Plant Anatomy and Embryology (LSCL4) Core Course - (CC) Credit:6

Course Objective (2-3)

The Objective of this paper is to provide basic knowledge of plant internal architecture and cellular composition and reproduction. This will help them to understand how different plant tissue structures evolve and modify their functions with respect to their environment.

Course Learning Outcomes

Knowledge regarding anatomy equipped the students to identify different types of tissues and make them able to correlate their physiology in a better away. This will also help them to understand how different plant tissue evolve and modify their structure and functions with respect to their environment. Knowledge regarding embryology make them understand how reproduction play significant role in defining population structure, natural diversity and sustainability of ecosystem in a better way.

Unit 1

Meristematic and permanent tissues (8 lectures)

Simple (parenchyma, collenchyma, sclerenchyma) and complex tissues (xylem, phloem), Root and shoot apical meristems (describe theories in brief with special reference to Tunica Corpus and Korper-Kappe theory)

Unit 2

Organs (4 lectures) Structure of dicot and monocot stem (include types of vascular bundles), root and leaf (including Kranz anatomy).

Unit 3

Secondary Growth (8 lectures)

Vascular cambium: structure and function, seasonal activity. Secondary growth in root and stem, Wood (heartwood and sapwood; Ring and diffuse porous wood; Early and late wood)

Unit 4

Adaptive and protective systems (8 lectures)

Epidermis (trichomes and hair), cuticle, stomata: structure and type (Metcalf and Chalk Classification); General account of adaptations in xerophytes and hydrophytes (Examples may be cited from *Nerium*, *Opuntia*, *Hydrilla* and *Nymphaea*).

Unit 5

Introduction to Plant Reproduction (5 lectures)

Modes of reproduction in plants: vegetative options - natural and artificial; introduction and Significance of sexual reproduction. History (contributions of G.B. Amici, W. Hofmeister, E. Strasburger, S.G. Nawaschin, P. Maheshwari, B.M. Johri, W.A. Jensen, J. Heslop-Harrison, and scope, Significance of Reproductive Biology studies.

Unit 6

Structural organization of flower (10 lectures)

Organization of flower; Structure: Anther (No developmental stage) and development of Pollen grains; Ovules:

Structure and types; Embryo sac Types (monosporic, bisporic and tetrasporic) and development (with special reference to *Polygonum* type).

Unit 7

Pollination and fertilization (10 lectures)

Pollination types and adaptations; Double fertilization and triple fusion; Seed: Structure (Dicot and Monocot, No developmental stages) appendages and dispersal mechanisms (– Autochory, Anemochory, Hydrochory, Zoochory with 1 example each) Adaptations (aril, caruncle).

Unit 8:

Embryo and endosperm (10 lectures)

Endosperm types (one example of each type), structure and functions; Dicot and Monocot embryo (Brief account of dicot embryo development); Embryo endosperm relationship (General account).

Practical

- 1. Study of meristems through permanent slides and photographs.
- 2. Tissues (parenchyma, collenchyma and sclerenchyma); Macerated xylary elements, Phloem (Permanent slides, photographs)
- 3. Stem: Monocot: Zea mays; Dicot: Helianthus.
- 4. Root: Monocot: Zea mays; Dicot: Helianthus.
- 5. Leaf: Dicot and Monocot (only Permanent slides).

- 6. Adaptive anatomy: Xerophyte (Nerium leaf); Hydrophyte (Hydrilla stem).
- 7. Structure of anther (young and mature).
- 8. Types of ovules: anatropous, orthotropous, circinotropous, amphitropous/ campylotropous.
- 9. Female gametophyte: *Polygonum* (monosporic) type of Embryo sac (Permanent slides/photographs).
- 10. Pollination types and seed dispersal mechanisms (including appendages, aril,caruncle) Photographs/specimens).
- 11. Dissection of embryo/endosperm from developing seeds.
- 12. Calculation of percentage of germinated pollen in a given medium.

References

- 1. Bhojwani, S.S., Bhatnagar, S.P., Dantu P. K. (2015). *Embryology of Angiosperms*, 6th edition. New Delhi, Delhi: Vikas Publication House Pvt. Ltd. (chapter 1 for unit 5;chapters 2, 3, 4, 6 and 7 for unit 6; chapters 8, 9 for unit 7; chapters 11, 12 and 15 for unit 8)
- 2. Dickison,W.C.(2000). *Integrated Plant anatomy*. Cambridge, U.K.: Academic press Inc. (chapter 2 for unit 1; chapter 3 for unit 2; chapter 4 for unit 3; chapters 2 and 8 for unit 4)
- 3. Fahn, A. (1982). *Plant anatomy*. Oxford, U.K.: Pergamon Press. (chapters 3 to 8 for unit 1; chapters 11 to 13 for unit 2; chapters 13, 14 for unit 3; chapters 10 to 13 for unit 4)
- Mauseth, J.D. (1988). *Plant Anatomy*. San Francisco, California: The Benjamin/Cummings Publisher. (chapters 3 to 8 for unit 1; chapters 11 to 13 for unit 2; chapters 14, 15 for unit 3; chapter 10 for unit 4)

Additional Resources

 Evert F. R., Eichhorn S. E. (2008). *Raven Biology of Plants*. 8th Edition. New York, W.H. Freeman and Company Publishers. (chapters 23 to 26 for units 1 to 4, Chapter 19 for units 5 to 8)

Teaching Learning Process

Theory: The theory topics are covered in lectures with the help of PowerPoint presentations and the chalkboard. Students are encouraged to ask questions. The reading list has been suitably upgraded. When the entire syllabus is completed, a few lectures are devoted to discuss the previous years' question papers, thus preparing the students for the examination.

Practicals: Every practical session begins with detailed instructions, followed by students conducting the experiment/s. When all the students have collected the data, the observations are discussed. Any deviation from the expected trend in results is explained. The students are encouraged to graphically represent the data and record the experiment during class hours. The students are asked to submit their record notebooks to the teacher/s for checking. Weekly lesson plan