**The University of Jordan**

**Faculty of Agriculture Dept. Horticulture & Crop Science**

**Agricultural biotechnology program 2015-2016/ Fall semester**

**Breeding Field Crops (**0601735**)**

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| **Credit hours** | **3** | **Level** | **2nd year** | **Pre-requisite** | **Non** |
| **Coordinator/ Lecturer** | **Prof. Muhanad Akash** | **Office number** | **290** | **Office phone** | **22340** |
| **Course website** | **http://elearning.ju.edu.jo/** | **E-mail** | **makash@ju.edu.jo** | **Place** |  |

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

This course is designed to discuss plant breeding foundations, like genetic variation, breeding hybrid varieties and genotype X environment interaction. Emphasis on recent research work in plant breeding.

**Learning Objectives**

The course is designed to expose graduate students to the following fields in molecular plant breeding:

1. Overview of crop breeding
2. Explore molecular techniques as tools for conventional crop breeding
3. Explore case studies on practical applications and impacts of crop breeding tools in crop improvement programs
4. Learn how to use breeding techniques data analysis software

**Intended Learning Outcomes (ILOs):**

Successful completion of the course should lead to the following outcomes:

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

**A1-**Know various breeding techniques in field crops

**A2-**Understand practical applications and impacts of breeding tools in crop improvement programs

**A3**-Use of specialized data analysis software packages

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

**B1**-Practice to read and use literature with critical understanding of crop breeding related papers

**B2**- Go through step by step understanding and applying breeding techniques and applications

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

**C1**- Utilize data analysis software packages

**C2**- Utilize practical breeding technique ideas

**D. Transferable Key Skills:** Students is expected to

**D1**-Draw and illustrate solid data into elastic easy to follow scheme

**D2**-Use scientific software

**D3**-Use internet for data mining

**D4**-Practice data analysis and interpretation

# ILOs: Learning and Evaluation Methods

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| --- | --- | --- |
| **ILO/s** | **Learning Methods** | **Evaluation Methods** |
| A. Knowledge and Understanding (A1-A3) | Lectures and Discussions | Exam, assignments |
| B. Intellectual Analytical and Cognitive Skills (B1-B2) | Lectures, Homework and Assignments | Exam, assignments |
| C. Subject Specific Skills (C1-C2) | Lectures, Homework | Exam , assignments |
| D.Transferable Key Skills (D1-D4) | Lectures, Assignments | Projects, presentation |

**Course Contents**

|  |  |  |  |
| --- | --- | --- | --- |
| **Content** | **Reference** | **Week** | **ILO/s** |
| Feeding 10 billion people in the 21st century | Evans, L T. 1998. Feeding the 10 Billion;  From the book on Heterosis: Borlaug, N. E. 1999. pp. 509. How to feed the 21st century?; Reeves, T. et al. 1999. Pp. 1. Food security and the role of agricultural research, 1999 | 1 | A2 |
| Selection Response Evaluation and Heritability | Nyquist, W. E.1991 | 2,3 | A1, A2 |
| Understanding and Exploiting Heterosis | From the book on Heterosis:  Pinagli, P. L. 1999. Pp. 493. Role of heterosis in meeting world cereal demand in the 2111 century; Stuber, C. W. 1999. Pp.173. Biochemistry, molecular biology, and physiology of heterosis; Lee, M. 1999. Pp. 185. Towards understanding and manipulating heterosis in crop plants: Can molecular genetics help? | 4,5 | A2, C2 |
| Quantitative Genetics of Heterosis and Theories | Chapters 4 thru 8 (pp. 31-93) in The Genetics and Exploitation of Heterosis)  1999) | 6.7 | B1, B2, C2 |
| Selection and Heterosis | From the Book on Heterosis:  Coors, J. G. pp. 225. Selection methodologies and heterosis; Souza, C. L., Jr. pp. 247. Recurrent selection and heterosis | 8 | A2, C1 |
| Epistasis and Heterosis |  | 9 | A2, B2, C2 |
| Molecular Markers and Heterosis | Kearsey and Pooni, 1996. Chapter 8 | 10,11 | A2, B2, C2 |
| Pollen Biotechnology |  | 12,13 | A2, B2, C2 |
| Bioinformatics and plant breeding |  | 14 | C1, A3 |
| Paper presentations | Selected pepers | 15,16 | B1, B2, D1-D4 |

**Learning Methodology**

1. **Lectures**: 2 per week (including one 2-hour exam)
2. **Duration:** 16 weeks, 48 hours in total
3. **Assignments:** to be notified

# Evaluation

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| --- | --- | --- |
| **Evaluation** | **Point %** | **Date** |
| **Midterm Exam** | 30 |  |
| **Project** | 10 |  |
| **Assignments** | 10 |  |
| **Homework** | 10 |  |
| **Final Exam** | 40 |  |

# References:

* Evans, L. T. 1998. Feeding the Ten Billion. Cambridge University Press (ISBN: 0-521-64685-5).
* Coors, J. G., and S. Pandey (Ed.). 1999. Genetics and Exploitation of Heterosis in Crops. ASA, CSSA, SSSA, Madison, WI (ISBN: 0-89118-549-6).
* Kang, M. S. (Ed.). 1997. Crop Improvement for the 21st Century. Research Signpost (ISBN: 81-86481-20-6).
* Henry, R J. 1997. Practical Applications of Plant Molecular Biology. Chapman & Hall (ISBN: 0-412-73220-3).
* Shivanna, K. R., and V. K. Sawhney. (Ed.). 1997. Pollen Biotechnology for Crop Production and Improvement. Cambridge University Press (ISBN: 0-521-47180 X).
* Kearsey, M. J, and H. S. Pooni. 1996. The Genetical Analysis of Quantitative Traits. Chapman & Hall (ISBN: 0-412-60980-0).
* Lynch, M, and B. Walsh. 1998, Genetics and Analysis of Quantitative Traits. Sinauer Associates (ISBN: 0-87893-481-2).
* Liu, B.-H. 1998. Statistical Genomics. CRC Press. (ISBN: 0-84933-166-8).
* Misener, S., and S. A. Krawetz. (Ed.). 2000. Bioinformatics: Methods and Protocols. Humana Press (ISBN: 0-89603-732-0)
* Nyquist, W. E. 1991. Estimation of heritability and prediction of selection response in plant populations. Crit. Rev. Plant Sci 10(3):235-322.

**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>