**The University of Jordan**

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

**Program: Ph.D. in Hort. & Crop Science Academic year: \_\_\_\_\_\_\_**

**Quantitative Genetics in Plant Breeding** (**0601933**)

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| --- | --- | --- | --- | --- | --- |
| **Credit hours** | **3** | **Level** | **1st year** | **Pre-requisite** | **0631240** |
| **Lecturer** | **Dr. 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** |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

**Course Description**

This course covers quantitative genetics and statistical methodology in relation to plant breeding. Genetic models and field evaluation design, estimation of genetic parameters, the selection theory methods and their relationship with quantitative genetics and genotype environment interactions

**Learning Objectives**

The course objective is to introduce models and tools to students and apply them in a variety of contexts to enable students to approach and resolve quantitative problems in their own genetical research.

**Intended Learning Outcomes (ILOs):**

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

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

**A1-** Examine a brief introduction and review for basic principles of quantitative traits.

**A2-** Understand genotypic and environmental values, their effects and interactions.

**A3**- Understand homeostasis, stability analyses, variances and covariances

**A4**- Understand combining ability analyses, genetic advance from selection, index selection

**A5**- Discuss molecular markers in plant breeding, and quantitative trait loci (QTL) mapping

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

**B1**- Achieve maximum benefits from quantitative experiments

**B2**- Use the scientific method to define and solve problems independently and collaboratively

**B3**- Accurately interpret scientific information

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

**C1**- Understand wide range of quantitative topics

**C2**- Introduce students to areas and concepts involved in quantitative genetics in plant breeding

**C3**- Seek out and interpret research literature related to quantitative genetics in plant breeding

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

**D1**- Ability to emphasis on laboratory-oriented sciences research problems

**D2**- Using scientific software

**D3**- Presentation and discussion

# ILOs: Learning and Evaluation Methods

|  |  |  |
| --- | --- | --- |
| **ILO/s** | **Learning Methods** | **Evaluation Methods** |
| A. Knowledge and Understanding (A1-A5) | Lectures and Discussions | Exam, assignments |
| B. Intellectual Analytical and Cognitive Skills (B1-B3) | Lectures, Homework and Assignments | Exam, assignments |
| C. Subject Specific Skills (C1-C3) | Lectures, Homework | Exam , assignments |
| D.Transferable Key Skills (D1-D3) | Lectures, Assignments | Projects, presentation |

**Course Contents**

|  |  |  |  |
| --- | --- | --- | --- |
| **Content** | **Reference**  | **Week** | **ILO/s** |
| 1. Introduction
 | Kang (1994) & Falconer and Mackay (1996) | 1 | A1 |
| 1. Inbreeding, Coancestry, Half sibs, Full sibs (variances)
 | Kang (1994) & Falconer and Mackay (1996) | 2 | A1 |
| 1. Epistatic variances, Combining ability
 | Kang (1994) & Falconer and Mackay (1996)  | 3 | A3, A4,C2 |
| 1. Diallel method I, II, III and IV
 | Kang (1994)  | 4,5 | A2,C2 |
| 1. Generation Mean Analysis
 | Kang (1994)  | 6 | A2,C2 |
| 1. North Carolina Designs I, II, and III
 | Kang (1994)  | 7 | A2,C2 |
| 1. Additive Genetic Correlations
 | Kang (1994)  | 8 | A2 |
| 1. Heritability and Genetic Advance
 | Kang (1994)  | 9 | A2,C2 |
| 1. Selection indices construction & evaluation
 | Kang (1994)  | 10 | A4 |
| 1. Molecular Markers in Plant Breeding
 | Kang (1994)  | 11 | A5 |
| 1. Quantitative Trait Loci (QTL) Mapping
 | Kang (1994)  | 12 | A5 |
| 1. Computer Software Applications
 | Selected articles | 13 | D2 |
| 1. Student presentations
 | Selected articles | 14-16 | B1-B3,C2,C3,D1-D3 |

**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 |  |

**Main Reference/s:**

* Kang M. S. Applied Quantitative Genetics. 1994.
* Falconer, D.S., and T.F.C. Mackay. 1996. Introduction to Quantitative Genetics. 4th ed. Prentice Hall, Harlow, U.K.
* Selected papers

# References:

* Lynch, M., and B. Walsh. 1998. Genetics and analysis of quantitative traits. Sinauer Associates, Sunderland, MA.
* Walsh, B., and M. Lynch. Evolution and Selection of Quantitative Traits.
* Hallauer, A.R., and .T. B. Miranda. 1988. Quantitative Genetics in Maize Breeding. Iowa State University Press.
* Kang, M. S., and H. G. Gauch, .Ir. 1996. Genotype-by-Environment Interaction. CRC Press, Boca Raton, FL.
* Kang, M. S. 2002. Quantitative genetics, genomics and plant breeding. CABI, NY
* Dudley, J. W. 1997. Quantitative genetics and plant breeding. Advances in Agronomy 59: 1-23.
* Kang, M. S. 1998. Using genotype-by-environment interaction for crop cultivar development. Advances in Agronomy 62: 199-252.
* Nyquist, W. E. 1991. Estimation of heritability and prediction of selection response in plant populations. Crit. Rev. Plant Sci. 10 :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>