Bot-315 & 316 ANATOMY OF VASCULAR PLANTS (Theory & Lab) Credit Hours: 3(2+1)
THEORY:

Introduction of the Course:

This course introduces the internal structure of vascular plants, including their cells, tissues, organs and systems. It emphasizes the variation in the appearance and description of plant parts based on developmental and functional aspects. The relationship of structures with their possible functions is also elucidated. The laboratory-based microscopic assays of the stained plant specimen sections are also included for understanding plant structures.

Course Objectives:

The course is designed:

1- To enable students, learn about basic structures of the plant tissues, organs and systems.
2- To describe in depth the basic cell types found in plants
3- To expand understanding of tissue types including the epidermis, xylem and phloem
4- To introduce about the basic structure of meristems found in shoots and roots
5- To be able to identify the structures associated with plant reproduction such as cones, flowers, fruits and seeds

Contents:

1. Introduction of plant Anatomy

1.1. The plant body and its development; fundamental parts of the plant body, internal organization, different tissue systems of primary and secondary body.

2. Types of Tissues

2.1.1. Types of Tissues: Meristematic, permanent, complex and special / glandular tissues

2.1.1.1. Meristematic Tissues: classification, cytohistological characteristics, initials and their derivatives. Apical meristem; Delimitation, different growth zones, evolution of the concept of apical organization.

2.1.1.2. Theories of Shoot and Root Apical Organization

2.1.2. Permanent Tissues

2.1.2.1. Types of permanent tissues: Parenchyma, Collenchyma, Sclerenchyma

2.1.3. Complex Tissues

2.1.3.1. Xylem Tissue

2.1.3.2. Phloem tissue

2.1.4. Special / Secretary Tissues

2.1.4.1. Secretory tissues; Laticifers (classification, distribution, development, structural characteristics, functions) and Resin Canals.

3. The Tissue System

3.1. **Types of Tissue Systems:**

3.1.1. **The Epidermal tissue system**

3.1.1.1. Origin, structure, development, functional and evolutionary specialization

3.1.2. **Ground or fundamental tissue system**

3.1.2.1. comparison between monocotyledons and dicotyledons with respect to cortex, pericycle and medulla or pith

3.1.3. **Vascular tissue system**

3.1.3.1. Types of vascular bundles

3.1.3.2. Stele

3.1.4. **Internal structure of stems, roots and leaves**

3.1.4.1. Internal structure of dicotyledonous and monocotyledonous Stem

3.1.4.1.1. Nodal anatomy

3.1.4.2. Internal structure of dicotyledonous and monocotyledonous Root

3.1.4.3. Root-Shoot transition

3.1.4.4. Internal structure of dicotyledonous and monocotyledonous Leaves with special reference to mesophyll, venation, bundle-sheaths and bundle-sheath extensions

4. **The Secondary Growth**
   4.1. Secondary growth in dicot Stem by Vascular cambium, Fusiform and Ray initials, Annual / growth Rings, porous and non-porous wood, heart wood and sap wood, tyloses.
   4.2. Secondary growth in dicot Stem by cork cambium, Phellogen, Phellem and Phelloderm, Bark, Lenticels
   4.3. Secondary growth in dicot Root by Vascular cambium and cork cambium
5. **Anomalous Secondary Growth in Stem**
6. **Secondary Growth in Monocotyledons**
7. **Anatomy of reproductive parts; Flower, Seed, Fruit**
8. **Economic aspects of applied plant anatomy. Anatomical adaptations. Molecular markers in tree species used for wood.**

Practicals:

1. Microscopy and interpretation of various parts of light microscope
2. Study of internal organization of various tissues of monocotyledonous and dicotyledonous stem, root and leaf by cutting of T.S and L.S sections
3. Study of organization of shoot and root meristem, different primary and secondary tissues from the living and preserved material in macerates and sections, hairs, glands and other secondary structures.
4. Study of abnormal/unusual secondary growth.
5. Peel and ground sectioning and maceration of fossil material.
6. Comparative study of wood structure of Gymnosperms and Angiosperms with the help of prepared slides.

Teaching-learning Strategies

1. Lectures
2. Field tours to contaminated sites and industrial areas
3. Group Discussion
4. Laboratory work
5. Seminar/ Workshop

Learning Outcome:

1. Students are expected to get familiarized with the internal organization of plant tissues.
2. They will be able to learn about role of different cells and tissues in plant development, as well as, its importance in various plant.
3. They will be able to learn basic and applied aspects of plant anatomy.
4. The students will be able to conceptually integrate organismal structure and function
5. They will be able to have acquaintance with the current developments in the field of plant anatomy.

Assessment Strategies:

1. Lecture Based Examination (Objective and Subjective)
2. Assignments
3. Class discussion
4. Quiz
5. Tests

Recommended Readings:

1. Anon. Manual of Microscopic Analysis of Feeding Stuffs. The American Association of feed Microscopists.
2. Cutler, D.F. (1969). *Anatomy of the Monocotyledons*. IV. Juncales. Clarendon Press, Oxford.
3. Dickison, W.C. (2000). Integrative plant anatomy. Academic Press, U.K.
4. Esau, K. (1960). Anatomy of Seed Plants. John Wiley, New York.
5. Fahn, A. (1990). Plant Anatomy. Pergamon Press, Oxford.
6. Metcalf, C.R. and Chalk, L. (1950). Anatomy of the Dicotyledons. Clerondon Press. Oxford.
7. Metcalfe, C.R. (1960). *Anatomy of the Monocotyledons. Gramineae*. Clerondon Press, Oxford.
8. Richard, C., Sheila, L., Robert, W. (2018). *Plant Anatomy*: A Concept-Based Approach to the Structure of Seed Plants, Springer Publisher

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