
Semester-III

Course Code: BC305T

Core Course V: Anatomy of Angiosperms

The objective of this course is to expose the students on the structural and anatomical organisations of plant tissues and their development

(Credits: Theory-4, Practical-2)

THEORY

Lectures: 60

Unit 1: Introduction and scope of Plant Anatomy (4 Lectures)

Importance of plant anatomy in systematics, forensics and pharmacognosy.

Unit 2: 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, Cyto-differentiation and organogenesis during embryogenic development.

Unit 2: Tissues (12 Lectures)

Classification of tissues; Simple and complex tissues (no phylogeny); cyto-differentiation 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 3: Apical meristems (15 Lectures)

Evolution of concept of organization of shoot apex (Apical cell theory, Tunica Corpus theory, continuing meristematic residue, cytohistological zonation); 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 (Histogen theory, Korper-Kappe theory); Quiescent centre; Root cap; Structure of dicot and monocot root; Endodermis.

Unit 4: Vascular Cambium and Wood (15 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 5: Adaptive and Protective Systems

(8 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 , hydrophytes and epiphytes.

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Core Course V- Practical: Anatomy of Angiosperms

1. Study of anatomical details through permanent slides/temporary stain mounts/ macerations/ museum specimens with the help of suitable examples.
2. Apical meristem of root, shoot and vascular cambium.
3. Distribution and types of parenchyma, collenchyma and sclerenchyma.
4. Xylem: Tracheary elements-tracheids, vessel elements; thickenings; perforation plates; xylem fibres.
5. Wood: ring porous; diffuse porous; tyloses; heart- and sapwood.
6. Phloem: Sieve tubes-sieve plates; companion cells; phloem fibres.
7. Epidermal system: cell types, stomata types; trichomes: non-glandular and glandular.
8. Root: monocot, dicot, secondary growth.
9. Stem: monocot, dicot - primary and secondary growth; periderm; lenticels.
10. Leaf: isobilateral, dorsiventral, C4 leaves (Kranz anatomy).
11. Adaptive Anatomy: xerophytes, hydrophytes, epiphytes.
12. 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 Benjammin/Cummings Publisher, USA.
4. 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.

Course Code: BC306T

Core Course VI: Economic Botany

The objective of this course is to expose the students on various economically important plants and plant products

(Credits: Theory-4, Practical-2)

THEORY

Lectures: 60

Unit 1: Origin of Cultivated Plants (6 lectures)

Concept of Centres of Origin, their importance with reference to Vavilov's work. Indigenous Knowledge System (IKS). Examples of major plant introductions; Crop domestication and loss of 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 wheat.

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, cinnamomum, cardamom and black pepper

Unit 6: Beverages (4 lectures)

Tea, Coffee (morphology, processing & uses)

Unit 7: Sources of oils and fats (8 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*, *Rawolfia*, *Andrographis*, *Aloe vera* and *Phyllanthus* (Morphology, processing, uses and health hazards).

Unit 10: Timber plants (3 Lectures)

General account with special reference to teak, sal, pine & sisu.

Unit 11: Fibers (3 lectures)

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

Unit 12: Aromatics and Petrocrops (4 lectures)

General account with special reference to *Aquilaria*, *Cymbopogon*, *Vetiveria*, *Pogostemon*, *Jatropha* and *Ricinus*.

Course Code: BC306P**Core Course VI - Practical: Economic Botany**

- Cereals:** Wheat (habit sketch, L. S/T.S. grain, starch grains, micro-chemical tests) Rice (habit sketch, study of paddy and grain, starch grains, micro-chemical tests).
- Legumes:** Soybean, Groundnut, (habit, fruit, seed structure, micro-chemical tests).
- Sources of sugars and starches:** Sugarcane (habit sketch; cane juice- micro-chemical tests), Potato (habit sketch, tuber morphology, T.S. tuber to show localization of starch grains, w.m. starch grains, micro-chemical tests).
- Spices:** Black pepper, Fennel and Clove (habit and sections).
- Beverages:** Tea (plant specimen, tea leaves), Coffee (plant specimen, beans).
- Sources of oils and fats:** Coconut- T.S. nut, Mustard-plant specimen, seeds; tests for fats in crushed seeds.
- Essential oil-yielding plants:** Habit sketch of *Rosa*, *Vetiveria*, *Aquilaria* and *Pogostemon* (specimens/photographs).
- Rubber:** specimen, photograph/model of tapping, samples of rubber products.
- Drug-yielding plants:** Specimens of *Digitalis*, *Papaver* and *Cannabis*.
- Tobacco:** specimen and products of Tobacco.
- Woods:** *Tectona*, *Pinus*: Specimen, Section of young stem.
- 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 on transverse section of stem and fiber).

Suggested Readings

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

Course Code: BC307T

Core Course VII: Genetics

The objective of this course is to impart knowledge of the principles of heredity and different mechanisms of inheritance

(Credits: Theory-4, Practical-2)

THEORY

Lectures: 60

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

Mendelism: History; Principles of inheritance; Chromosome theory of inheritance; Autosomes and sex chromosomes, euchromatin & heterochromatin; 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 (6 lectures)

Chloroplast mutation: Variegation in Four o'clock plant; Mitochondrial mutations in yeast; Maternal effects-shell coiling in snail; Infective heredity- 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 Linked, sex-limited and sex-influence traits

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

Deletion, Duplication, Inversion, Translocation, Position effect, Euploidy and Aneuploidy, hereditary abnormalities in human due to aneuploidy

Unit 5: Fine structure of gene (6 lectures)

Classical vs molecular concepts of gene; Cis-Trans complementation test for functional allelism; Structure of Phage T4, rII Locus.

Unit 6: Gene mutations (6 lectures)

Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents); Detection of mutations: CIB method. Role of Transposons in mutation. DNA repair mechanisms.

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.

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Core Course VII - Practical: Genetics

1. Meiosis through temporary squash preparation.
2. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
3. Chromosome mapping using point test cross data.
4. Pedigree analysis for dominant and recessive autosomal and sex linked traits.
5. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
6. Blood Typing: ABO groups & Rh factor.
7. Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes.
8. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.
9. Study of human genetic traits: Sickle cell anemia, Xeroderma Pigmentosum, Albinism, red-green Colour blindness, Widow's peak, Rolling of tongue, Hitchhiker's thumb and Attached ear lobe.

Suggested Readings

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, John Wiley & sons, India. 8th edition.
2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5th edition.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjamin Cummings, U.S.A. 9th 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. 10th edition.