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

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

**Seed Physiology and Biochemistry** (0601947)

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| **Credit hours** | 3 | **Level** | Ph.D. | **Pre-requisite** |  |
| **Lecturer** | Dr. Monther Sadder | **Office #** | 212 | **Office phone** |  |
| **Course website** |  | **E-mail** | sadderm@ju.edu.jo | **Place** |  |

|  |
| --- |
| **Office hours** |
| **Day/Time** | **Sunday** | **Monday** | **Tuesday** | **Wednesday** | **Thursday** |
|  |  |  |  |  |  |

**Course Description:**

This course covers the definition of seed germination, seed dormancy theories, plant bioregulators, environmental factors affecting seed, abiotic stresses on seed, molecular mechanisms and metabolism of seed germination. In addition, the course will highlight new developments in seed physiology and biochemistry.

**Learning Objectives:**

The course is designed to expose students to the following fields:

1. Introduction to seed structure and development.
2. Seed germination and environmental conditions.
3. Seed germination and related measurements.

**Intended Learning Outcomes:**

1. **knowledge and understanding:**

A1. Seed Structure: testa, perisperm, endosperm, embryo.

A2. Developmental patterns, filling of the grain, source of assimilates.

A3. Seed imbibition, germination, and growth.

A3. Respiration-pathways and products, requirement for oxygen by seeds.

A4. Mobilization of stored carbohydrate reserves in cereals, embryo reserves, endosperm reserves, endospermic legumes and stored lipid metabolism.

A5. Gibberellin and the barley aleurone layer, ga-induced enzymes in cereals, membranes, polysomes, and α-amylase, events during the lag period

A6. Life-span of seeds buried in soil, viability of seeds in storage, recalcitrant seeds, orthodox seeds.

1. **Intellectual analytical and cognitive skills:**

B1. Different seed structures related to function.

B2. Critical environmental factors in seed filling.

B3. Requirements for successful seed germination.

B4. Interaction between plant growth regulators and enzymes in seed.

1. **Subject-specific skills:** Student is expected to

C1. Show high concentration and hand work dedicated to the scope of seed testing techniques.

C2. Understand food reserves, location of reserves, proteins, proteins bodies, lectines, phytin, carbohydrates, starch, oils and oil bodies.

C3. Understand development of the endosperm and aleurone layer, synthesis of starch, protein and RNA synthesis, establishment of cotyledon reserve in dicots.

C4. Be aware of kinetics of water uptake by seeds, soaking injury and solute leakage, radical expansion-cell elongation or cell division?.

1. **Transferable key skills:** Student is expected to know

D1. Lab practical work, precession and time management

D2. Drawing and illustrations of solid data into elastic easy to follow scheme

D3. Data analysis and interpretation

D4. Reporting data in a proper way and understanding scientific articles

**ILOs Learning and Evaluation Methods**

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| --- | --- | --- |
| **ILO/s** | **Learning Methods** | **Evaluation Methods** |
| A1-A6 | Lectures and Discussions | Quiz, Exam |
| B1-B4 | Lectures and DiscussionsPresentation | Quiz, Exam, Assignment |
| C1-C4 | Lectures and Discussions | Quiz, Exam, Assignment |
| D1-D4 | Lectures and Discussions | Quiz, Exam, Assignment |

**Course Contents**

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| --- | --- | --- | --- |
| **Content** | **Reference** | **Weeks** | **ILOs** |
| Viability and Longevity | Lectures, Article | 1 | A6, B1, B2, C1, C2, D1, D4 |
| Dormancy | Lectures, Article | 1 | A6, B1, B2, B4, C1, D1, D4 |
| The Release from Dormancy | Lectures, Article | 1 | A6, B2, C1, C2, C3, D2 |
| The Control of Dormancy | Lectures, Article | 1 | A6, B4, C1, D4 |
| Environmental Control of Germination | Lectures, Article | 2 | A3, A5, B3, C1, D2, D4 |
| The Structure of Seeds and their Food Reserves | Lectures, Article | 2 | A1, A2, B1, C1, C2, C3, D3, D4 |
| Seed Maturation | Lectures, Article | 1 | A1, B1, B4, C1, D4 |
| Imbibition, Germination, and Growth | Lectures, Article | 2 | A3, A5, B2, B4, C1, C4, D3, D4 |
| Biochemistry of Germination and Growth | Lectures, Article | 2 | A3, A4, A5, B3, C1, C2, D3, D4 |
| Mobilization of Reserves | Lectures, Article | 1 | A4, B2, B4, C1, C3, D4 |
| Control Processes in the Mobilization of Stored Reserves | Lectures, Article | 2 | A2, A4, A5, B3, C1, C4, D4 |

**Learning Methodology**

## This course will be structured in

## Lectures and discussions,

## Presentations of recent articles

## Lab project

# Evaluation

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| --- | --- | --- |
| **Evaluation** | **Point %** | **Date** |
| **Midterm Exam**  | 30 | After 10 weeks |
| **Discussion & Quizes** | 15 | After 4, 6 and 12 weeks |
| **Presentation** | 15 | As indicated in table above |
| **Final Exam**  | 40 | Determined by Registration Dept. |

**References**

1. Sakdeo, B. (2015) Studies On Physiology & Biochemistry Of Seed Germination & Growth, LAP LAMBERT Academic Publishing, 176 pp
2. Bewley, J.D., Bradford, K.J., Hilhorst, H.W.M. and Nonogaki, H. (2013) Seeds: Physiology of Development, Germination and Dormancy, 3rd Edition, Springer, Germany. 392 pp.
3. Bewley, J.D. and Black, M (1978) Physiology and Biochemistry of Seeds in Relation to Germination: Vol 1 Development, Germination, and Growth, Springer, Germany. 306 pp.
4. Bewley, J.D. and Black, M (1982) Physiology and Biochemistry of Seeds in Relation to Germination: Vol 2 Viability, Dormancy, and Environmental Control, Springer, Germany. 375 pp.
5. Mayer, A.M. and Poljakoff-Mayber, A. (1982) The Germination of Seeds, 3rd Edition, Pergamon, 232 pp.
6. Other seed information resources:
* https://www.seedtest.org/en/home.html
* http://theseedsite.co.uk/
* http://www.kew.org/science-conservation/millennium-seed-bank
* http://www.seedbiology.de/index.html
* https://www.grainscanada.gc.ca/guides-guides/identification/seeds-graines/sows-pogmb-3-eng.htm
* http://www.fabinet.up.ac.za/index.php/international-seed-testing-ass