

## 6. BOTANY

The Botany curriculum provides students with a comprehensive understanding of plants, incorporating subject knowledge, technical skills, and interdisciplinary components. It equips them with cutting-edge technologies used in plant science research and emphasizes the social and environmental importance of plants. Students gain awareness of plants' role in maintaining ecological balance, conserving biodiversity, and mitigating environmental challenges. The curriculum also highlights the economic relevance of plants in sectors like agriculture, horticulture, and pharmaceuticals. By integrating these elements, the curriculum prepares students as well-rounded professionals capable of addressing complex challenges, contributing to scientific advancements, and making informed decisions for the benefit of society, the environment, and the economy.

**Programme Outcomes (POs):** Expected outcome of the programme:

1. Gain comprehensive understanding of different branches of Botany: Systematics, evolution, ecology, developmental biology, physiology, biochemistry, plant interactions, morphology, anatomy, reproduction, genetics, and molecular biology.
2. Acquire competence in analytical and technical skills relevant to plant sciences.
3. Develop abilities in plant identification, experimental design, database utilization, and statistical analysis.
4. Conduct short research projects using various tools and techniques in plant sciences, fostering a scientific and research-oriented mindset.

### **BOT-100: PLANT DIVERSITY–I: ALGAE, BRYOPHYTES AND PTERIDOPHYTES**

**(Contact Hours: 75, Credits: 4)**

#### **Course Objectives (Cos):**

This paper aims to provide students with a comprehensive understanding of the lower groups of plants, enabling them to grasp the interrelationships and evolutionary affinities among these plant groups. Additionally, it will equip students with proficiency in experimental techniques for analyzing and studying these plant groups.

#### **Learning Outcomes (LOs):**

After the completion of the course, the students will be able to:

1. Acquire knowledge regarding the classification, diversity, and life cycles of various groups of algae, including their economic significance.
2. Develop a critical understanding of the morphology, anatomy, reproduction, and life cycles of bryophytes.
3. Gain a critical understanding of the morphology, anatomy, reproduction, and life cycles of pteridophytes.

4. Understand the ecological and economic uses of archegoniate plants.
5. Demonstrate proficiency in employing experimental techniques and methods for the appropriate analysis of algae, bryophytes, and pteridophytes.

### **Unit – I: Algae**

1. Salient features of algae and Classification by Fritsch (1935) with characteristic features of each class.
2. Range of thallus and reproductive structures in algae.
3. Life cycles of *Chara*, *Oedogonium*, and *Polysiphonia*.
4. Economic importance of algae.

### **Unit – II: Bryophytes** Salient features of bryophytes and classification by Proskauer (1957).

1. Origin and range of gametophytic structures in Bryophytes.
2. Life cycle of *Marchantia*, *Anthoceros* and *Funaria*.
3. Economic importance of Bryophytes.

### **Unit- III: Pteridophytes**

1. Salient features of pteridophytes and classification by Smith (1955).
2. Types of stelar structures in Pteridophytes.
3. Life cycle of *Lycopodium* and *Selaginella*.
4. Economic importance of Pteridophytes.

### **Unit - IV: Practical**

1. Study of vegetative and reproductive parts with the help of temporary preparations of all genera prescribed in Paper BOT-100-T.
2. Dissection, sectioning, drawing, description and identification of the specimens covered in the preparations.
3. Spotting: Includes those specimens not covered in experiments 1 and 2.
4. Field visit to nearby areas to observe different groups of plants prescribed in the theory syllabus.

### **Suggested Readings:**

1. Bold, H.C. and Wynne, M.J. (1978). Introduction to Algae: Structure and Reproduction. Prentice Hall, New Jersey.
2. Bux, F. and Chisti, Y. (2018). Algae Biotechnology: Products and Processes. Springer, International Publishing, Cham.
3. Geissler, P and Greene, S.W. (1982). Bryophyte Taxonomy: Methods, Practices and Floristic Exploration. J Cramer, Germany.
4. Hait, G., Bhattacharya, K. and Ghosh, A.K. (2011). Textbook of Botany. Volume 1. New Central Book Agency (P) Ltd., New Delhi.
5. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press Pvt. Ltd., New Delhi.
6. Lee, R.E. (2008). Phycology. Fourth Edition. Cambridge University Press.

7. Mitra, J.N., Mitra, D. and Chaudhuri, S.K. (2023). Studies in Botany. Volume I. 10<sup>th</sup> Revised Edition. Moulik Library, Kolkata.
8. Pandey, B.P. (2017). Botany for degree students. Biodiversity. S. Chand & Company Ltd., New Delhi.
9. Shaw, A.J. and Goffinet, B. (2000). Bryophyte Biology. Cambridge University Press.
10. Stevenson, R.J., Bothwell, M.L. and Lowe, R.L. (1996). Algal Ecology: Freshwater Benthic Ecosystems. Academic Press, Cambridge.
11. Van den Hoek, C., Mann, D.G. and Jahns, H.M. (1995). Algae. An Introduction to Phycology, Cambridge University Press.
12. Vanderpoorten, A. and Goffinet, B. (2009). Introduction to Bryophytes. Cambridge University Press.
13. Vashishta, P.C., Sinha, A.K., and Kumar, A. (2006). Botany for degree students. Pteridophyta (Vascular Cryptogams). S. Chand & Company Ltd., New Delhi.
14. Vashishta, B.R., Sinha, A.K., and Singh, V.P. (2010). Botany for degree students. Part-I Algae. S. Chand & Company Ltd., New Delhi
15. Vashishta, B.R., Sinha, A.K., and Kumar, A. (2010). Botany for degree students. Part-III Bryophyta. S. Chand & Company Ltd., New Delhi.

**BOT-150: PLANT DIVERSITY–II: GYMNOSPERMS, PALAEOBOTANY,  
ANGIOSPERM MORPHOLOGY AND ANATOMY**

**(Contact Hours: 75, Credits: 4)**

**Course Objectives (Cos):**

This paper provides an overview of the higher groups of plants, focusing on the interrelationships and evolutionary pathways that connect them. By studying this topic, students will develop a comprehensive understanding of how different plant groups are related to each other and how they have evolved over time. Through exploring the interconnections and evolutionary trajectories of higher plant groups, students will gain valuable insights into the diversity and complexity of the plant kingdom, enriching their knowledge of plant biology and evolution.

**Learning Outcomes (LOs):** Upon completion of the course, students will be able to:

1. Develop a critical understanding of the morphology, anatomy, and reproduction of Gymnosperms and Angiosperms.
2. Gain knowledge about the geological history of the Earth and the life forms that existed during prehistoric periods.
3. Comprehend the process of fossil formation and recognize different types of fossils.
4. Understand the fundamental concepts of plant morphogenesis and the development of organs.
5. Analyze the variations in morphology and internal structures among different parts of plants and across various plant groups, supporting the concept of evolution.
6. Demonstrate proficiency in utilizing experimental techniques and methods for the appropriate analysis of Gymnosperms.

7. Master the techniques for preparing double-stained specimens and studying anomalous growth in angiosperms.

### **Unit-I: Gymnosperms and Paleobotany**

1. Salient features and classification of gymnosperms by Coulter and Chamberlain (1910).
2. Phylogenetic relationship and affinities of gymnosperms.
3. Life cycle of *Cycas*, *Pinus*, and *Gnetum*.
4. Economic importance of gymnosperms.
5. Geological time scale; Fossil formation and plant fossil types.

### **Unit-II: Angiosperm Morphology**

1. Leaf morphology: Phyllotaxy and venation.
2. Types of stipules, bracts and inflorescence.
3. Floral morphology: Forms of calyx, corolla, and their aestivation.
4. Types of stamens and carpels.
5. Types of fruits, ovule forms, and placentation.
6. Types of seeds: albuminous and exalbuminous

### **Unit- III: Plant Anatomy**

1. Organization of apical meristem.
2. Types of stomata in angiosperms.
3. Components of xylem and phloem with their functions.
4. Concept of primary and secondary growth; Secondary growth in stem and root of dicots.
5. Anomalous secondary growth in *Bignonia* and *Dracaena*.
6. Root-stem transition.

### **Unit - IV: Practical**

1. Study of vegetative and reproductive structures of all prescribed gymnosperms by preparing temporary stained slides (dissection, sectioning, drawing, description, and identification up to genus).
2. Study of fossils through slides or specimens.
3. Sectioning and observation of placentation types, ovule structure, and anther through temporary preparations.
4. Study of permanent slide preparation by double staining techniques (Safranin and Haematoxylin or Safranin and fast green).
5. Anatomical studies of anomalous secondary structures of *Bignonia* and *Dracaena* by temporary double staining techniques (Safranin and Haematoxylin or Safranin and fast green).
6. Spotting: Includes those groups and sections not covered in the preparations.

### **Suggested Readings:**

1. Beck, B. (1988). Origin and Evolution of Gymnosperms. Columbia University Press.
2. Bhatnagar, A. K. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi.
3. Bhattacharya, K., Hait, G. and Ghosh, A.K. (2015). A Textbook of Botany. Volume II. New Central Book Agency (P) Ltd., New Delhi.

4. Bhojwani, S.S. and Bhatnagar, S.P. (2000). The Embryology of Angiosperms. Vikas Publishing House.
5. Crang, R., Lyons-Sobaski, S., and Wise, R. (2018). Plant anatomy: A concept-based approach to the structure of seed plants. Springer.
6. Dickison, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.
7. Evert, R.F. (2006). Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function, and Development. John Wiley and Sons, Inc.
8. Fahn, A. (1990). Plant Anatomy. Pergamon Press.
9. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.
10. Mishra, S. R. (2010). Textbook of Palaeobotany. Discovery Publishing House Pvt Ltd.
11. Mitra, J.N., Mitra, D. and Chaudhuri, S.K. (2023). Studies in Botany. Volume I. 10th Revised Edition. Moulik Library, Kolkata.
12. Pandey, B.P. (2017) A Textbook of Botany: Angiosperms. S. Chand & Company Pvt Ltd.

\*\*\*