

3. Jordan E.L., Verma P.S., 2018. *Chordate Zoology*. S. Chand Publishers, New Delhi, India.
4. Rastogi S.C., 2019. *Essentials of Animal Physiology*, 4th Edition. New Age International Publishers.
5. Verma P.S., Agarwal V.K., 2006. *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology*. S. Chand Publishers, New Delhi, India.
6. Sathyanarayana U., Chakrapani U., 2013. *Biochemistry*, 4th Edition. Elsevier Publishers.
7. Jain J.L., Jain S., Jain N., 2000. *Fundamentals of Biochemistry*. S. Chand Publishers, New Delhi, India.
8. Timberlake K., Timberlake W., 2019. *Basic Chemistry*, 5th Edition. Pearson Publishers.
9. Subrata Sen Gupta, 2014. *Organic Chemistry*, 1st Edition. Oxford Publishers.

ACTIVITIES

1. Prepare a display chart of the life cycle of non-flowering plants.
2. Prepare a display chart of the life cycle of flowering plants.
3. Study of stomata.
4. Activity to prove that chlorophyll is essential for photosynthesis.
5. Study of pollen grains.
6. Observation of pollen germination.
7. Ikebana (flower arrangement).
8. Differentiate between edible and poisonous mushrooms.
9. Visit a nearby mushroom cultivation unit and study its economics.
10. Draw the ultrastructure of prokaryotic and eukaryotic cells.
11. Visit a zoology lab and observe different methods of specimen preservation.
12. Hands-on experience with laboratory equipment – Microscopes, Centrifuge, pH Meter, Electronic Weighing Balance, Laminar Air Flow.
13. Visit a zoo, sericulture, apiculture, or aquaculture unit.
14. List different hormonal, genetic, and physiological disorders observed in society.

REFERENCES

1. Tortora G.J., Funke B.R., Case C.L., 2016. *Microbiology: An Introduction*, 11th Edition. Pearson Publications, London.
2. Pelczar M.J., Chan E.C.S., Krieg N.R., 2002. *Pelczar Microbiology*, 5th Edition. McGraw Education, New York, USA.
3. Sathyanarayana U., Chakrapani U., 2013. *Biochemistry*, 4th Edition. Elsevier Publishers.
4. Jain J.L., Jain S., Jain N., 2000. *Fundamentals of Biochemistry*. S. Chand Publishers, New Delhi, India.
5. Dubey R.C., 2014. *Advanced Biotechnology*. S. Chand Publishers, New Delhi, India.
6. Ratledge C., Kristiansen B., 2008. *Basic Biotechnology*, 3rd Edition. Cambridge Publishers.
7. Sathyanarayana U., 2005. *Biotechnology*, 1st Edition. Books and Allied Publishers Pvt. Ltd., Kolkata.
8. Upadhyay, Upadhyay, Nath, 2016. *Biophysical Chemistry: Principles and Techniques*. Himalaya Publishing House.
9. Lesk A.M., *Introduction to Bioinformatics*, 5th Edition. Oxford Publishers.
10. Kulkarni A.P., 2020. *Basics of Biostatistics*, 2nd Edition. CBS Publishers.

ACTIVITIES

1. Identify given organisms as harmful or beneficial.
2. Observe microorganisms from house dust under a microscope.
3. Identify microorganisms from pond water.
4. Visit a microbiology industry or biotech company.
5. Visit a wastewater treatment plant.
6. Retrieve a DNA or protein sequence of a gene.
7. Perform BLAST analysis for DNA and protein.
8. Solve problems on biostatistics.
9. Conduct field trips and awareness programs on environmental pollution caused by wastes and hazardous materials.
10. Demonstration of basic biotechnology laboratory equipment.
11. Prepare 3D models of genetic engineering techniques.
12. Prepare 3D models of transgenic plants and animals.

1. General characteristics of bryophytes; classification by Rothmaler (1951).
2. Occurrence, morphology, anatomy, reproduction, and life cycles of:
 - a) Hepaticopsida – *Marchantia*
 - b) Anthocerotopsida – *Anthoceros*
 - c) Bryopsida – *Funaria*
3. General account of evolution of sporophytes in bryophytes.

IV. TEXT BOOKS

1. Pandey B.P. (2013). *College Botany*, Volume I. S. Chand Publishing, New Delhi.
2. Hait G., Bhattacharya K., Ghosh A.K. (2011). *Textbook of Botany*, Volume I. New Central Book Agency Pvt. Ltd., Kolkata.

V. REFERENCE BOOKS

1. Fritsch F.E. (1945). *The Structure and Reproduction of Algae* (Vol. I & II). Cambridge University Press, UK.
2. Bold H.C., Wynne M.J. (1984). *Introduction to the Algae*. Prentice-Hall Inc., New Jersey.
3. Lee R.E. (2008). *Phycology*. Cambridge University Press, New York.
4. Van Den Hoek C., Mann D.G., Jahns H.M. (1996). *Algae: An Introduction to Phycology*. Cambridge University Press.
5. Alexopoulos C.J., Mims C.W., Blackwell M. (2007). *Introductory Mycology*. Wiley & Sons, New York.
6. Mehrotra R.S., Aneja K.R. (1990). *An Introduction to Mycology*. New Age International Publishers, New Delhi.
7. Kavanagh K. (2005). *Fungi: Biology and Applications*. John Wiley & Sons, England.
8. Webster J., Weber R.W.S. (2007). *Introduction to Fungi*. Cambridge University Press.
9. Shaw A.J., Goffinet B. (2000). *Bryophyte Biology*. Cambridge University Press.

VI. SUGGESTED ACTIVITIES AND EVALUATION METHODS

Unit 1:

Activity: Collection of algal specimens from local water bodies; recording characteristics, identification, and classification based on Fritsch system.

Evaluation Method: Assessment of report/presentation.

Unit 2:

Activity: Microscopic observation of six algal forms (excluding syllabus genera) and recording distinguishing features.

Evaluation Method: Quiz/exam or evaluation of charts/drawings/comparative data.

Unit 3:

Activity: Collection or laboratory culture of fungi and reporting key features.

Evaluation Method: Report evaluation, JAM/Quiz/Group discussion.

Unit 4:

Activity: Microscopic observation and summarization of features of fungal genera and lichens.

Evaluation Method: Quiz/exam or evaluation of charts/drawings.

Unit 5:

Activity: Collection, identification, and classification of four bryophytes from local areas.

Evaluation Method: Assessment based on accuracy, documentation, and presentation/report.

1. Acharya, B.C., (2019) Archchegoniates, Kalyani Publishers, New Delhi
2. Bhattacharya, K., G. Hait & Ghosh, A. K., (2011) A Text Book of Botany, Volume II, New Central Book Agency Pvt. Ltd., Kolkata
3. Hait, G., K. Bhattacharya & A.K. Ghosh (2011) A Text Book of Botany, Volume-I, New Central Book Agency Pvt. Ltd., Kolkata
4. Pandey, B.P. (2013) College Botany, Volumes-I & II, S. Chand Publishing, New Delhi

V. Reference Books:

1. Smith, G.M. (1971) Cryptogamic Botany Vol. II., Tata McGraw Hill, New Delhi
2. Sharma, O.P. (2012) Pteridophyta. Tata McGraw-Hill, New Delhi
3. Sporne, K.R. (1971) The Morphology of Gymnosperms. Hutchinsons Co. Ltd., London
4. Coulter, J.M. & C.J. Chamberlain (1910) Morphology of Gymnosperms, The University of Chicago Press, Chicago, Illinois
5. Bhatnagar, S.P. & Alok Moitra (1996) Gymnosperms. New Age International, New Delhi
6. Sambamurty, A.V.S.S. (2005) Taxonomy of Angiosperms I. K. International Pvt. Ltd., New Delhi
7. Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi.
8. Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.

VI. Suggested activities and evaluation methods:

Unit-1: Activity: Making temporary slides/models/drawings of Pteridophytes in the syllabus.

Evaluation method: Assessment of the temporary slides/model/drawing.

Unit-2: Activity: Study of wood elements in locally available Gymnosperms and making temporary slides.

Evaluation method: Validation of prepared slides submitted by the learner.

Unit-3: Activity: Botanical field trip and collecting plant specimens for herbarium.

Evaluation method: Attendance in field trip and submission of field note book and herbarium sheets with filled in labels.

Unit-4: Activity: Making good models or drawings or collection of photographs of some important plant species from the families included in the syllabus.

Evaluation method: Authorize the quality of the work and conferring reward.

Unit-5: Activity: Collection of scientific literature on solving taxonomic problems by taking evidences from other branches of Botany.

Evaluation method: Validation of the collection submitted along with summary.

IV. TEXT BOOKS

1. Sharma P.D. (2011). *Fundamentals of Plant Pathology*. Tata McGraw-Hill, New Delhi.
2. Singh R.S., Singh U.S. (2017). *Plant Pathology: An Introduction*. CRC Press, USA.
3. Mehrotra R.S. (2008). *Plant Pathology*. Tata McGraw-Hill, New Delhi.
4. Reddy M.S., Singh G. (2016). *Plant Pathology: Concepts and Laboratory Exercises*. Scientific Publishers, Jodhpur.

V. REFERENCE BOOKS

1. Agrios G.N. (2005). *Plant Pathology* (5th Ed.). Academic Press, USA.
2. Dehne H.W. (Ed.) (2012). *Plant Pathology: From Molecular Biology to Biological Control*. Springer.
3. Dicklow M.B., Beaudry R.M. (2013). *Plant Pathology Concepts and Laboratory Exercises*. CRC Press.
4. Lucas J.A. (1998). *Plant Pathology and Plant Pathogens*. Blackwell Science, UK.
5. Schumann G.L., D'Arcy C.J. (2010). *Essential Plant Pathology*. APS Press.
6. Singh R.P., Singh U.S. (2020). *Plant Diseases: Identification, Management and Challenges*. Springer.

VI. SUGGESTED ACTIVITIES AND EVALUATION METHODS

Unit 1:

Activity: Field survey and report on plant pathogens, their survival, and dispersal.

Evaluation: Assessment based on reports, presentations, and documentation.

Unit 2:

Activity: Case studies on plant infections and disease development factors.

Evaluation: Evaluation of case study reports for analytical skills.

Unit 3:

Activity: Survey of preventive and control measures used by local farmers.

Evaluation: Peer review of reports.

Unit 4:

Activity: Field survey on diseases of local field crops.

Evaluation: Report evaluation based on rubric.

Unit 5:

Activity: Microscopic observation and drawing of diseased samples.

Evaluation: Assessment based on presentation and accuracy of drawings.

I. LEARNING OBJECTIVES

By the end of this course, the learner will be able to:

1. Understand the objectives and scope of plant breeding along with reproductive methods in plants.
2. Learn different breeding methods used for developing new plant varieties.
3. Gain comprehensive knowledge of tools and techniques used in plant breeding.

II. LEARNING OUTCOMES

On completion of this course, students will be able to:

1. Compare and contrast methods of reproduction and pollination mechanisms.
2. Design appropriate pollination methods for a given crop plant.
3. Recommend suitable breeding methods for specific crop species.
4. Outline steps involved in the production of hybrid varieties.
5. Apply molecular techniques for developing improved plant varieties.

III. SYLLABUS OF THEORY

UNIT 1: Basic Concepts of Plant Breeding (8 Hrs.)

1. Definition, aims, objectives, and scope of plant breeding; concepts of genetic variation, heritability, and selection.
2. Asexual and sexual reproduction – advantages and disadvantages; apomixis – definition, types, and significance.
3. Self and cross-pollination – genetic consequences and significance; classification of crops based on pollination and reproduction.

UNIT 2: Contrivances for Cross Pollination (7 Hrs.)

1. Self-incompatibility – Definition; heteromorphic and homomorphic systems; role in hybrid production.
2. Male sterility – Genetic, cytoplasmic, and cytoplasmic-genetic; applications in plant breeding.
3. Domestication of plants and centers of origin of crop plants.

UNIT 3: Breeding Methods in Plants (9 Hrs.)

1. Plant introduction – Types, objectives, agencies in India, procedure, merits, and demerits; germplasm collection, genetic erosion, gene sanctuaries.
2. Selection – Natural and artificial selection; basic principles.
3. Self-pollinated crops – Pure line selection: procedure, advantages, disadvantages, and achievements.
4. Vegetatively propagated crops – Clonal selection: procedure, advantages, disadvantages, and achievements.

UNIT 4: Breeding Methods in Cross-Pollinated Plants (12 Hrs.)

1. Hybridization – Objectives, types, procedure, advantages, disadvantages, and achievements.
2. Backcross method – Procedure, advantages, disadvantages, and achievements.
3. Heterosis – Definition; genetic basis (dominance, overdominance, epistasis) and physiological basis; commercial utilization.
4. Synthetics and composites – Production, merits, demerits, and achievements.

UNIT 5: Modern Methods in Plant Breeding (9 Hrs.)

1. Mutation breeding – Spontaneous and induced mutations; characteristics, procedure, applications, advantages, limitations, and achievements.
2. Polyploidy breeding – Autopolyploids and allopolyploids; applications and limitations.
3. DNA markers – RFLP, SSR, SNP and their applications in plant breeding.
4. Marker Assisted Selection (MAS) – Applications in crop improvement.

IV. TEXT BOOKS

1. Singh B.D. (2001). *Plant Breeding: Principles and Methods*. Kalyani Publishers, New Delhi.
2. Poehlman J.M., Sleper D.A. (1995). *Breeding Field Crops* (4th Ed.). Iowa State University Press, USA.
3. Patil J.V., Patil S.S., Balikai R.A. (2019). *Principles and Methods in Plant Breeding*. Scientific Publishers, Jodhpur.
4. Purohit S.S. (2014). *Plant Breeding: Principles and Methods*. Agrobios, Jodhpur.

V. REFERENCE BOOKS

1. Acquaah G. (2012). *Principles of Plant Genetics and Breeding* (2nd Ed.). Wiley-Blackwell, USA.
2. Allard R.W. (1999). *Principles of Plant Breeding*. John Wiley & Sons, USA.
3. Stuber C.W., Edwards M.D., Wendel J.F. (1987). Molecular markers in plant breeding. *Science*, 238: 1659–1664.
4. Hayes H.K., Kirk R.E., Jones R.H. (1951). *Statistical Analysis of Plant Breeding Experiments*. Iowa State College Press.
5. Simmonds N.W. (1979). *Principles of Crop Improvement* (2nd Ed.). Longman, UK.

VI. SUGGESTED ACTIVITIES AND EVALUATION METHODS

Unit 1:

Activity: Written assessment on reproduction and pollination mechanisms.

Evaluation: Grading based on clarity and descriptive explanation.

Unit 2:

Activity: Collection of scientific literature on mechanisms promoting cross-pollination.

Evaluation: Assessment based on organization, data collection, and analysis.

Unit 3:

Activity: Hands-on practice of selection procedures for a crop plant.

Evaluation: Evaluation of understanding and application skills.

Unit 4:

Activity: Field visit to agricultural/horticultural research stations to observe hybridization.

Evaluation: Assessment based on participation and learning outcomes.

Unit 5:

Activity: Case studies on molecular techniques in crop improvement.

Evaluation: Grading based on rubric with defined criteria.

I. COURSE OUTCOMES

On successful completion of this practical course, the student shall be able to:

1. Differentiate self- and cross-pollinated plants based on floral biology.
2. Perform techniques related to self and cross-pollination.
3. Conduct hybridization to develop new plant varieties.

II. LABORATORY / FIELD EXERCISES

1. Study of floral biology in self- and cross-pollinated plant species.
2. Identification and classification of plants based on pollination mechanisms.
3. Pollen viability test.
4. Observation of pollen germination.
5. Practice of emasculation technique.
6. Practice of selfing and crossing techniques.
7. Assessment of genetic variability.
8. Estimation of heterosis and inbreeding depression.
9. Study of mutants and polyploids in crop plants.

3. Mascarenhas A.F. (1991). *Handbook of Plant Tissue Culture*. ICAR, New Delhi.
4. Narayanaswamy S. (1994). *Plant Cell and Tissue Culture*. Tata McGraw-Hill, New Delhi.

V. REFERENCE BOOKS

1. Stewart C.N. Jr. (2018). *Plant Biotechnology and Genetics*. Wiley, USA.
2. Slater A., Scott N.W., Fowler M.R. (2008). *Plant Biotechnology*. Oxford University Press, UK.
3. Jain S.M., Gupta P.K. (2010). *Plant Biotechnology: Methods and Applications*. CRC Press.
4. Singh R.L. (2017). *Plant Biotechnology: Recent Advances and Future Prospects*. Springer.
5. Altman A., Hasegawa P.M. (2013). *Plant Biotechnology and Agriculture*. Elsevier.

VI. SUGGESTED ACTIVITIES AND EVALUATION METHODS

Unit 1:

Activity: Preparation of culture media.

Evaluation: Assessment based on accuracy and technique.

Unit 2:

Activity: Group discussion on tissue culture practices.

Evaluation: Participation, critical thinking, and presentation skills.

Unit 3:

Activity: Designing a bioreactor system for plant cell culture.

Evaluation: Assessment based on design and conceptual understanding.

Unit 4:

Activity: Collection of literature on transgenic plants.

Evaluation: Evaluation based on relevance, analysis, and conclusions.

Unit 5:

Activity: Case studies on applications of plant biotechnology.

Evaluation: Assessment based on data analysis and report presentation.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

III SEMESTER

BOTANY B-Mi1 3151 (2)

W.e.f. "23AK"

BOTANY

Plant Biotechnology

Practical Syllabus

TIME: 2Hrs/week

Max.Marks:50

I. COURSE OUTCOMES

On successful completion of this practical course, the student shall be able to:

1. Operate equipment used in plant tissue culture laboratories.
2. Establish callus and organ cultures.
3. Produce quality plants through micropropagation techniques.

II. LABORATORY / FIELD EXERCISES

1. Study of equipment used in plant tissue culture laboratory.
2. Practice of sterilization techniques.
3. Preparation of culture media.
4. Callus induction and subculturing.
5. Organogenesis using plant growth regulators (PGRs).
6. Demonstration of cell and protoplast cultures.
7. Demonstration of organ cultures.
8. Demonstration of anther and pollen cultures.

IV. Text Books:

1. Pandey, B.P. (2013) College Botany, Volumes-II & III, S. Chand Publishing, New Delhi
2. Bhattacharya, K., G. Hait & Ghosh, A. K., (2011) A Text Book of Botany, Volume-II, New Central Book Agency Pvt. Ltd., Kolkata

V. Reference Books:

1. Esau, K. (1971) Anatomy of Seed Plants. John Wiley and Son, USA.
2. Fahn, A. (1990) Plant Anatomy, Pergamon Press, Oxford.
3. Cutler, D.F., T. Botha & D. Wm. Stevenson (2008) Plant Anatomy: An Applied Approach, Wiley, USA
4. Paula Rudall (1987) Anatomy of Flowering Plants: An Introduction to Structure and Development. Cambridge University Press, London
5. Bhojwani, S. S. and S. P. Bhatnagar (2000) The Embryology of Angiosperms (4th Ed.), Vikas Publishing House, Delhi.
6. Pandey, A. K. (2000) Introduction to Embryology of Angiosperms. CBS Publishers & Distributors Pvt. Ltd., New Delhi
7. Maheswari, P. (1971) An Introduction to Embryology of Angiosperms. McGraw Hill Book Co., London.
8. Johri, B.M. (2011) Embryology of Angiosperms. Springer-Verlag, Berlin

VI. Suggested activities and evaluation methods:

- **Unit-1: Activity:** Microscopic observations on different tissues in plants and recording characteristics.
 - **Evaluation method:** Judgement of the report/seminar on comparative and contrasting features of various tissues in plants.
- **Unit-2: Activity:** Visits to timber depots and furniture shops and making a report on various woods.
 - **Evaluation method:** Assessment of report submitted with data, photographs and summary.
- **Unit-3: Activity:** Study of pollen structure, germination and viability in some local plant species.
 - **Evaluation method:** Evaluating the report/seminar presentation with collected data.
- **Unit-4: Activity:** Group discussion/quiz on endosperm types and functions.
 - **Evaluation method:** Assessment of the best performing group.
- **Unit-5: Activity:** Drawings of embryogeny in some angiosperms and making comparative report.
 - **Evaluation method:** Evaluating the best drawings and comparative report.

UNIT 5: Phytogeography (7 Hrs.)

1. Principles of phytogeography; distribution – wide, endemic, and discontinuous species.
2. Endemism – Types and causes.
3. Phytogeographic regions of the world.
4. Phytogeographic regions of India.
5. Vegetation types in Andhra Pradesh.

IV. TEXT BOOKS

1. Pandey B.P. (2013). *College Botany*, Volumes II & III. S. Chand Publishing, New Delhi.
2. Bhattacharya K., Hait G., Ghosh A.K. (2011). *Textbook of Botany*, Volume II. New Central Book Agency Pvt. Ltd., Kolkata.
3. Subrahmanyam N.S., Sambamurty A.V.S.S. (2008). *Ecology*. Narosa Publishing House, New Delhi.
4. Sharma P.D. (2012). *Ecology and Environment*. Rastogi Publications, Meerut, India.
5. Kumar U. (2007). *Biodiversity: Principles and Conservation*. Agrobios (India), Jodhpur.
6. Mani M.S. (1974). *Ecology and Biogeography of India*. Dr. W. Junk Publishers, The Hague.

V. REFERENCE BOOKS

1. Kormondy E.J. (1996). *Concepts of Ecology*. Prentice-Hall of India Pvt. Ltd., New Delhi.
2. Begon M., Harper J.L., Townsend C.R. (2003). *Ecology*. Blackwell Science Ltd., USA.
3. Odum E.P. (1996). *Fundamentals of Ecology*. Natraj Publishers, Dehradun.
4. Kumar H.D. (1992). *Modern Concepts of Ecology (7th Ed.)*. Vikas Publishing Co., New Delhi.
5. Newman E.I. (2000). *Applied Ecology*. Blackwell Scientific Publisher, UK.
6. Chapman J.L., Reiss M.J. (1992). *Ecology: Principles and Applications*. Cambridge University Press, UK.
7. Kumar H.D. (2000). *Biodiversity and Sustainable Conservation*. Oxford & IBH Publishing Co. Ltd., New Delhi.
8. Cain S.A. (1944). *Foundations of Plant Geography*. Harper & Brothers, New York.
9. Good R. (1997). *The Geography of Flowering Plants (2nd Ed.)*. Longmans, Green & Co., London & Allied Science Publishers, New Delhi.

VI. SUGGESTED ACTIVITIES AND EVALUATION METHODS

Unit 1:

Activity: Field visit to local ecosystems and preparation of a report on biotic and abiotic components and their interactions.

Evaluation Method: Assessment based on attendance, report submission, and conclusions.

Unit 2:

Activity: Case studies on population and community ecology; preparation of a comprehensive report.

Evaluation Method: Evaluation of report and grading.

Unit 3:

Activity: Case studies on global and local climate change and their impacts; preparation of a report.

Evaluation Method: Assessment and grading of report.

Unit 4:

Activity: Survey in the local area to identify endangered and threatened species.

Evaluation Method: Evaluation of survey report using a rubric.

Unit 5:

Activity: Collection of local flora data and preparation of a project report.

Evaluation Method: Assessment and grading of project report.

1. Jain S.K., Jain R.A. (2015). *Handbook of Plant Resources*. Springer, New York.
2. Panda H., Padhi A.K. (2017). *Medicinal Plants and Their Utilization*. Springer, Singapore.
3. Wickens G.E. (1998). *Economic Botany: Principles and Practices*. Chapman & Hall, London.
4. Kochhar S.L. (1990). *Economic Botany of the Tropics*. Macmillan, London.

V. REFERENCE BOOKS

1. Peter K.V. (2004). *Handbook of Herbs and Spices*. CRC Press.
2. Simon J.E., Duke J.A., Bobilya E.A.L. (1990). *Handbook of Edible Weeds*. CRC Press.
3. Smartt J., Haq N. (2016). *Handbook of Industrial Crops*. Springer.
4. Ravindran P.N. (2017). *Encyclopaedia of Herbs and Spices*. CABI.
5. Simpson B.B. (2010). *Economic Botany: Plants in Our World*. Academic Press.
6. Balick M.J., Cox P.A. (1996). *Plants, People and Culture: The Science of Ethnobotany*.
7. Van Wyk B.E. (2016). *Food Plants of the World*. Timber Press.
8. Homan J. (2012). *Plants That Changed History*. Chartwell Books.
9. Martin G.J. (2004). *Ethnobotany: A Methods Manual*. Earthscan Publications.

VI. SUGGESTED ACTIVITIES AND EVALUATION METHODS

Unit 1:

Activity: Assignment on origin of crop plants.

Evaluation: Based on quality and relevance of collected data.

Unit 2:

Activity: Group discussion on plant products and their sources.

Evaluation: Assessment of logical flow and clarity.

Unit 3:

Activity: Survey of commercial plant products in local markets.

Evaluation: Evaluation based on clarity of survey and analysis.

Unit 4:

Activity: Case study on phytomedicines used in healthcare.

Evaluation: Assessment based on depth of analysis and interpretation.

Unit 5:

Activity: Field visit to timber depots and plantations.

Evaluation: Based on participation and engagement.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

IV SEMESTER
BOTANY B-Ma 4151
W.e.f. "23AK"

BOTANY
Plant Resources and Utilization
Practical Syllabus

TIME: 2Hrs/week
Max.Marks:50

I. COURSE OUTCOMES

On successful completion of this practical course, the student shall be able to:

1. Identify plant products through morphological and microscopic observations.
2. Recognize economically important plants and their products.
3. Classify different plant products used by humans.

II. LABORATORY / FIELD EXERCISES

1. Morphological and microchemical study of stored materials from any three food crops.
2. Morphological and anatomical study of plant fibres (cotton, jute, hemp, ramie, sisal).
3. Study of medicinal and aromatic plants and their useful parts.
4. Study of oil-yielding crops and properties of oils.
5. Study of plants yielding gums, resins, tannins, and dyes.
6. Study of firewood, biofuel, and timber yielding plants.

4. Vasil, I.K. and Thorpe, T.A. (1994) Plant Cell and Tissue Culture. Kluwer Academic Publishers, the Netherlands.
5. Web resources suggested by the teacher concerned and the college librarian including reading material.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

V SEMESTER

BOTANY

TIME: 3Hrs/Week

B-E3-5153

PLANT TISSUE CULTURE

Max. Marks: 50

w.e.f. 20-21 admitted batch - "20AH" PRACTICAL SYLLABUS

Plant Tissue Culture – Practical syllabus

IV. Learning Outcomes: On successful completion of this practical course, student will be able to:

1. List out, identify and handle various equipment in plant tissue culture lab.
2. Learn the procedures of preparation of media.
3. Demonstrate skills on inoculation, establishing callus culture and Micro propagation.
4. Acquire skills in observing and measuring callus growth.
5. Perform some techniques related to plant transformation for secondary Metabolite production.

V. Practical (Laboratory) Syllabus: (30 hrs)

1. Principles and applications of- Autoclave, Laminar Airflow, Hot Air Oven.
2. Sterilization techniques for glass ware, tools etc.,
3. MS medium - Preparation of different stock solutions; media preparation
4. Explant preparation, inoculation and initiation of callus from carrot.
5. Callus formation, growth measurements.
6. Induction of somatic embryos, preparation of synthetic seeds.
7. Multiplication of callus and organogenesis.
8. Hardening and acclimatization in green house.

VI. Lab References:

1. Reinert, J. and M.M. Yeoman, 1982. Plant Cell and Tissue Culture - A Laboratory
2. Manual, Springer-Verlag Berlin Heidelberg

VII. Co-Curricular Activities:

a) Mandatory: (Lab/field training of students by teacher: Lab: 10 + field: 05 hours)

1. **For Teacher:** Training of students by teacher in the laboratory/field for a total of not less than 15 hours on the field techniques/skills of sterilization procedures, preparation of media, establishment of callus culture, growth measurements; morphogenesis and organogenesis; acclimatization and hardening of plantlets.
2. **For Student:** Students shall (individually) visit anyone of plant tissue culture laboratories in universities/research organizations/private facilities, write their observations on tools, techniques, methods and products of plant tissue culture; and submit a hand-written Fieldwork/Project work Report not exceeding 10 pages to the teacher in the given format.
3. Max marks for Fieldwork/Project work Report: 05
4. Suggested Format for Fieldwork/Project work Report: Title page, student details, index page, details of place visited, observations, findings and acknowledgements.
5. Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Training of students by related industrial experts.
2. Assignments (including technical assignments like identifying tools in plant tissue culture and their handling, operational techniques with safety and security, IPR)
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on tools and techniques in plant tissue culture.

5. Collection of material/figures/photos related to products of plant tissue culture, writing and organizing them in a systematic way in a file.
6. Visits to plant tissue culture/biotechnology laboratories in universities, research organizations, private firms, etc.
7. Invited lectures and presentations on related topics by field/industrial experts

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

V SEMESTER

BOTANY

TIME: 3Hrs/Week

B-E3-5104

MUSHROOM CULTIVATION

Max. Marks: 100

w.e.f. 20-21 admitted batch - "20AH"

SYLLABUS

I. Learning Outcomes:

Students at the successful completion of the course will be able to:

1. Understand the structure and life of a mushroom and discriminate edible and poisonous mushrooms.
2. Identify the basic infrastructure to establish a mushroom culture unit.
3. Demonstrate skills preparation of compost and spawn.
4. Acquire a critical knowledge on cultivation of some edible mushrooms.
5. Explain the methods of storage, preparation of value-added products and marketing.

II. Syllabus: (Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)

(Syllabi of theory, practical and lab (skills) training together shall be completed in 80 hours)

Unit – 1: Introduction and value of mushrooms (10h)

1. Mushrooms: Definition, structure of a mushroom and a brief account of life cycle; historical account and scope of mushroom cultivation; difference between edible and poisonous mushrooms.
2. Morphological features of any four edible mushrooms, Button mushroom (*Agaricus Bosporus*), Milky mushroom (*Calocybe indica*), Oyster mushroom (*Pleurotus sajor-caju*) and Paddy straw mushroom (*Volvariella volvacea*).
3. Nutraceutical value of mushrooms; medicinal mushrooms in South India - *Ganoderma lucidum*, *Phellinus rimosus*, *Pleurotus florida* and *Pleurotus pulmonaris* – their therapeutic value; Poisonous mushrooms - harmful effects.

Unit – 2: Basic requirements of cultivation system (10h)

1. Small village unit and larger commercial unit; layout of a mushroom farm - location of building plot, design of farm, bulk chamber, composting, equipment and facilities, pasteurization room and growing rooms.
2. Compost and composting: Definition, machinery required for compost making, materials for compost preparation.
3. Methods of composting- long method of composting and short method of composting.

Unit – 3: Spawning and casing (10h)

1. Spawn and spawning: Definition, facilities required for spawn preparation; preparation of spawn substrate.
2. Preparation of pure culture, media used in raising pure culture; culture maintenance, storage of spawn.
3. Casing: Definition, Importance of casing mixture, Quality parameters of casing soil, different types of casing mixtures, commonly used materials.

Unit – 4: Mushroom cultivation (10h)

Raw material, compost, spawning, casing, cropping, and problems in cultivation (diseases, pests and nematodes, weed molds and their management strategies), picking and packing for any Four of the following mushrooms:

(a) Button mushroom (b) Oyster mushroom (c) Milky mushroom and (d) Paddy straw mushroom

Unit – 5: Post harvest technology (10h)

1. Shelf life of mushrooms; preservation of mushrooms - freezing, dry freezing, drying and canning.
2. Quality assurance and entrepreneurship - economics of different types of mushrooms; value added products of mushrooms.
3. Management of spent substrates and waste disposal of various mushrooms.

III. References:

1. Tewari Pankaj Kapoor, S. C. (1988). Mushroom Cultivation. Mittal Publication, New Delhi.
2. Pandey R.K, S. K Ghosh, (1996). A Hand Book on Mushroom Cultivation. Emkey Publications
3. Nita Bhal. (2000). Handbook on Mushrooms (Vol. I and II). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
4. Pathak, V. N. and Yadav, N. (1998). Mushroom Production and Processing Technology. Agrobios, Jodhpur.
5. Tripathi, D.P. (2005) Mushroom Cultivation, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
6. Pathak V.N., Nagendra Yadav and Maneesha Gaur (2000), Mushroom Production and Processing Technology Vedams Ebooks Pvt. Ltd., New Delhi
7. Web resources suggested by the teacher concerned and the college librarian including reading material.

IV. Learning Outcomes: On successful completion of this practical course, student will be able to:

1. Identify and discriminate different mushrooms based on morphology.
2. Understand facilities required for mushroom cultivation.
3. Demonstrate skills on preparation of spawn, compost and casing material.
4. Exhibit skills on various cultivation practices for an edible mushroom.

V. Practical (Laboratory) Syllabus: (30 hrs)

1. Identification of different types of mushrooms.
2. Preparation of pure culture of an edible mushroom.
3. Preparation of mother spawn.
4. Production of planting spawn and storage.
5. Preparation of compost and casing mixture.
6. Demonstration of spawning and casing.
7. Hands on experience on cropping and harvesting.
8. Demonstration of storage methods.
9. Preparation of value-added products.

VI. Lab References:

1. Sushma Sharma Sapna Thakur Ajar Nath Yadav, 2018. Mushroom Cultivation: A

Laboratory Manual, Eternal University, Sirmour, H.P.

2. Kadhila-Muandingi, N.P., F. S. Mubiana and K. L. Halueendo, 2012. Mushroom

Cultivation: A Beginners Guide, The University of Namibia

3. Gajendra Jagatap and Utpal Dey, 2012. Mushroom Cultivation: Practical Manual, LAMBERT Academic Publishing, Saarbrücken, Germany

4. Deepak Som, 2021. A Practical Manual on Mushroom Cultivation, P.K. Publishers & Distributors, Delhi

5. Web sources suggested by the teacher concerned.

VII. Co-Curricular Activities:

a) Mandatory: (*Lab/field training of students by teacher: Lab: 10 + field: 05 hours*)

1. **For Teacher:** Training of students by teacher in the laboratory/field for not less than 15 hours on the field techniques/skills of identification of edible and poisonous mushrooms, basic facilities of a mushroom culture unit, preparation of compost and spawn, cultivation practices of edible mushrooms, storage and marketing of produce.

2. **For Student:** Students shall (individually) visit mushroom culture units in universities/research organizations/private sector write their observations on infrastructure, cultivation practices and products of a mushroom culture unit etc., and submit to the teacher a hand-written Fieldwork/Project work Report not exceeding 10 pages in the given format.

3. Max marks for Fieldwork/Project work Report: 05.

6. Suggested Format for Fieldwork/Project work Report: Title page, student details, index page, details of place visited, observations, findings and acknowledgements.

4. Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Training of students by related industrial experts.

2. Assignments (including technical assignments like identifying various mushrooms, tools and techniques for culture, identification and control of diseases etc.,

3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).

4. Preparation of videos on tools and techniques in mushroom culture.
5. Collection of material/figures/photos related to edible and poisonous mushrooms, cultivation of mushrooms in cottage industries, writing and organizing them in a systematic way in a file.
6. Visits to mushroom culture units in universities, research organizations, private firms, etc.
7. Invited lectures and presentations on related topics by field/industrial experts.