

Course code	Course Title	C	H	I	E	T
17P4BME2	PLANT PHYSIOLOGY	6	6	25	75	100

Objectives:

1.To thoroughly understand the various principles governing the functional aspects of plants.

2. To help students to think, design and execute and experiment

Learning outcome:

Ensured that the students can achieve an upto date level of understanding and competence that will serve as a lasting and practical basis for the carrier (research, industry etc.) as well as teaching.

Unit I (15 hr)

Thermodynamic concept – free energy and driving force – Active and passive modes.

Basic processes: Diffusion – simple and facilitated. Osmosis – Active systems – pumps, ATPases. Water potential – components, cell water potentials and its value. Water uptake, root hair, passive and active modes, relative water potentials of roots and soil; rainy days vs dry season.

Unit II (20 hr)

Mineral nutrition: Essential and non-essential elements - major, minor and trace elements – deficiency symptoms. Mechanism of mineral salt absorption; active – cytochrome pump theory; passive – Donnan’s equilibrium. Mycorrhizae and their role in absorption of mineral salts. Translocation of organic solutes – Munch’s mass flow hypothesis. Mechanism of loading and unloading of phloem. Source and sink relationship and determining factors.

Unit III (25 hr)

Metabolism. Photosynthesis: Chloroplast as a photosynthetic machinery. Light reactions – Light harvesting complexes, photolysis, non-cyclic and cyclic electron transport, photophosphorylation. Hill reaction – NADP reduction. Dark reactions – Calvin cycle (C3), significance and tracing the path of C in C3. Hatch and slack (C4) pathway, Kranz anatomy,

RUBISCO. CAM pathway. Alternative to C4 pathway – NAD⁺ - ME and PCK type. Light and CO₂ compensation point.

Respiration. Site, types and phases of respiration. Glycolysis, Citric acid cycle (TCA), mitochondrial electron transport and ATP synthesis; oxidative phosphorylation (chemi-osmotic theory). Alternative oxidases, photorespiratory pathway. Energy budget of glucose metabolism.

Nitrogen metabolism. Nitrate and ammonium assimilation and amino acid biosynthesis.

Unit IV (15 hr)

Stress and reproductive biology: Response of plants to abiotic stress - heat, water, salinity and metal. Discovery and role of growth hormones – auxins, gibberellins, cytokinins, ABA and ethylene.

Unit V (15 hr)

Sensory photobiology: Structure, function and mechanism of phytochromes, cryptochromes and phototropins - tropic movement – thigmotropism; nastic – nyctinastic. Photoperiodism - circadian rhythm - biological clock – Vernalization. Senescence and seed dormancy.

References

1. Malik, C. P. 2014. Plant Physiology. Kalyani publishers.
2. Barton, W. 2007. Recent Advances in Plant Physiology. Read books publishers.
3. Verma, J. and Verma, K. 2005. A text book of Plant Physiology. Emkay publications.
4. Mukherji, S. and Ghosh, A. K. 2009. Plant Physiology. New central book agency publications.
5. Salisbury, F. B. and Ross, C.W. 2006. Plant Physiology. CBS publishers, New Delhi.
6. Taiz, L. and Zeiger, E. 2006. Plant Physiology. Sinauer Associates Inc., Publishers. Sunderland, U.S.A.
7. Bajracharya, D. 1998. Experiments in Plant Physiology. A laboratory manual. Narosa Publishing house.
8. Devlin, R. M. 1969. Plant Physiology, Holt, Rinehart & Winston & Affiliated East West Press (P) Ltd., New Delhi.
9. Noggle, R. and Fritz. J. 1989. Introductory Plant Physiology. Prentice hall of india.
10. <https://www.plantphysiol.org>;
11. <https://www.academic.oup.com>

Practicals:

1. Cell as an osmotic system.
2. Determination of water potential of plant tissue by tissue weight method.
3. Demonstration of mechanism of opening and closing of stomata.
4. Effect of different organic solvents on the permeability of plasma membrane.
5. Selective ion uptake by roots.
6. Selective ion uptake by plants.
7. Plant nutrition and mineral deficiencies.

8. Estimation of total chlorophyll and carotenoids.
9. Estimation of anthocyanins.
10. Separation of chloroplast pigments by paper chromatography.
11. Demonstration of starch formation during photosynthesis.
12. Evidence for the presence of chlorophyll in non-green leaves.
13. Light microscopic method to see fluorescence emission from chlorophyll a.
14. Experiment on C₃ and C₄ plants by leaf anatomy.
15. Experiment on C₃ and C₄ plants by Starch test.