

BOT-HC-3016
Morphology and Anatomy of Angiosperms

Total Lectures: 60 Credits: 6 (Theory - 4, Practical - 2)

5.1 THEORY

Unit 1: *Morphology* (4 Lectures)

Morphology of inflorescence, stamens and carpel, fruit; Telome theory, phyllode theory; Role

Unit 2: *Introduction and scope of plant Anatomy* (4 Lectures)

Application in systematics, forensics and pharmacognosy.

Unit 3: *Structure and Development of Plant Body* (6 Lectures)

Internal organization of plant body: The three tissue systems, types of cells and tissues. Development of plant body: Polarity, Cytodifferentiation and organogenesis during embryogenic development.

Unit 4: *Tissues* (11 Lectures)

Classification of tissues; Simple and complex tissues (no phylogeny); cytodifferentiation of tracheary elements and sieve elements; Pits and plasmodesmata; Wall ingrowths and transfer cells, adcrustation and incrustation, Ergastic substances. Hydathodes, cavities, lithocysts and laticifers.

Unit 5: *Apical meristems* (14 Lectures)

Evolution of concept of organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory, continuing meristematic residue, cytohistological zonation); Types of vascular bundles; Structure of dicot and monocot stem. Origin, development, arrangement and diversity in size and shape of leaves; Structure of dicot and monocot leaf, Kranz anatomy. 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 6: Vascular Cambium and Wood

(14 Lectures)

Structure, function and seasonal activity of cambium; Secondary growth in root and stem. Axially and radially oriented elements; 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. Development and composition of periderm, rhytidome and lenticels.

Unit 7: Adaptive and Protective Systems

(7 Lectures)

Epidermal tissue system, cuticle, epicuticular waxes, trichomes(uni-and multicellular, glandular and nonglandular, two examples of each), stomata (classification); Adcrustation and incrustation; Anatomical adaptations of xerophytes and hydrophytes.

5.2 PRACTICAL

1. Study of special types of inflorescence – Cyathium, Hypanthodium, Verticillaster, Hypanthium.
2. Study of special types of fruits- Superior fruits (*Dillenia*); Aggregate fruits (Custard apple, *Michelia*, Periwinkles, *Polyalthia*); Multiple fruits (Pine apple, Jack fruits).
3. Study of anatomical details through permanent slides/temporary stain mounts / macerations / museum specimens with the help of suitable examples.
4. Apical meristem of root, shoot and vascular cambium.
5. Epidermal system: cell types, stomata types; trichomes: non-glandular and glandular.
6. Root: monocot, dicot, secondary growth.
7. Stem: monocot, dicot - primary and secondary growth; periderm; lenticels.
8. Leaf: isobilateral, dorsiventral, C4 leaves (Kranz anatomy).
9. Adaptive Anatomy: xerophytes, hydrophytes.
10. Secretory tissues: cavities, lithocysts and laticifers.

Suggested Readings

1. Dickison, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.
2. Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA.
3. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.
4. , 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.

6

BOT-HC-3026 Economic Botany

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

6.1 THEORY

Unit 1: *Origin of Cultivated Plants* **(6 lectures)**

Centres of Origin, their importance with reference to Vavilov's work. Introductions, domestication and loss of crop genetic diversity; evolution of new crops/varieties, importance of germplasm diversity.

Unit 2: *Cereals* **(6 lectures)**

Wheat and Rice (origin, morphology, processing & uses); Brief account of millets.

Unit 3: *Legumes* **(6 lectures)**

Origin, morphology and uses of Chick pea, Pigeon pea and fodder legumes. Importance to man and ecosystem.

Unit 4: *Sources of sugars and starches* **(4 lectures)**

Morphology and processing of sugarcane, products and by-products of sugarcane industry. Potato – morphology, propagation & uses.

Unit 5: *Spices* **(6 lectures)**

Listing of important spices, their family and part used. Economic importance with special reference to fennel, saffron, clove and black pepper.

Unit 6: *Beverages* **(4 lectures)**

Tea, Coffee (morphology, processing & uses).

Unit 7: Sources of oils and fats**(10 lectures)**

General description, classification, extraction, their uses and health implications groundnut, coconut, linseed, soybean, mustard and coconut (Botanical name, family & uses). Essential Oils: General account, extraction methods, comparison with fatty oils & their uses.

Unit 8: Natural Rubber**(3 lectures)**

Para-rubber: tapping, processing and uses.

Unit 9: Drug-yielding plants**(8 lectures)**

Therapeutic and habit-forming drugs with special reference to *Cinchona*, *Digitalis*, *Papaver* and *Cannabis*; Tobacco (Morphology, processing, uses and health hazards).

Unit 10: Timber plants**(3 Lectures)**

General account with special reference to teak and pine.

Unit 11: Fibers**(4 lectures)**

Classification based on the origin of fibers; Cotton, Coir and Jute (morphology, extraction and uses).

6.2 PRACTICAL

1. **Cereals:** Study of useful parts: Rice/Bean (habit sketch, study of paddy and grain, starch grain, micro-chemical test).
2. **Legumes:** Bean, Groundnut, (habit, fruit, seed structure, micro-chemical tests).
3. **Beverages:** Tea (plant specimen, tea leaves), Coffee (plant specimen, beans).
4. **Sources of oils and fats:** Coconut and Mustard.
5. **Rubber:** Specimen, photograph/model of tapping, samples of rubber products.
6. **Test for alkaloids:** Neem, *Vinca rosea*.
7. **Fiber-yielding plants:** Cotton (specimen, whole mount of seed to show lint and fuzz; whole mount of fiber and test for cellulose), Jute (specimen, transverse section of stem, test for lignin).

Suggested Readings

1. Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
2. Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
3. Chrispeels, M.J. and Sadava, D.E. 1994 Plants, Genes and Agriculture. Jones & Bartlett Publishers.

BOT-HC-3036 Genetics

Total Lectures : 60 Credits : 6 (Theory - 4, Practical - 2)

7.1 THEORY

Unit 1: *Mendelian genetics and its extension* (16 lectures)

Mendelism: History; Principles of inheritance; Chromosome theory of inheritance; Autosomes and sex chromosomes; Probability and pedigree analysis; Incomplete dominance and codominance; Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Recessive and Dominant traits, Penetrance and Expressivity, Numericals; Polygenic inheritance.

Unit 2: *Extrachromosomal Inheritance* (7 lectures)

Chloroplast inheritance: Variegation in Four o'clock plant; Mitochondrial inheritance in yeast; Maternal effects-shell coiling in snail; Kappa particles in *Paramecium*.

Unit 3: *Linkage, crossing over and chromosome mapping* (12 lectures)

Linkage and crossing over-Cytological basis of crossing over; Recombination frequency, two factor and three factor crosses; Interference and coincidence; Numericals based on gene mapping; Sex Linkage.

Unit 4: *Variation in chromosome number and structure* (8 lectures)

Deletion, Duplication, Inversion, Translocation, Position effect, Euploidy and Aneuploidy

Unit 5: *Gene mutations* (7 lectures)

Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical (Base

Unit 6: *Fine structure of gene* (4 lectures)

analogs, deaminating, alkylating and intercalating agents); Detection of mutations: ClB method. Role of Transposons in mutation. DNA repair mechanisms. Classical vs molecular concepts of gene; Cistron, Recon, Muton, rII locus

Unit 7. Population and Evolutionary Genetics

(6 lectures)

Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection, mutation, genetic drift. Genetic variation and Speciation.

2 PRACTICAL

1. Meiosis through temporary squash preparation.
2. Mendel's laws through seed ratios.
3. Chromosome mapping using point test cross data.
4. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
5. Permanent Slides showing Translocation Ring, Photograph showing Laggards and Inversion Bridge.

Suggested Readings

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, John Wiley & sons, India. 8 edition.
2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5 edition.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjamin Cummings, U.S.A. 9 edition.
4. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10 edition.

