**The University of Jordan**

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

**Program: Bachelor Academic Year/ Semester: 2015/2016**

**Environmental Soil Physics (604222)**

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| **Credit hours** | **3** | **Level** | **BSc 604222** | **Pre-requisite** | **Soil principles (604101)**  **Principles of irrigation (604103)** |
| **Coordinator/ Lecturer** | **Prof. Anwar M. Battikhi** | **Office number** | **230** | **Office phone** | **22523** |
| **Course website** |  | **E-mail** | **a.battikhi@ju.edu.jo** | **Place** |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Office hours** | | | | | |
| **Day/Time** | **Sunday** | **Monday** | **Tuesday** | **Wednesday** | **Thursday** |
| **12:00-13:00** |  | **√** |  | **√** |  |
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**Course Description**

Historical Background; Soil Physical Quantities and Relationships; Soil Texture; Soil Structure; Deformation of Soil; Water Properties; Soil Water Retention; Soil Water Movement (Saturated and Unsaturated); Gas Flow; Heat Flow; and Soil Management.

**Learning Objectives**

To get good knowledge about soil physical properties, soil water systems , soil water, gas, and heat processes. Principles, measurements, laws, and examples are explained and exams are given to test students comprehension of the materials.

**Intended Learning Outcomes (ILOs):**

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

**A. Knowledge and Understanding:** Students are expected to **learn about:**

**A1- Soil physical properties and processes**

**A2- soil water, gas, and heat relationships**

**A3- Soil management**

**A4- Examples are given and laboratory experiments are carried out**

**.….**

**B. Intellectual Analytical and Cognitive Skills:** Students are expected to

B1- comprehend the materials and use mathematics and physical laws to understand soil water, heat and gaseous relations

**.….**

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

C1- Properties & process learned will be used by students to know how to conserve soil and water in relation to crop management and how to modify soil temperature and O2 content and control to improve crop production.

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**D. Transferable Key Skills:** Students are expected tolearn skills of:

D1- Physical laws and mathematical sciences are used to modify soil conditions in terms of soil properties and processes.

**.….**

# ILOs: Learning and Evaluation Methods

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| **ILO/s** | **Learning Methods** | **Evaluation Methods** |
|  | **Lectures and Discussions, √**  **Homework and Assignments, √**  **Projects, Presentation, …√** | **Mid Term Exam, √**  **Assignments, .. √**  **Laboratory Experiments √** |
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**Course Contents**

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| --- | --- | --- | --- |
| **Content** | **Reference** | **Week** | **ILO/s** |
| **1. Introduction**  **2. Historical Background** | \*Ch.1, soil physics in perspective.H. Don Scott, Soil Physics: Agric. & Env. Applic. 2000, Iowa St. Univ. Press., 1st ed  \*Ch.1, Introduction. L.D.Baver, Soil physics,John Wiley and sons, Inc., New York, London, 3rd edition.  \* Walter H.G., 1997, Historical Highlights in American Soil Physics, 1776-1996, Soil Science Society of America Journal, Vol.41, No.2, pp 221-227 | **Week 1** | A1 |
| **1. Soil Physical Quantities and Relationships** | Ch.2, physical quantities.H. Don Scott, Soil Physics: Agric. & Env. Applic. 2000, Iowa St. Univ. Press., 1st ed | **Week 2** | **A2, B1** |
| **1. Soils Texture**  **i.** Classification of Soil Particles  **ii.** Physical, Chemical, and Mineralogical nature of the Soil Particles.  **iii.** Behavior of Soil Particles  **iv.** Particle Size Distribution | \*Ch.3, soil texture.H. Don Scott, Soil Physics: Agric. & Env. Applic. 2000, Iowa St. Univ. Press., 1st ed.  \* L.D.Baver, W.H.Gardner, 1972, Soil physics,John Wiley and sons, 4th edition. | **Week 3** | A3, B1 |
| **1. Soil Structure**  **i.** Classification and Genesis  **ii.** Measurement  **iii.** Agricultural Significance | \*Ch.4, soil structure.H. Don Scott, Soil Physics: Agric. & Env. Applic. 2000, Iowa St. Univ. Press., 1st ed  \*\* L.D.Baver, W.H.Gardner, 1972, Soil physics,John Wiley and sons, 4th edition | **Week 4+5** | A3, B1 |
| **1. Deformation of Soil**  **i.** Consistency  **ii.** Strength  **iii.** Compression  **iv.** Compaction  **v.** Swelling & Shrinkage | Ch.3, The Dynamic Properties of Soils, L.D.Baver, W.H. Gardner, 1972, Soil physics, John Wiley and sons, 4th edition | **Week 6+7** | A3, B1 |
| **1. Water Properties**  **i.** Molecular Structure  **ii.** Surface Tension  **iii.** Curvature  **iv.**  Capillarity | Ch.8, soil water principles.H. Don Scott, Soil Physics: Agric. & Env. Applic. 2000, Iowa St. Univ. Press., 1st ed | **Week 8+9** | A4 |
| **1. Soil Water Retention**  **i.** Energy State of Soil Water  **ii.** Soil Water Characteristic Curve  **iii.** Hysteresis  **iv.**  Measurement | \* L.D.Baver, W.H.Gardner, 1972, Soil physics,John Wiley and sons, 4th edition**.**  **\*** H. Don Scott, Soil Physics: Agric. & Env. Applic. 2000, Iowa St. Univ. Press., 1st ed | **Week 10+11** | **A4, B2, D3** |
| **1. Soil Water Movement**  **i.** Saturated Flow  - Poiseulle's Law  - Darcy's Law  - Hydraulic Conductivity  - Permeability  **ii.** Unsaturated Flow  - Richard's Eq.  - Emperical Eq.  - Soil Water Diffusivity  - Phillips Eq.  - Advance of wet Fronts and Water movement  - Infiltration | Ch.9, soil water flow.H. Don Scott, Soil Physics: Agric. & Env. Applic. 2000, Iowa St. Univ. Press., 1st ed | **Week 12+13** | A5, B3, C3 |
| **1. Gas Flow**  **-** Diffusion, Fick's Law  **-** Mass Flow  **-** Factors affecting Mass Flow | Ch.7, soil aeration.H. Don Scott, Soil Physics: Agric. & Env. Applic. 2000, Iowa St. Univ. Press., 1st ed | **Week 14** | A6, B4 |
| **1. Heat Flow**  **-** Thermal Conductivity and Fourier's Law  **-** Modification of Thermal Regimes in Soils | Ch.6, soil temperature.H. Don Scott, Soil Physics: Agric. & Env. Applic. 2000, Iowa St. Univ. Press., 1st ed | **Week 15** | A6 |
| **1. Soil Management** | \*Ch. 10, soil physics as a factor in soil management, kohnke H., soil physics, 1968, TATA MCGRAW Hill publishing company LTD, New Delhi  \*Ch. 12, Baver, LD, Soil Physics, 1965, 3rd . ed., John Wiley & Sons | **Week 16** | C1, C2, C3, D1, D2, D3, D4. |

**Learning Methodology**

The course concentrated on lectures, exercises, and Practical training on the laboratory and on the field, using power point presentation, which were also given to students to photocopy. Extra materials also added during discussion in the classroom.

Questions were given in the laboratory for the students in the lab. sheets, to answer , graded, and then discussed afterward.

## Assignments:

## Students will give different assignments and home work that cover all the course contents through the semester.

# Evaluation

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| **Evaluation** | **Point %** | **Date** |
| **Midterm Exam** | 30 | 16/11/2015 |
| **Home Assignments** | 5 |  |
| **Laboratory Reports** | 15 |  |
| **Final Exam** | 50 |  |

**Main Reference/s:**

# H. Don Scott. Iowa State University Press.

# References:

1. Baver, LD, Soil Physics, 1965,3rd . ed., John Wiley & Sons.

2. Hillel, D, Fundamentals of Soil Physics, 1980., Academic Press.

3. Marshall, T.J and J.W. Holmes, Soil Physics, 1992, 2nd ed., Cambridge.

4. Jury, W.A., W.R. Gardner, and W.H. Gardner, Soil Physics, 1991. Wiley & Sons. 5th ed.

5. Hillel Dan, Environmental Soil Physics, 1998, 1st ed. Academic Press

**Intended Grading Scale (Optional)**

**F**

**D**-

**D**

Every instructor should use his own scale each term according to the class final grades at that term.

**D+**

**C**-

**C**

**C+**

**B**-

**B**

**B+**

**A**-

**A**

**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>