

## SEMESTER II

### CORE- I PTERIDOPHYTA, GYMNOSPERM AND PALAEOBOTANY

#### UNIT-I

A brief account of origin of pteridophytes, classification of pteridophytes, heterospory and seed habit, evolution of stelar system, telome theory, evolution of sorus, apogamy, apospory and apomixis.

A brief account of the following classes with emphasis on the given genera:

Psilophytopsida: Rhynia, Horneophyton; Psilotopsida: Psilotum; Lycopsida: Lycopodium, Lepidodendron, Lepidocarpon, Selaginella, Isoetes'; Sphenopsida: Hyenia, Sphenophyllum, Calamites, Equisetum; Pteropsida: Eusporangiate (Ophioglossales and Marattiales) with special reference to phylogeny of Ophioglossales; Protoleptosporangiate (Osmunda, Leptopteris); Leptosporangiate: (a) Filicales (Hymenophyllum, Adiantum, Pteris, Dryopteris) (b) Marsileales (Marsilea) (c) Salviniaceae (Salvinia, Azolla)

#### UNIT-II

Introduction: History, classification, distribution and evolution of Gymnosperms with special reference to Progymnosperms and origin of seeds. Endangered gymnosperms, their conservation and present status. Economic importance of Gymnosperms.

#### UNIT-III

Brief account of the families of Pteridospermales (Lyginopteridaceae, Medullosaceae, Caytoniaceae and Glossopteridaceae) and Cycadeoideales. General account of Cordaitales. General account of Pentoxylales. Morphology, anatomy and reproduction in Cycadales, Ginkgoales and Coniferales. General account of Ephedrales, Welwitschiales and Gnetales.

#### UNIT-IV

Preservation of fossil plants. Types of fossils, modes of formation of different kinds of fossils, Gondwana flora.

#### Suggested readings:

1. Rashid, A, 2011, An Introduction to Pteridophyta, 1<sup>st</sup> edition, (Reprint), Pub. Vikas Publishing House Pvt. Ltd., Noida.
2. Gifford, Ernest, M., Foster, Adriance.S., 1989, Morphology and Evolution of vascular plant. W. H. Freeman; Third Edition.
3. Rashid, A.1999, An Introduction to Pteridophyta: Diversity,Development,Differentiation. Vikas Publishing House Pvt Ltd.
4. Parihar, Narayan Singh., 1977, The Biology and Morphology of The Pteridophyte. Central Book Depot
5. Eames, A.J. (1936) Morphology of Vascular plant-lower group. Tata Mc Graw Hill, New Delhi.

6. Chamberlain, Charles Joseph, b.1863, *Gymnosperm Structure and Evolution*. Chicago, Ill., The University of Chicago Press
7. Chhaya Biswas and B.M. Johri. *The Gymnosperm*. Springer; 1997 edition (16 April 2014)
8. Bhatnagar, S.P. Moitra, Alok. 1996. *Gymnosperms*. New Age International.
9. Pant DD. 2002, *An Introduction to Gymnosperms, Cycas, and Cycadales*, Birbal Salmi Institute of Palaeobotany.

## **CORE-II PLANT MORPHOLOGY, PLANT ANATOMY AND EMBRYOLOGY**

### **UNIT-I**

Morphology of flower, stamen and carpel. Plant adaptations and their morphological nature. Shoot Development: Organization of the shoot apical meristem (SAM); control of cell division and tissue differentiation especially xylem and phloem; secretory ducts and laticifers; wood development in relation to environmental factors and wood anatomy. Leaf growth and differentiation (structural development and classification of stomata and trichomes). Root development: Organisation of root apical meristem (RAM); vascular tissue differentiation; lateral roots; root hairs.

### **UNIT-II**

Tissue - General account; Stem anatomy - Dicot and Monocot; Root anatomy - Dicot and Monocot. Anomalous Secondary Growth - *Boerhaavia*, *Dracaena*, *Nyctanthes*, *Mirabilis*, *Salvadora*, *Laptadenia*. Periderm formation.

### **UNIT-III**

Male gametophyte: Structure of anther; microsporogenesis; pollen germination, pollen allergy; pollen embryos. Female gametophyte: Ovule development; megasporogenesis; development and organization of the embryo sac.

### **UNIT-IV**

Pollination, Pollen-pistil interaction and fertilization: Floral characteristics, pollination mechanism and vectors; commercial consideration; structure of the pistil; pollen stigma interactions, sporophytic and gametophytic self-incompatibility (cytological, biochemical and molecular aspects); double fertilization; in vitro fertilization. Seed development and fruit growth: Endosperm development during early, maturation and desiccation stages; embryogenesis, cell lineages during late embryo development; polyembryony; apomixis, embryo culture.

### **Suggested readings:**

1. Katherine Esau (1965), *Plant Anatomy*, published by John Wiley and Sons. Inc, New York.
2. Arthur J. Earnes; Laurence H. Mac Daniels (1951), *An Introduction To Plant Anatomy*, published by London; New York: Mc Graw Hill.
3. Carquist, S. (1961), *Comparative Plant Anatomy* Holt, Rinehart and Winston, published by New York Press.

4. A.Fahn (1982), Plant Anatomy Vol I and Vol II, published by Pergamon Press. Oxford New York
5. Pandey, B.P., Angiosperms-Taxonomy, Embryology and Anatomy, S. Chand and Co., New Delhi
6. Bhojwani, S.S. and Bhatnagar, S.P., Embryology of Angiosperms, Vikash Publishing House, New Delhi

## **CORE- III TAXONOMY OF ANGIOSPERM**

### **UNIT-I**

History of plant taxonomy in India, history of plant classification, needs and aim of classification, units of classification, delimitation of taxa and their practical consideration, artificial, natural and phylogenetic system of classification, A critical study of Takhtajans, modern system of classification, an introduction of angiosperm phylogeny group (APG), characteristics and phylogeny of orders. A brief account of major contribution made by the following Taxonomists: Carl Linnaeus, Joseph Dalton, Hooker, William Roxburgh, John Friminger and Duthie.

### **UNIT-II**

Needs and aim of nomenclatures, International Rules of Botanical Nomenclature, Concept of species, genus, family with special reference to the type concept. Interrelationship of plant taxonomy with morphology, anatomy, embryology, palynology, cytology, genetics, phytogeography and Chemistry, A general survey of recent advances in taxonomy: Biosystematics, biochemical and molecular systematic and numerical taxonomy.

### **UNIT-III**

Indigenous flora of the country with special reference to local flora (Uttar Pradesh), A general knowledge of Herbarium and Botanical garden of the world and India, organization of Botanical Survey of India and its role.

### **UNIT-IV**

Distinguishing features only of the following families and their economic importance: Ranunculaceae, Rutaceae, Fabaceae, Rosaceae, Cucurbitaceae, Apiaceae, Asteraceae, Apocynaceae, Asclepiadaceae, Acanthaceae, Rubiaceae, Solanaceae, Lamiaceae, Verbenaceae, Polygonaceae, Euphorbiaceae, Orchidaceae, Zingiberaceae, Cyperaceae and Poaceae.

### **Suggested readings:**

1. Sumbhamurti A. V. S. S., Taxonomy of Angiosperm, I. K. international Pvt Ltd.
2. APG III 2009. An update of the Angiosperm Phylogeny Group Classification for the Order and Families of Flowering Plants: APG III. *Bot. J Linn. Soc.* 161: 105-121.
3. Jain, S.K. and Rao, R.IL 1977. *A Handbook of Field and Herbarium Methods*. Today and Tomorrow's Printers and Publishers, New Delhi.
4. Jones, SB. 1986. *Plant Systematics*. McGraw Hill
5. N. S. Subramaniam, Taxonomy of Angiosperm, Vikas publishing house Pvt Ltd.

6. Pandey, A. K., J.V.V. Dogra. & Wen, J. 2006. *Plant Taxonomy: Advances and Relevance*. CBS Pvt. Ltd.
7. Pullaiah, T. 2007. *Taxonomy of Angiosperm*. Regency Publications, New Delhi.
8. Rao, R. It 1994. *Biodiversity in India (Plant Aspects)*, Bishan Singh Mahandrapal Singh, Dehradun.
9. S. N. Pandey and S. P. Mishra, *Taxonomy of Angiosperm*. Awe Books Pvt Ltd.
10. Sharma, O. P. 1993. *Plant Taxonomy*. Tata McGraw Hill Publishing Co. Ltd., New Delhi
11. Singh, V. and Jain, DX., *Taxonomy of Angiosperms*. Rastogi Publication, Meerut
12. Velma, B. K. 2010. *An introduction to Taxonomy of Angiosperms*. PHI Learning Pvt, Ltd. New Delhi.

### **THIRD ELECTIVE - PLANT RESOURCE UTILIZATION**

#### **Unit-I**

Food Plants: Cereal crops, sugar yielding plants, legume or pulses, vegetables, fruit, oil and fats, spices, condiments.

#### **Unit-II**

Medicinal and Aromatic Plants: Medicinal plant, aromatic plants, insecticide, herbicide and sacred plants.

#### **Unit-III**

Beverages and Masticatories: Tobacco, areca, cannabis, coca, tea, coffee

#### **UNIT IV**

Timber, fibre and petro crops: Timber, tannins and dye stuffs, rubber, gums, resin and bio-fuels.

#### **Suggested reading:**

1. S. L. Kocchar, *Economic Botany in the Tropics*. Macmillan Publisher,
2. Albert F. Hill, *Economic Botany: A Textbook of Useful Plants and Plant Products*. McGraw-Hill publications, New York

### **THIRD ELECTIVE - MEDICINAL PLANTS AND ETHNOBOTANY**

#### **UNIT-I**

Ethnobotany: Its Concept, Scope and Relevance. Indigenous systems of medicines in India. Traditional Agriculture Practices in Ancient India. Some aspects of Biodiversity and Indian Traditions.

#### **UNIT-II**

Role of Ethnobotany in primary health care programmes and development of new drugs. Ethnobotany on development and conservation of bioresources.

#### **UNIT-III**

Plant exploration, Crop and Germplasm collection of land races: Methods and strategies. Traditional knowledge of Uttar Pradesh: With special reference to food and medicine. Ethnobotany of major tribal communities (Gond, Bhil, Baiga etc ) of Uttar Pradesh.

#### **UNIT-IV**

Contributions of Ethnobotanists: J.W.Harshberger, R.E.Schultes, E.K.Janakiammal, S.K.Jain, K.S.Manilal, V.V Sivarajan & P.Pushpangadan. Role of ethnobotany in conservation and sustainable development.

**Suggested Reading:**

1. Jain, S. K. (1981). Glimpses of Indian Ethnobotany. Oxford & IBH publishing Co. Pvt. Ltd., New
2. Jain, S. K. (1989). Methods and approaches in Ethnobotany. Society of Ethnobotanists, Lucknow 13.
3. Jain, S. K. (1995). A manual of Ethnobotany. Scientific Publishers, Jodhpur.

**FOURTH ELECTIVE****PRACTICAL : Lab work based on Core/Elective      OR****PRACTICAL/INDUSTRIAL TRAINING/PROJECT PRESENTATION****(The candidate are required to choose only one elective)****SEMESTER-III****CORE-I PLANT PHYSIOLOGY****UNIT-I**

Membrane transport and translocation of water and solutes: Plant-water relations, mechanism of water transport through xylem, phloem loading and unloading, passive and active solute transport, membrane transport of proteins. Transpiration: Types and mechanism of stomatal opening and closing. Mineral Nutrition: Essential and beneficial elements, Role and deficiency effects of essential nutrient elements.

**UNIT-II**

Nitrogen fixation and metabolism: Biological nitrogen fixation, mechanism of nitrate uptake and reduction, ammonium assimilation. Glycolysis, TCA Cycle, electron transport and ATP Synthesis, pentose phosphate pathway, glyoxylate cycle, Cyanide resistant respiration, Lipid metabolism.

**UNIT-III**

Photosynthesis: General concepts and historical background, steps of photosynthesis, Emerson's effect, two pigment systems, Calvin cycle, photorespiration and its significance, C4 cycle, CAM pathway.

**UNIT-IV**

Plant growth regulators: Physiological effects and mechanism of auxins, gibberellins, cytokinins, ethylene, abscisic acid, polyamines, jasmonic acid, hormone receptors and vitamins and hormones. Photoperiodism and vernalization: Photoperiodism and its significance, floral induction and development, significance of vernalization, devernialization.