

BACHELORS WITH BOTANY AS MAJOR

Semester 4th

BOT422J2 BOTANY _ PLANT PHYSIOLOGY

(CREDITS: THEORY: 04; PRACTICALS: 02)

Objectives: To give students understanding about the concept and mechanism of various physiological processes viz water and nutrient uptake, transport, photosynthesis, respiration and plant hormones

THEORY (4 CREDITS; 60 LECTURES)

UNIT I: PLANT-WATER RELATIONS AND TRANSPORT

Plant water relations: Water potential and its components; Water absorption by roots; Root pressure and guttation; Ascent of sap; Transpiration and its significance; Factors affecting transpiration; Pressure flow model; Phloem loading and unloading.

Mineral nutrition: Essential elements, macro- and micro-nutrients; criteria for essentiality of elements; Role of essential elements; Symptoms of mineral deficiency; Transport of ions across cell membrane; Active and passive transport.

UNIT II: PHOTOSYNTHESIS

Photosynthetic pigments (Chlorophyll- a, Chlorophyll- b, Xanthophylls, Carotenes); Absorption and action spectra of pigments; Quantum requirements in photosynthesis, red drop and Emerson enhancement effect; Photosynthetic electron transport and mechanism of ATP synthesis (Photophosphorylation); C₃, C₄ and CAM pathways of carbon fixation; Photorespiration.

UNIT III: RESPIRATION & NITROGEN METABOLISM

Respiration: Aerobic and anaerobic respiration; Glycolysis, TCA cycle; Electron transport system and oxidative phosphorylation (Chemiosmotic hypothesis);

Nitrogen Metabolism: Symbiotic and asymbiotic associations; Biological nitrogen fixation; Factors affecting biological nitrogen fixation; Nitrate and ammonium assimilation.

UNIT IV: PLANT GROWTH AND RESPONSE

Plant growth regulators: Discovery, structure and physiological roles of auxins, gibberellins, cytokinins, abscisic acid and ethylene.

Plant response to light and temperature: Photoperiodism (SDPs, LDPs, Day neutral plants); Discovery and structure of phytochromes and cryptochromes; Red and far-red responses of phytochrome; Vernalization; Seed dormancy and germination

PRACTICALS (2 CREDITS)

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. To study the effect of environmental factors (light and wind) on transpiration of excised twig.
3. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
4. To demonstrate the ascent of sap in young plant seedling using eosin solution.
5. Demonstration of Hill reaction.
6. To study the effect of light intensity and bicarbonate concentration on oxygen evolution in photosynthesis.
7. Comparison of the rate of respiration in any two parts of a plant.
8. Separation of photosynthetic pigments by paper Chromatography.
9. Separation of photosynthetic pigments by Thin layer Chromatography (TLC).
10. Demonstration of bolting experiment.
11. To determine the value of R.Q. of different respiratory substrates.
12. Demonstrate the effect of auxins on rooting of stem cuttings
13. To demonstrate aerobic respiration by conical flask method.

Suggested Readings

1. Taiz, L., Zeiger, E., Moller, I.M. and Murphy, A. 2015. **Plant Physiology and Development** (6th edition). Sinauer Associates Inc. USA.
2. Taiz, L., Moller, M., Murphy, A. and Zeiger, E. 2022. **Plant Physiology and Development** (7th Edition). Sinauer Associates, Inc. Publishers, USA.
3. Hopkins, W.G. and Huner, A. 2008. **Introduction to Plant Physiology**. John Wiley and Sons. U.S.A. 4th edition.
4. Mohr Hans, Schoper. P and Gamon A. 2019. **Plant Physiology** (5th edition). Springer
5. Salisbury, F.B. and Ross, C.W. 1992. **Plant Physiology** (4th Edition). Wadsworth Publishing Company, Inc. California, USA.
6. Srivastava, L. M. 2002. **Plant Growth and Development: Hormones and Environment** (1st edition). Academic Press, USA.
7. Bhatia, K.N. 2019. **Plant Physiology & Metabolism** for 4th Semester. Trueman's Publication. Trueman Book Company, Jalandhar.
8. Singh, K., Thakur, A.K, Bassi, S.K. and Shah, I. A. 2017. **Plant Physiology & Metabolism** for 4th Semester. Danish Publication. S. Danish & Co. Jalandhar.
9. Jain. V. K. 2011. **Plant Physiology**. New Age International Publishers
10. Sastri R. K. 2017. **Plant Physiology**. Cengage Learning, India
11. Bajracharya D. 1999. **Experiments in Plant Physiology-A Laboratory Manual**. Narosa Publishing House, New Delhi.
12. Sharma, O.P and Dixit Shivani. 2008. **Practical Botany –III**. Pragati-Prakashan, Meerut, India.