

**ANDHRA UNIVERSITY**

**DEPARTMENT OF BOTANY**

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

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| **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 |
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**Department of Botany, Andhra University, Visakhapatnam M.Sc. BOTANY(**With effect from **2021 - 2022** admitted batches)

PROGRAMME OUTCOMES (PO)

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| 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)

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| 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)

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| 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 |



**ANDHRA UNIVERSITY DEPARTMENT OF BOTANY M.Sc. BOTANY**

**Course Structure (w.e.f. 2020-2021)**

**(Modifications in BoS meeting held on 23-10-2020)**

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| **S.**  **no.** | **Paper Code** | **Paper Name** | **Internal** | **Semester end** | **Total Marks** | **Credits** |
| **1st Semester** | | | | | | |
|  | **Theory** | |  |  |  |  |
| 1. | 101 | Biology & Diversity of Algae and Bryophytes | 20 | 80 | 100 | 4 |
| 2. | 102 | Biology & Diversity of Bacteria, Viruses & Fungi | 20 | 80 | 100 | 4 |
| 3. | 103 | Cell Biology of Plants | 20 | 80 | 100 | 4 |
| 4. | 104 | Ethnobotany, Medicinal & Aromatic Plants | 20 | 80 | 100 | 4 |
|  | **Practicals** | |  |  |  |  |
|  | Practical -I | Biology & Diversity of Algae and Bryophytes & Biology & Diversity of Bacteria, Viruses & Fungi | 20 | 80 | 100 | 3 |
|  | Practical -II | Cell Biology of Plants  & Ethnobotany, Medicinal & Aromatic Plants | 20 | 80 | 100 | 3 |
| **Total marks and credits for I semester** | | | | | **600** | **22** |
| **2nd Semester** | | | | | | |
|  | **Theory** | |  |  |  |  |
| 1. | 201 | Genetics | 20 | 80 | 100 | 4 |
| 2. | 202 | Molecular Biology | 20 | 80 | 100 | 4 |
| 3. | 203 | Biology & Diversity of Pteridophytes & Gymnosperms | 20 | 80 | 100 | 4 |
| 4. | 204 | Plant Cell Tissue & Organ Culture | 20 | 80 | 100 | 4 |
|  | **Practicals** | |  |  |  |  |
|  | Practical -I | Genetics & Molecular Biology | 20 | 80 | 100 | 3 |
|  | Practical -II | Biology & Diversity of Pteridophytes & Gymnosperms &  Plant Cell Tissue & Organ Culture | 20 | 80 | 100 | 3 |
| **Total marks and credits for II semester** | | | | | **600** | **22** |

\* Credits not included in CGPA Each paper contains 4 theory hours Each practical contains 12hours.

M.Sc. Botany – Semester I

Core Paper 101: BIOLOGY AND DIVERSITY OF ALGAE AND BRYOPHYTES

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

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| **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

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| 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

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| **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. | |

M.Sc. Botany - Semester I

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

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

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| **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

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| 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

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

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| **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. |

M.Sc. Botany - Semester I

Core Paper–103: CELL BIOLOGY OF PLANTS

(With effect from 2021-2022 admitted batches)

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| **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

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| 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

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| **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

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| --- | --- |
| **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. |

M.Sc. Botany – Semester I

Core paper 104: ETHNOBOTANY, MEDICINAL AND AROMATIC PLANTS

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

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| **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. |

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|  | **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

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| **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. |

M.Sc. Botany – Semester II Core paper 201: GENETICS

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

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| **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 3. To distinguish crossing over, Linkage and Linkage mapping, 4. 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 |

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|  | **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 F2 ratios in two gene interactions |
| Unit : **2.** | Linkage and crossing over: identifying linkage from F2 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

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| **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

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| **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 |

M.Sc. Botany - Semester II

Core Paper 202: MOLECULAR BIOLOGY OF PLANTS

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

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| **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

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| 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

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| **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

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| --- | --- |
| **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. |

M.Sc. Botany - Semester II

Core Paper 203: BIOLOGY AND DIVERSITY OF PTERIDOPHYTES AND GYMNOSPERMS

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

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| **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

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| **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

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|  | **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

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| **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. |

.M.Sc. Botany - Semester II

Core Paper 204: PLANT CELL, TISSUE AND ORGAN CULTURE

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

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| **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

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| 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

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| **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.** | ryo culture – groundnut. |
| **6.** | Anther culture – *Datura*/tobacco. |
| **7.** | blishment of cell cultures and determination of growth pattern. |
| **8.** | ermination 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

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| **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. |