**Semester III**

**Core Course Botany-Paper III**

**Plant Anatomy and Embryology**

**(Credits; Theory-4, Practicals-2)**

**THEORY**

**Lectures : 60**

**UNIT 1: PLANT TISSUES AND ORGANS (12 Lectures)**

**1. Meristematic and permanent tissues:**Simple and Complex tissue (Types and Functions); Organization of root and shoot apical meristem- Histogen theory ; Tunica and corpus theory.

**2. Plant organs:** Structure of a typical dicot and monocot root, stem and leaf.

**UNIT II: SECONDARY GROWTH AND ADAPTATIONS (16 Lectures)**

**1.Secondary growth :** Cambium- types, structure and function ; Secondary growth in typical dicot root and stem (Helianthus, Sunflower) ; General account of wood structure (Heart wood and Sap wood) .

**2. Adaptations:** General structure and function of cuticle, epidermis and stomata; General account of adaptations in xerophytes and hydrophytes.

**UNIT III: FLOWER AND POLLINATION (16 Lectures)**

1. **Structural organization of flower:** Development and structure of anther and pollen; Structure and types of ovules; Types of embryo sacs; Structure of a typical embryo sac.

**2. Pollination and fertilization:** Types of pollination –Floral modifications favoring self and cross pollination; Double fertilization ; Seed dispersal mechanism.

**UNIT IV : EMBRYO AND ENDOSPERM (16 Lectures)**

**1. Embryo and Endosperm:** Endosperm development, structure and functions; Structure and development of dicot and monocot embryo (Capsella-bursa pestoris; maize).

**2. Apomixis and Embryogeny:** Definition, types and practical applications of apomixis and polyembryony.

**PRACTICALS**

1. Study of meristems through permanent slides/bio-visual aids.

2.Tissues(Parenchyma,Collenchymas and Sclerenchyma) through permanent slides and photographs.

3.Adaptive anatomy: Xerophytes(*Nerium* leaf); Hydrophyte(*Hydrilla* stem)

4. Structure of anther (young and mature), Tapetum -amoeboid and secretory (through permanent slides/materials/ bio-visual aids).

5. Types of Ovules; anatropous, orthotropous, circinotropous, amphitropous, campylotropous (through permanent slides/materials/ bio-visual aids).

6. Female gametophyte; Polygonum (monosporic) type of embryo sac development (through permanent slides and photographs)

7. Ultrastructure of mature egg apparatus cells through electron micrograph.

8. Pollination types and seed dispersal mechanisms( including appendages, aril, caruncle) through photograph and specimens

9. Root: Monocot: *Zea mays*; Dicot:*Helianthus* ( preparation of temporary mount and permanent slides) Secondary: Helianthus (Permanent slides only)

10. Stem: Monocot: *Zea mays*; Dicot :*Helianthus* ( preparation of temporary mount and permanent slides) Secondary Helianthus(Permanent slides only)

11.Leaf: Dicot and monocot leaf ( preparation of temporary mount and permanent slides)

12. Dissection of embryo/endosperm from developing seeds

13. Calculation of percentage of germinated pollen in a given medium

**Suggested Readings**

1. Bhojwani, S.S. & Bhatnagar , S.P. (2011). Embryology of angiosperms. Vikas Publication House Pvt.Ltd.New Delhi. 5th Edition.
2. Singh, V., Pande, P. C. and Jain, D.K. 2010. Structure, Development and Reproduction in Angiosperms. Rastogi Publications, Meerut, India.
3. Maheshwari, P. 1950. An Introduction to the Embryology of Angiosperms. McGrawHill, New York.
4. Pandey, A.K. 1997. Introduction to Embryology of Angiosperms. CBS Publishers and Distributors, New Delhi.
5. Pandey, S.N. and Chadha. 1996. Embryology. Vikas Publishing house, New Delhi.
6. Cutler, D.F., Botha, T. and Stevenson, D.W. 2008. Plant anatomy: An applied approach. Wiley-Blackwell Publishers.
7. Evert, R.F. and Esau, K. 2006. Esau’s Plant Anatomy. John Wiley and Sons.
8. Pandey, B.P. (2001). Plant Anatomy. S. Chand and Company, New Delhi.
9. Mauseth,J.D. (1988). Plant Anatomy. The Benjamin/ Cummings Publisher,USA
10. Pandey, B.P.(2010).Modern practical botany volume II.S. Chand & Company Ltd. New Delhi.
11. Bendre,A. and Kumar, A.(2012).A text book of practical botany volume II. Rastogi publications Meerut.

**Semester-IV**

Core Course Botany –Paper IVPlant Physiology and Metabolism (Credits: Theory-4, Practicals-2)

**UNIT 1: PLANT-WATER RELATIONS AND PHLOEM TRANSPORT (Lectures-16)**

1. Plant Water Relations: water potential and its components; Transpiration and its significance; Factors affecting transpiration; Ascent of Sap, Pressure flow model; Phloem loading and unloading.
2. **Mineral nutrition:** Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport.

**UNIT II: PHOTOSYNTHESIS AND RESPIRATION (Lectures-16)**

1. **Photosynthesis:** Photosynthetic Pigments (Chl-a, Chl-b, xanthophylls, carotene); light harvest complexes, Photosystem I and II, Electron transport and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbon fixation; Photorespiration.
2. **Respiration:** Glycolysis, anaerobic respiration, TCA cycle; Electron Transport system and Oxidative phosphorylation.

**UNIT III: ENZYMES AND NITROGEN METABOLISM (Lectures-14)**

1. **Enzymes:** Structure, Classification and properties; Mechanism of enzyme action and enzyme inhibition.
2. **Nitrogen metabolism:** Concept of symbiotic and asymbiotic associations, Biological nitrogen fixation; Nitrate and ammonia assimilation.

**UNIT IV: PLANT GROWTH AND RESPONSE (Lectures-14)**

1. **Plant growth regulators:** Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA and ethylene.
2. **Plant response to light and temperature:**Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis;Vernalization.

**PRACTICALS**

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. To study the effect of two environmental factors (light and wind) on transpiration by
excised twig.
3. Calculation of stomatal index and stomatal frequency of a mesophyte and a
xerophyte.
4. Demonstration of Hill reaction.
5. Demonstrate the activity of catalase and study the effect of pH and enzyme
concentration.
6. To study the effect of light intensity and bicarbonate concentration on Oxygen evolution in photosynthesis.
7. Separation of photosynthetic pigments by Paper/Thin Layer Chromatography (TLC).

**Demonstration experiments:**

1. Bolting.

2. Effect of auxins on rooting.

3. Suction due to transpiration.

**Suggested Readings**

1. Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5th
Edition.

2. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley &
Sons, U.S.A. 4th Edition.

3. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual.
Narosa Publishing House, New Delhi.

4. Mohr, H. and Schopfer, P. 1995: Plant Physiology. Springer-Verlag, Berlin
Germany.

5. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology. 4th Edition. Wadsworth Publishing Company, Inc. California, USA.

6. Sharma, O.P and Dixit Shivani. 2008. Practical Botany –III . Pragati Prakashan, Meerut, India.