Lahore University of Management Sciences

Plant Physiology (BIO 5112)
Spring 2022

Instructors	**Khurram Bashir**
Room No.	9-431
Office Hours	Wednesday 15:00-16:30
Email	khurram.bashir@lums.edu.pk
Telephone	Extension: 8362
Secretary/TA	TBA
TA Office Hours	NA
Course URL (if any)	

Course Basics				
Credit Hours	**Three (3)**			
Lecture(s)	Nbr of Lec(s) Per Week	Two (2)	Duration	75 minutes
Recitation/Lab (per week)	Nbr of Lec(s) Per Week	One (0)	Duration	50 minutes
Tutorial (per week)	Nbr of Lec(s) Per Week	none	Duration	

Course Distribution	
Core	No
Elective	Yes
Open for Student Category	Biology Majors/Anyone interested
Close for Student Category	Others

COURSE DESCRIPTION
Plants are essential to humans and animals not only for food but also by maintaining our ecosystem. Understanding the plant physiology is a is an essential component for crop improvement and understanding of eco system. This course would enable students to understand how plants function and what are essential components to maintain/boost crop production.

COURSE PREREQUISITE(S)	
	Students enrolled in this course are expected to have taken at least introductory level courses in biology/ molecular biology, cell biology or biochemistry

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COURSE OBJECTIVES	
	The course aims to help student learn the following: ▪ The general principles of plant growth and how they interact with environment ▪ Requirements of plants to complete their life cycle ▪ How plants acquire Carbon and other minerals ▪ What factors cause stress to plants and how plants respond to these stresses ▪ How plants maintain their metabolism ▪ How to improve plant growth/crop production and their nutritional value

Learning Outcomes	
	After taking this course students should: ▪ Be able to appreciate and understand how plants growth and maintain their metabolism ▪ Have a good understanding of key signaling pathways ▪ The contribution of plants to provide health food ▪ How to improve plant growth

Grading Breakup and Policy
Midterm Examination: 25% Quiz: 15% Assignment(s): 20% Final Examination: 35% Attendance: 5%

Examination Detail	
Midterm Exam	Yes/No: Yes Combine/Separate: Combined Duration: 75 Minutes Preferred Date: 8th week Exam Specifications: Multiple choice, short questions
Final Exam	Yes/No: Yes Combine/Separate: Combined Duration: 3 hours Exam Specifications: Short answer questions

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COURSE OVERVIEW			
Weeks	**Topics**	**Recommended Readings**	***Tutorial paper***
Week 1	▪ **Introduction to the course** ▪ **Plant and Cell Architecture**	**Book A:2-31**	
Week 2	▪ **Essential factors for growth and development** ▪ **Mineral nutrition** ▪ **Macro and Micro Nutrients**	**BOOK A 67-86** **Book B: 3-5; 6-78**	
Week 3	▪ **Water potential** ▪ **Plant transpiration** ▪ **Stomatal closure/opening**	**Book A: 85-102**	Root architecture and hydraulics converge for acclimation to changing water availability. *Nature Plants* **volume 6**, pages744–749(2020)https://doi.org/10.1038/s41477-020-0684-5
Week 4	▪ **Photosynthesis** ▪ **Photosystems I and II**	**Book A: 111-194**	Red drop and role of auxiliary pigments in photosynthesis. R. Emerson and E. Rabinowitch Plant Physiol. 35: 477-485. doi:10.1104/pp.35.4.477. **1960**
Week 5	▪ **Photosynthesis** ▪ The Carbon reaction ▪ Its Implications	**Book A:199-226**	
Week-6	▪ **Glycolysis** ▪ **Citric Acid Cycle** ▪ **Gluconeogenesis** ▪ **Carbon metabolism** ▪	**Book A: 309-312** **Book A: 315-329**	Arabidopsis uses two gluconeogenic gateways for organic acids to fuel seedling establishment. Eastmond et al., Nature Communications 2015. 6, 6659. https://doi.org/10.1038/ncomms7659. 2015
Week 7	▪ **Mitochondrial Electron Transport** ▪ **Mitochondrial interactions with cytoplasm**	**Book A: 315-338**	Signals from chloroplasts and mitochondria for iron homeostasis regulation. Vigani et al. Trends in Plant Science 18 (6), 305-311. **2013**.
Week 8	▪ **Source sink transport** ▪ **Root to shoot communication** ▪	**Book A: 272-298** **Book B: 85-133**	A small peptide modulates stomatal control via abscisic acid in long-distance signaling Takahashi et al., Nature 556, 235–238 **2018**.
Week 9	▪ **Plant Growth Regulators** ▪ **Photoperiod and its implications** ▪ **Plant Response to Environmental Stress** ▪ **Water deficiency**	**Book A: 546-578; 584-614; 730-736; 757-759;765-770**	Recent advances in the characterization of plant transcriptomes in response to drought, salinity, heat, and cold stress. Bashir et al., F1000Research 8. **2019.**
Week 10	▪ **Plant Response to Environmental Stress** ▪ **Mineral Deficiency** ▪ **Micronutrient deficiency/toxicity**	**Book A 108-118** **Book B: 191-248** **Book B: 409-472**	The transport of essential micronutrients in rice. Bashir et al., Molecular Breeding 39 (12), 168. **2019**

Week 11	▪ **Plant Response to Environmental Stress** ▪ **High temperature stress** ▪ **Vernalization and Low temp stress** ▪ **Common components of Stress response**	Book A: 749-749; 756-778 **Customized materials would also be provided.**	Redox Homeostasis and Signaling in a Higher-CO_2 World. Foyer CH and Noctor G. Annual review plant Biology. 71:157-182. DOI:10.1146/annurev-arplant-050718-095955. **2020.**
Week 12	▪ **Methods of plant improvement** ▪ **Plant transformation** ▪ **Molecular tools used for plant improvement**	**Book C: Chapter 7**	Acetate-mediated novel survival strategy against drought in plants. Kim et al., Nature Plants. 3: 17097. https://doi.org/10.1038/nplants.2017.97. **2017**
Week 13	▪ **Future prospects** ▪ **Problems and challenges for Plant production** ▪ **New technologies for Plant improvement** ▪ **Medicines for plants**	**Customized teaching materials would be provided.**	
Week 14	▪ Student presentations	TBA	

Textbook(s)/Supplementary Readings

(A) Plant Physiology. Lincoln Taiz and Eduardo Zeiger ISBN: 9780878935659
(B) Marschner's Mineral Nutrition of Higher Plants. Third edition. 2012. ISBN:978-0-12-384905-2
(C): Gene Cloning and DNA Analysis: An Introduction. TA Brown. 7th Edition.