**The University of Jordan**

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

**Program: Academic Year/ Semester: fall/2013/2014**

**Course Name (Course Number)**

**Environmental Soil Physics (604222)**

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| **Credit hours** | **3**  **(2 lec. + 1 Lab.)** | **Level** | **2nd year** | **Pre-requisite** | **Principles of Soil (604101)**  **Principles of Irrigation (604103)** |
| **Coordinator/ Lecturer** | **Prof. Anwar Battikhi** | **Office number** | **230** | **Office phone** | **22523** |
| **Course website** | **www2.ju.edu.jo/sites/academic/a.battikhi/material/forms/A||items.aspx** | **E-mail** | **a.battikhi@ju.edu.jo** | **Place** | **Mudaraj Al Eshbili** |

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| **Office hours** | | | | | |
| **Day/Time** | **Sunday** | **Monday** | **Tuesday** | **Wednesday** | **Thursday** |
| **Lec.** |  | **1.00-2.00** |  | **1.00-2.00** |  |
| **Lab.** |  | **2.00-5.00** |  |  |  |

**Course Description**

Historical background, texture, structure, dynamic properties, soil water, soil moisture storage, soil water potential, soil water movement, soil aeration, soil temperature, soil management.

**Learning Objectives**

1. Introduce students to the science of Environmental Soil Physics, its theories, its applications, its relationships with other Soil Sciences.
2. It is also intended in this course to update students with the new developments of soil physical properties, determinations, and the methods of improvement of these properties
3. Processes effecting soil water movement, soil aeration and soil heat flow are also dealt with in some details.
4. Solute transport in soils is also included, but not in details.

**Intended Learning Outcomes (ILOs):**

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

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

A1- soil physics definition and its history.

A2- soil physical quantities and their mathematical relationships.

A3- soil physical properties in detail such as: texture and structure and their important for agriculture.

A4- main water properties and their effects on soil water retention and water movement through out the soil in case of saturation and unsaturated condition.

A5- gas and heat flow in the soil and the equations govern this flow.

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

B1- has ability to determine and measure soil physical quantities and properties such as soil water content, soil texture, bulk density, and structure.

B2- has ability to draw soil water retention curve for different soil types.

B3- has ability to know how to measure soil water movement in the Laboratory and by using equations.

B4- has ability to measure gas flow in soil.

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

C1- evaluate the current status of the soil and the possible modification can made on soil.

C2- determine the best land use.

C3- evaluate solute transport in soil for environmental impact assessment under saturated and unsaturated flow.

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

D1- evaluate soil physical properties for the farmer.

D2- make the soil physically fertile for plant growth.

D3- make a correct decision for irrigation schedule.

D4- make modification for non developed soil physical properties.

# ILOs: Learning and Evaluation Methods

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| **ILO/s** | **Learning Methods** | **Evaluation Methods** |
| **A. Knowledge and Understanding** | **Lectures and Discussions+Homework and Assignments.** | **Exams+Quizes** |
| **B. Intellectual Analytical and Cognitive Skills** | **Lectures and Discussions+Homework and Assignments+ Practical work in Labs** | **Exams+Quizes** |
| **C. Subject- Specific Skills** | **Lectures and Discussions+Homework and Assignments** | **Exams+Quizes** |
| **D. Transferable Key Skills** | **Lectures and Discussions+Homework and Assignments** | **Exams+Quizes** |

**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 | 25 | 2/4/2014 |
| Laboratory Mid Term Exam | 5 | 2/4/2014 |
| Drop Quizzes | 5 | - |
| Home assignments | 5 | - |
| Laboratory Reports | 10 | - |
| Final Laboratory Exam | 10 | - |
| Final Exam | 40 | - |

**Main Reference/s:**

H. Don Scott, Soil Physics: Agric. & Env. Applic. 2000, Iowa St. Univ. Press., 1st ed

# 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>