

Course Code	Course Name	Credits
26BY008	PLANT PHYSIOLOGY	04

Course Objectives

- Analyze water potential dynamics and predict plant hydration under environmental variables.
- Evaluate mineral nutrition strategies, including sustainable uptake and deficiency mitigation.
- Compare photosynthetic/respiratory efficiencies across pathways and stress conditions.
- Design growth regulator applications for stress physiology and development.

Learning Outcomes

Upon successful completion of this course, it is intended that a student will be able to:

- Compute water potential components and assess aquaporin roles in transport pathways.
- Diagnose deficiencies, model ion uptake, and integrate symbiotic N-fixation.
- Critique C3/C4/CAM mechanisms, calculating Blackman's limiting factors
- Simulate phloem flow, interpret RQ, propose hormone/ROS interventions, and develop stress mitigation strategies with hormones and allelopathy.

Unit 1 - Plant Water Relations (12 Hrs.)

Diffusion, imbibition, osmosis. Water potential (Ψ_s , Ψ_p , Ψ_m , Ψ_g). Active/passive absorption; apoplastic/symplastic/transmembrane (aquaporins) pathways. Cohesion-tension - ascent of sap. Transpiration types, stomatal regulation, factors, antitranspirants, and guttation.

Unit 2 – Mineral Nutrition (12 Hrs.)

Essential macro/micronutrients, roles, deficiency symptoms, and essentiality criteria. Passive/active uptake (ion exchange, carriers, transporters). Hydroponics applications. Symbiotic nitrogen fixation (*Rhizobium*, *Azotobacter*) for sustainable agriculture.

Unit 3 - Photosynthesis (12 Hrs.)

Pigments, light absorption, red drop, Emerson effect. PSI/PSII organization; cyclic/non-cyclic photophosphorylation. C3, C4 (Kranz anatomy), CAM pathways. Photorespiration. Factors (light, CO₂, temperature, water); Blackman's limiting factors.

Unit 4 – Solute Translocation & Respiration (12 Hrs.)

Phloem transport: pressure-flow hypothesis, loading/unloading. Respiration: aerobic/anaerobic; glycolysis, Krebs cycle, ETC. Oxidative phosphorylation, chemiosmosis, RQ significance, and factors.

Unit 5 - Growth, Development & Stress Physiology (12 Hrs.)

Plant hormones: auxins, gibberellins, cytokinins, ABA, ethylene, brassinosteroids, jasmonates, salicylic acid, strigolactones. Photoperiodism, vernalization. Abiotic stresses (drought, salinity, temperature); biotic (pathogens). ROS/antioxidant defenses, allelopathy.

Reference Books:

1. Taiz, L., Møller, I. M., Murphy, A., & Zeiger, E. (2022). *Plant Physiology and Development* (7th ed.). Oxford University Press.
2. Buchanan, B. B., Gruissem, W., & Jones, R. L. (2015). *Biochemistry and Molecular Biology of Plants* (2nd ed.). Wiley-Blackwell.
3. Jain, V. K. (2025). *Fundamentals of Plant Physiology* (21st ed.). S. Chand Publishing.
4. Hopkins, W. G., & Hüner, N. P. A. (2014). *Introduction to Plant Physiology* (4th ed.). Wiley.
5. Salisbury, F. B., & Ross, C. W. (1992). *Plant Physiology* (4th ed.).