

**University of Jordan Dept. Horticulture & Crop Science**

**Faculty of Agriculture Academic year: \_\_\_\_\_\_\_**

**STRESS PHYSIOLOGY (601946)**

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| **Instructor** Name | **Section** | **Class time** | **Room** | **Office** | |
| **No.** | **Hours** |
| Dr. Jamal Ayad | 1 |  |  |  |  |

**Course Description:**

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| This course covers concepts related to stress physiology and plant response to environmental stresses: temperature (freezing, chilling, high temperature, water (drought, flooding), salinity, radiation and other stresses. Most recent literature on plant responses to stresses will be also discussed. |

**Learning Objectives**

1. Learning basic physiological mechanisms regulating plant responses to abiotic and biotic stresses.
2. Studying stress physiology from different perspectives (physiological, genetic, cell biological, biochemical).
3. Comprehensive view of how plants interact with their environment and learning how to place fundamental mechanisms operating at the cellular or sub-cellular level in a whole plant context.
4. Develop student ability to present and critically evaluate primary scientific literature in stress physiology.

**Learning outcomes**

**A. Knowledge and understanding; students are expected to**

1. Describe the effects of biotic and abiotic stress factors on plants growth and development.
2. Discuss plant adaptations to stress factors.
3. Differentiate between short and long term plant adaptations.
4. Outline and explain the importance of chemical defense systems in plants.
5. Identify characteristics of plants adapted to different environmental conditions.

**B. Intellectual Analytical and Cognitive Skills: Student is expected to**

1. Develop higher order and critical thinking skills through the understanding of the role of biotic and abiotic factors in controlling plant growth and development.
2. Demonstrate comprehension of basic concepts and the ability to use scientific terminology accurately through effective oral and written communication.
3. Develop methodologies for identifying physiological limitations to crop growth and development.

**C. Subject Specific Skills; Students is expected to**

1. Demonstrate ability to participate in class discussions of current affairs information and/or journal article findings.
2. Demonstrate the ability to develop scientific ideas for application in the area of abiotic and biotic stress tolerance in plants.

**D. Transferable skills; Students are expected to**

1. Communicate in both oral and written forms about key scientific concepts related to major abiotic and biotic stresses that plant encounter during various growth stages.
2. Apply the scientific methods to construct understanding of various crop strategies that plant adapt to tolerate various stress factors and develop critical thinking skills

**Attendance Policy**

Class attendance and participation of students is required. Students who miss more than 4 class meetings will be dropped from the course unless by an excuse.

**Teaching methods:**

The course includes readings, discussions, class activities, written assignments, and two midterm exams beside the final. Various reading material will be available via the course website ([**http://elearning.ju.edu.jo**](http://elearning.ju.edu.jo)**)**. *Username and password: student ID# and or email/No.*

Students should read the materials before we cover them in class. As class discussions are the core components of the course, it is essential that students come well prepared to actively engage. Learning is an interactive process that involves not only providing knowledge but more importantly allowing students to integrate and synthesize the knowledge into their own understanding of a particular subject.

**Review Journal Article and Oral Class Presentation**

Students will be assigned an articles that should utilize modern techniques to answer a basic scientific question about physiology of plant growth and development and are required to present it to their peers and lead the discussion. You will need to do some background reading on the subject of your article in order to produce a satisfactory paper. Critique the methods used in the journal article and analyze their results and conclusions.

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| ILOs: Learning and Evaluation Methods | | |
| **ILO/s** | **Learning Methods** | **Evaluation Methods** |
| **A**. Knowledge and Understanding (**A1-A5**) | Lectures,, Discussion, Assignment readings | Exams, quizzes |
| **B**. Intellectual Analytical and Cognitive Skills (**B1-B3**) | Lectures, Discussion, Assignment readings | Exams, quizzes |
| **C**. Subject Specific Skills (**C1-C2**) | Paper presentations & discussions | Presentations, class discussions and participation |
| **D**. Transferable Key Skills (**D1-D2**) | Term paper and research problems discussions | Writing and presentations of term papers. |

**Class Schedule (subject to revision)**

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| **Week** | **Lecture Topic** | **Source/ Reading** | **ILOs** |
| 1 | Introduction: Review of topics to be covered | Instructor presentation |  |
| 1, 2 | Stress physiology, review of concepts used to understand both biotic and abiotic stresses and how plant copes with it. | Taiz and Zeiger  Chr 26 | A1 |
| 2,3 | Transport and translocation of water and solutes in plant - Review | Taiz and Zeiger  Ch.3, 4, 5, 6 | A1-A5 |
| 3,4 | Biochemistry and metabolism in plants- Review | Taiz and Zeiger  Ch. 7, 8, 9 | A1-A5 |
| 4,5 | Plant growth and development-Review | Taiz and Zeiger  Ch. 14, 16 | A1-A5 |
| 6 | Radiation stress and adaptation strategies in plants | Taiz and Zeiger, Ch. 26  Hopkins 2008, Ch 13, 14, 15 | A1-A5,  B1-B3  C1-C2 |
| 7 | Impact of high temperature stress on plants and their adaptations | Taiz and Zeiger, Ch 26  Hopkins 2008, Ch 13, 14, 15 | A1-A5,  B1-B3  C1-C2 |
| 8 | Impact of low temperature stress on plants and their adaptations | Taiz and Zeiger, Ch 26  Hopkins 2008, Ch 13, 14, 15 | A1-A5,  B1-B3  C1-C2 |
| 8 | Mid Term Exam |  |  |
| 9 | Impact of water stress (drought) on plants | Taiz and Zeiger chapter 26 | B1-B3  C1-C2  D1-D2 |
| 10 | Impact of salinity stress on plants | Taiz and Zeiger chapter 26 | B1-B3  C1-C2  D1-D2 |
| 11 | Imbalances in Soil Minerals | Taiz and Zeiger chapter 26 | B1-B3  C1-C2  D1-D2 |
| 11 | Oxygen stress and adaptation strategies | Journal articles | B1-B3  C1-C2  D1-D2 |
| 12 | Biotic stresses: insect pests and disease represent potential bioitic stresses | Hopkins 2008, Ch 13, 14, 15 | B1-B3  C1-C2  D1-D2 |
| 13 | Developmental and physiological mechanisms that protect plants against environmental Extremes | Taiz and Zeiger, Ch. 26  Hopkins 2008, Ch 13, 14, 15 | B1-B3  C1-C2  D1-D2 |
| 13 | Strategies for breeding for stress factors in plants | Journal articles | B1-B3  C1-C2  D1-D2 |
| 14-15 | Research proposal / term paper presentations | Journal articles | C1-C2  D1-D2 |
| 16 | Final Exam |  |  |

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| **Grade Weight Distribution** | |
| **30%** | One Midterm Exam |
| **40%** | Final Exam (Comprehensive) |
| **15%** | Research Proposal/term paper (Must be non-thesis related) |
| **15%** | Oral presentation, class participation, quizes |

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| **Readings** | |
| 1 | Taiz L & Zeiger E .2010. [Plant Physiology](http://www.plantphys.net/). 5th Edition. Sinauer. (<http://www.plantphys.net/>) |
| 2 | William G. Hopkins, Norman P. A. Hüner. 2008. Introduction to Plant Physiology, Wiley; 4th Edition |
| 3 | Larcher, W. 2003. Physiological plant ecology. 4th Edition, Berlin: Springer. |
|  | Kanayama, Yoshinori. 2016. Abiotic Stress Biology In Horticultural Plants. S.L.: Springer Verlag, Japan, |
|  | * Ahmad P, Prasad MNV (2012a) Abiotic stress responses in plants: metabolism, productivity and sustainability. Springer, New York * Ahmad P, Prasad MNV (2012b) Environmental adaptations and stress tolerance in plants in the era of climate change. Springer Science + Business Media, New York |
|  | Buchanan, Gruissem and Jones. 2015. Biochemistry and Molecular Biology of Plants. Buchanan, , 2nd Edition, Wiley. |
| 4 | Journal articles |