VIDYASAGAR UNIVERSITY



Curriculum for 3 -Year B Sc (HONOURS) in Botany

Under Choice Based Credit System (CBCS) w.e.f 2017-2018

SEM-III HONS

CC-5: Anatomy of Angiosperms Credits 06

C5T: Anatomy of Angiosperms Credits 04

Course Contents:

Unit 1: Introduction and scope of Plant Anatomy: Applications in systematics, forensics and pharmacognosy.

Unit 2: Structure and Development of Plant Body

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, Root-stem transition, Nodal anatomy - Basic concept.

Unit 2: Tissues

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 3: Apical meristems

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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, exodermises and origin of lateral root.

Unit 4: Vascular Cambium and Wood

Structure, function and seasonal activity of cambium; Secondary growth in root and stem. Anomalous secondary growth in Bignonia, Boerhaavia, Aristolochia and Dracaena. 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

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. Mechanical tissue – distribution and significance.

C5P: Anatomy of Angiosperms Credits 02

Practical

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.

12. Secretory tissues: cavities, lithocysts and laticifers.

Suggested Readings:

- Dickison, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA. \geq
 - \triangleright Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA.
 - \triangleright Mauseth, J.D. (1988). Plant Anatomy. The Benjammin/Cummings Publisher, USA.
 - \triangleright 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.

CC-6: Economic Botany Credits 06

C6T: Economic Botany Credits 04

Course Contents:

Unit 1: Origin of Cultivated Plants

Concept of Centres of Origin, their importance with reference to Vavilov's work. Examples of major plant introductions; Crop domestication and loss of genetic diversity; evolution of new crops/varieties, importance of germplasm diversity.

Unit 2: Cereals

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

Unit 3: Legumes

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

Unit 4: Sources of sugars and starches

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

Unit 5: Spices

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

Unit 6: Beverages

Tea, Coffee (morphology, processing & uses)

Unit 7: Sources of oils and fats

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

Para-rubber: tapping, processing and uses.

Unit 9: Drug-yielding plants

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

General account with special reference to teak and pine.

Unit 11: Fibers

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

C6P: Economic Botany Credits 02

Practical

1. 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).

2. Legumes: Soybean, Groundnut, (habit, fruit, seed structure, micro-chemical tests).

3. **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).

4. Spices: Black pepper, Fennel and Clove (habit and sections).

5. Beverages: Tea (plant specimen, tea leaves), Coffee (plant specimen, beans).

6. Sources of oils and fats: Coconut- T.S. nut, Mustard-plant specimen, seeds; tests for fats in crushed seeds.

7. Essential oil-yielding plants: Habit sketch of *Rosa*, *Vetiveria*, *Santalum* and *Eucalyptus* (specimens/photographs).

8. Rubber: specimen, photograph/model of tapping, samples of rubber products.

9. Drug-yielding plants: Specimens of Digitalis, Papaver and Cannabis.

10. Tobacco: specimen and products of Tobacco.

11. Woods: Tectona, Pinus: Specimen, Section of young stem.

12. 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.

CC-7: Genetics Credits 06

C7T: Genetics Credits 04

Course Contents:

Unit 1: Mendelian genetics and its extension

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: Extra-chromosomal Inheritance

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Maternal effects-shell coiling in snail; Infective heredity- Kappa particles in *Paramecium*.

Unit 3: Linkage, crossing over and chromosome mapping

Linkage and crossing over-Cytological and molecular 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

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

Unit 5: Gene mutations

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 6: Fine structure of gene

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

Unit 6. Population and Evolutionary Genetics

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

C7P: Genetics Credits 02

Practical

- 1. Demonstration on pretreatment, fixation, staining and squash and smear preparation.
- 2. Study of Mitosis from Onion / Garlic / Lentil root.
- 3. Study of Meiosis with pollen mother cell (PMC) of Onion / Solanum / Datura by smear preparation.
- 4. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
- 5. Chromosome mapping using point test cross data.
- 6. Pedigree analysis for dominant and recessive autosomal and sex linked traits.

7. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).

8. Blood Typing: groups & Rh factor.

- 9. Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes.
- 10. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.

11. Study of human genetic traits: Sickle cell anemia, Xeroderma Pigmentosum, Albinism, redgreen Colour blindness, Widow's peak, Rolling of tongue, Hitchhiker's thumb and Attached ear lobe.

Suggested Readings:

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➢ Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, John Wiley & sons, India. 8th edition.

Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India.5th edition.

≻ Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjamin Cummings, U.S.A. 9th edition.

➢ 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.

Skill Enhancement Course (SEC)

SEC-1: Biofertilizers Credits 02 SEC1T: Biofertilizers Credits 02

Course Contents:

Unit- 1: General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis.

Unit- 2: *Azospirillum:* isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms. *Azotobacter*: classification, characteristics – crop response to *Azotobacter* inoculum, maintenance and mass multiplication.

Unit- 3: Cyanobacteria (blue green algae), Azolla and Anabaena azollae association,

nitrogen fixation, factors affecting growth, blue green algae and Azolla in rice cultivation.

Unit- 4: Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.

Unit-5: Organic farming – Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field Application.

Suggested Readings:

Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi.

Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.

John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay _Publication, New Delhi.

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Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.

Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New _Delhi.

➢ Vayas,S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic _Farming Akta Prakashan, Nadiad

OR

SEC- 1: Floriculture Credits 02 SEC1T: Floriculture

Course Contents:

Unit 1: Introduction: History of gardening; Importance and scope of floriculture and landscape gardening.

Unit 2: Nursery Management and Routine Garden Operations: Sexual and vegetative methods of propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role of plant growth regulators. **Unit 3:**Ornamental Plants: Flowering annuals; Herbaceous perennials; Divine vines; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and Selaginellas; Cultivation of plants in pots; Indoor gardening; Bonsai.

Unit 4: Principles of Garden Designs: English, Italian, French, Persian, Mughal and Japanese gardens; Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden. Some Famous gardens of India.

- Unit 5: Landscaping Places of Public Importance: Landscaping highways and Educational institutions.
- **Unit 6:** Commercial Floriculture: Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation
- of Important cut flowers (Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolous, Marigold,Rose, Lilium, Orchids).

Unit 7: Diseases and Pests of Ornamental Plants.

Suggested Readings:

Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.

GE-3: Economic Botany and Plant Biotechnology Credits 06 GE3T: Economic Botany and Plant Biotechnology Credits 04 Course Contents:

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Cultivated Plants

Concept of centres of origin, their importance with reference to Vavilov's work.

Unit 2: Cereals

Wheat - Origin, morphology, uses

Unit 3: Legumes

General account with special reference to Gram and soybean

U nit 4: Spices

General account with special reference to clove and black pepper (Botanical name, family, part used morphology and uses)

U nit 5: Beverages

Tea (morphology, processing, uses)

Unit 6: Oils and Fats

General description with special reference to groundnut

Unit 7: Fibre Yielding Plants

General description with special reference to Cotton (Botanical name, family, part used, morphology and uses)

Unit 8: Introduction to biotechnology

Unit 9: Plant tissue culture

Micropropagation ; haploid production through androgenesis and gynogenesis; brief account of embryo and endosperm culture with their applications

Unit 10: Recombinant DNA Techniques

Blotting techniques: Northern, Southern and Western Blotting, DNA Fingerprinting; Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing, PCR and Reverse Transcriptase-PCR.

Hybridoma and monoclonal antibodies, ELISA and Immuno detection. Molecular diagnosis of human disease, Human gene Therapy.

GE3P: Economic Botany and Plant Biotechnology Credits 04 Practical:

1. Study of economically important plants : Wheat, Gram, Soybean, Black pepper, Clove Tea, Cotton, Groundnut through specimens, sections and micro chemical tests

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2. Familiarization with basic equipments in tissue culture.

3. Study through photographs: Anther culture, somatic embryogenesis, endosperm and embryo culture; micropropagation.

4. Study of molecular techniques: PCR, Blotting techniques, AGE and PAGE.

Suggested Readings:

➢ Kochhar, S.L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition.

Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.

➢ Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.