Anatomy of Angiosperms
(BHCC5)
Core Course - (CC) Credit:6

Course Objective (2-3)

1. To acquaint the students with internal basic structure and cellular composition of the plant body.
2. To correlate structure with important functions of different plant parts.
3. Study of various tissue systems and their development and functions in plants

Course Learning Outcomes

1. Knowledge of various cells and tissues, meristem, epidermal and vascular tissue system in plants.
2. Various aspects of growth, development of the tissues and differentiation of various plant organs.Knowledge of basic structure and organization of plant parts in angiosperms.
3. Correlation of structure with morphology and functions.

Unit 1

Tissues (12Lectures): Classification of tissues; Simple and complex tissues (no phylogeny); Pits and plasmodesmata; Wall ingrowths and transfer cells; Ergastic substances.

Unit 2

Stem and leaf(12Lectures): Organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory, continuing meristematic residue, cyto-histological zonation); Types of vascular bundles; Structure of dicot and monocot stem; Shoot Chimeras; Structure of dicot and monocot leaf, Kranz anatomy; Development of Leaf.

Unit 3

Root (6Lectures) : Organization of root apex (Apical cell theory, Histogen theory, Korper-Kappe theory); Quiescent centre; Root cap; Structure of dicot and monocot root; Endodermis, exodermis and origin of lateral root.

Unit 4

Vascular Cambium(7 Lectures): Structure (Axially and radially oriented elements); function and seasonal activity of cambium; Secondary growth in root and stem, Anomalies in secondary growth in stem: Included phloem and Phloem wedges.

Unit 5

Wood(8Lectures): Types of rays and axial parenchyma; Cyclic aspects and reaction wood; Sapwood and heartwood; Ring and diffuse porous wood; Early and late wood, tyloses; Dendrochronology.

Unit 6

Periderm (3Lectures): Development and composition of periderm;rhytidome and lenticels.

Unit 7

Adaptive and Protective Systems (8Lectures): Epidermal tissue system; cuticle; epicuticular waxes;trichomes (uni-and multicellular, glandular and non-glandular, two examples of each); stomata (classification); Adcrustation and incrustation; Anatomical adaptations of xerophytes and hydrophytes.

Unit 8

Secretory System (3Lectures): Hydathodes, cavities, lithocysts and laticifers.

Unit 9: Scope of Plant Anatomy (1 Lectures)

Applications in systematics, forensics and pharmacognosy**.**

Practical

Study of anatomical details through permanent slides/temporary stain mounts/ macerations/ museum specimens with the help of suitable examples.

1. Apical meristem of root, shoot and vascular cambium.
2. Distribution and types of parenchyma, collenchyma and sclerenchyma.
3. Xylem: Tracheary elements-tracheids, vessel elements; thickenings; perforation plates; xylem fibres.
4. Wood: ring porous; diffuse porous; tyloses; heartwood and sapwood.
5. Phloem: Sieve tubes-sieve plates; companion cells; phloem fibres.
6. Epidermal system: cell types, stomata types; trichomes: non-glandular and glandular.
7. Root: monocot, dicot, secondary growth.
8. Stem: monocot, dicot - primary and secondary growth; phloem wedges in *Bignonia*, included phloem in *Leptadenia*/*Salvadora*; periderm; lenticels.
9. Leaf: isobilateral, dorsiventral, C4 leaves (Kranz anatomy).
10. Adaptive Anatomy: xerophytes, hydrophytes.
11. Secretory tissues: cavities, lithocysts and laticifers.

References

1. Dickison, W.C. (2000).*Integrative Plant Anatomy.* Cambridge, U.K.: Harcourt Academic Press. (Chapter 1 for Unit 1, Chapter 4 for Unit 4, Chapter 4 for Unit 5, Chapter 4 for Unit 6, Chapters 8 and 11 for Unit 7, Chapter 11 for Unit 8, Chapters 5, 13 and 17 for Unit 9)
2. Esau, K. (1977).*Anatomy of Seed Plants.* New Delhi, Delhi: John Wiley & Sons, Inc. (Chapters 1, 4, 5, 6, 9 and 11 for Unit 1, Chapters 16, 18 and 19 for Unit 2, Chapter 14 for Unit

3, Chapters 10, 15 and 17 for Unit 4, Chapter 8 and 9 for Unit 5, Chapter 12 for Unit 6, Chapter 13 for Unit 7, Chapter 13 for Unit 8)
3. Evert, R.F., Eichhorn, S. E. (2006). *Esau's Plant anatomy: Mersitems, Cells, and tissues of the Plant Body: their structure, function and development.* New Jersey, U.S.: Wiley- Liss. (Chapter 1, 4, 7, 8 and 13 for Unit 1, Chapter 6 for Unit 2, Chapter 12 for Unit 4, Chapter 12 for Unit 5, Chapter 15 for Unit 6, Chapters 9, 16 and 17 for Unit 7, Chapters 16 and 17 for Unit 8)
4. Fahn, A. (1974) Plant Anatomy. Pergmon Press, USA and UK. (Chapters 11 and 12 for Unit 2, Chapter 13 for Unit 3, Chapter 14 for Unit 4, Chapter 1 for Unit 9)

Additional Resources:
1. Mauseth, J.D. (1988). *Plant Anatomy.* San Francisco, California: The Benjammin Cummings Publisher. (Chapter 3,4,5 for Unit 1; Chapter 8 for Unit 4: Chapter 10 for Unit 7: Chapter 11 for Unit 2; Chapter 6 for Unit 2,3: Chapter 9 for Unit 8: Chapter 15 for Unit 5: Chapter 17 for Unit 6).
2. Raven, F.H., Evert, R. F., Eichhorn, S.E. (1992). *Biology of Plants.* New York, NY: W.H. Freeman and Company. Chapter 25 for Unit 3; Chapter 26 for Unit 2; Chapter 27 for Unit 4)

Teaching Learning Process

Chalk and blackboard teaching methodology
Powerpoint presentations
Study of anatomical details through permanent slides/temporary stain mounts/ macerations/ museum specimens with the help of suitable examples

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Assessment Methods

Assignments/ Projects
Class tests, Student presentations, Continuous evaluation
Making drawings as part of practical record book. we may ponder over making students involve in highlighting the salient features of the genera/ groups through digital media such as ppt and animations.

Assessment method

Unit No	Course learning Outcome	Teaching and Learning Activity	Assessment Task
Unit I:	Classification of tissues; Simple and complex tissues	Activity :Class room lectures and Practical demonstration, experiments	Assessment: Hands on exercises, PPT, assignments, tests
Unit II:	Organization of shoot apex (Apical cell theory, Types of vascular bundles; Structure of dicot and monocot stem, leaf, Kranz anatomy	Class room lectures and Practical demonstration, experiments	Hands on excercises, PPT, assignments, tests
Unit III:	Root cap; Structure of dicot and	Class room lectures and	Hands on exercises,

	monocot root; Endodermis, exodermis and origin of lateral root	Practical demonstration, experiments	PPT, assignments, tests
Unit IV:	function and seasonal activity of cambium; Secondary growth in root and stem, Anomalies in secondary growth in stem	Class room lectures and Practical demonstration, experiments	Hands on exercises, PPT, assignments, tests
Unit V:	Types of rays and axial parenchyma; Cyclic aspects and reaction wood; Sapwood and heartwood; Ring and diffuse porous wood; Early and late wood	Class room lectures and Practical demonstration, experiments	Hands on exercises, PPT, assignments, tests
Unit VI:	Development and composition of periderm;rhytidome and lenticels	Class room lectures and Practical demonstration, experiments	Hands on exercises, PPT, assignments, tests
Unit VII:	cuticle; epicuticular waxes;trichomes (uni-and multicellular, glandular and non-glandular); stomata; Anatomical adaptations of xerophytes and hydrophytes	Class room lectures and Practical demonstration, experiments	Hands on exercises, PPT, assignments, tests
Unit VIII:	Hydathodes, cavities, lithocysts and laticifers.	Class room lectures and Practical demonstration, experiments	Hands on exercises, PPT, assignments, tests
Unit IX:	Applications in systematics, forensics and pharmacognosy**.**	Class room lectures and Practical demonstration, experiments	Hands on exercises, PPT, assignments, tests

Keywords

Tissues, Stem, Leaf, Root, Vascular cambium, Wood, Periderm, Anatomical adaptations, Secondary anomalies. Plant tissue systems, meristems, trichomes,