



Institute of Botany
Faculty of Life Sciences
University of the Punjab, Lahore
Course Outline
Semester – V



Programme	BS Botany	Course Code	Bot-305	Credit Hours	2
------------------	-----------	--------------------	---------	---------------------	---

Course Title	Advanced Plant Physiology (Theory)				
---------------------	---	--	--	--	--

Introduction

Advanced Plant Physiology explores the intricate mechanisms of plant growth regulators, water relations, solute transport, phytochromes, and flowering control. It examines the roles of natural hormones, the movement and properties of water in plants, membrane transport processes, the function of light-sensitive proteins, and the genetic and environmental regulation of flowering. This course provides a comprehensive understanding of plant life's complex physiological processes.

Learning Outcomes

On the completion of the course, the students will be able to:

- Understand the physiological processes, photosynthesis and respiration for plant growth and development.
- Describe how plants respond to environmental stresses.
- Explain the role of hormones in plant growth regulation and their commercial importance.
- Use experimental techniques to study plant physiological processes

Course Contents

- **Plant Growth Regulators:**
 - Major natural hormones (Auxins, Gibberellins, Cytokinins, Abscisic acid, Ethylene), Structure, biosynthesis, receptors, signal transduction, mode of action, transport, and physiological effects.
- **Solute Transport:**
 - The channels and electrogenic pumps, nature of membrane carriers, Passive and active (primary and secondary) transport and their energetics, Membrane transport proteins, Ion traffic into the root.
- **Phytochromes:**
 - Discovery of phytochromes, Physical and chemical properties of phytochromes, Role of phytochromes in biological processes, Phytochromes signaling pathways.
- **Control of Flowering:**
 - Floral meristem and floral organ development, floral organ identity genes and the ABC model, Circadian rhythms, Photoperiodism, Vernalization
- **Environmental stresses/abiotic stresses:**
 - Defining plant stress, acclimation and adaptation, acclimation allow plants to respond to environmental fluctuation, environmental factors and their biological impacts on plants (water scarcity, salinity stress, light stress, temperature stress, and heavy metals stress generate ROS), signaling pathways activated in response to abiotic stress, developmental and physiological mechanisms in response to abiotic stresses.

Programme	BS Botany	Course Code	Bot-306	Credit Hours	1
------------------	-----------	--------------------	---------	---------------------	---

Course Title	Advanced Plant Biochemistry (Lab)				
---------------------	--	--	--	--	--

Lab Course Contents

Upon completion of practical content, the students will be able to:

- Measure and analyze the osmotic potential of plant tissues using freezing point depression and osmometry.
- Use dye methods and water potential apparatus to measure and interpret water potential in plant tissues.

- Quantify stomatal density and conductance to understand their roles in gas exchange and plant responses to environmental conditions.
- Measure potassium uptake by excised roots and comprehend its significance in plant nutrition.
- Examine the preferential absorption of ions by corn seedlings and potato slices to understand ion selectivity and nutrient management.

Textbooks and Reading Material

1. Taiz, L., Zeiger, E. Møller I.M. and Murphy, A. (2015). *Plant Physiology and Development*, 6th Edition. Sinauer Associates Inc., Sunderland MA. ISBN: 0-87893-831-1,700pp.
2. Jones, R. L., Ougham, H. H. Thomas, S. and Waaland. (2012). *The Molecular Life of Plants*. Wiley Blackwell. ISBN: 978-0-470-87011-2012, 766pp.
3. Buchanan, B. B., Gruissem, W., Jones, R. L. (2015). *Biochemistry and Molecular Biology of Plants*. Wiley-Blackwell. 2nd Edition, ISBN: 978-0-470- 71421-8, 1280pp.
4. Grotewold, E., Chappell, J. and Kellogg, E. A. (2015). *Plant Genes, Genomes, and Genetics*. Wiley-Blackwell ISBN: 978-1-119-99888.
5. **Suggested Readings**
6. Plant Physiology and Development (<http://6e.plantphys.net/>).
7. The Arabidopsis Book (<https://aspb.org/publications/other-aspb-publications/the-arabidopsis-book/>).
8. Plant Physiology (<http://www.plantphysiol.org/>).
9. Annual Review of Plant Biology (<http://www.annualreviews.org/journal/arplant>).
10. The Plant Cell (<http://www.plantcell.org/site/teachingtools/>).
11. Teaching tools in Plant Biology (<http://www.plantcell.org/content/teaching-tools-plant-biology>).
12. Basic Biology Concepts Khan Academy (<http://le4learning.com.pk/category/basic-sciences/biology>).
13. Current Protocols in Plant Biology (<http://www.currentprotocols.com/WileyCDA/Section/id-810246.html>).

Teaching Learning Strategies

- Lectures
- Group Discussion
- Laboratory work
- Seminar/ Workshop

Assignments: Types and Number with Calendar

- Lecture Based Examination (Objective and Subjective)
- Assignments
- Class discussion
- Quiz
- Tests
