M.Sc. Botany - Syllabus

(With effect from **2021 - 2022** admitted batches)

1st 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

2nd 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

3rd 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

4th 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 – 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 = **100Practical**: 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 Cycadophyta.
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 Fritsch, Bold and Wynne, Thallus organization, Reproduction and Life cycles in algae and Economic importance of Algae

Unit : **2** Range of thallus structure, reproduction, life histories of Chlorophyceae with special reference to the genera: *Chlamydomonas, Tetraspora, Volvox, Chlorella, Scenedesmus, Ulva, Cladophora, Fritschiella, Oedogonium, Spirogyra, Cosmarium, Caulerpa, Chara.* Salient features of Protochlorophyta; Xanthophyta: *Vaucheria*. Bacillariophyta: *Cyclotella, Navicula;* Phaeophyta: *Ectocarpus, Padina, Laminaria, Sargassum*.Salient features of Rhodophyta: *Gracilaria, Polysiphonia*; Cyanophyta: *Nostoc, Lyngbya, and Spirulina*.

Unit : **3** Extraction of Agar Agar and Alginic acid, Cultivation of economically important seaweeds, Mass culture of micro algae, Waste land reclamation, Bio-fouling and Bio-remediation through the Algae. Classification of Bryophytes given by Smith, Campbell. Ecological and economic importance of Bryophytes. Conduction in Bryophytes.

Unit : **4** General characters Morphology, structure, reproduction and life history of Hepatocopsida: Marchantiales: *Marchantia*; Jungermaniales: *Pellia*, *Porella*;. General characters Morphology, structure, reproduction and life history of Anthocertopsida: Anthocerotaceae ,*Anthoceros*; Notothylaceae - Notothylas

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*.
4. Examination vegetative and reproductive morphology of Xanthophyceae: *Vaucheria*Cyanophyceae: *Nostoc, Lyngbya, Spirulina*.
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

1. Lee RW. 2007. **Classification of Algae.**
2. Kumar HD. 1988.**Introductory Phycology.** AffiliatedEast West Press Pvt. Ltd., New Delhi.
3. Round FE. 1986. **The Biology of Algae**. CambridgeUniversity Press, New York.
4. Bold HC and Wyne MJ. 1978. **Introduction to the Algae.** Prentice-Hall, New Jersey.
5. Presscot GW. 1969. **The Algae- a Review**.Houghton Mifflin Company, Boston.
6. Morris I. 1967. **An Introduction to the Algae.**CambridgeUniversityPress, UK.
7. Chapman VJ.1962**. The Algae.**Macmillan and Co Ltd., London.
8. Lewin RA. 1962. **Physiology and Biochemistry of Algae.**Academic Press, New York.
9. Round FE. 1962. **Ecology of Algae**. CambridgeUniversity Press, New York
10. Smith GE (ed) 1950. **Fresh Water Algae.** Elsevier Science, USA.
11. Fritsch FE.1945. **The Structure and Reproduction of Algae Vols. 1& II**. CambridgeUniversityPress, New York.
11. Chopra RN and Kumra PK. 1988. **Biology of Bryophytes.** New Age International (P) Ltd. Publishers, New Delhi.
12. PariharNS. 1991. **Bryophyta**. Central Book Depot, Allahabad.
13. Puri P. 1980. **Bryophytes**.Atmaram and Sons, Delhi.
14. Smith GM. 1955. **Cryptogamic Botany Vol.II.** Tata McGraw Hill Publishing Co. Ltd., New Delhi.
15. KashyapS. 1929. **Liverworts of the Western Himalayas and Punjab Plains Part I and Part II.** University of Panjab, Lahore, Pakistan.

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 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,reproductionand life history of Hepaticopsida

b. Write a note on Marchantiales

OR

8. a. Critically Analyse the Morphology, structure, reproductionand life history of Anthocerotopsida.

b. Enumerate the Morphology, structure, reproduction and life history of Jungermaniales

Unit – V

9. a. Write an account ofstructure, reproduction and life history ofSphagnales

b. Discuss the structure, reproduction and life history of Bryopsida

OR

10. a. Analyze the structure, reproduction and life history ofFunariales

b. Examine the structure, reproduction and life history of Polytrichales

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

(With effect from **2021 - 2022** admitted batches)

Theory: Semester end examination 80marks + 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

Unit : 1 General account of: Archaebacteria, Eubacteria and Cyanobacteria. Classification of eubacteria. Ultrastructure, Nutrition, Reproduction and Economic importance of bacteria.

Unit : 2 Morphology and Chemical composition of: Actinomycetes, Spirocetes, Rickettsia and Mycoplasmas. Classification of viruses. Ultrastructure and Chemistry of Viruses. Replication and Transmission of viruses. History, origin and evolution of plant viruses. Plant Viral diseases

Unit : 3 Microbial Ecology: quorum sensing, gentrification, phosphorous solubilization, Nitrogen fixation. Fungi in Industry: Medicine, Food, Pest and Weed Management (bio-control agents). Mushroom cultivation. Fermentation methods. Mycorrhiza.

Unit : 4 Classification and Phylogeny of Fungi. General account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina. Molecular aspects in classification. Fungal diseases in Plants and Humans.

Unit : 5 Thallus organization in Fungi. Ultrastructure of Fungal cell. Unicellular and multicellular organization. Cell wall composition. Reproduction in Fungi: Vegetative, Asexual and Sexual. Heterothallism, Heterokaryosis and Para-sexuality. Nutrition in fungi: Saprobic, bio-trophic, and Symbiotic.

PRACTICAL

Exhibits/ Experiments

1. Tools of microbiology: Care and use of the microscope, Spectrophotometer, P^H 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.
9. Morphological study of: *Stemonitis*, *Saprolegnia*, *Mucor*, *Morchella*, *Aspergillus, Agaricus, Cyathus, Synchitrium, Helminthosporium.*
10. Symptomatology and anatomical study of some diseased specimens: White rust, Powdery mildew, Green ear of Bajra, Rust of Wheat, Rust of Linseed, Tikka disease of Ground nut, Red rot of Sugarcane, Blast of Rice, Citrus canker, Tobacco Mosaic Disease.

References Books

1. Kaursethi I and Surinder KW 2011. **Text Book of Fungi and their Allies.** Macmillan publishers, New Delhi, India.
2. Ram Reddy S & Reddy SM 2007. **Essentials of Virology.** Scientific publishers, Jodhpur, India.
3. Sharma K 2005. **Manual of Microbiology Tools and Techniques.**Ane Book, New Delhi, India.
4. Matthew RH 2004. **Plant virology.** 4th edition. Academic press an imprint of Elsevier, California, USA.
5. Prescott *et al.* 2003.**Microbiology**. McGraw Hill Education, New York.
6. Aneja KR 2003. **Experiments in Microbiology, Plant pathology and Biotechnology**. New Age International publishers, New Delhi.
7. Verma HN 2003. **Basics of plant Virology.** IBH publishing co. Pvt. Ltd., New Delhi.
8. Mehrotra KS and Aneja KR 2003. **An Introduction to Mycology**. New Age International Publishers, New Delhi.
9. Sullia SB and Shantharam S 2001. **General Microbiology**. Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.
10. Reddy SM and Ram Reddy S 2000. **Microbiology a Laboratory Manual**. BSC Publishers and Distributors, Hyderabad.
11. Flint SJ, Enquist LW, Krug RM, Racaniello VR, Skalka AM 2000. **Principles of Virology, Molecular Biology, Pathogenesis and Control.** ASM press, Washington DC.
12. Rao AS 1999. **Introduction to Microbiology**. Prentice Hall of India Pvt. Ltd., Delhi.
13. Alexopoulus CJ, Mims CW, Blackwell M 1996. **Introductory Mycology**. 4th edition. Replika press, North Delhi.
14. Paul S 1995. **Bacteria in Biology, Biotechnology and Medicine**. 5th edition. John Wiley and son Ltd., UK.
15. Pelczar, Chan and Krieg 1993. **Microbiology.** 5th edition. McGraw Hill Education, New York.
16. *Stainer*RT, Ingraham JL, Wheelis ML and Painter PR 1987.***General Microbiology***. 5th Edition. Macmillan, London.
17. Smith KM 1968. **Plant viruses**. Elsevier, New York.
18. Rangaswamy G 1962. **Bacterial Plant disease in India**. Asia Publishing House, Bombay.

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:1

1 A Write a note on general account of Archaebacteria

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

4 A Write a note on Morphology and Chemical composition of Mycoplasmas.

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 80marks + 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 : 1. Origin and development of Cell Biology as a separate branch, Dimensions of size and weight: micron to angstrom, microgram to pictogram. Ultra structure and organization of Prokaryotic and Eukaryotic cells. Specialized cell types. Plasmodesmata: structure and function, comparison to gap junctions of animal cells. Plasma membrane: structure; models and functions. Vacuole structure and functions.

Unit : 2. Cell wall: structure and functions, architecture, biogenesis and growth. Structure and functions of Chloroplast, Mitochondria, Endoplasmic reticulum, Golgi apparatus, Lysosomes, Ribosomes, Microbodies and Peroxisomes. Cytoskeleton: microtubules and microfilaments, their role in cell division and motility, Intermediate filaments, their role in providing strength. Labelled antibody techniques for visualizing cytoskeleton.

Unit : 3. Nucleus: structure of nuclear membrane and nuclear pore complex, nucleolus, ribosome biosynthesis. Chromosome structure, centromeres and telomeres Chromatin: Eu and heterochromatin, arrangement of chromatin.. Special types of chromosomes: Lampbrush and Polytene

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.

Unit : 5. Different stages of Mitosis and Meiosis: description of the different stages. Experimental control of cell division. Apoptosis: mechanism and significance. Cell cycle and its regulation: the G1, S, G2 and M phases. Synchronous and asynchronous cell divisions.

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

1 Alberts B, Breyer D, Hopkin K, Johnson AD, Lewis J, Raff M, Roberts K and Watter P 2014. **Essential Cell Biology.** 4th Edition. Garland publishers, New York.

2 Sharp D, Ploppe G and Sikorski E 2014. **Cells.** 3rd Edition. Viva Books, New Delhi.

3 Cooper GM, Hausman RE 2013. **The Cell – A Molecular Approach**. 6th Edition. Sinauer Associates, Incorporated, USA

4 Karp G 2013. **Cell and Molecular Biology – Concepts and Experiments.** 7th Edition. Wiley Global Education, USA

5 Cowling G, Allen T 2011. **The Cell. A very Short Introduction**. Oxford University Press, USA.

6 Schaffer SW 2007. **Mitochondria: The Dynamic Organelle.** 1st Edition. Springer Verlag

7 Celis JE (ed) 2006. **Cell Biology–A Laboratory Hand Book.** 3rd Edition. Elsevier, USA

8 Lodish H, Berk A, Kaiser CA, Kreiger M, Scott P M, Bretcher A, Ploegh H, Matsudaira P. 2004. **Molecular Cell Biology.** 5th edition. W. H. Freeman and Company, New York

9 De DN 2000. **Plant Cell Vacuoles. An Introduction**. CSIRO Publication Collingwood, Australia

10 Krishna Murthy KV 2000. **Methods in Cell Wall Cytochemistry.** CPC Press, Boca Raton, Florida.

11 Kleinsmith LJ and Kish VM 1995. **Principles of Cell and Molecular Biology.** 2nd Edition. Harper Collins College Publishes, New York, USA.

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 ofa 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 Ethonobotanical, medicinal and aromatic plants.
5. Conservation practices (*in-vivo&in-vitro*) of medicinal and aromatic plants.
6. Visit to Botanical/medicinal garden, forest, Wildlife Sanctuary etc.

Reference Books

1. Advances in Horticulture : Volume 11: Medicinal & Aromatic Plants : Edited by K.L. Chadha, Malhotra Publishing House, 2006, Reprint, xl, 935 p, ISBN : 8185048290
2. An Introduction to Ethnobotany : Definitions Methods New Concepts and Approaches : edited by S.K. Jain and Ashok K. Jain, Deep Publications, 2013, viii, 250 p, ISBN : 9789380702056
3. Chadha, K.L. 2001. Hand Book of Horticulture. ICAR Publication, KrishiAnusandhanBhavan, Pusa, New Delhi
4. Cotton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons – Chichester
5. Ethnic Tribes and Medicinal Plants: Edited by Pravin Chandra Trivedi, Pointer Pub, 2010, xii, 264 p, ISBN :9788171326235
6. Ethno-Medicine in India Vol. II: A Selective Bibliography : Kamal Kant Misra, Mohammad Rehan and Ravindra K. Gupta, Gyan Publishing House, 2013, 359 p, ISBN : 9788121211895
7. Farooqi, A.A. and B.S. Sreeramu. 2001. Cultivation of Medicinal and Aromatic Crops. Universities Press (India) Ltd.3-5-819, Hyderguda, Hyderabad – 29
8. Faulks, P.J. 1958. An introduction to Ethnobotany, Moredale Pub. Ltd., London.
9. Jain S.K., (ed.) 1981 Glimpses of Indian Ethnobotany, Oxford and I B.H., New Delhi.
10. Jain S.K., 1995 Manual of Ethnobotany, Scientific Publishers, Jodhpur
11. Kumar, N., J.B. Md. Abdul Khadar, P. Rangaswamy and I. Irulappan. 1982. Introduction to spices, plantation crops, medicinal and aromatic plants. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
12. Martin, G.J... 1996, Ethnobotany, A methods manual, Chapman & Hall, London
13. Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd edn. Agrobios, India
14. Rama Rao, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India, Howrah
15. Ramachandran, S.P. 1991, Recent Advances in Medicinal aromatic and spice crops
16. Schultes, R.E. 1995, Ethnobotany, Chapman and Hall
17. Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.

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**

(16 X 5 = 80)

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.

OR

10. **a.** Write Comment on aromatic plants with any two suitable examples.

    b. Write a note on cultivation methods and Medicinal importance of *Withaniasomnifera.*

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 : **1.** Mendel's experiments and theories, application of probability laws to Mendelian principles. Chi-square testing for goodness of fit. Penetrance and expressivity. Pleiotropism. Phenocopies. Codominance and incomplete dominance. Concept of genetic markers and their types Multiple allelism: interaction among multiple alleles, complementation test, pseudo alleles. Gene interaction and modified F_2 ratios in two gene interactions

Unit : **2.** Linkage and crossing over: identifying linkage from F_2 and test cross, recombination frequency and distance between genes. Linkage maps. Tetrad analysis–ordered and unordered tetrads.Recombination in procaryotes: transformation, conjugation, transduction, sexduction. Mapping of genes in bacteria using transformation and conjugation (interrupted mating). Fine structure analysis of gene – Benzer's work.

Unit : **3.** Sex determination: chromosomal and genetic basis. Sex-linked inheritance. Sex influenced and sex limited characters. Polygenic inheritance: heritability and its measurement. QTL mapping. Extra chromosomal inheritance: inheritance of mitochondrial and chloroplast genes. Male sterility. Chloroplast mutations. Maternal inheritance.

Unit : **4.** Nature of the eukaryotic gene: split gene with a promoter and terminator. Variant forms of eukaryotic gene – nested genes, overlapping genes, assembled genes, assorted genes. Multigene families– organization and significance. Transposable elements in pro- and eukaryotes: types, mechanism of transposition, significance of transposable elements.

Unit : **5** Mutations: types, causes and detection. Physical and chemical mutagens. Lethal, conditional, biochemical, loss of function, gain of function. Molecular basis of mutations. Spontaneity of mutations, site-directed mutagenesis. Recombination: molecular mechanism– role of rec A, B, C, D enzymes, Holliday model, site specific recombination.),

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

1. Lewis B. 2000. **Genes VII**. Oxford University Press, New York, USA.
2. Snustad D P. and Simons M J 2000. **Principles of Genetics.** 2nd Edition. John Wiley and Sons Inc., USA.
3. Atherly A G, Girton J R and McDonald J F. 1999.**The Science of Genetics**. Saunders College Publishing, Fort Worth, USA.
4. Karp G. 1999. **Cell and Molecular Biology: Concepts and Experiments**. John Wiley and Sons Inc., USA.
5. Hartl D L and Jones E W. 1998. **Genetics: Principles and Analysis.** 4th Edition**.** Jones and Bartlett Publishers, Massachusetts, USA.
6. Malacinski GM and Freifelder D. 1998. **Essentials of Molecular Biology**. 3rd Edition. Jones and Bartlet Publishers Inc., London.
7. Russel PJ. 1998. **Genetics**. 5th Edition. The Benjamin/ Cummings Publishing Company Inc., USA.
8. Lewis R. 1997. **Human Genetics: Concepts and Applications**. 2nd Edition. WCB McGraw Hill, USA.
9. Griffiths RCL, Anthony JF, Miller JH and Suzuki DT. 1996. **Genetic analysis**. 6th Edition. W. H. Freeman and Co., New York.
10. Benajamin Pierce 2013. **Genetics: A Conceptual Approach.**5thEdition.W.H.Freeman and Company

Model Question Paper

M.Sc. Botany – Semester II

Core paper 201: GENETICS

(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 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 = **100Practical**: 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 : 1 Composition and structure of Biomolecules: Carbohydrates, Lipids, Proteins (Ramachandran plot) domains, motifs and folds. Nucleic acids– DNA structure, A, B and Z forms of DNA. Protein sorting and targeting of proteins into nucleus, chloroplasts, mitochondria, vacuoles and peroxisomes. Protein trafficking through GERL system– signal peptide, signal recognition particle, vesicles. Signal transduction: signaling molecules, ligands and receptors. G protein coupled receptors. Receptor tyrosine kinases. MAP kinases. Second messengers, signal amplification, cAMPs. Ca-calmodulin pathway.

Unit : 2 Protein synthesis: structure of tRNA, amino acylation of tRNA, amino acyl tRNA synthetases. Ribosome as a translation factory. Genetic code– codon assignment, characteristics of genetic code. Mechanism of translation in prokaryotes and eukaryotes– initiation elongation and termination. Chemical proof reading during translation. Translation inhibitors. Post translational modifications.

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.

Unit : 4 DNA replication: semi-conservative, semi-discontinuous, uni and bi directional mode of replication. RNA priming, enzymes for DNA replication– gyrase, helicase, topoisomerases and polymerases, SSBs. Mechanism of DNA replication– in prokaryotes–rolling circle and theta mode of replication, in eukaryotes– multiple replicons. Fidelity of replication. Replication at ends of chromosomes. Extra chromosomal replicons. DNA damage and repair.

Unit : 5 Regulation of gene expression in prokaryotes: bacteria – Lac, arabinose, Tryp operons, positive and negative control. Regulation in viruses–lytic and lysogenic cycles. Regulation of gene expression in eukaryotes: cis and trans factors. Motifs of DNA binding domains of trans factors–zinc fingers, leucine zippers, helix turn helix. Temporal and spatial

regulation. Role of chromatin in gene expression. DNA methylation and gene imprinting. Gene silencing.

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

1 Snustad P, Simmons MJ. 2003. **Principles of Genetics.** 3rd Edition**.** John Wiley and Sons, Inc, USA.

2 Buchaman BB, Gruissem,W and Jones R. 2000. **Biochemistry and Molecular Biology of plants:** American Societies of plant physiologists, John Wiley and Sons Ltd., Maryland, U.S.A.

3 Lewin B. 2000. **Genes IX,** Oxford University Press, New York.

4 Lodish BA, Zipursky SL, Matsdaira P, Baltimore D and Darnell J. 2000. **Molecular Cell Biology.** 4th Edition. W.H. Freeman and Co., New York.

5 Alberts B, Bray D, Lewis J, Ralf M, Roberts K and Watson JD.1999. **Molecular Biology of the Cell.** Garland publishing Inc., New York.

6 Weaver RF. 1999**. Molecular Biology**. WCB /McGraw-Hill,.

7 Shaw CH. 1998**. Plant Molecular Biology. A practical approach,** IRL Press, Oxford.

8 Glick BR and Thompson JE. 1992. **Methods in Plant Molecular Biology and Biotechnology,** CRC Press, Boc Raton Florida.

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

B Describe the zinc fingers and leucine zippers

OR

10 A Explain the Tryptophan operons,

B Describe the DNA methylation and gene imprinting

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 80marks + Average midterm examinations 20marks = **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 in to 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 1 Classification of Pteridophyta. Origin of Pteridophytes. Pteridophytes in comparison to Bryophytes and Gymnosperms. Distinguishing features of Pteridophyta. Economic importance of Pteridophytes. Evolution of stelar types in Pteridophytes.

Unit 2 Morphology, anatomy and reproduction of *Psilotum, Lycopodium, Selaginella, Isoetes, Equisetum, Ophioglossum, Osmunda, Gleichenia, Cyathea, Marselia, Adiantum, 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–Cycadeodiaceae; 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 *Ophioglosum,*

*Osmunda, Gleichenla, Cyathea, Marselia, Adiantum, Salvinla*and *Azolla*.

3. Observations of the slides of the following fossil plants–*Rhynia, Lepidodendron, Lepidocarpon, Miadesmia,* and*Sphenophyllum.*
4. Observations of the slides fossil Pteridophytes: *Calamites, Calamostachys, Zygopters* and *Etapteris*.
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

1. Saxena P and Pathak C. 2012. **A Text Book of Pteridophyta.**, Wisdom Press, New Delhi.
2. Sharma OP.2006. **Pteridophyta**. MacMillan India Ltd., New Delhi.
3. Parihar NS. 1996. **Biology and Morphology of Pteridophytes**. Central Book Depot, Allahabad.
4. Smith GM. 1995. **Cryptogamic Botany. Vol. II**. McGraw Hill Book Company, New York.
5. Sporne KR. 1962. **The Morphology of Pteridophytes**. Hutchinson University Library, London.
6. Evans AJ. 1936. **Morphology of Vascular Plants (Lower groups)**. McGraw Hill Book Company, New York.
7. Biswas C and Johri BM. 1997. **The Gymnosperms.**Narosa Publishing House, New Delhi.
8. Bhatnagar SP and Moitra A. 1996. **Gymnosperms**. New Age International Private Limited, New Delhi.
9. Sharma OP. 1996. **Gymnosperms**. PragatiPrakashan, Meerut.
11. Stewart WN and Rothwell GW. 1993. **Paleobotany and the Evolution of Plants**. Cambridge University Press, USA.
12. Singh H. 1978. **Embryology of Gymnosperms**. GebrudevBortraeger, Berlin.
13. Arnold CA. 1974. **An introduction to Paleobotany**. McGraw Hill Book Co., Inc., New York.
14. Sporne KR. 1967. **The Morphology of Gymnosperms**. Hutchinson University Library, London.
15. Chamberlain CJ. 1935. **Gymnosperms structure and evolution**. University of Chicago Press, USA.

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

9. a. Economic importance of Gymnosperms.

b. Structure and reproduction in living Gymnospermsof 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 verities 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 **3** Fundamental aspects of morphogenesis, somatic embryogenesis. Methods of androgenic and gynogenic haploid production-dihaploids and application in agriculture. Embryo rescue.Cell culture: establishment, plating efficiency, induction and selection of mutants.

Unit **4** Free cell cultures: production of secondary metabolites/natural products. Somatic hybridization: protoplast isolation, fusion and culture, hybrid selection and regeneration, possibilities, achievements, limitations, merits and demerits. Cybrids. Protoplasts in genetic transformation.

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 out lay of plant tissue culture laboratory.
2. Preparation of media.
3. Callus induction – carrot.
4. Clonal propagation through meristem cultures.
5. ɔryo culture – groundnut.
6. Anther culture – *Datura*/tobacco.
7. ablishment of cell cultures and determination of growth pattern.
8. ɛrmination of plating efficiency of cell cultures.
9. oplast isolation and culture.
10. oplast fusion.
11. Observation of different developmental stages of somatic embryo in embryogenic callus.
12. Preparation of artificial seeds.

Reference Books

1. Collin HA and Edwards S. 1998. **Plant Cell Culture.** Bioscientific Publishers, Oxford, UK.
2. Callow JA, Ford-Lloyd BV and Newbury HJ. 1997. **Biotechnology and Plant Genetic Resources: Conservation and Use.** CAB International, UK.
3. Raghavan V. 1997. **Molecular Biology of Flowering plants.** Cambridge University press, New York, USA.
4. Bhojwani SS and Razdan MK. 1996. **Plant tissue culture: Theory and Practice**. (A revised edition). Elsevier Science Publishers, New York, USA.
5. Jain SM, Sopory SK and Velleux RE. 1996. **In Vitro Haploid production in Higher Plants.Volumes 1-5**. Fundamental aspects and Methods Kluwer Academic Publishers, Dordrecht, Netherlands.
6. Vasil IK and Thorpe TA. 1994. **Plant Cell and Tissue Culture.** Kluwer Academic Publishers, Dordrecht, Netherlands.
7. Bhojwani SS. 1990. **Plant Tissue Culture: Applications and Limitations**. Elsevier Science Publishers, New York, USA.
8. Raghavan V. 1986. **Embryogenesis in Angiosperms: A Developmental and Experimental Study.** Cambridge University Press, New York, USA.
9. Kartha KK. 1985. **Cryopreservation of Plant Cells and Organs**. CRC Press, Boca Raton, Florida, USA.

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

1. 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 dihapolids 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.Explainabout typesof 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. Origin and evolution of Angiosperms. Fossil Angiosperms. Taxonomy and Systematics. Concepts of species. Taxonomic hierarchy - species, genus, family and other categories; Principles used in assessing relationship and delimitation of taxa and attribution of rank. Plant identification, Plant nomenclature –Binomial nomnclature, Plant collection and Documentation.

2. Brief analysis of the features and evolutionary tendencies noticed in the following groups: Ranales, Rosales, Centrospermae, Tubiflorae, Amentiferae, Helobiales, Liliflorae and Glumiflorae. Taxonomic evidences: embryology, cytology and phytochemistry. Taxonomic tools: herbaria, floras, botanical gardens, biochemicaland molecular techniques, computers and GIS (Geo Information Systems). Cladistics in taxonomy. Numerical taxonomy and Sero taxonomy.

3 Systems of Angiosperm classification: Phenetic versus Phylogenetic system, Relative merits and demerits of major systems of classification: Takhtajan, Cronquist and Thorne. Basic concepts of Molecular Systematics: Gene sequencing, Restriction site analysis, Allozymes etc., Angiosperm Phylogeny Group (APG IV} classification system, Relevance of Taxonomy to conservation, sustainable utilization of bioresources and ecosystem research.

4. World canters of primary diversity of domesticated plants. The Indo-Burmese Centre, Plant Introductions and Secondary canters. Plant explorations. Origin of agriculture.

Origin, evolution, Botany, cultivation and uses of :

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, , Cymbopogan*

5 Green Revolution: benefits and adverse consequences. Ethnobotany: Introduction, concept, objectives and scope. Plant biodiversity: Concept, status in India, utilization and concerns, conservation of wild biodiversity Principles of conservation: Strategies for conservation, *In-situ* conservation: protected areas in India- reserves, wetlands, mangroves, *Ex-situ* conservation: principles and practices. Botanical gardens. BSI, ICAR and CSIR.

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

1. Mondal AK. 2011. **Advanced Plant Taxonomy**. New Central Book Agency Pvt. Ltd., Kolkata.
2. Simpson MG. 2006. **Plant Systematics**. Elsevier Academic Press, California, USA.

.

3 Takhtajan AL. 1997. **Diversity and classification of Flowering Plants**. Columbia University Press, New York.

4. Zomlefer WB. 1994. **AGuide to flowering plant families**. University of California Press, USA.
5. Woodland DW. 1991. **Contemporary Plant Systematics.** Prentice Hall, New Jersey.
6. Stace CA. 1989. **Plant Taxonomy and Biosystematics** .2nd Edition. Edward Arnold Ltd., London.
7. Jones SB Jr. and Luchsinger AE. 1986. **Plant Systematics.** 2nd Edition. McGraw Hill Book Co., New ork.
8. Radford AE. 1986. **Fundamentals of Plant Systamatics**. Harper and Row Publications, USA.
9. Heywood VH and Moore DM. 1984. **Current concepts in Plant Taxonomy**. Academic Press, London.
10. Davis PH and Heywoos VH. 1973. **Principles of Angiosperms Taxonomy**. Robert E Kreiger Pub. Co., New York.
11. Harrison HJ. 1971. **New concepts in Flowering Plant Taxonomy**. Hieman Educational Books Ltd., London.
12. Jones AD and Wilbins AD. 1971. **Variations and Adaptations in Plant species.**Hiemen and Co., Educational Books Ltd., London.
13. Grant V. 1971. **Plant Biosystematics**. Academic press, London.
14. Solbrig OT. 1970. **Principles and Methods of Plant Biosystamatics**. Macmillan, London.
15. Heslop-Harrison J. 1967. **Plant Taxonomy**. English language Books Soc. and Edward Arnold Pub. Ltd., U.K.

Plant Resource Utilization And Conservation

16. Sambamurthy AVSS and Subramanyam NS. 2000. **Economic Botany of Crop Plants**. Asiatech Publishers, Inc., New Delhi.
17. Conway G. 1999. **The Doubly Green Revolution:Food for All in the 21st Century**. Comstock Publishing Associates, New York.
18. Kocchar SL. 1998. **Economic Botany of the Tropics**. 2nd Edition. Mac Millan India Ltd., Delhi.
19. Plant Wealth of India 1997. Special Issue of Proceedings Indian National Science Academy B-63.
20. Sharma OP. 1996. **Hills Economic Botany**. (Late Dr. A.F. Hill, adapted by O.P. Sharms). Tata McGraw Hill Co., Ltd., New Delhi.
21. Frankel OH, Brown AHD and Burdon JJ. 1995. **The conservation of Plant Diversity**. Cambridge University Press, Cambridge, UK.
22. Paroda RS and Arora RK. 1991. **Plant Genetic Resources Conservation and Management.** IPGRI (Publication) South Asia Office, C/o. NBPGR Pusa Campus, New Delhi.
23. Thakur RS, Puri HS and Hussain A. 1989. **Major Medicinal Plants of India. Central Institute of Medicinal and Aromatic Plants**. CSIR, Lucknow.
24. Council of Scientific & Industrial Research 1986. **The useful plants of India. Publications and Information Directorate**. CSIR, New Delhi.

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

4. a. Explain the use of biochemical and molecular markers in Taxonomy. Add a note on cladistics in Taxonomy.

   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 ofThorne systems of classification.

Unit – IV

7. a. Write in detailed on origin, evolution, Botany, cultivation and uses of Cotton.

   b. Write an account of the origin of agriculture and add a note on secondary centers.

OR

8. a.Write an account of the origin, evolution, botany, cultivation and uses of Red gram.

   b. Write an essay on the world centers of domestication with special focus on the Indo-Burmese center.

Unit – V

9. a. Write an essay on Green Revolution, its history, benefits and adverse consequences.

   b.Explain in detail about the introduction, concept, objectives and scope ofEthnobotany.

OR

10. 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 : 1 Simple and complex tissues. Epidermis– stomata, trichomes. Secretory cells and tissues. Vascular tissue development: development and structure of the primary xylem, primary phloem, secondary xylem, secondary phloem. Root- shoot transition. Root development: organization of root apical meristem (RAM), cell fates and lineages, tissue differentiation. Lateral roots, root hairs, root microbe interactions. Cambium–structure, cell types, development of vascular cambium, cork cambium– structure of its derivatives, bark.

Unit : 2 Shoot development: organization of the shoot apical meristem (SAM), cytological and molecular analysis of SAM. Leaf growth and differentiation: Differentiation of epidermis and mesophyll. Structure of foliage leaves and modified leaves. Phyllotaxy. Anomalous secondary growth in dicot and monocot stems.Floral development taking the examples of homeotic mutants in *Arabidopsis* and *Antirrhinum*.

Unit : 3 Pollination: mechanisms and vectors. Pollen-pistil interaction–structure of the pistil, pollen-stigma interaction. Self-incompatibility: sporophytic, gametophytic, different methods to overcome self-incompatibility. Fertilization: pollen germination, pollen tube growth and guidance, entry of pollen tube into the embryo sac, pollen tube discharge, syngamy and triple fusion, polyspermy and hetero fertilization.

Unit : 4 Male gametophyte: structure of anther, microsporagenesis, 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.

Unit : 5 Post-fertilization events: endosperm– development, types, functions, endosperm - embryo relationship. Embryo development–Johanson and Soueges systems; Types. Polyembryony; apomixis; parthenocarpy. Storage proteins of endosperm and embryo– LEA proteins. Seed dormancy, overcoming seed dormancy.

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 C_3 and C_4 anatomy of plants

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

3 Study of elements of wood from macerations and sections taken in three planes T.S., T.L.S. and R.L.S

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

1 Pullaiah T, Naidu KC, Lakshminarayana K and Hanumantha Rao B. 2007. **PlantDevelopment**. Regency Publications, New Delhi.

2 Fosket DE. 2004. **Plant Growth and Development. A Molecular approach.** Academic Press, San Diego.

3 Howell SH. 1998. **Molecular Genetics of Plant Development**. Cambridge University Press,

4 Fahn A. 1982. **Plant Anatomy**. 3rd edition. Pergamon Press, Oxford

Plant Reproduction

1 Pulliah T, Lakshminarayana K and Hanumantha Rao B. 2008. **Plant Reproduction**. Scientific Publishers, Jodhpur, India.

2 Bhojwani SS and Bhatnagar SP. 2000. **The Embryology of Angiosperms**. 4th revised and enlarged edition. Vikas Publishing House, New Delhi.

3 Raghavan V. 1999. **Developmental Biology of Flowering Plants**. Springer – Verlag, New York.

4 Raghavan V. 1997. **Molecular Embryology of Flowering Plants**. Cambridge University Press, Cambridge.

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:1

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 Microsporagenesis,

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 2 Species interactions: types of interactions, interspecific competition, herbivory, carnivory. Ecological succession: types, mechanisms, changes involved in succession, concept of climax. Hydrosere and Xerosere.Community ecology: nature of communities, communities' structure and attributes, levels of species diversity and its measurement, Diversity indices, edges and ecotones, community classification.

Unit 3 The environment: physical environment, biotic environment and abiotic environment. Ecology and human welfare. Climate, soil and vegetation patterns of the world: life zones, major biomes, vegetation and soil types of the world.Climate change– greenhouse gases, ozone layer and ozone hole, consequences of climate change. Biodiversity status, monitoring and documentation, major drivers of biodiversity change.

Unit 4 Ecosystem: structure and function. Energy dynamics. Mineral cycling (carbon, nitrogen and phosphorus). Primary production and decomposition. Structure and function of some Indian ecosystems– Terrestrial (forest, grassland) and aquatic (fresh water, marine, estuarine).Biogeography: Major terrestrial biomes. Theories of island biogeography. Bio geographical zones of India.

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 (Shamon - 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.
18. Estimation of chlorophyll.
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

1. American Public Health Association American Water Works Association. 2013. Standard Methods for the Examination of Water and Waste Water. General Books LLC, USA.
2. Sharma PD. 2007. Ecology and Environment. Rastogi Publications, Meerut.
3. Sharma PD. 2001. Ecology and Environment. Rastogi Publications, Meerut.
4. Smith RL. 1996. Ecology and field Biology. Harper Collins, New York.
5. Sokal RR and Rohit FJ. 1995. Biometry. W.H. Freeman and Co., New York.
6. Batra NK. 1992. Treatise on Plant Ecology. Pradeep Publications, Delhi.
7. CJ. 1989. Ecological Methodology. Harper and Row, New York, USA.
8. Ludwig JA and Reynolds JF. 1988. Statistical Ecology. Wiley, New York.
9. Magurran AE. 1988. Ecological Diversity and its measurement. Croom Helm, UK.
10. Moore PD and Chapman SB. 1986. Methods in Plant Ecology. Blackwell Scientific, Oxford, UK.
11. Pielow EC. 1984. The interpretation of Ecological Data. John and Wiley Sons, USA.
12. Muller – Dombois D and Ellenberg H. 1974. Aims and Methods of Vegetation Ecology. Blackburn Press, New Jersey.
13. Odum PE. 1971. Fundamentals of Ecology. 3rdEdition. W. B. Sounders, Philadelphia.
14. Dansemmire RF. 1968. Plant Communities. Horpes and Row, New York.
15. Misra R. 1968. Ecology Work Book. Oxford and IBH Publishing Co., New Delhi.
16. Ambasht RS and Ambasht NK. AText Book Plant Ecology. CBS Publishers and distributors, New Delhi.

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 nitch. Explain differences between fundamental and realized nitch.
   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 1. Plant water Relations: Free energy and chemical potential, osmotic potential, water potential and its determination, Active and Passive absorption of water, Stomatal physiology and mechanisms of stomatal opening and closing, Soil-plant-atmosphere-continuum concept (SPAC) and mechanism of water transport. Mineral nutrition: Passive and Active uptake of ions, translocation of minerals in plants, Essential elements: Their functions and symptoms of mineral deficiency, importance of foliar nutrition.

Unit 2. The flowering process: Photoperiodism and its significance, mechanisms of floral induction. Physiology seed germination. Plant growth regulators and elicitors: Biosynthesis, physiological effects and mechanism of action of Auxins, Gibberellins, Cytokinins, Ethylene, Abscisic acid, Brassinosteroids, Polyamines, Jasmonic acid and Salicylic acid.

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 C_4 cycle and CAM pathway.

Unit 4. Respiration: Glycolysis, the TCA cycle, electron transport and ATP synthesis, pentose phosphate pathway, glyoxylate cycle, alternative oxidase system and Lipid metabolism. Michaelis-Menten Equation and its significance, Mechanism of enzyme action. Nitrogen metabolism: Nitrogen fixation studies, biosynthesis of amino acids and proteins.

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.

PRACTICAL

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.
9. Determination of amylase activity
10. Extraction and separation of chloroplast pigments by paper chromatographic method
11. Determine chlorophyll a / chlorophyll b contents in C_3 and C_4 plants by spectrophotometric method
12. Determination of Hill reaction
13. Determination of rate of Aerobic respiration by continuous current method
14. Determination of rate of Anaerobic respiration by continuous current method
15. Determination of catalase activity

REFERENCES

1 Noggle GR and Fritz GJ. 1977. Introductory plant physiology

2 Reinert J and Bajaj YPS. 1977. Plant Cell, Tissue and Organ Culture. Springer – verlag, Berlin

3 Lange OI, Kappen L and Schule DD. 1976. Water and Plant Life

4 Burris RH and Black CC (ed) 1975. CO2 Metabolism and Productivity of Plants

5 Evans IT. 1975. Crop Physiology

6 Major AM and Mayber P. 1975. The germination of seeds. 2nd Edition

7 Mayber PA and Gele J. (ed) 1975. Plants in Saline Environments

8 Ashston and Crafts A. 1973. Mode of Action of Herbicides

9 Epstein E. 1972. Mineral Nutrition of Plants: Principles and Perspectives

10 Fogg GK. 1972. Photosynthesis

11 Hillman WS. 1972. The Physiology of Flowering

12 Kozlowski TT. (ed) 1972. Seed Biology. 3 Vols

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

14 Hatch MD, Osmond CB and Slatyer RO (ed) 1971. Photosynthesis and Photorespiration

14 Gregory RPF. 1971. Biochemistry of Photosynthesis

16 Zelitch I. 1971. Photosynthesis, Photorespiration and Plant Productivity

17 Gollek B. (ed) 1970. Structure and Function of Plant Cells in Saline Habitats.

18 Kozlowski TT. (ed) 1968. Water Deficit and Plant Growth

19 Annual Review of Plant Physiology. 1950. Vol. – Annual Reviews Inc., Stanford

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 1. Basics of rDNA technology: restriction enzymes–types, nomenclature, mechanism of action. Methodology of rDNA molecule synthesis–joining overlapping ends, blunt end joining, polylinkers. Vectors–features. Cloning vectors– plasmids, viral DNA, cosmids, bacterial and yeast artificial chromosomes (BACs and YACs). Expression vectors.

Unit 2. Bacterial transformation. *In-vitro* packaging. Recognition of transformants–antibiotic resistance, *Lac Z*gene based selection. Genomic library, cDNA library. Methods of gene transfer in plants: electroporation, gene gun, *Agrobacterium* mediated– binary and co integrative vector based. Chloroplast transformation.

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

Unit 5. Plant growth promoting bacteria – nitrogen fixers, siderophores, phytoharmone production. Genetic improvement of industrially important microbes for production of useful products – biopesticides, biofertilizers, antibiotics. Intellectual Property Rights, farmer's rights. Patents. Ethical and environmental issues in genetic engineering. Bioinformatics: Scope. Data bases– types, Genbank, PIR, PDB. An account of NCBI. Web based tools for sequence searches – BLAST. Genome projects, genome annotation, gene annotation, features of the genome of *Arabidopsis*, rice. Genomics– structural genomics, comparative genomics, functional genomics. Molecular phylogeny and phylogenetic trees.

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

1. Glick BR, Pasternak JJ and Patten CL. 2010. **Molecular Biotechnology Principles and Applications of rDNA.** ASM Press, USA.
2. Attwood TK, Smith DJP and Phukan S. 2009. **Introduction to Bioinformatics**. Pearson Education Ltd., UK.
3. Sateesh MK. 2008. **Bioethics and Biosafety**. I K International Pvt. Ltd., Bangalore.
4. Channarayappa. 2007. Molecular Biotechnology Principles and practices. Taylor and Francis, UK.
5. Watson JD. 2007. **Recombinant DNA: Genes and Genomes: A short course**. W. H. Freeman, USA.
6. Primrose SB and Twyman RM. 2006. **Principles of Genome Analysis and Genomics.** Blackwell publishers, USA.
7. Lewin B. 2004. **Genes VIIII**. Pearson Prentice Hall, New Jersey.
8. Chawla HS. 2002. **Introduction to Plant Biotechnology**. Oxford and I B H Publlishers, USA.

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 the technique of DNA fingerprinting and its applications.
   b. Explain in detail about the methods used in restriction mapping.

OR

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

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 1. Origin of life and unicellular evolution: Origin of basic biological molecules, abiotic synthesis of monomers and polymers, concept of Oparin and Haldane, experiment of Miller (1953). The first cell – evolution of prokaryote, Origin of eukaryotic cells– Endosymbiont theory, evolution of unicellular eukaryotes, anaerobic and aerobic metabolism.

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.

Molecular evolution: molecular divergence and molecular clocks–protein and nucleotide sequence analysis, gene duplication and divergence. Hardy-Weinberg equilibrium and its applications.

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.

Unit 4. Methods of breeding self-pollinated crops**:** Mass selection, Pureline selection, Pedigree method, Bulk method, Backcross method, Multiline varieties.

Methods of breeding cross pollinated plants**:** Bulk Selection, Recurrent selection, Synthetic varieties, Hybridization. Breeding of vegetative propagated crops. Mutation breeding. Plant Introduction, domestication and acclimatization.Heterosis – genetic and molecular basis.

Unit 5. Bio statistical methods**:** basic concept of parametric and non-parametric methods. Graphical representation. Probability distributions–Binomial, Poisson and Normal distributions. Measures of central tendency and dispersion. Concepts of confidence intervals, types of error, levels of significance. Regression and correlation; t-test, chi square test, ANOVA. Basic introduction to multivariate statistics.

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.
4. Methods of hybridization in rice, sorghum, bajra, cotton in standing crop in the field.
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

1. Singh BD. 2012. **Plant Breeding: Principles and Methods.**Kalyani Publishers, Delhi.
2. Stickberger MW. 1985. **Genetics**. McMillan, New York.
3. Frey KJ. 1981. **Plant Breeding II**. Iowa State University Press, Oxford.
4. Jones DA and Wilkins DA. 1971. **Variation and adaptation in plant species.** Heinemann Educational Books Ltd., London.
5. Stebbins GL.1971. **Chromosomal evolution in Higher Plants**. Edward Arnold Publishers Ltd., London.
6. Poehlman JM and Borthakur D. 1969. **Breeding Asian field crops: With Special Reference to Crops of India.** Oxford and IBH Pub. Co., Delhi.
7. Briggs FN and Knowles PF. 1967.**Introduction to Plant Breeding.** Reinhold Pub. Corp., New York.
8. Brewbaker JL. 1964. **Agricultural Genetics**. Prentice-Hall, New Jersey, USA.
9. Allard RW. 1961. **Principles of Plant Breeding.** 2nd Edition. John Wiley and Sons Inc., New York.

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**

(16 X 5 = 80)

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 Wien burg 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 : 1 Importance of plant diseases, classification of plant diseases, causes of plant diseases, symptoms of plant diseases, post-harvest diseases. Dispersal of plant pathogens- Active and passive. Control of plant diseases: Cultural practices: field & crop sanitation, crop rotation, Chemical control: systematic & nonsystematic fungicides; and Biological control. Plant diseases management through host resistance: Vertical, horizontal, monogenic, polygenic, specific & general resistance. Development of resistant varieties.

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 : 3 Bacterial diseases – Citrus Canker, Angular leaf spot of cotton, Bacterial leaf Blight of rice, Brown rot of potatoes. Viral and phytoplasmas diseases – Grassy shoot diseases of sugarcane, Little leaf of Brinjal, Rice Tungro.

Unit : 4 Infection phenomena – pre penetration, penetration and post penetration. Factors affecting infection. Effect of environment on plant disease development – Temperature, humidity and light.. Defense mechanisms in plants: Pre–inflectional defense mechanisms, Post–inflectional defense mechanisms, Phytoalexins. Molecular basics of host pathogen interactions (fungi, bacteria & viruses) and genetic engineering for disease resistance

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

1. Study of symptoms, microscopic examination of diseased parts and identification of the pathogens involved in different plant diseases. 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. Bacterial diseases–Citrus Canker, Angular leaf spot of cotton, Bacterial leaf Blight of rice, Brown rot of potatoes. Viral and phytoplasma diseases – Grassy shoot disease of sugarcane, Little leaf of brinjal, rice tungro.
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.
6. Isolation of plant pathogen– bacteria.
7. Isolation (purification) of plant viruses.

Reference Books

1. Ravichandra NG. 2013. **Fundamentals of Plant Pathology**. PHI Learning Pvt. Ltd., Delhi.
2. Ronald PC. 2007. **Plant-Pathogen Interactions: Methods in Molecular Biology.** Humana Press, New Jersey.
3. Mehrotra RS.2006. **Plant pathology**. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4. Sharma PD. 2004. **Plant pathology**. Rastogi Publications, New Delhi.
5. Bilgrami S and Dubey HC. 1998. **A text book of modern Plant pathology.** Sangam Books Ltd., Mumbai.
6. Singh RS. 1990. **Plant diseases.** Oxford and IBH Publishing Co., New Delhi.
7. Butler EJ. 1973. **Fungi and diseases in plants**. Periodical Expert Book Agency, Delhi.
8. Rangaswamy G. 1972. **Disease of crop plants in India.** Prentice Hall of India, New Delhi.
9. Smith KM. 1968. **Plant viruses**. Methuen, London.
10. Mundkar BB.1967. **Fungi and Plant diseases.** McMillan and Co. Ltd., Calcutta.
11. Rangaswamy G. 1962. **Bacterial Plant Diseases in India**. Asia Publishing House, Bombay.

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:1

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

Unit: II

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

Unit: III

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

Unit: IV

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

Unit: V

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.

M.SC. BOTANY - SEMESTER IV

COREPAPER 404: CROP PHYSIOLOGY AND BIOTECHNOLGY

(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 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 Bio informatics 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.
2. Molecular biology of light reactions: Photosynthetic pathways, Biotechnological strategies to improve Photosynthesis, Yield components, Source – sink relationships. Signal transduction in higher plants: Receptors and G-proteins, Calcium – Calmoudulin cascade
3. Stress Physiology: Physiology and molecular biology of stress tolerance in response to water, salt and heavy metal stress.
4. Methods in Biotechnology: Plant Tissue culture techniques in crop improvement, Protoplast isolation and culture, somatic hybridization, soma clonal variations. Basic principles of recombinant DNA technique; Techniques for transferring genes into plants and its applications in crop improvement.
5. Potentials of Biotechnology: Molecular mechanism to confer herbicide resistance in crop plants. Genetic engineering to improve plant disease resistance. Genetic manipulation of crops for insect resistance, Genetic engineering of seed proteins and oils. Bioinformatics: Scope and importance of Bioinformatics, Genomics, Proteomics. Principles of microarray technology and its applications in crop improvement

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

1 Lebowitz RJ. 1995. **Plant Biotechnology, a laboratory manual**. Wm. C. Brown Publishers, Qubuque

2 Murray Meo – young. 1995. **Comprehensive Biotechnology. Vol . 1.** Pergamon Press Oxford

3 Marshall G and Walters O (ed) 1994. **Molecular Biology in Crop Protection.**Champman and Hall

4 Old RW and Primrose SB. 1994. **Principles of gene manipulation.** Blackwell Science

5 Salunkhe DK, Bhatt NR and Desai BB. 1990. **Post-Harvest Biotechnology of Flowers and Ornamental Plants**. N. Bayoprokash, Calcutta

6 es KE. (ed) 1988. **Genome Analysis**. IRI Press, Oxford

7 Pierik RIM. 1987. **Invitro Culture of Higher Plants**. MartinusNihoff Publishers, Dordrecht

8 Primrose SB. 1987. **Molecular Biotechnology**. Blackwell Scientific Publications

9 Day PR. 1986. **Biotechnology and Crop Improvement and Protection**. BCPC Publications

10 Mantell SH and Smith N (ed) 1983. **Plant Biotechnology**. Cambridge University Press, Cambridge

Model Question Paper

M.Sc. Botany - Semester IV

Core Paper 404: CROP PHYSIOLOGY AND BIOTECHNOLGY

(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 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.