**The University of Jordan Department: Plant Protection**

**Faculty: Agriculture Year: Semester:**

**Herbicides (606452)**

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| Credit hours | 3 (2 LECTURES & 1 LAB) | Level | BSc. | Pre-requisite | Weed Science |
| Coordinator/ Lecturer | J. R. Qasem | Office number | 266 | Office phone | 22515 |
| Course website |  | E-mail | jrqasem@ju.edu.jo | Place | Faculty of Agriculture |

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| --- | --- | --- | --- | --- | --- |
| Office hours | | | | | |
| Day/Time | Sunday | Monday | Tuesday | Wednesday | Thursday |
|  | 10-12 | 10-12 | 9-11 | 10-12 | 11-1 |

**Course Description**

This course deals with herbicides, definition, relevant terminology, registration, storage, formulations, mixtures, herbicides classification, methods of application and consideration, chemical drift and managements, selectivity, mode and mechanism of action, persistence in the environment, fate of herbicides molecules and degradation, herbicides in the plants, herbicides in the soil, herbicides chemical groups, detailed chemical weed control in major crop groups including “cereals, vegetables and fruit trees”, chemical control of noxious weeds .

**Learning Objectives**

Students learn on herbicides, groups, application and uses in different crops. Factors affect herbicides effectiveness and success in weed control. Herbicides and environment and weed control using herbicides in different crops and useful recommendations. Students will be finally well trained in the course of herbicides on how to apply herbicides safely and how to evaluate their effects on weeds and crop plants and yield.

**Intended Learning Outcomes (ILOs):**

At the end of this course, students are expected to:

* Have an idea on the importance of herbicides in weed control.
* Be able to identify & categorize herbicides according to different classification methods, which enable students to know better these chemicals and the role they have on the environment and food production.
* Know the role of different ecological factors on the effectiveness of these herbicides and their fate in the environment.
* Able to control different weed species in different plants.
* Have an idea on the fate of herbicides in plants and soils. Familiarized with the available herbicides in Jordan's markets and in neighboring countries and their uses in weed control.

A**. Knowledge and Understanding: Student is expected to**

* Know most common used herbicides available in local markets in Jordan and their problems in agriculture and environment.
* Get familiar with herbicides, their uses for weed control in different crops and other uncultivated places. Student are familiarized with all types of sprayers, parts, uses, and their calibration. .
* Information on herbicides and their application in the field as well as other methods of weed control in different crops are also practiced.

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

* Keep up to date with any progress in chemical weed control research and recent developments in herbicide development and methods of herbicides application.
* Consult recent published papers or references on the subject
* Interact with the lecturer and discuss any important related issues students think that introduce new knowledge or satisfy student quires on the topic.
* Become familiar with all herbicides, equipments and tools available in local markets and to farmers which used in weed control.
* Practice chemical weed control in the field.

C. **Subject- Specific Skills: Students is expected to**

* Know how to obtain information on available herbicides and prepare a report on these chemicals including all required information.
* Analyze and explain herbicides labels and information included in technical pamphlets.
* Learn methods of herbicides application and needs for effective control.
* Know on loss of herbicides molecules after application or persistence in the environment and management
* Get familiar with most recent developments in herbicides industry by collecting literature from different sources during the course and have their own readings..
* Know how to direct farmers in the field to achieve successful chemical weed control operation and safe application of the herbicides to farmers, and environment.
* Know weed species distributions and their possible herbicides useful for their control.
* Design chemical weed control programs

**D. Transferable Key Skills: Student is expected to know:**

How to collect information and samples of herbicides, know all necessary information on their uses in different crops for different types of weeds, methods of application and requirements. Train farmers on herbicides application in their field and on uses of sprayers and tools.

**Course Contents**

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| --- | --- | --- | --- |
| **Content** | **Reference** | **Week** | **ILO/s** |
| Introduction to course contents and requirements  Herbicide definition, importance and 14, characteristics | 14, 15, 16 | 1 | A, B, C, D. |
| Advantages and disadvantages of chemical weed control | 14 | 2 | A, B, C, D. |
| Herbicides mixtures and examples | 14 | 2 | A, B, C, D. |
| Herbicides formulations and surfactants | 6, 14 | 3 | A, B, C, D. |
| Herbicides classification | 14, 16, 17 | 4 | A, B, C, D. |
| Herbicides selectivity | 1, 11, 14, 16, | 5 | A, B, C, D. |
| Herbicides applications and requirements | 12, 14 | 5 | A, B, C, D. |
| Herbicides in the plants | 2, 4, 10, 11, 13, 14, 15 | 6 | A, B, C, D. |
| Herbicides in the soil | 4, 8, 14, 15 | 7 | A, B, C, D. |
| Herbicides chemical groups | 14, 15, 16 | 8, 9, 10, 11 | A, B, C, D. |
| Midterm Exam | | | |
| Chemical weed control in cereal crops | 9, 14, 16, 17 | 12 | A, B, C, D. |
| Chemical weed control in vegetable crops | 14 | 13, 14 | A, B, C, D. |
| Chemical weed control in fruit trees | 9, 14, 16, 17 | 15 | A, B, C, D. |
| Chemical control of noxious weeds | 14 | 16 | A, B, C, D. |

**Learning Methodology**

Learning through lectures, field work, practical part of this course and laboratory work, Herbicides samples collection, slides on chemical; weed control, herbicide application and weed control in different cases, literature review, all herbicides labels, technical bulletins and other information on each herbicide are displayed in the laboratory.

**Projects and Assignments**

Each student is required to collect information and technical Bulletins on herbicides available in local markets. Complete information is required on each herbicide. Most recent information on uses of these herbicides should be obtained and student gets familiar with. Students are required to submit lab reports on each exercise practiced during the laboratory session.

**Evaluation**

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| Exam | Grade% | Date |
| Mid. Term Exam | 30 | 8-9th week |
| Quizzes | 5 | Weakly expected |
| Lab. Reports | 5 | 0ne week ahead of final exam |
| Herbicides gathered information and data | 10 | Two weeks before final exam |
| Final Lab. Exam | 15 | As scheduled by the university |
| Final Exam | 35 | As scheduled by the university |

**Main Reference/s:**

Weed Science Society of America.(1994) *Herbicide Handbook*,7th Edition. K.S. Lawrence.

**References:**

1. Caseley, J.C., Cussans, G.W. and Atkin, R.K.(eds.). (1991). *Herbicide Resistance in Weeds and Crops*. Butterworth-Heinemann, Oxford, England.
2. Cobb, A. (1992). *Herbicides and Plant Physiology*. Chapman and Hall. London.
3. Duke, S.O. (1996). *Herbicide-Resistant Crops. Agricultural*, *Environmental, Economic, Regulatory, and Technical Aspects*. CRC Press, Boca Raton, Florida.
4. Fedtke, C. (1982). *Biochemistry and Physiology of Herbicide Action*. Springer – Verlag, Berlin Heidelberg New York.
5. Fletcher, W.W. and Kirkwood R.C. (1982). *Herbicides and Plant Growth Regulators.* Granada, London, PP. 93-99.
6. Foy, C.L. and Pritchard, D.W. (eds.). (1996). *Pesticide Formulation and Adjuvant Technology*. CRC Press, Boca Raton, Florida.
7. Gorover, R. and Cessna, A.J. (eds.). (1991). *Environmental Chemistry of Herbicides*, Vol. II. CRC Press, Boca Raton, Florida.
8. Hance, R.J. (1980). *Interaction between Herbicides and the Soil*. Academic Press. London
9. Hatfield, J.L., Buhler, D.D. and Stewart, B.A. (eds.). (1998). *Integrated Weed and Soil Management.* Sleeping Bear Press. USA.
10. Hatzios, K.K. and Penner, D. (1982). *Metabolism of Herbicides in Higher Plants*. Burgess Publishing, Minneapolis.
11. LeBaron, H.M. and Gressel, J. (eds.). (1982). *Herbicide Resistance in Plants*. John Wiley & Sons. New York, USA.
12. McWhorter, C.G., and Gebhardt, M.R. (eds.). (1987). Methods of Applying Herbicides. No. 4, *Monograph Series of the Weed Science Society of America*, Lawrence, Kansas.
13. Powles, S.B. and Holtum, J.A.M. (eds.). (1994). *Herbicide Resistance in Plants. Biology and Biochemistry*. Lewis Publishers, Boca Raton, Florida.
14. Qasem, J.R. (2003). *Weeds & their Control*. Deanship of Academic Research, University of Jordan, Amman, Jordan. 628 PP. (Reference in Arabic).
15. Schnoor, J.L. (1992). *Fate of Pesticides and Chemicals in the Environment*. John Wiley-Interscience, New York.
16. Weed Science Society of America. (1979). *Herbicide Handbook*. 4th Edition. Champaign, IL.
17. Weed Science Society of America.(1994) *Herbicide Handbook*,7th Edition. K.S. Lawrence.

**Intended Grading Scale (Optional)**

0-49 F

50-52 D-

53-55 D

56-58 D+

59-61 C-

62-64 C

65-67 C+

68-70 B-

71-73 B

74-76 B+

77-79 A-

80-100 A

**LABORATORY OUTLINE**

1. Introduction to the lab and requirements
2. Herbicides samples, formulations, lables and technical bulletins, surfactants
3. Sprayers and spreaders, types and their parts
4. Sprayers calibration
5. Application of general and selective herbicides in cropped and non-cropped area
6. Application of contact and translocated herbicides of different types
7. Pre-transplanting soil applied herbicides
8. Post emergence applied herbicides
9. Control of noxious perennial weeds
10. General weed control in non-cropped area
11. Spot application of herbicides in cropped area
12. Weed control in fruit trees with different herbicides
13. Evaluation of herbicides treatments
14. Evaluation of herbicides treatments

Notes:

* Concerns or complaints should be expressed in the first instance to the module lecturer; if no resolution is forthcoming, then the issue should be brought to the attention of the module coordinator (for multiple sections) who will take the concerns to the module representative meeting. Thereafter, problems are dealt with by the Department Chair and if still unresolved the Dean and then ultimately the Vice President. For final complaints, there will be a committee to review grading the final exam.
* For more details on University regulations please visit:

[**http://www.ju.edu.jo/rules/index.htm**](http://www.ju.edu.jo/rules/index.htm)