**The University of Jordan**

**Faculty of Agriculture Department of Land, Water and Environment**

**Program: 2013-2014/First semester**

**Principles of Irrigation (604103)**

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| **Credit hours** | 3 | **Level** | First or second year | **Pre-requisite** |  |
| **Coordinator/ Lecturer** | Dr. Michel Rahbeh | **Office number** | 119 | **Office phone** | 22465 |
| **Course website** | http://www2.ju.edu.jo/sites/academic/m.rahbeh/default.aspx | **E-mail** | m.rahbeh@ju.edu.jo | **Place** | 106 |
| **Time** | 12:30 – 2:00 pm Mon, Wed |  |  |  |  |

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| --- |
| **Office hours** |
| **Day/Time** | **Sunday** | **Monday** | **Tuesday** | **Wednesday** | **Thursday** |
| **Day** | - | \* | - | \* | - |
| **Time** | - | 10 a.m -12 p.m | - | 10 a.m -12 p.m | - |

**Course Description**

This course introduces the fundamental knowledge required to carry out basic irrigation activities, such as determining the irrigation depth and interval, and determining the soil water content for undisturbed soil samples. Also it prepares the students for advanced courses in irrigation management and design. At the beginning of the course the students will get acquainted with water resources in Jordan, as well as the purpose and objective of irrigation. The attention will then be shifted to the conversion of measurement units, calculation of soil water content, and crop water requirement. The lectures after the midterm will be allocated to discuss irrigation efficiencies and irrigation systems.

**Learning Objectives**

1. The course aims at giving the students an overview of the irrigation systems, and their advantages and disadvantages.
2. At the end of course the students will be able to carry out basic soil water calculations and determine the crop water requirements.

**Intended Learning Outcomes (ILOs):**

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

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

**A1.** Understand the purposes, objectives and benefits of irrigation practice

**A2.** Understand the prioritization policies of water resources and allocation of irrigation water in terms of quality and quantity

**A3.** Describe basic soil properties such as porosity, soil bulk density, soil particle density and soil texture

**A4.** Define the soil field capacity and permanent wilting point

**A5.** Describe the direct and indirect methods of evapotranspiration measurements

**A6.** Describe the direct and indirect methods of soil water measurements

**A7.** Describe the advantages and disadvantages of the surface, sprinkler and drip irrigation.

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

**B1.** Explain the basic design concepts for furrow, border and basin irrigation

**B2.** Use guideline tables to select the appropriate furrow length, border and basin size.

**B3.** Explain the appropriate operation of drip and sprinkler irrigation system

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

**C1**. Convert between the different units of measurements

**C2.** Determine soil texture from soil textural triangle

**C3.** Determine the volumetric and gravimetric soil water content

**C4.** Determine the readily available water

**C5.** Calculate the daily and monthly evapotranspiration

**C6.** Estimate the crop water requirements

**C7.** Determine the different irrigation efficiencies

**C8.** Determine the leaching fraction

**C9.** Determine the net irrigation requirements

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

**D1.** Select the appropriate irrigation system based on given circumstances

**D2.** Determine when and how much to irrigate

# ILOs: Learning and Evaluation Methods

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| **ILO/s** | **Learning Methods** | **Evaluation Methods** |
| **A**. Knowledge and Understanding (**A1-A7**) | Lectures, discussions and homeworks | Quizzes and Exams |
| **B**. Intellectual Analytical and Cognitive Skills (**B1-B3**) | Lectures, discussion and homeworks | Quizzes and Exams |
| **C**. Subject Specific Skills (**C1-C9**) | Lectures, discussion and home works | Quizzes and Exams |
| **D**.Transferable Key Skills (**D1-D2**) | Lectures, discussion and homeworks | Quizzes and Exams |

**Course Contents**

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| --- | --- | --- | --- |
| **No. of 1.5 hour lecture (s) /Week** | **Subject** | **Sources** | **ILOs** |
| **4 / 1st and 2nd wk** | Introduction* Definition and importance of irrigation
* Water resources in Jordan
* Units conversion
 | James 1988 (Chapter 1,2) | **A1, A2, C1** |
| **8/ 2nd, 3rd 6th and 7th wk** | Porosity * Soil bulk density and soil particle density
* Soil water content
* Field capacity
* Permanent wilting point,
* Available water
 | James 1988 (Chapter 1) | **A3,A4,A6,C2,C3,C4,D2** |
| **5th week** | El Eid holiday |  |  |
| **3/ 8th and 9th wk** | Consumptive use of water * Evapotranspiration
* Crop water requirement
 | James 1988 (Chapter 1) | **A5, C5,C6,D2** |
| **1/9th wk** | Midterm exam | 20/11/2013 |  |
| **2/10th wk** | Water Quality * Salinity of irrigation water
* Soil salinity tolerated by the crop,
* Leaching requirements
 | James 1988 (Chapter 3) | **C8,D2** |
| **2/11th wk** | Irrigation efficiency * Application efficiency
* Conveyance efficiency
* Storage efficiency
* Distribution uniformity
 | James 1988 (Chapter 2) | **C7, C9,D2** |
| **8/12,13,14 and 15th wk** | Irrigation methods (4 weeks) * Surface
* Sprinkler
* Drip
 | FAO websites, training manual no 1, 4 and 5 by Brouwer et al.James 1988 (Chapters 5, 6 ,7) | **A7, B1,B2,B3,D1** |
| **16th wk** | Exam week | Final Exam as scheduled by the University registration |  |

**Learning Methodology**

# Question and answer teaching method will be used in this course; therefore, the students are encouraged to participate in classroom discussions. All study material will be circulated electronically, made available at the instructor’s website. The lectures will focus on comprehensive understanding of the course material and problem solving. The homework problem sets are designed to help the students to widen their understanding of the course material and practice their problem solving skills. The students will have the opportunity to demonstrate their newly acquired knowledge through a series of quizzes.

# Evaluation

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| --- | --- | --- |
| **Evaluation** | **Point %** | **Date** |
| **Midterm Exam**  | 30 | 20/11/2013 |
| **Class room participation** | 5 | Throughout the semester |
| **Quizzes and homework** | 15 | Homeworks will be assigned after each topic. Each homework is followed by a quiz |
| **Final Exam**  | 50 | Exam week |

**Main Reference/s:**

1. James, L., 1988, Principles of farm irrigation system design, 2nd edition, , John Wiley and Sons.

# References:

1. ***Irrigation Water Management: Training Manual No. 1 - Introduction to Irrigation***, by C. Brouwer, A. Goffeau, M. Heibloem, <http://www.fao.org/docrep/R4082E/R4082E00.htm#Contents>
2. ***Irrigation Water Management: Irrigation Scheduling***, Training manual no. 4, by C. Brouwer, K. Prins and M. Heibloem. <http://www.fao.org/docrep/T7202E/t7202e00.htm#Contents>
3. ***Irrigation Water Management: Irrigation Methods***, Training manual no 5, by C. Brouwer, K. Prins, M. Kay and M. Heibloem. <http://www.fao.org/docrep/S8684E/s8684e00.htm#Contents>

**Grading Scale**

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| --- | --- | --- | --- | --- |
| From (%) | To (%) | Scale | Letter Grade | Result |
| 86 | 100 | 4 | A | Excellent |
| 83 | 85 | 3.75 | A- | Excellent |
| 77 | 82 | 3.5 | B+ | Very Good |
| 74 | 76 | 3.0 | B | Very Good |
| 71 | 73 | 2.75 | B- | Very Good |
| 65 | 70 | 2.5 | C+ | Good |
| 62 | 64 | 2.0 | C | Good |
| 59 | 61 | 1.75 | C- | Good |
| 53 | 58 | 1.25 | D+ | Accepted |
| 50 | 52 | 1.00 | D | Accepted |
| 36 | 49 | 0.75 | D- | Fail |
| 0  | 35 | 0 | F | Fail |

**Notes and class room policies**

* Regular and timely attendances are expected from all students. University regulations concerning class attendance will apply
* The students are expected to submit homework in due time, a late submission will result in 20% deduction of the homework grade and will not be accepted once the key answers are provided
* Exams absentees are allowed to write makeup exams only if an acceptable and documented excuse is provided; for example, a medical report. Makeup exam are usually more difficult than regular exams
* Zero tolerance for cheating and plagiarism
* For more details on University regulations please visit: <http://www.ju.edu.jo/rules/index.htm>