DEPARTMENT OF AGRONOMY
Faculty of Agricultural Sciences
University of the Punjab, Lahore

Course Outline

Programme	B.Sc. (Hons.) Agriculture (Agronomy)	**Course Code**	AGR-305	**Credit Hours**	3 (2-1)
Course Title	**FIELD CROP PHYSIOLOGY**				

Course Introduction

To study mechanisms, processes and functions involved in plants under field conditions.

Learning Outcomes

On successful completion of this course, students will have;

5. Get introduced to the discipline of crop physiology
6. Basic concept of photosynthetic and respiratory mechanisms
7. To evolve brief concept of stress physiology
8. To develop presentational skills through class participation and improve learning abilities of students with home assignments.

	Course Content	**Assignments/Readings**
Week 1	**Unit-I** 1.1 Concept and Importance of Crop Physiology 1.1.1 Introduction of crop physiology	• Chapter 1 • Introduction: The Organization of Plants and Plant Cells. Introduction to Plant Physiology. 2nd Edition. John Wiley & Sons, Inc. • Internet Source
	Unit-I 1.1.2 History & Significance and importance 1.1.3.Role of crop physiology in agriculture	
	Practical Equipment used in Crop Physiology • pH meter • Incubator • EC meter • Growth Chamber • IR gas analyzer • PCR • Chlorophyll meter	
Week 2	**Unit-II** 1.2 Carbon Metabolism; factors affecting photosynthesis and respiration	• Chapter 10 Photosynthesis: Carbon Metabolism:

	1.2.1 Activation and Regulation of the PCR Cycle	Introduction to Plant Physiology. 2nd Edition. John Wiley & Sons, Inc. • Internet Source
	Unit-II 1.2.2 Photorespiration and the Photosynthetic Carbon Oxidation Cycle	
	Practical Visit to research center/Labs and agricultural field for instruments observation and working	
Week 3	**Unit-III** 1.3 Carbon Metabolism; factors affecting photosynthesis and respiration 1.3.1 Discovery and General Principles of the C4 Syndrome	• Chapter 10 • Photosynthesis: Carbon Metabolism: Introduction to Plant Physiology. 2nd Edition. John Wiley & Sons, Inc. • Internet Source
	Unit-III 1.3.2 Kranz Anatomy 1.3.3.Ecological Significance of the C4 Syndrome	
	Practical • Preparation of solutions of various strength • Determination of adequate content of solution • Balancing of solvent and solute during preparation of solution	
Week 4	**Unit-IV** 1.4 Energy Conservation in Photosynthesis • 1.4.1 Photosynthetic Electron Transport	• Chapter 9 Bioenergetics and the Light- Dependent Reactions of Photosynthesis Introduction to Plant Physiology. 2nd Edition. John Wiley & Sons, Inc. • Internet Source
	Unit-IV 1.4.2 Photosystems and Reaction Centers 1.4.3.Photosystem II and the Oxidation of Water	
	Practical Demonstration of various type of seed germination	
Week 5	**Unit-V** 1.5 Photosynthetic efficiency of different crop plants 1.5.1 The Role of Carotenoids in Photosynthesi	• Chapter 9 Bioenergetics and the Light- Dependent Reactions of Photosynthesis Introduction to Plant
	Unit-V	

	1.5.2 Light-Harvesting Complexes and Dynamic Regulation of Photosynthesis 1.5.3. Photophosphorylation	Physiology. 2nd Edition. John Wiley & Sons, Inc. • Internet Source
	Practical Respiratory loses of food reserves during seed germination	
Week 6	**Unit-VI** 1.6 Physiology of germination, dormancy, seedling establishment 1.6.1 Introduction, Seed Morphology, Seed Germination	Chapter: 4 Germination and Emergence. Handbook of Plant and Crop Physiology, 2nd Ed. Taylor and Francis, Boca Raton, USA. Internet Source
	Unit-VI 1.6.2 Physiological And Environmental Factors Adaptive Factors	
	Practical Imbibition of water by seeds; process, mechanism, factor affecting retardation of process	
Week 7	**Unit-VII** 1.7 Physiology of germination, dormancy, seedling establishment 1.7.1 Types of dormancy, Seed treatments, Seed dormancy	Chapter: 4 Germination and Emergence. Chapter: 8 Dormancy: Manifestations and Cause Handbook of Plant and Crop Physiology, 2nd Ed. Taylor and Francis, Boca Raton, USA. Internet Source
	Unit-VII 1.7.2 Bud dormancy 1.7.3.Methods for breaking or prolonging dormancy	
	Practical Imbibition of water by seeds; process, mechanism, factor affecting retardation of process	
Week 8	**Unit-VIII** 1.8 Tillering root, stem, leaf, flower and seed development 1.8.1 Introduction, Prerequisites for fruit formation, Vegetative Propagation	Chapter 6: Eco physiological Aspects of the Vegetative Propagation Chapter 7: Fruit Development, Maturation, and Ripening. Handbook of Plant and Crop Physiology, 2nd Ed. Taylor and Francis, Boca Raton, USA. Internet Source
	Unit-VIII 1.8.2 Field Transfer and Establishment of Rooted Cutting	

	Practical Determination of water content of plant and seed	
Week 9	**MID TERM EXAM**	
Week 10	**Unit-XIV** 1.9 Maturity, senescence and abscission 1.9.1 Introduction, Patterns of senescence in the life cycle of plant	Chapter: 9 Senescence in Plants and Crops. Chapter: 10 Abscission Handbook of Plant and Crop Physiology, 2nd Ed. Taylor and Francis, Boca Raton, USA
	Unit-XIV 1.9.2 General Features Of Abscission Regulation Of Abscission	
	Practical • Preparation of solutions of various strength • Determination of adequate content of solution	
Week 11	**Unit-X** 1.10 Source-sink relationship in crop plants 1.10.1 Increased source strength: elevated co2 and the "temporal shift" model	Chapter: 5 Influence of Source Strength on Leaf Developmental Programming. Handbook of Plant and Crop Physiology, 2nd Ed. Taylor and Francis, Boca Raton, USA Internet Source
	Unit-X 1.10.2 Leaf Development In The Rubisco Antisense Mutant	
	Practical Impact of various stress on seed germination and seedling growth	
Week 12	**Unit-XI** 1.11 Stress Physiology 1.11.1 What is Stress? 1.11.2 Plant Responses to Stress 1.11.3 Water Stress	Chapter 22 • The Physiology of Plants Under Stress. Introduction to Plant Physiology. 2nd Edition. John Wiley & Sons, Inc. Internet Source
	Unit-XI 1.11.4 Temperature Stress 1.11.5.Salt Stress	
	Practical Determination of amylase activity during respiration	
Week 13	**Unit-XII**	

	1.12 Biological nitrogen fixation 1.12.1 The Nitrogen Cycle 1.12.2.Biological Nitrogen Fixation 1.12.3.Symbiotic Nitrogen Fixation in Legumes	Chapter 6 • Plants and Nitrogen. Introduction to Plant Physiology. 2nd Edition. John Wiley & Sons, Inc. Internet Source
	Unit-XII 1.12.4 The Biochemistry of Nitrogen Fixation 1.12.5.The Genetics of Nitrogen Fixation	
	Practical Influence of growth regulators on plants	
Week 14	**Unit-XIII** 1.13 Plant growth regulators, their synthesis, translocation and mode of action 1.13.1 Introduction 1.13.2 Growth, Differentiation, and Development 1.13.3 Control of Growth and Development	Chapter 15 • Patterns in Plant Development. Introduction to Plant Physiology. 2nd Edition. John Wiley & Sons, Inc. Internet Source
	Unit-XIII 1.13.4 Genetic Control of Development 1.13.5Hormonal/Environmental Regulation of Development	
	Practical Study the effect of growth regulators on plants	
Week 15	**Unit-XIV** 1.14 Seed Development 1.14.1 A Survey of Plant Development 1.14.2 Seed Structure and Development	Chapter 15 • Patterns in Plant Development. Introduction to Plant Physiology. 2nd Edition. John Wiley & Sons, Inc. Internet Source
	Unit-XIV 1.14.3. Shoot/Root/Flower/Fruit Development 1.14.4.How Do Cells Grow? 1.14.5.Kinetic Analysis of Growth	
	Practical Identification of crop growth stages	
Week 16	**Unit-XV** 1.15 Physiological determinants of crop yield 1.15.1 Key Determinants of Crop Growth and Yield 1.15.2 Crop–climate interactions 1.15.3 Water availability	Internet Source: **Article:** Determinants of Crop Growth and Yield in a Changing Climate By P.K. Aggarwal

	Unit-XV 1.15.4 Soil suitability 1.15.5 Crop–pest interactions 1.15.6 Socio-economic constraints.	
	Practical Identification of crop growth stages,Zadhok Scale	
Week 17	**Unit-XVI** 1.16 Course review 1.16.1 Review of whole course through class discussion	
	Unit-XVI 1.16.2 Review of whole course through class discussion	
	Practical Revision of Lab work	
Week 18	**FINAL EXAM**	

Textbooks and Reading Material

1. Textbooks.
   In the detail course outline, one may mention chapters of the textbook with the content topics
2. Suggested Readings
   2.1. Books

   2.1.1. Lambers, H., F.S. Chapin, and T.L. Pons. 2009. Plant Physiological Ecology. Springer-Verlag New York Inc.
   2.1.2. Pessarakli, M. 2014. Handbook of Plant and Crop Physiology, 3rd Ed. Taylor and Francis, Boca Raton, USA.
   2.1.3. Ross, C.W and F. B. Salisburry. 2011. Plant Physiology 5th Ed., Wadsworth *Publ.* Co., Belmont, California, USA.
   2.1.4. Taize, L. and E., Zeiger. 2010. Plant Physiology 5th Ed. Sinauers Associate, Inc. Sunderland, Massachusetts, USA.
   2.1.5 Hopkins.W 1999. Introduction to Plant Physiology, 2nd Edition. John & Wiley Sons, Inc. USA.

   2.2. Journal Articles/ Reports

Note:

1. It is preferable to use latest available editions of books. Mention the publisher & year of publication.
2. The References/ bibliography may be in accordance with the typing manual of the concerned faculty/subject. Preferably follow APA 7th Edition publication manual.

Teaching Learning Strategies
1. Lectures 2. Reports 3. Class discussion
Assignments: Types and Number with Calendar
1. Determination of heat units of different crops 2. Impact of Climate Change On Crop physiology 3. Global warming; effect on crop yield 4. Determination of growth yield parameter 5. Impact of Climate Warming and management on Rice Phenology 6. Agriculture contribution in Green House emission in Pakistan
Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.