Bio-remediation through the Algae.
   Unit – IV
7. a. Enumerate Morphology, structure, reproduction and life history of Hepaticopsida
   b. Write a note on Marchantiales
   OR
8. a. Critically Analyse the Morphology, structure, reproduction and life history of Anthocerotopsida.
   b. Enumerate the Morphology, structure, reproduction and life history of Jungermaniales
   Unit – V
9. a. Write an account of structure, reproduction and life history of Sphagnales
b. Discuss the structure, reproduction and life history of Bryopsida

OR

10. a. Analyze the structure, reproduction and life history of Funariales
b. Examine the structure, reproduction and life history of Polytrichales

M.Sc. Botany - Semester I

Core Paper 102: BIOLOGY AND DIVERSITY OF VIRUSES, BACTERIA AND FUNGI

(With effect from 2021 - 2022 admitted batches)

Theory: Semester end examination 80 marks + Average midterm examinations 20 marks = 100
Practical: Semester end examination 80 + internal assessment 20 marks = 100.

Course Objectives:

1. This educates the student about prokaryotic and eukaryotic microorganism and their adaptations to different environmental conditions and their classification.
2. To provide knowledge on History, origin and evolution, structure, chemistry, replication and transmission of plant viruses.
3. Classification of Fungi and phylogeny, thallus structure, nutrition and reproduction and their economic importance for the welfare of mankind.

Course learning outcomes:

1. Student can learn about different types of bacteria and their classification
2. Student can learn about morphology and chemistry and transmission of plant Viruses
3. Student can learn about microbial ecology
4. Student can learn about classification of fungi and general characteristics of different subdivisions
5. Student can learn about ultrastructure of fungal cell, cell wall composition and different types of reproductions in fungi

THEORY


PRACTICAL

Exhibits/ Experiments
1. Tools of microbiology: Care and use of the microscope, Spectrophotometer, pH meter, Micrometer, Hemocytometer, Autoclave, Centrifuge, Biological safety cabinets, Inoculation needle and loop, Incubator, Colony counter & Lyophilizer.
2. Differential staining: Gram staining.
3. Differential staining: Acid fast staining.
4. Study of bacterial growth: To prepare the growth curve of bacteria.
5. Study of cyanobacteria: Isolation and cultivation of cyanobacteria.
6. Isolation of Rhizobia from root nodules.
7. Cultivation of Viruses in embryonated Eggs.
8. Isolation of fungi by Petri plate exposure method.

References Books

Model Question Paper

M.Sc. Botany - Semester I

Core Paper 102: BIOLOGY AND DIVERSITY OF VIRUSES, BACTERIA AND FUNGI

(With effect from 2021 - 2022 admitted batches)

Time: 3 hours  Max. Marks: 80 marks

(16 X 5 = 80)

Answer one question from each Unit.

All questions carry equal marks

Unit: I

1. A Write a note on general account of Archaeobacteria
   B Explain the classification of Eubacteria.

   OR

2. A Describe the Ultrastructure of Eubacteria
   B Illustrate the Economic importance of bacteria.

   Unit: II

3. A Describe the morphology and chemical composition of Actinomycetes
   B Explain the ultrastructure and chemistry of Viruses.

   OR

   B Explain the Transmission of viruses.

   Unit: III

5. A Write a note on Nitrogen fixation
   B Explain the steps in Mushroom cultivation

   OR

6. A Write a note on Mycorrhiza.
   B Write a note on use of Fungi in Industry and Medicine

   Unit: IV

7. A Write a note on Classification of Fungi.
   B Illustrate the Fungal diseases in Plants

   OR

8. A Describe the general characters of Ascomycotina.
   B Write a note on Phylogeny of Fungi.

   Unit: V

9. A Describe the Thallus organization in Fungi.
   B Write a note on Nutrition in fungi

   OR
10
A Describe the Ultrastructure of Fungal cell
B Write a note on Asexual Reproduction in Fungi

M.Sc. Botany - Semester I
Core Paper–103: CELL BIOLOGY OF PLANTS
(With effect from 2021-2022 admitted batches)

Theory: Semester end examination 80 marks + Average midterm examinations 20 marks = 100
Practical: Semester end examination 80 + internal assessment 20 marks = 100.

Course Objectives:
1. To give the knowledge of the Ultra structure, properties and functions of the Plant cell and its various organelles
2. To explain the types and stages in Cell division.
3. To stain and identify plant chromosomes
4. To create awareness on the chromosomal structural and numerical aberrations
5. To use cytological methods.

Course learning outcomes:
1. Student will be taught about the origin and the development of Cell Biology as a separate branch.
2. Learn about the identification, distinction, ultra structure of the plant cell and its organelles.
3. The student will know about the various parts of the cell, their functions and significance.
4. Gain the knowledge about the types and stages of cell division cell cycle and their significance.
5. Understand and identify the structural and numerical abnormalities of chromosomes in the cell.

THEORY


Unit : 4. Chromosomal structural aberrations: Origin, meiosis and breeding behaviour of deletions, duplications, inversions and interchanges; Chromosomal numerical aberrations: Aneuploids– trisomics (primary, secondary, tertiary), monosomics and nullisomics–meiotic
behaviour. Eupolyploids-origin and production of auto and allopolyploids, meiosis in autotetraploid. Genome of tobacco and wheat as examples of allopolyploids.


**PRACTICAL**

**Exhibit/Experiment**

1. Electron microscopic picture of prokaryotic and eukaryotic cells
2. Images of cytoskeleton
3. Electron microscope pictures of Chloroplast and Mitochondria
4. Electron microscope pictures of Endoplasmic Reticulum, Golgi apparatus
5. Study of Mitosis in root tips using Acetocarmine
6. Preparation of slides from Allium floral buds for observation and identification of stages of Meiosis.
7. Photographs of Meiosis showing structural and numerical aberrations
8. Pictures of Lampbrush and Polytene chromosomes

**Reference Books**

Model Question Paper
M.Sc. Botany - Semester I
Core Paper 103: CELL BIOLOGY OF PLANTS
(With effect from 2021 - 2022 admitted batches)

Time: 3 hours  Max. Marks: 80 marks  
(16 X 5 = 80)

Answer one question from each Unit
All questions carry equal marks

Unit – I

1. a. Explain in detail about the ultrastructure and organization of a prokaryotic cell.
   b. Write an essay on plasmodesmata structure and functions.

   OR

2. a. Explain in detail about plasma membrane structure, models and functions.
   b. Write an essay on vacuoles structure and functions.

Unit – II

3. a. Write a detailed essay on cell wall.
   b. Explain in detail about chloroplast and endoplasmic reticulum.

   OR

4. a. Write an essay on the structure and functions of lysosomes, Micro bodies and Peroxisomes.
   b. Write an essay on cytoskeleton and add a note on the techniques used for their Visualization.

Unit – III

5. a. Write in detail about the nucleus.
   b. Write an essay about structure of chromosomes and add a note on centromere and Telomeres.

   OR

6. a. Write an essay on the types and organization of chromatin.
   b. Write in detail about the lamp brush and polytene chromosomes.

Unit – IV

7. a. Write an essay on chromosomal structural aberrations.
   b. Write in detail about aneuploidy with special focus on their meiotic behavior.

   OR

8. a. Write in detail about chromosomal numerical aberrations.
   b. Write about the genomes of wheat and tobacco as examples of allopolyploids.

Unit – V

9. a. Explain in detail about the different stages of mitosis.
b. Write an essay on the mechanism and significance of Apoptosis.

OR

10. a. Write a detailed essay on the process of Meiosis.
   b. Write an essay on cell cycle and its regulation.

M.Sc. Botany – Semester I
Core paper 104: ETHNOBOTANY, MEDICINAL AND AROMATIC PLANTS
(With effect from 2021 - 2022 admitted batches)

Theory: Semester End examination 80 marks + average midterm examinations 20 marks = 100
Practical: Semester End examination 80 marks + internal assessments 20 marks = 100

Course Objectives
1. Proper documentation of indigenous knowledge about medicinal plants.
2. Preservation of unwritten traditional knowledge about herbal plants.
3. To create awareness about its role in cultural social and health of people.
4. To train people or students for utilization and conservation of medicinal plants.
5. Cultivation methods of some Medicinal and Aromatic plants.

Course specific objectives.
1. Student can learn about indigenous medicinal plants used for ethnic people
2. Student can learn about Ethnic communities in Andhra Pradesh
3. Student can learn about secondary metabolites of Medicinal Plants
4. Student can learn about cultivation of Medicinal and aromatic plants in Andhra Pradesh.
5. Student can learn about IPR of Medicinal and ethnomedicinal plants.

THEORY

Unit : 1 Ethnobotany definition, history, scope, interdisciplinary approaches, World centres of Ethnobotany, Ethnobotany in India.

Ethnic communities of India, conservation practices of biodiversity, taboos and totems

Different categories of Ethno botanical plants: Food, Medicine, Shelter, Fodder, Timber, Fuel wood, NTFPs etc.

Unit : 2 Role of research institutes on medicinal and aromatic plants (CDRI, CIMAP, NBRI, NBPGR & IUCN)

Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, Blood pressure, skin diseases etc.,

Unit : 3 History, scope, significance, recent trends of medicinal and aromatic plants in the World and India. History and principles of Ayurveda, Homeopathy, Allopathy, Unani and Siddha system of medicines.

Unit : 4 Conservation of endangered and endemic medicinal plants. In situ conservation: Biosphere reserves, sacred groves, National Parks; Ex situ conservation: Botanic Gardens & In-vitro conservation.

Unit : 5 History, origin, distribution, significance, Taxonomy, Ecology, Alkaloids, Chemical constituents, Patenting and IPR and Cultivation methods of medicinal and aromatic plants (Medicinal plants:
**Catharanthus, Rauwolfia, Withania.** Aromatic plants: Lemon grass, Mint and Ocimum.

**PRACTICAL**

**Exhibit/Experiment**

1. Identification of major Ethnic groups of Andhra Pradesh.
2. Identification of the different categories of Ethno botanical plants.
3. Identification of locally available Medicinal and aromatic plants.
4. Herbarium preparation of Ethnomedical, medicinal and aromatic plants.
6. Visit to Botanical/medicinal garden, forest, Wildlife Sanctuary etc.

**Reference Books**

15. Ramachandran, S.P. 1991, Recent Advances in Medicinal aromatic and spice crops
Model Question Paper

M.Sc. Botany – Semester I

Core paper 104: ETHNOBOTANY, MEDICINAL AND AROMATIC PLANTS
(With effect from 2021 - 2022 admitted batches)

Time: 3 hours
Max. Marks: 80 marks

Answer one question from each Unit
All questions carry equal marks

Unit – I

1. a. What is Ethnobotany? Describe the scope of Ethnobotany in Detail.
   b. Write an essay on centers of Ethnobotany in India.

   **OR**

2. a. Write an account on major and minor ethnic groups of Andhra Pradesh
   b. Enlist and give the uses of ethno botanical plants used by the primitive tribes for Wood and NTFP’s.

Unit – II

3. a. Describe the role of CIMAP in medicinal and aromatic plant conservation.
   b. Describe the uses of ethno botanical plants used by the primitive tribes for Jaundice.

   **OR**

4. a. Write any two Role of research institutes in medicinal and Aromatic plats.
   b. Briefly explain Ethnomedicinal plants used for Skin disease.

Unit – III

5. a. Describe the recent trends of medicinal and aromatic plants in the World.
   b. Give an account of the principles and Importance of Ayurveda systems of Medicines.

   **OR**

6. a. Explain about Siddha system of medicines.
   b. Give an account of the principles and Importance of Homeopathy systems of Medicines.

Unit – IV

7. a. What are different strategies of plant conservation? Add a note on status of plants based on IUCN.
   b. Explain Botanic Gardens & In-vitro conservation.

   **OR**

8. a. Write detailed account on biosphere reserves in India with special reference to Andhra Pradesh
   b. Write a note on sacred groves and In-vitro conservation.

Unit – V

9. a. Describe the occurrence and Classification of Alkaloids.
   b. What is IPR? Explain the mode of patenting of active principles.
10. **a.** Write Comment on aromatic plants with any two suitable examples.
    
    **b.** Write a note on cultivation methods and Medicinal importance of *Withania somnifera*.

**M.Sc. Botany – Semester II**

**Core paper 201: GENETICS**

(With effect from 2021 - 2022 admitted batches)

**Theory:** Semester End examination 80 marks+ average midterm examinations 20 marks=100

**Practical:** Semester End examination 80 marks + internal assessments 20 marks=100

**Course Objectives.**

1. To know Mendelian and non-Mendelian inheritance,
2. To explain quantitative and quantitative characters in genetics,
3. To understand Molecular markers and their uses
4. To distinguish crossing over, Linkage and Linkage mapping,
5. To differentiate prokaryotic and eukaryotic genome structure, gene function and regulation,

**Course specific objectives.**

1. The student learn about Inheritance of qualitative and quantitative traits
2. Mapping genes in bacteria
3. The structure and organization of different components of the eukaryotic genomes
4. Transposons types and their significance.
5. The use of linkage and recombination frequencies to map genes

**THEORY**


Unit : 5 Mutations: types, causes and detection. Physical and chemical mutagens. Lethal,

PRACTICAL

Exhibit/Experiment/Assignment

1. Assignment on Mendel’s principles, Chi-square test, Probability.
2. Assignment on dominance relationships, multiple alleles and two gene interactions.
3. Assignment on linkage and crossing over.

Reference Books

Answer one question from each Unit
All questions carry equal marks

Unit – I
1. a. Write about Mendel’s experiments and theories and the applications of probability laws to Mendelian principles.
   b. Explain about the concepts of Penetrance, expressivity, pleiotropism, complete and incomplete dominance.

   OR

2. a. Explain about the Concept of genetic markers and their types.
   b. Write in detail about Multiple allelism and the interactions among multiple alleles.

Unit – II
3. a. Write in detail about linkage and crossing over.
   b. Write an essay on Tetrad analysis.

   OR

4. a. Explain about the various methods of recombination in prokaryotes.
   b. Write about the fine structure analysis of gene and methods of gene mapping in bacteria.

Unit – III
5. a. Write an essay on the chromosomal and genetic basis of sex determination.
   b. Explain in detail about sex-linked, sex-influenced and sex-limited characters and their inheritance.

   OR

6. a. Write an essay on polygenic inheritance and add a brief note on QTL mapping.
   b. Write an essay on extra chromosomal inheritance and male sterility.

Unit – IV
7. a. Write an essay on the eukaryotic gene and its various functional parts.
   b. Explain about the organization and significance of multigene families.

   OR

8. a. Write an essay on Transposable elements, their types, mechanisms of transposition and their significance.
   b. Explain about the variant forms of the eukaryotic genes like nested genes, overlapping genes, assembled and assorted genes.

Unit – V
9. a. Write an essay on Mutations- its types, causes and detection.
b. Explain about the molecular basis of mutations and add a brief note on mutagens.

OR

10. a. Explain in detail about the molecular mechanism of recombination.
    b. Write an essay on the various theories or models of recombination.

M.Sc. Botany - Semester II

Core Paper 202: MOLECULAR BIOLOGY OF PLANTS
(With effect from 2021 - 2022 admitted batches)

Theory: Semester end examination 80marks + Average midterm examinations 20marks = 100
Practical: Semester end examination 80 marks + internal assessment 20 marks = 100

Course Objectives:

1. To provide knowledge on Biomolecules and their utilization
2. To gain the knowledge in protein synthesis and involvement of different types of nucleic acids during the process of protein synthesis
3. This educates the student in DNA replication in both prokaryotes and Eukaryotes
4. To gain the knowledge in gene regulation in both prokaryotes and Eukaryotes

Course learning outcomes:

1. Student can learn about different types of Biomolecules and their mobility and functions
2. Student can learn the central dogma molecular biology which includes transcription, translation, different types of DNA replication and number of enzymes involved.
3. Student can learn about the gene regulation in both Prokaryotes and Eukaryotes

THEORY


Unit : 3 Types of small RNAs: Si RNA, micro RNA, catalytic RNA. RNA synthesis and processing: transcription process in prokaryotes and eukaryotes. Transcription factors. RNA processing– mRNA processing – spliceosome, capping and tailing, processing of tRNA and rRNA.

Replication at ends of chromosomes. Extra chromosomal replicons. DNA damage and repair.


PRACTICAL

Exhibit/Experiment
1. Isolation of DNA using CTAB method.
2. Histochemical staining of carbohydrates, proteins and fats in the plant cells.
3. Electrophoresis of seed proteins.
4. Assignments on problems related to DNA structure, replication, transcription and translation
5. Photographs depicting the content of theory

Reference Books
Model Question Paper
M.Sc. Botany - Semester II
Core Paper 202: MOLECULAR BIOLOGY OF PLANTS
(With effect from 2021 - 2022 admitted batches)

Time: 3 hours
Max. Marks: 80 marks
(16 X 5 = 80)

Answer one question from each Unit.
All questions carry equal marks

Unit: 1
1 A Write a note Carbohydrates
   B Describe the Protein trafficking through GERL system
   OR
2 A Describe the Ca-calmodulin pathway.
   B Explain the DNA structure, A, B and Z forms of DNA

Unit: II
3 A Explain the process of protein synthesis
   B Write a note Genetic code
   OR
4 A Explain the Ribosome as a translation factory
   B Explain the structure and functions of tRNA

Unit: III
5 A Describe the Types of small RNAs
   B Write a note spliceosome,
   OR
6 A Describe the Transcription factors.
   B Explain the capping and tailing

Unit: IV
7 A Write the differences between uni and bi directional mode of DNA replication
   B Explain the theta mode of DNA replication,
   OR
8 A Write a note on DNA damage and repair.
   B Explain the rolling circle mode of DNA replication

Unit: V
9 A Explain the Lac operons
M.Sc. Botany - Semester II
Core Paper 203: BIOLOGY AND DIVERSITY OF PTERIDOPHYTES AND GYMNOSPERMS
(With effect from 2021 - 2022 admitted batches)

Theory: Semester end examination 80 marks + Average midterm examinations 20 marks = 100
Practical: Semester end examination 80 marks + internal assessment 20 marks = 100.

Course objectives:
1. To understand the classification and evolution of Pteridophytes and Gymnosperms with special reference to Indian taxa.
2. To get an insight into the life histories of tracheophytes (Pteridophytes and Gymnosperms).
3. To know the evolution of Bryophytes and Pteridophytes and Gymnosperms.
4. To get knowledge about economic importance of Pteridophytes and Gymnosperms.
5. To get an understanding of the past history of the biosphere and evolution of Plants through fossils.

Course learning outcomes
1. To understand the phylogeny of Pteridophytes and Gymnosperms.
2. To understand the stelar evolution and seed formation habit in pteridophytes.
3. To gain knowledge about life cycles of gymnosperm plants.
4. To explain about fossils and fossilization.
5. The student will understand the evolutionary history of plant kingdom.
6. To understand about geological time scale.

THEORY


Unit 2 Morphology, anatomy and reproduction of Psilotum, Lycopodium, Selaginella, Isoetes, Equisetum, Ophioglossum, Osmunda, Gleichenia, Cyathea, Marselia, Salvinia and Azolla. General account of fossil pteridophytes—Psilopsida, Lycopsida, Sphenopsida and Pteridopsida.

Unit 3 Heterospory and origin of seed habit. Evolution of the sporophyte. The evolutionary time scale: eras, periods and epochs. General account of fossils. Types of fossil formations. Gymnosperms in comparison to ferns and seed plants.

Unit 4 Classification of Gymnosperms and their distribution in India. General account of the families of Pteridospermales—Lyginopteridaceae, Meduloisaceae, Caytoniaceae; Bennettitales—Cycadeoideae; Pentoxylales—Pentoxylaceae; Cordaitales–Cordaitaceae.

Unit 5 Economic importance of Gymnosperms. Structure and reproduction in living Gymnosperms of Cycadopsida, Coniferopsida and Gnetopsida.

PRACTICAL
Exhibit/Experiment

1. Examination of the external features, anatomy and reproductive structures of Psilotum, Lycopodium, Selaginella, Isoetes and Equisetum.

2. Examination of the external features, anatomy and reproductive structures of Ophioglossum, Osmunda, Gleichenia, Cyathea, Marselia, Adiantum, Salvinia, and Azolla.

3. Observations of the slides of the following fossil plants—Rhynia, Lepidodendron, Lepidocarpon, Miadesmia, and Sphenophyllum.


5. Examination of the external features, anatomy and reproductive structures of Ginkgo, Pinus, Cupressus and Cryptomeria.

6. Examination of the external features, anatomy and reproductive structures of Araucaria, Ephedra and Gnetum.

7. Study of fossil gymnosperms from prepared slides: Lyginopteris, Lagenostoma and Medullosa.

8. Study of fossil gymnosperms from prepared slides: Triganocarpus, Conostoma, Heterangium, Cordaites.

Reference Books


Model Question Paper
M.Sc. Botany - Semester II

Core Paper 203: BIOLOGY AND DIVERSITY OF PTERIDOPHYTES AND GYMNOSPERMS
(With effect from 2021 - 2022 admitted batches)

Time: 3 hours Max. Marks: 80 marks

(16 X 5 = 80)

Answer one question from each Unit.
All questions carry equal marks

Unit – I
1. a. Distinguish the characteristics of Pteridophytes when compare to bryophytes and Gymnosperms.
   b. Examine the stellar Evolution in Pteridophytes

   OR

2. a. Give an account on Classification of Pteridophytes
   b. Discuss the Economic importance of Pteridophytes in different aspects

   Unit – II
3. a. Enumerate the Morphology, anatomy and reproduction of Selaginella, Isoetes.
   b. Explain the morphology and reproduction of Equisetum.

   OR

4. a. How Marselia sporophyte is advanced over other pteridophytes. Discuss its advanced features.
   b. Critically explain the fossil Pteridophytes.

   Unit – III
5. a. Analyse the Heterospory and explain the origin of seed habit.
   b. Examine the evolutionary time scale Gymnosperms.

   OR

6. a. General account of fossils. Types of fossil formations.
   b. Analyse Gymnosperms in comparison to ferns and seed plants.

   Unit – IV
7. a. Enumerate Classification of Gymnosperms and their distribution in India.
   b. Elaborate fossil gymnosperms and general account on pteridospermales.

   OR

8. a. Critically Analyse the Bennettitales.
   b. Enumerate the Cordaitales.

   Unit – V
   b. Structure and reproduction in living Gymnosperms of Cycadopsida.

   OR
10. a. Write an account of structure and development of male and female strobili of Coniferales.
b. Discuss the structure and reproduction of Gnetum

M.Sc. Botany - Semester II
Core Paper 204: PLANT CELL, TISSUE AND ORGAN CULTURE
(With effect from 2021 - 2022 admitted batches)

Theory: Semester End examination 80 marks + average midterm examinations 20 marks = 100.
Practical: Semester End examination 80 marks + internal assessments 20 marks = 100

Course objectives:
1. To study the plant tissue culture basic concepts and its applications
2. To understand the preparation of culture medium, basic components, Phyto hormones and its effects.
3. Study the techniques and applications of cryopreservation and germplasm storage
4. Study the methods of production of haploids, dihaploids, somatic embryos and artificial seeds.
5. Understanding the procedures of cell cultures, making protoplasts and genetic transformation through protoplasts and its applications

Course Specific objectives:
1. Students learn about basic concepts and protocols of different types of tissue culture
2. Students learn about totipotency, morphogenesis and cell differentiation.
3. Students learn about how to produce secondary metabolites in large scale and hybrids, new varieties in crop improvement using protoplast and haploid cultures.
4. Students learn about applications of tissue culture in crop improvement
5. Student can learn about conservation of natural bio diversity resources

THEORY

Unit 1  Plant cell and tissue culture: introduction, history, scope. Basic concepts of tissue of culture: tissue culture cycle, types of cultures. Concept of cellular differentiation, totipotency.
Culture media: composition and effects of media components, phytohormones – effects in tissue culture. Sterilization methods

Unit 2  Pathways of regeneration – biochemical and molecular aspects of tissue culture cycle. Technique and applications of cryopreservation and germplasm storage. Organogenesis and adventitious embryogenesis.


Unit 5  Applications of plant tissue culture: clonal propagation, artificial seeds and its applications, somaclonal variation and its applications. Plant tissue culture in forestry.
PRACTICAL

Exhibit/Experiment

1. General outlay of plant tissue culture laboratory.
2. Preparation of media.
4. Clonal propagation through meristem cultures.
5.ryo culture – groundnut.
6. Anther culture – Datura/tobacco.
7. Oblishment of cell cultures and determination of growth pattern.
8. Ermination of plating efficiency of cell cultures.
10. Oplast fusion.
11. Observation of different developmental stages of somatic embryo in embryogenic callus.
12. Preparation of artificial seeds.

Reference Books

Model Question Paper

M.Sc. Botany - Semester II
Core Paper 204: PLANT CELL, TISSUE AND ORGAN CULTURE
(With effect from 2021 - 2022 admitted batches)

Time: 3 hours Max. Marks: 80 marks

(16 X 5 = 80)

Answer one question from each Unit.
All questions carry equal marks

Unit – I
a. Define tissue culture and describe the basic concepts and methods of tissue culture
b. What is Totipotency and explain about concept of cellular differentiation.
   OR
2. a. Explain about different sterilization methods used in tissue culture.
b. Write an essay on different types of cultures.

Unit – II
3. a. Explain about Bio chemical and molecular aspects of tissue culture cycle.
b. Write about techniques and applications of cryopreservation and germplasm storage.
   OR
4. a. What is organogenesis and give a general account of organogenesis.
b. What is somatic embryogenesis. Describe the principle and protocol to induce somatic embryogenesis.

Unit – III
5. a. Describe the methods for development of androgenic and gynogenic haploid production.
b. What are dihaploids. Explain about production and importance of dihaploids in agriculture.
   OR
6. a. What is embryo rescue? Explain about principle and applications of embryo culture.
b. Write a brief account on induction and selection of mutants.

Unit – IV
7. a. Explain about types of cell cultures and production of secondary metabolites through cell culture techniques.
b. What is somatic hybridization and discuss its importance.
   OR
8. a. Give a general account on protoplast culture and its merits and demerits.
b. Discuss the role of protoplasts in genetic transformation.

Unit – V
9. a. Write an essay on tissue culture applications in plants.
b. What are artificial seeds explain its production and applications.
   OR
10. a. Discuss about soma clonal variations and its applications.
    b. Explain about different techniques of plant tissue culture in forestry.
M.Sc. Botany - Semester III
Core Paper 301: TAXONOMY OF ANGIOSPERMS AND PLANT RESOURCES UTILIZATION AND CONSERVATION
(With effect from 2021 - 2022 admitted batches)

Theory: Semester end examination 80marks + Average midterm examinations 20marks = 100
Practical: Semester end examination 80 + internal assessment 20 marks = 100.

Course Objectives:
1. To the advanced concepts and principles of Taxonomy, evolutionary inference of Angiosperms.
2. To understand .Biodiversity
3. To know important orders and families of flowering plants,
4. To classify and the role of important characters
5. To utilize and conservation of Plant resources

Course learning outcomes:
1. Student will learn about the Angiosperms
2. Understand Nomenclature and how is it governed by the ICN?
3. Important morphological characters delineate flowering plants
4. Different classification systems
5. Principles and applications of Molecular Taxonomy

THEORY


   1. Food Crops : Wheat, Rice
   2. Forage Crops : Sorghum, Red gram
   3. Fibre Crops : Cotton, Jute
4. Oil yielding crops : Groundnut, Coconut
5. Medicinal and aromatic crops : Catheranthus, Withania, Cymbopogan


PRACTICAL

Exhibits/ Experiments/ Suggested Laboratory Exercises

Taxonomy
1. Description of a specimen from representative and locally available families.
2. Description of a species based on various specimens to study intraspecific variation: A collective exercise.
3. Description of various species of a genus: location of key character and preparation of keys at genetic level.
4. Location of key characters and use of keys at family level.
5. Field trips within and around the campus; compilation of field notes and preparation of herbarium sheets of such plants, wild or cultivated, as are abundant.
6. Training in using floras and herbaria for identification of specimens described in the class.
7. Demonstration of the utility of secondary metabolites in the taxonomy of some appropriate genera.
8. Comparison of different species of a genus and different genera of a family to calculate similarity coefficients and preparations of dendrograms.

Plant Resources Utilization and Conservation

1. Laboratory work:
   1. Food crops : Wheat, Rice
   2. Forage/fodder crops : Sorghum, Red gram
   3. Fiber crops : Cotton, Jute
   4. Oil yielding : Groundnut, Coconut
   5. Medicinal and Aromatic plants : Catheranthus, Withania, Cymbopogan

2. Scientific visits:
The students should be taken to one of the following:
A protected areas or Biosphere reserve or national park or sanctuary.
A wetland.
A mangrove.
NBPGR (National Bureau of Plant Genetic Resources – New Delhi).
BSI.
CSIR Laboratory.
FRI.
Tropical Botanical Gardens.
Reference Books

Taxonomy of Angiosperms


Plant Resource Utilization And Conservation

Model Question Paper
M.Sc. Botany - Semester II
Core Paper 301: TITLE TAXONOMY OF ANGIOSPERMS AND PLANT RESOURCES UTILIZATION AND CONSERVATION
(With effect from 2021 - 2022 admitted batches)

Time: 3 hours Max. Marks: 80 marks

(16 X 5 = 80)
Answer one question from each Unit.
All questions carry equal marks

Unit – I
1. a. Write an essay on the origin and evolution of angiosperms and add a brief note on fossil angiosperms.
b. Explain the concepts of taxonomy, systematics, and taxonomic hierarchy.

OR

2. a. Explain in detail about plant identification and the principles used in assessing relationship and delimitation of taxa.
b. Write an essay on the concepts of Plant nomenclature

Unit – II
3. a. Write a detailed account of the salient features and evolutionary tendencies in Glumiferae.
b. Explain the role of Embryology in Taxonomy.

OR

b. Explain the phytochemical features of interest in taxonomical studies with examples.

Unit – III
5. a. Write an essay on the various systems of Angiosperm classification
b. Explain in detail about the basic concepts of Molecular Systematics.

OR

6. a. Write an essay on the relevance of Taxonomy to conservation, sustainable utilization of bio resources and ecosystem research.
b. Explain in detail about the relative merits and demerits of Thorne systems of classification.

Unit – IV
7. a. Write an account of the origin, evolution, Botany, cultivation and uses of Cotton.
b. Write an essay on the world centers of domestication with special focus on the Indo-Burmese center.

OR

8. a. Write an essay on Green Revolution, its history, benefits and adverse consequences.
b. Explain in detail about the introduction, concept, objectives and scope of Ethnobotany.

Unit – V
9. a. Write an essay on the principles of conservation and the in-situ and ex-situ strategies undertaken in India.
b. Explain in detail about the concept of biodiversity, its status in India, its utilization and concerns.
M.Sc. Botany - Semester III
Core Paper 302: PLANT DEVELOPMENT AND PLANT REPRODUCTION
(With effect from 2021 - 2022 admitted batches)

Theory: Semester end examination 80marks + Average midterm examinations 20marks = 100
Practical: Semester end examination 80 + internal assessment 20 marks = 100.

Course Objectives:
1. To provide knowledge on Simple and complex tissues of plants
2. To gain the knowledge in Shoot and Root apical meristems, secondary growth and anomalous secondary growth in dicot and monocot plant
3. This educates the student in Pollination and pollen stigma interactions and fertilization in plant.
4. To gain the knowledge in fertilization and post fertilization events in Plants.

Course learning outcomes:
1. Student can learn about different types of tissues in plant, Root apical meristems, shoot apical meristems and Root – Shoot transition
2. Student can learn about Phyllotaxy, Anomalous secondary growth in dicot and monocot stems. Floral development.
3. Student can learn about Pollination, Pollen pistil interactions, self-incompatibility, male and female gametophyte development and fertilization
4. Student can learn about different post fertilization events (Endosperm, Embryo development Polyembryony; apomixis, parthenocarpy, Seed dormancy.

THEORY


Unit : 4 Male gametophyte: structure of anther, microsporogenesis, Types and role of tapetum, pollen development, sperm dimorphism, pollen embryo sacs and compound pollen grains. Pollen allergy. Female gametophyte: types of ovule, development of ovule, megasporogenesis, types of embryo sacs, organization of the embryo sac – ultra structure of the embryo sac cells.

PRACTICAL

Exhibits/Experiments/ Suggested Laboratory Exercises

Plant Development

1. Microscopic examination of transverse sections of leaves such as *Nerium* and *Maize* to understand the internal structure of leaf tissues and trichomes, glands etc. Study of the C₃ and C₄ anatomy of plants

2. Study of epidermal peels of different kinds of leaves to study the development and nature of stomata, computing stomatal index.


4. Study of the anomalous structure of the stems of *Aristolochia*, *Achyranthes*, *Bignonia*, *Boerhaavia*, *Leptadenia* and *Dracaena*.

Plant Reproduction

1. Study of microsporogenesis and gametogenesis in sections of anthers.

2. Tests for pollen viability using stains and *in-vitro* germination.

3. Embryo sac development through examination of permanent stained serial sections.

4. Study of nuclear and cellular endosperm through dissections and staining.

5. Isolation of different stages of embryo development from suitable seeds.

Reference Books

Plant Development


Plant Reproduction


Model Question Paper
M.Sc. Botany - Semester III

Core Paper 302: PLANT DEVELOPMENT AND PLANT REPRODUCTION
(With effect from 2021 - 2022 admitted batches)

Time: 3 hours                      Max. Marks: 80 marks
                                          (16 X 5 = 80)

Answer one question from each Unit.
All questions carry equal marks

Unit: I

1 A Diagrammatically explain the simple tissues in plants
   B Describe the Root-microbe interactions

   OR

2 A Diagrammatically explain Complex tissues in plants
   B Describe the Root-shoot transition

Unit: II

3 A Describe the Shoot apical meristem (SAM).
   B Explain the Floral development taking the examples of homeotic mutant Arabidopsis

   OR

4 A Describe the structure of foliage leaves and modified leaves
   B Write a note on Anomalous secondary growth in dicot

Unit: III

5 A Describe the Pollination mechanisms and vectors
   B Illustrate the methods to overcome self-incompatibility

   OR

6 A Describe the process of fertilization
   B Write a note on Sporophytic Self-incompatibility:

Unit: IV

7 A Explain the process of Microsporogenesis,
   B Describe the different Types of ovule in Angiosperms

   OR

8 A Write a note on Types and role of tapetum in Pollen development
   B Describe the different Types of embryo sacs.

Unit: V

9 A Explain the Types and functions Endosperm
   B Write a note on Seed dormancy

   OR

10 A Diagrammatically explain the Embryo development angiosperms
   B Write a note on LEA proteins
M.Sc. Botany – Semester III
Core paper 303: PLANT ECOLOGY
(With effect from 2021 - 2022 admitted batches)

Theory: Semester end examination 80marks + Average midterm examinations 20marks = 100
Practical: Semester end examination 80 + internal assessment 20 marks = 100.

Course objectives:
1. To study the geographical distribution, diversity and abundance of organisms.
2. To study the biological productivity of nature and its relationship with mankind.
3. To study the inter-relationship between organisms in population and communities.
4. Temporal changes in the occurrence, abundance and activities of organisms.
5. Conservation and management of natural resources and pollution

Course learning outcomes
1. Understanding populations in terms of diversity, habitat, niche and growth rates.
2. Student learns about ecosystems and populations.
3. Student learn about interactions in the community in terms of competition and predation
4. Student learns about succession and climax communities.
5. Student learns about biodiversity and its conservation.
6. Exploring ecological problems and understanding of the greenhouse effect, global warming and climate change.

THEORY

Unit 1  Habitat and niche: concept of habitat and niche, niche width and overlap, fundamental and realized niche, resource partitioning, character displacement.

Population Ecology: characteristics of a population, population growth curves, population regulation, life history strategies (r and k selection), concept of meta population, demes and dispersal, interdemic extinctions, age structured population.


Unit 5 Conservation biology: principles of conservation, major approaches to management. Indian case studies on conservation, management strategy (Biosphere reserves, Project tiger), biodiversity management approaches. Applied ecology: Environmental pollution –air, water and soil, kind’s sources, quality parameters. Effects on plant ecosystems.
PRACTICAL

Exhibits/Experiments/ Suggested Laboratory Exercises
1. To study the stratification of plants in botanical gardens.
2. To prepare life forms of botanical gardens of college campus. Compare the biological spectrum of college campus with normal biological spectrum.
3. To estimate the frequency of plants in the college campus.
4. To estimate the relative frequency of plants in the college campus.
5. To estimate the density of a plant species in the college campus.
6. To estimate the relative density of a plant species in college campus.
7. To determine the minimal size and number of quadrats required for reliable estimate of biomass in grass land.
8. To determine the basal area of a plant species in the campus.
9. To determine the important value index (IVI) of plant species in the campus.
10. To estimate IVI of the plant species in a woodland using point center quarter methods.
11. To determine plant diversity indices (Shanon - Wiener) continuum of dominance, species richness, equitability and biodiversity of species in the campus.
12. To estimate rate of carbon dioxide evolution from different soils using soda lime or alkali absorption method.
13. To study environmental impact of a given developmental activity using check list as a EIA method.
14. Enumeration in pond ecosystems.
15. To study the composition of woodland ecosystem.
16. Demonstration of chemical energy stored in leaves which was the transformed from radiation energy.
17. Estimation of biomass of cropland plots.
19. Determination of leaf area index methods with plain graph sheets.
20. To determine the water holding capacity of soil collected from different locations

Reference Books
Model Question Paper
M.Sc. Botany - Semester III
Core Paper 303: PLANT ECOLOGY
(With effect from 2021 - 2022 admitted batches)

Time: 3 hours
Max. Marks: 80 marks
(16 X 5 = 80)

Answer one question from each Unit.
All questions carry equal marks

Unit – I
1. a. Define the concepts of niche. Explain differences between fundamental and realized niche.
   b. What is population? Explain the characteristics of population.

   OR

2. a. Explain about different factors that influence the population growth.
   b. What are r and k selection?

Unit – II
3. a. Explain about different species interactions.
   b. What is ecological succession? Explain this with by using the example hydrosere.

   OR

4. a. Explain what you understand about community structure and its components.
   b. What is species diversity and discuss about diversity index.

Unit – III
5. a. Discuss about different components of Environment and its effect on life
   b. What is biome? Explain different biomes across the world.

   OR

6. a. What is greenhouse effect? Explain about causes and its importance on climate change
   b. Discuss the importance of biodiversity and its threats

   Unit – IV

7. a. Explain about energy dynamics in different ecosystems.
   b. Discuss the structure and functions of aquatic ecosystems.

   OR

8. a. Explain about island Biogeography.
   b. Give a brief account on different bio geographical zones of India.

   Unit – V

9. a. Discuss the principles of conservation and different conservation methods used
   b. Explain about biosphere reserves with examples.

   OR

10. a. What is air pollution and explain its causes and effects on human and animal health.
    b. Discuss the effects of pollution on plant ecosystem.
M.Sc. Botany – Semester III
Core Paper 304: PLANT PHYSIOLOGY
(With effect from 2021-2022 admitted batches)

Theory: Semester and examination 80 marks + average midterm examinations 20 marks=100
Practical: Semester and examination 80 marks + internal assessments 20 marks=100

Course Objectives
1. To create awareness about the stomatal physiology.
2. To understand the students the role of Phytohormones.
3. To create awareness about the process of water transport in plants.
4. To understand students about the nitrogen fixation.
5. To create awareness about different types of stress.

Course Specific Objectives
1. Student can learn about plant water relations.
2. Student can learn about abiotic stress facing by plants.
3. Student can learn about the plant regulators.
4. Acquire the knowledge in Enzyme kinetics.
5. Acquaint the knowledge about Biotic and Abiotic stress.

THEORY


Unit 3. Photosynthesis: Photosynthetic pigments and light harvesting complexes, photooxidation of water, mechanisms of electron and proton transport, structure, synthesis and function of ATP. Carbon assimilation-the Calvin cycle, photorespiration and its significance, the C4 cycle and CAM pathway.


Unit 5. Stress Physiology: Plant responses to biotic and abiotic stress, mechanisms of biotic and abiotic stress tolerance, water deficit and drought resistance, salinity stress, metal toxicity, heat stress and oxidative stress.
Exhibits/ Experiments/ Suggested Laboratory Exercises

1. Determination of osmotic potential.
2. Determination of water potential.
3. Demonstration of osmosis.
4. Determination of root pressure.
5. Effects of high and low temperatures upon the permeability of the cytoplasmic membranes.
6. Determination of suction force due to transpiration.
7. Stomatal frequency and stomatal index of leaves.
8. Rate of transpiration in leaves by cobalt chloride paper method.
10. Extraction and separation of chloroplast pigments by paper chromatographic method.
11. Determine chlorophyll a / chlorophyll b contents in C₃ and C₄ plants by spectrophotometric method.
15. Determination of catalase activity.

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13 Levitt J. 1972. Response of Plants to Environmental Stresses.

Model Question Paper
M.Sc. Botany - Semester III
Core Paper 304: PLANT PHYSIOLOGY
(With effect from 2021 - 2022 admitted batches)

Time: 3 hours
Max. Marks: 80 marks

(16 X 5 = 80)

Answer one question from each Unit.
All questions carry equal marks

Unit – I
1. a. Explain determination of water potential.
   b. Write a brief notes on Micro elements.
   
   OR

2. a. Write a brief notes on Ascent of Sap.
   b. Explain the role of Macro nutrients in Plants.

Unit – II
3. a. Explain the Photoperiodism and its significance.
   b. Describe the Phytochrome structure.
   
   OR

4. a. Write a brief notes on Jasmonic acid and Salicylic acid.
   b. Explain the role of Plant growth hormones.

Unit – III
5. a. Describe the photo oxidation of water.
   b. Write a brief notes on photosynthetic pigments.
   
   OR

6. a. Explain the significance differences between C3 and C4 plants.
   b. Write a brief notes on Photorespiration.

Unit – IV
7. a. Explain the Glycolysis cycle.
   b. Describe the Pentose Phosphate Pathway.
   
   OR

8. a. Explain the Glyoxylate Cycle.
   b. Describe the biosynthesis of Proteins.

Unit – V
9. a. Write a brief notes on Water stress.
   b. Explain the tolerance mechanism in plants.
   
   OR

10. a. Write a brief notes on Oxidative stress.
    b. Write a brief notes on heat shock proteins.

M.Sc. Botany – Semester IV
Core Paper 401: GENETIC ENGINEERING OF PLANTS AND MICROBES
(With effect from 2021-2022 admitted batches)

Theory: Semester and examination 80 marks + average midterm examinations 20 marks=100
Practical: Semester and examination 80 marks + internal assessments 20 marks=100

Course Objectives

1. To provide a contextual and inquiry based learning of modern day advances in the field of recombinant DNA technology
2. To understand methods of Gene transfer
3. To know the different types of Vectors
4. To produce transgenic plants.
5. To have a concept on Bioinformatics

Course Specific Objectives

Students will acquire understanding of:
1. Basic principles and modern age applications of recombinant DNA technology and proteomics.
2. Learning molecular and technical skills along with applications of the instrumentation.
3. Designing/conducting experiments and analyzing experimental data.
4. Ethics of Recombinant DNA Technology and proteomics.

THEORY


Unit 3. Classical examples of successful cases of transgenic plants– fungal, bacterial, viral and Insect tolerance (BT and proteinase inhibitors), herbicide tolerance, abiotic stress tolerance, male sterility– Barnase-Barstar. Quality improvement –golden rice, lateripening tomatoes (FlavrSavr).

Unit 4. Techniques in genetic engineering: Blotting techniques– Southern, Northern and Western blotting, radioactive and non-radioactive labeling, detection of hybridization. *In-situ* hybridization– technique, radioactive and non-radioactive probes, enzyme and fluorescence detection methods (FISH), applications of the technique. PCR– technique, types, applications. DNA sequencing– basic principle of Sanger’s method, automated DNA sequencing, high throughput DNA sequencing. DNA fingerprinting–hybridization based (RFLP), PCR based (RAPD, AFLP). Restriction mapping. Microarray technique and its applications. Sequencing genomes–whole genome sequencing, shot gun sequencing. Next generation sequencing– 454 sequencing


PRACTICALS
Exhibit/Experiment

1. Isolation of plasmid DNA
2. Bacterial transformation and identification of transformation
3. Plant DNA isolation
4. Restriction enzyme digestion and gel electrophoresis
5. Assignments on the syllabus
6. Pictorial demonstration of the various techniques

Reference Books


Model Question Paper
M.Sc. Botany - Semester IV

Core Paper 401: GENETIC ENGINEERING OF PLANTS AND MICROBES.

(With effect from 2021 - 2022 admitted batches)

Time: 3 hours  Max. Marks: 80 marks

(16 X 5 = 80)

Answer one question from each Unit.

All questions carry equal marks

Unit – I

1. a. Write about the various cloning vectors and give their importance in genetic engineering.
   b. Write a detailed essay on Restriction enzymes and their types, nomenclature and mechanism of action.

   OR

2. a. Write an essay on the methodology of recombinant DNA synthesis and add a note on expression vectors.
   b. Explain in detail about cloning vectors and their role in rDNA technology.

   Unit – II

3. a. Write an essay on bacterial transformation and add a brief note on the methods of gene transfer in plants.
   b. Explain in detail about transgenic plants and add notes on Golden Rice and Flavr-Savr Tomatoes.

   OR

4. a. Write an essay on Agrobacterium mediated gene transfer methods and add a note on Chloroplast transformation.
   b. Explain in detail about the concepts of genomic library, cDNA library and lacZ gene based selection of transformants.

   Unit – III

5. a. Write an essay on the technique of Southern blotting.
   b. Explain in detail about the technique of PCR and its types and applications.

   OR

6. a. Write an essay on In-situ hybridization, its types and the probes used in each and its applications.
   b. Explain in detail about the technique and methods of DNA sequencing.

   Unit – IV

7. a. Write an essay on DNA fingerprinting and its applications.
   b. Explain in detail about genome sequencing and add a note on Next Generation Sequencing.

   OR

8. a. Write an essay on microarray technique and its applications.
   b. Explain in detail about genome sequencing and add a note on BLAST.

   Unit – V

9. a. Write an essay on Plant growth promoting bacteria and add a note on Siderophores.
   b. Explain in detail about the ethical and environmental issues in genetic engineering and add a note on Intellectual Property rights.

   OR

10. a. Write an essay on Bioinformatics, its scope, types of databases and add a note on BLAST.
    b. Explain in detail about genomics, its types and add a note on Human Genome Project.
Core Paper 402: EVOLUTION AND PLANT BREEDING
(With effect from 2021 - 2022 admitted batches)

Theory: semester and examination 80 marks+ average midterm examinations 20 marks=100
Practical: semester and examination 80 marks + internal assessments 20 marks=100

Course objectives:
1. Hardy-Weinberg equilibrium
2. The relationship between natural selection and evolution
3. Crop improvement
4. Improved agronomic characters
5. Resistance against biotic and abiotic stress

Course learning outcomes
1. Student can learn about Origin of life
2. Student can learn about Plant breeding methods
3. Student can learn about Bio statistical methods

THEORY


Unit 2. Theories of organic evolution: Lamarckism, Darwinism–concepts of variation, adaptation, struggle, fitness and natural selection, Synthetic theory, phyletic gradualism, punctuated equilibrium, concepts of neutral evolution.

Unit 3. Plant breeding: history, objectives, activities, important achievements and undesirable consequences. Organizations for crop improvement in India: ICAR, Agriculture universities, Central institutes for crop improvement, All India coordinated programs.


PRACTICAL
1. Problems based on Hardy Weinberg law
2. Line diagrams showing the plan of different methods of breeding self-pollinated crops- Mass selection, Pure line selection, Pedigree method,
3. Line diagrams showing the plan of different methods of breeding cross pollinated crops- Bulk Selection, Recurrent selection.
5. Assignments with problems for computing measures of central tendency and dispersion- mean, median and mode, standard deviation and standard error.
6. Assignment with problems for computing correlation and regression coefficients.
7. Assignment with problems for implementing t test.
8. Assignment with problems for computing ANOVA.

References

Model Question Paper  
M.Sc. Botany - Semester IV  
Core Paper 402: EVOLUTION AND PLANT BREEDING  
(With effect from 2021 - 2022 admitted batches)

Time: 3 hours  
Max. Marks: 80 marks  

Answer one question from each Unit.  
All questions carry equal marks

Unit – I
1. a. Write an essay on Basic concepts of monomers and polymers evolution.  
b. Write a note on Oparin and Haldane’s theory.  

OR

2. a. Write a brief note on Miller’s experiment  
b. Write an essay on evolution of Prokaryotic cells and Eukaryotic cells.

Unit – II
3. a. Write an essay on Darwinism  
b. Discuss about synthetic theory of evolution.

OR

4. a. Write a note on gene duplications and divergence  
b. Discuss about Hardy Wienburg equilibrium and its applications

Unit – III
5. a. Write an essay on scope, history and objectives of plant breeding  
b. Write an essay on important achievements and undesirable consequences of plant breeding

OR

6. a. Write a note on ICAR and ASRB  
b. Discuss about central institutes for crop improvement.

Unit – IV
7. a. Write an essay on mass selection in plant breeding  
b. Write a note on pedigree method in plant breeding  

OR

8. a. Write a note on synthetic varieties  
b. What is heterosis. Write its genetic and molecular significance.

Unit – V
9. a. Explain about basic concept of parametric methods  
b. Write a note on non-parametric methods  

OR

10. a. Write an essay on central tendency and dispersion  
b. Give a brief note on t-test and ANOVA.
M.Sc. Botany - Semester IV
Core Paper 403: PLANT PATHOLOGY
(With effect from 2021 - 2022 admitted batches)

Theory: Semester end examination 80 marks + Average midterm examinations 20 marks = 100
Practical: Semester end examination 80 marks + internal assessment 20 marks = 100.

Course Objectives:

1. To provide knowledge on importance, Classification, symptoms and control of plant diseases.
2. To gain the knowledge in Symptoms, etiology, epidemiology & control measures with reference to some Fungal, Bacterial and Viral diseases.
3. This educates the student in know about different stages in Infection phenomena.
4. To gain knowledge on Role of enzymes, toxins, Phytotoxins. Vivo toxins.

Course learning outcomes:

1. Student can gain knowledge on importance, Classification, symptoms and control of plant diseases
2. Student gain knowledge on Symptoms, etiology, epidemiology & control measures with reference to some Fungal, Bacterial and Viral diseases
3. Student gain knowledge on different stages in Infection phenomena, Role of enzymes, toxins, Phytotoxins and Vivo toxins.

THEORY


Unit : 2 Symptoms, etiology, epidemiology & control measures with reference to the following: Fungal diseases – Club root of crucifers, Damping off of seedlings. Leaf spot of turmeric, Ergot of bajra, Powdery mildew of Cucurbits, Whip smut of sugarcane, Grain smut of Sorghum, Bean rust, Coffee rust, Blast disease of rice, Wilt of cotton, Tikka disease of ground nut.


Unit : 5 Role of enzymes in plant diseases – Pectic, Macerating, cellulolytic, Lignolytic, Proteolytic, Lypolytic enzymes and hemicelluloses, inactivation of enzymes Role of toxins in plant diseases – Phytotoxins. Vivo toxins, host specific patho toxins & nonspecific patho toxins.
PRACTICAL

Exhibits/ Experiments


2. Isolation of fungal pathogens from leaves.

3. Isolation of fungal pathogens from soil.

4. Extraction of pectolytic enzymes from a pathogen.

5. Extraction of cellulase enzyme from a pathogen.


7. Isolation (purification) of plant viruses.

Reference Books


Model Question Paper
M.Sc. Botany - Semester IV
Core Paper 403: PLANT PATHOLOGY
(With effect from 2021 - 2022 admitted batches)

Time: 3 hours  Max. Marks: 80 marks
(16 X 5 = 80)

Answer one question from each Unit.
All questions carry equal marks

Unit: I
1. A Explain the Importance of plant diseases,
   B Write a note Plant diseases management through host resistance
   OR
2. A Describe the classification of plant diseases
   B Write a note Control of plant diseases
   OR
3. A Describe the Symptoms, etiology, and epidemiology of Tikka disease of ground nut.
   B Write a note on soil borne diseases
   OR
4. A Describe the Symptoms, etiology and epidemiology of Leaf spot of turmeric
   B Write a note on Rust diseases
   OR
5. A Describe the Symptoms, etiology, epidemiology & control measures Citrus Canker
   B Write a note on Viral diseases in Plants
   OR
6. A Write a note on phytoplasmas diseases
   B Describe the Symptoms, etiology and epidemiology of Bacterial leaf Blight of rice
   OR
7. A Describe the Infection phenomena
   B Write a note on Phytoalexins.
   OR
8. A Explain Defense mechanisms in plants
   B Write a note on Role of environmental effect of on plant disease development
   OR
9. A Write a note on Pectic, Macerating enzymes
   B Explain types of Phytotoxins and Vivo toxins,
   OR
10. A Write a note on cellulolytic, Lignolytic, Proteolytic enzymes
    B Describe the host specific patho toxins & nonspecific patho toxins.
Theory: Semester and examination 80 marks + average midterm examinations 20 marks = 100

Practical: Semester and examination 80 marks + internal assessments 20 marks = 100

Course Objectives

1. To create awareness about the seed Biology.
2. To understand the Photosynthetic pathways.
3. To create awareness about the stress tolerance mechanism in plants.
4. To understand students role of Bioinformatics in crop improvement.
5. To create awareness about crop physiology.

Course Specific Objectives

1. Student can learn about synthetic seeds.
2. Student can apply genetic engineering techniques.
3. Student can learn about the plant tissue culture.
4. Acquires the knowledge in Bioinformatics techniques.
5. Acquaint the knowledge about crop development.

THEORY

1. Biology of Seed: Seed germination, Seed reserves and nutritional quality, Phytohormones and seed development, Dormancy – factors effecting and regulations, Synthetic seeds.


PRACTICAL

Exhibit/Experiment
1  Exercise-1: Chlorophyll absorption spectrum and quantitative determinations, assay of Hill reaction in isolated chloroplast. Crop growth analysis
2  Exercise-2: Determination of CO2 compensation points in some crop plants, Estimation of carbohydrate, protein and nucleic acid contents in plants
3  Exercise-3: Determination of the activities of some enzymes associated with Carbohydrates and protein metabolism
4  Exercise-4: Effect of nitrogen and potassium on the growth and yield of crop plants
5  Exercise-5: Leaf anatomy in relation to diversity in photosynthetic pathways
6  Exercise-6: Effect of water and salt stress on the accumulation of proteins
7  Exercise-7: Estimation of nitrogen, phosphorus and potassium
8  Exercise-8: Experiments to study the effect of water and salt stress on seed germination and seedling development
9  Exercise-9: Experiments to study the weed control using some common herbicides
10 Exercise-10: Polyacrylamide gel electrophoresis of proteins
11 Exercise-11: Isolation of DNA
12 Exercise-12: Polymerase chain reaction
13 Exercise-13: Isolation of explants, establishment and maintenance of callus; Sub-culture of callus. Study of Somaclonal variation
14 Exercise-14: Isolation and culture of single cells
15 Exercise-15: Experiments on herbicide resistance and disease resistance in plants

REFERENCES

Answer one question from each Unit.

All questions carry equal marks

Unit – I
1. a. Write a brief notes on Seed Germination.
   b. Explain the synthetic seeds.

   OR

2. a. Write a brief notes on Seed Dormancy.
   b. Write an essay on seed reserves and nutritional quality.

   Unit – II
3. a. Explain the Light reactions.
   b. Describe the Source Sink relationship.

   OR

4. a. Explain the Signal transduction in higher plants.
   b. Write a brief notes on Calcium-Calmodulin Cascade.

   Unit – III
5. a. Write a brief notes on Salt stress.
   b. Explain the defence mechanism under stress.

   OR

6. a. Write an essay on Heavy metal stress.
   b. Write a brief notes on abiotic stress.

   Unit – IV
7. a. Explain the plant tissue culture techniques in Crop improvement.
   b. Write a brief notes protoplast fusion.

   OR

8. a. Explain about basic principles of Recombinant DNA technique.
   b. Write a brief notes on Somatic hybridization.

   Unit – V
9. a. Write a brief notes on Herbicide resistance in crop plants.
   b. Explain about genetic manipulation of crops for insect resistance.

   OR

10. a. Write a brief notes on Genomics.
    b. Explain the principles of Micro array technology.