16/25

M.P.C. (Auto.) College, Tankapur, Baripada
24/6/16

Semester – III

Core Course V : Anatomy of Angiosperms – 100 marks
(Credits -6 : Theory -4, Practical -2)
Theory (each class 1 hour)

Unit -I	Introduction , Types of tissue Tissues: Classification of tissues, Simple and complex tissues (no phylogeny) Pits and plasmodesmata , Ergastic, Substancs	7 Lecturers
Unit - II	Stem: Organization of shoot apex (Apical cell theory, Histogen theory, Tunica-Corpus theory) , Types of vascular bundles, structure of dicot and moncot stem .	5 Lecturers
	Leaf: Structure of dicot and monocot leaf	4 Lecturers
	Root: Organization of Root apex (Apical cell theory, Histogen theory , Korper-Kappe theory) structure of dicot and monocot root	4 Lecturers
Unit - III	Vascular Cambium : Structure function and Seasonal activity of cambium, Secondary growth in root and dicot stem (sap wood and heart wood)	5 Lecturers
	Periderm :Development and composition of periderm and lenticels	3 Lecturers
Unit - IV	Adaptive and protective system : Epidermal tissue system (cuticle, waxes, Trichomes (Uni and Multicellular, glandular and non-glandular, two examples of each), stomata (Classification, Anatomical adaptation of xerophytes and Hydrophytes	5 Lectures
Unit- V	Secretary System : Hydathodes, cavaties , Lithosysts and Laticiferas	3 Lecturers
	Mechanical tissue System	
Practical	1. Study of Anatomical details through permanent slides / temporary stain mounts / museum specimen with the help of suitable example. 2. Apical meristem of root, shoot of vascular cambium. 3. Distribution and types of parenchyma, Collenchyma and Sclerenchyma. 4. Xylem : Tracheary elements- tracheids, vessel elements, thickenings ; perforation plates, xylem fibers. 5. Wood: ring porous; diffuse porous; heart and sap wood. 6. Phloem : Sieve tubes-sieve plates; companion cells; Phloem fibers . 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 . 11. Adaptive Anatomy : xerophytes , Hydrophytes	

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Semester-III

Core Course VI: Economic Botany – 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit-I	**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.	3 lectures
Unit-II	**Cereals :** Wheat and Rice (origin, morphology, processing & uses).	3 lectures
	Legumes: General account, importance to man and ecosystem.	3 lectures
	Sugars & Starches: Morphology and processing of sugarcane, roducts and by-products of sugarcane industry. Potato – morphology, propagation & uses.	3 lectures
Unit-III	**Spices:**Listing of important spices, their family and part used, economic importance with specialreference to fennel, saffron, clove and black pepper	4 lectures
	Beverages: Tea, Coffee (morphology, processing & uses)	4 lectures
	Drug-yielding plants: Therapeutic and habit-forming drugs with special reference to *Cinchona, Digitalis, Papaver* and*Cannabis.*	4 lectures
	Tobacco: Tobacco (Morphology, processing, uses and health hazards)	2 lectures
Unit-IV	**Oils & Fats:** General description, classification, extraction, their uses and health implications groundnut, coconut, linseed and *Brassica* and Coconut (Botanical name, family & uses)	4 lectures
	Essential Oils: General account, extraction methods, comparison with fatty oils & their uses.	4 lectures
Unit-V	**Natural Rubber:** Para-rubber: tapping, processing and uses.	2 lectures
	Timber plants: General account with special reference to teak and pine.	2 Lectures
	Fibres: Classification based on the origin of fibres, Cotton and Jute (morphology, extraction and uses).	2 lectures

Practical (20 classes, each class of 2h)

Practical	1. **Cereals**: Rice (habit sketch, study of paddy and grain, starch grains, micro-chemical tests). 2. **Legumes**: Soya bean, Groundnut, (habit, fruit, seed structure, micro-chemical tests). 3. **Sugars & 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. **Oils & Fats**: Coconut- T.S. nut, Mustard–plant specimen, seeds; tests for fats in crushedseeds. 7. **Essential oil-yielding plants**: Habit sketch of*Rosa*, V*etiveria, 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. **Fibre-yielding plants**: Cotton (specimen, whole mount of seed to show lint and fuzz;whole mount of fibre and test for cellulose), Jute (specimen, transverse section of stem, test for lignin on transverse section of stem and fibre).

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Semester-IV

Core Course VII: Genetics & Plant Biotechnology – 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit-I	**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.	4 lectures
	The Structures of DNA and RNA / Genetic Material: DNA Structure: Miescher to Watson and Crick- historic perspective, DNA structure, Salient features of double helix, Types of DNA, Types of genetic material, denaturation and renaturation; Organization of DNA- Prokaryotes, Viruses, Eukaryotes.	6 lectures
Unit-II	**The replication of DNA:** Chemistry of DNA synthesis (Kornberg's discovery); General principles – bidirectional, semi-conservative and semi discontinuous replication	4 lectures
	Central dogma and genetic code: Key experiments establishing-The Central Dogma, Genetic code. Transcription in prokaryotes; Transcription in eukaryotes.	4 lectures
	Translation (Prokaryotes and eukaryotes): Ribosome structure and assembly, mRNA; aminoacyl tRNA synthetases; Various steps in protein synthesis.	4 lectures
Unit-III	**Linkage, crossing over and chromosome mapping:** Linkage and crossing over-Cytological basis of crossing over; Recombination frequency, two factor and three factor crosses; Numericals based on gene mapping; Sex Linkage.	6 lectures
Unit-IV	**Variation in chromosome number and structure:** Deletion, Duplication, Inversion, Translocation, Position effect, Euploidy and Aneuploidy	8 lectures
	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.	6 lectures
Unit-V	**Fine structure of gene:** Classical vs molecular concepts of gene; Cis-Trans complementation test for functional allelism; Structure of Phage T4, rII Locus.	6 lectures
	Plant Tissue Culture: Historical perspective; Aseptic tissueculture techniques, Composition of media; Nutrient and hormone requirements (role of vitamins and hormones).	6 lectures
	Totipotency; Organogenesis; Embryogenesis (somatic and zygotic); Protoplast isolation, culture and fusion; Tissue culture applications (micropropagation, androgenesis, virus elimination, secondary metabolite production, haploids, triploids and hybrids; Cryopreservation; Germplasm Conservation).	6 lectures

Practical (20 classes, each class of 2h)

Practical	1. Meiosis through temporary squash preparation. 2. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square analysis. 3. Chromosome mapping using test cross data. 4. Pedigree analysis for dominant and recessive autosomal and sex linked traits with floral chart.

Semester-IV

Core Course VIII: Plant Ecology and Phytogeography – 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit-I	**Introduction** Concept of ecology, Autoecology, Synecology, system ecology, Levels of organization. Inter-relationships between the living world and the environment, the components of environment.	2 lectures
Unit-II	**Soil:** Importance; Origin; Formation; Composition; Physical; Chemical and Biological components; Soil profile.	5 lectures
	Water: Importance: States of water in the environment; Atmospheric moisture; Precipitation types (rain, fog, snow, hail, dew); Hydrological Cycle.	2 lectures
	Light, temperature, wind and fire: Variations; adaptations of plants to their variation.	4 lectures
Unit-III	**Biotic interactions:**	2 lectures
	Population ecology: Characteristics and Dynamics .Ecological Speciation	4 lectures
	Plant communities: Concept of ecological amplitude; Habitat and niche; Characters: analytical and synthetic; Ecotone and edge effect; succession – types.	4 lectures
Unit-IV	**Ecosystems:** Trophic organisation; Food chains and Food webs; Ecological pyramids.	4 lectures
	Functional aspects of ecosystem: Principles and models of energy flow; Production and productivity; Biogeochemical cycles; Cycling of Carbon, Nitrogen and Phosphorus.	5 lectures
Unit-V	**Phytogeography:** Principles; Theory of tolerance; Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra).	8 lectures

Practical (20 classes, each class of 2h)

Practical	1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter. 2. Determination of pH of various soil and water samples (pH meter, universal indicator/Lovibond comparator and pH paper) 3. Analysis for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency from two soil samples by rapid field tests. 4. Determination of organic matter of different soil samples by Walkley & Black rapid titration method. 5. Comparison of bulk density, porosity and rate of infiltration of water in soils of three habitats. 6. Determination of dissolved oxygen of water samples from polluted and unpolluted sources. 7. (a). Study of morphological adaptations of hydrophytes and xerophytes (four each). (b). Study of biotic interactions of the following: Stem parasite (*Cuscuta*), Root parasite (*Orobanche*) Epiphytes, Predation (Insectivorous plants). 8. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus, by species area curve method (species to be listed). 9. Quantitative analysis of herbaceous vegetation in the college campus for frequency and

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Semester-V IV

Core Course IX: Plant Systematics – 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit-I	**Plant identification, Classification, Nomenclature; Biosystematics.**	2 lectures
	Identification: Field inventory; Functions of Herbarium; Important herbaria and botanical gardens of the world and India; Virtual herbarium.	5 lectures
Unit-II	**Taxonomic hierarchy:** Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary).	5 lectures
	Botanical nomenclature: Principles and rules (ICN); principle of priority and its limitations.	5 lectures
Unit-III	**Systematics- an interdisciplinary science:** Evidence from palynology, cytology, phytochemistry and molecular data.	6 lectures
	Systems of classification: Major contributions of Hutchinson, Takhtajan and Cronquist; Classification systems of Bentham and Hooker (upto series) and Engler and Prantl (upto series); Brief reference of Angiosperm Phylogeny Group (APG III) classification.	6 lectures
Unit-IV	**Biometrics, numerical taxonomy and cladistics:** Characters; Variations; cluster analysis; Phenograms, cladograms.	4 lectures
Unit-V	**Phylogeny of Angiosperms:** Homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly and clades).origin& evolution of angiosperms; co-evolution of angiosperms and animals.	7 lectures

Practical (20 classes, each class of 2h)

Practical	1. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): Ranunculaceae - *Ranunculus, Delphinium* Brassicaceae - *Brassica, Alyssum / Iberis* Myrtaceae - *Eucalyptus, Callistemon* Umbelliferae - *Coriandrum /Anethum / Foeniculum* Asteraceae - *Sonchus/Launaea, Vernonia/Ageratum, Eclipta/Tridax* Solanaceae - *Solanum nigrum/Withania* Lamiaceae - *Salvia/Ocimum* Euphorbiaceae - *Euphorbia hirta/E.milii, Jatropha* Liliaceae - *Asphodelus/Lilium/Allium* Poaceae - *Triticum/Hordeum/Avena* 2. Field visit (local) – Subject to grant of funds from the university. 3. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book)

Suggested Readings

1. Singh, G. (2012). *Plant Systematics:* Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi. 3rdedition.
2. Jeffrey, C. (1982). An Introduction to *Plant Taxonomy*. Cambridge University Press, Cambridge.
3. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). Plant Systematics-A Phylogenetic Approach. Sinauer Associates Inc., U.S.A. 2nd edition.
4. Maheshwari, J.K. (1963). *Flora* of Delhi. CSIR, New Delhi.
5. Radford, A.E. (1986). Fundamentals of *Plant Systematics*. Harper and Row, New York.

Semester-V

Core Course X: Reproductive Biology of Angiosperms – 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit-I	**Introduction:** History (contributions of G.B. Amici, W. Hofmeister, E. Strasburger, S.G. Nawaschin, P. Maheshwari, B.M. Johri, W.A. Jensen, J. Heslop-Harrison) and scope.	2 lectures
Unit-II	**Anther:** Anther wall: Structure and functions, microsporogenesis.	2 lectures
	Pollen biology: Microgametogenesis; Pollen wall structure, MGU (male germ unit) structure, NPC system; Palynology and scope (a brief account); Pollen wall proteins; Pollen viability, storage and germination.	5 lectures
Unit-III	**Ovule:** Structure; Types; Special structures–endothelium; Female gametophyte– megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis (details of *Polygonum* type); Organization and ultrastructure of mature embryo sac.	5 lectures
	Endosperm: Types, development, structure and functions.	3 lectures
	Embryo: Six types of embryogeny; General pattern of development of dicot and monocot embryo.	6 lectures
Unit-IV	**Pollination and fertilization:** Pollination types and significance; double fertilization.	4 lectures
	Self incompatibility: Basic concepts; Methods to overcome self-incompatibility: Intraovarian and *in vitro* pollination; Cybrids, *in vitro* fertilization.	5 lectures
Unit-V	**Seed:** Structure, importance and dispersal mechanisms	3 lectures
	Polyembryony and apomixes: Introduction; Classification; Causes and applications.	4 lectures
	Germline transformation: Pollen grain and ovules through pollen tube pathway method/ *Agrobacterium*/ biolistic.	4 lectures

Practical (20 classes, each class of 2h)

Practical	1. Anther: Wall and its ontogeny; Tapetum (amoeboid and glandular); MMC, spore tetrads, uninucleate, bicelled and dehisced anther stages through slides/micrographs, male germ unit (MGU) through photographs and schematic representation. 3. Pollen grains: Fresh and acetolyzed showing ornamentation and aperture, psuedomonads, polyads, pollinia (slides/photographs,fresh material), ultrastructure of pollen wall(micrograph); Pollen viability: Tetrazolium test.germination: Calculation of percentage germination in different media using hanging drop method. 4. Ovule: Types-anatropous, orthotropous, amphitropous/campylotropous, circinotropous, unitegmic, bitegmic; Tenuinucellate and crassinucellate; Special structures: Endothelium, obturator, hypostase, caruncle and aril (permanent slides/specimens/photographs). 5. Female gametophyte through permanent slides/ photographs: Types, ultrastructure of mature egg apparatus. 6. Embryogenesis: Study of development of dicot embryo through permanent slides; dissection of developing seeds for embryos at various developmental stages; Study of suspensor through electron micrographs.