

## Semester-IV

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

#### UNIT 1: PLANT-WATER RELATIONS AND 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; C<sub>3</sub>, C<sub>4</sub> 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 (SDPs, LDPs, 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. Demonstration of catalase activity and study the effect of pH and enzyme concentration.
6. Demonstrate the activity of Peroxidase and study the effect of pH and enzyme concentration.
7. To study the effect of light intensity and bicarbonate concentration on Oxygen evolution in photosynthesis.
8. Comparison of the rate of respiration in any two parts of a plant.
9. Separation of photosynthetic pigments by paper chromatography.
10. Separation of photosynthetic pigments by Thin Layer Chromatography (TLC).

### **Demonstration experiments (any four)**

1. Bolting.
2. Effect of auxins on rooting.
3. Suction due to transpiration.
4. To determine the value of R.Q. of different respiratory substrates.
5. Respiration in roots.

## **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. Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell (eds.). 1997: Plant Metabolism (2<sup>nd</sup> Edition), Longman, Essex, England.
5. Galston, A.W. 1989: Life Processes in Plants, Scientific American Library, Springer-Verlag, New York, USA.
6. Hopkins, W.G., 1995: Introduction to Plant Physiology, John Wiley & Sons, Inc., New York, USA.
7. Mohr, H. and Schopfer, P. 1995: Plant Physiology. Springer-Verlag, Berlin Germany.
8. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology. 4th Edition. Wadsworth Publishing Company, Inc. California, USA.
9. Sharma, O.P and Dixit Shivani. 2008. Practical Botany –III . Pragati Prakashan, Meerut, India.