**The University of Jordan**

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

**Program: 2013-2014/ Second Semester**

**Soil Reclamation (634422)**

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| **Credit hours** | **3** | **Level** | **Fourth Year** | **Pre-requisite** | **Environmental Soil Chemistry** |
| **Coordinator/ Lecturer** | **Dr. ‘Mohammed Hashem’ Stietiya** | **Office number** |  | **Office phone** | **22447** |
| **Course website** | <http://www2.ju.edu.jo/sites/academic/h.stietiya/default.aspx> | **E-mail** | h.stietiya@ju.edu.jo | **Place** | **Dept. Seminar room** |

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| **Office hours** |
| **Day/Time** | **Sunday** | **Monday** | **Tuesday** | **Wednesday** | **Thursday** |
| **Office hrs** | **10-12** |  |  |  | **9-12** |
| **Lecture** |  | **9.30-11.0** |  | **9.30-11.0** |  |

**Course Description**

The course tackles problematic soils and means of their reclamation and best management practices that ensure their agricultural sustainability. The course focuses on problematic soils relevant to arid environments such as in Jordan including soil salinity, sodicity, pollution, and erosion. The course also places focus on the efficient use of non-conventional water resources, mainly treated wastewater for irrigation and reclamation of land for agricultural productivity. For each of the problematic soils, students are taught how to diagnose degradation in soil properties, the proper methods of reclamation, and how to manage soils post their reclamation. The course will enable students to apply fundamentals of soil science acquired from previous courses for the maintenance of land and their reclamation.

**Learning Objectives**

The objectives of this course are to introduce students to problematic soils, identify processes resulting in deterioration of soil physical and chemical properties, and to use the fundamentals of soil science disciplines for the reclamation of degraded soils. At the end of the course, the student will be able to identify problematic soils, set up a plan for their reclamation, and their post-reclamation management in a manner that is sustainable. The course is designed to shed light on the local Jordanian environment so that students are equipped to handle, reclaim, and manage problematic soils.

**Intended Learning Outcomes (ILOs):**

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

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

A1- Identify degradation of soil chemical and physical properties.

A2- Understand the chemistry of soil degradation processes.

A3- Understand methods of reclaiming problematic soils.

A4- Understand best management practices for reclaimed soils.

A5- Identify problematic soils in Jordan and reasons for their degradation

A6- Understand the efficient use of treated wastewater for prevention of soil degradation.

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

B1- Become competent in analyzing soil degradation and reclamation processes.

B2- Use the concepts of soil chemistry to explain problematic soils and their restoration.

B3- Enhance mathematical skills and ability to use mathematical equations for reclamation of problematic soils.

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

C1- Know how to deal with the following problematic soils: saline, sodic, saline-sodic, calcareous, eroded soils, and use of treated wastewater.

C2- Know how to calculate soil amendment requirements for reclamation of problematic soils according to set goals.

C3- Identify hazards associated with irrigation water including salinity, sodicity, and toxicity hazards.

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

D1- Manage problematic soils related to chemical processes at the farm level

D2- Manage low quality irrigation water in a manner that ensure agricultural sustainability.

# ILOs: Learning and Evaluation Methods

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| **ILO/s** | **Learning Methods** | **Evaluation Methods** |
| **A**. Knowledge and Understanding (**A1-A6**) | Lectures and Discussions | Exam, Classwork, Homework, Project |
| **B**. Intellectual Analytical and Cognitive Skills (**B1-B3**) |  Lectures and Discussions | Exam, Classwork, Homework, Project |
| **C**. Subject Specific Skills (**C1-C3**) | Lectures and Discussions | Exam, Classwork, Homework, Project |
| **D**.Transferable Key Skills (**D1-D2**) | Lectures and Discussions | Exam, Classwork, Homework, Project |

**Course Contents**

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| **Content** | **Reference**  | **Week** | **ILO/s** |
| Introduction to important soil properties and reasons of their degradation  | * Balba, Monem. Management of Problem Soils in Arid Ecosystems
* Troeh, Frederick et al. Soil and Water Conservation for Productivity and Environmental Protection
 | Wk1(lectures1,2) | **A-1** |
| Concepts of soil reclamation and types of degraded soils | * Balba, Monem. Management of Problem Soils in Arid Ecosystems
* Troeh, Frederick et al. Soil and Water Conservation for Productivity and Environmental Protection
 | Wk 2 (lectures 3,4) | **A1-A2** |
| Reclamation and management of salt-affected soils: saline soils, sodic soils, saline-sodic soils:* Identification of salt-affected soils.
* Chemistry of salinity and sodicity.
* Salinity and Sodicity in Jordan.
* Reclamation methods and calculations.
* Crop selection
* Post-reclamation management practices.
 | * Balba, Monem. Management of Problem Soils in Arid Ecosystems
* Carrow R.N., and R.R. Duncan. 2012. Best Management Practices for Saline and Sodic Turfgrass Soils: Assessment and Reclamation
* Essington, M.E. 2004, Soil and Water Chemistry: An Integrative Approach
 | Wk 3-6(Lectures 5-12) | **A1-A3 , B-1 , B-2, B-3, D-1, D-2** |
| Non-conventional water resources for land reclamation:* Identification of irrigation water hazards (salinity, sodicity, toxicity).
* Introduction to water resources and water shortage in Jordan.
* Pros and cons of use of non-conventional water resources.
* Best management practices for use of treated wastewater.
* Future prospects in Jordan.
 | * Carrow R.N., and R.R. Duncan. 2012. Best Management Practices for Saline and Sodic Turfgrass Soils: Assessment and Reclamation
 | Wk 6-8(Lectures 6-11) | **A-4 , B-1 , C-1 , C-3, D-1, D-2,** |
| Reclamation of contaminated soils:* Identification and sources of soil contamination.
* Reclamation of contaminated soils.
* Phytoremediation.
* Contaminant transport and groundwater pollution.
* Contaminated soils in Jordan.
* Prospects of reclaiming contaminated soils in Jordan.
 | - Essington, M.E. 2004, Soil and Water Chemistry: An Integrative Approach- Sparks, D. L. 2003. Environmental Soil Chemistry | Wk 9-11(Lectures 12-17) | **B-2,C-1,C-2,C-34,**  |
| Reclamation and management of sandy soils:* Physical and chemical properties of sandy soils.
* Preparation and management of sandy soils for agriculture.
* Geographic distribution of sandy soils in Jordan.
* Prospects of use of sandy soils for agriculture in Jordan.
 | FAO Bulletins on Sandy Soils, Calcareous Soils, and Salt-Affected Soils | Wk 12-13(Lectures 18-21) | **C1-C3, D1-D2** |
| Reclamation and management of eroded soils* + Identification of soil erosion processes.
	+ Reclamation and management of eroded soils.
	+ Post-reclamation management practices.
	+ Eroded soils of Jordan; distribution and erosion processes.
	+ Soil erosion prevention measures in Jordan.
 | Troeh, Frederick et al. Soil and Water Conservation for Productivity and Environmental Protection | Wk 14-16(Lectures 22-27) | **A1-A4,B1-B3,C1-C3** |

**Learning Methodology**

## The course will include lecturing, discussion, classwork, homeworks, and project work. Through classwork students will be able to apply the concepts they learn in class immediately through class exercises. Also, through project work students will analyze soil and water samples in the laboratory and make a comprehensive assessment of their quality and propose best management practices. Analysis will be conducted on treated wastewater samples used for irrigation where students will determine associated hazards of salinity, sodicity, and toxicity. Students will analyze soils obtained from the Jordan Valley for salinity and sodicity and will propose suitable crops for soils based on salinity levels. At the end of the semester, students will submit a comprehensive report on irrigation water and soil management.

# Evaluation

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| **Evaluation** | **Point %** | **Date** |
| **First and Second Exams** | 25 | March 31st 2014 and May 12th 2014 |
| **Project** | 15 | Duration of semester |
| **Classwork** | 5 | Daily |
| **Homework**  | 5 | Weekly |
| **Final Exam**  | 50 | To be determined |

**Main References:**

Balba, Monem. Management of Problem Soils in Arid Ecosystems. Lewis Publishers.

Troeh, Frederick et al. Soil and Water Conservation for Productivity and Environmental Protection. Princeton-Hall, Inc.

Carrow R.N., and R.R. Duncan. 2012. Best Management Practices for Saline and Sodic Turfgrass Soils: Assessment and Reclamation, CRC Press. Boca Raton, Fl.

FAO Bulletins on Sandy Soils, Calcareous Soils, and Salt-Affected Soils.

Essington, M.E. 2004, Soil and Water Chemistry: An Integrative Approach. CRC Press, Boca Roton.

# Sparks, D. L. 2003. Environmental Soil Chemistry. Acad. Press. New York.

**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>