Introduction to Soil Sciences

Spring 2024

3 weekly hours (one hour theoretical and two hours experimental) 3 academic credits

Overview

Soils form a unique and irreplaceable essential resource for all terrestrial organisms, including man. Soils form not only the very thin outer skin of the earth's crust that is exploited by plant roots for anchorage and supply of water and nutrients. Soils are complex natural bodies formed under the influence of plants, microorganisms and soil animals, water and air from their parent material, solid rock or unconsolidated sediments. Soil composition under variable conditions, usually differ strongly from the parent (parent = original) material, and normally are far more suitable as a rooting medium for plants.

In addition to serving as a substrate for plant growth, including crops and pasture, soils play a dominant role in the cycling of water, carbon, nitrogen and other elements, influencing the composition and turnover rates of substances in the atmosphere and the hydrosphere.

Specific Goals

Students who successfully complete this course will be able to:

1. Recall and define the basic terms used for the description, study, and management of soils.
2. Describe the soil forming factors and the effect of each factor on soil development.
3. Identify and describe soil physical properties such as texture, structure, and color.
4. Explain how soil properties and processes affect agricultural and nonagricultural land use and management.
5. Summarize the ecological functions of soil and explain the role of soil management in maintaining and improving environmental quality.

Laboratory

The laboratory will provide hands-on experience in a variety of soil analytical skills and illustrate soil science concepts. During the lab work, two sites will be sampled in 3 depths. Each group will analyze one sample from the oil spill flooded and one sample from the non-flooded site. In the field, general characteristics as color, moisture status, texture or carbonate content are estimated during sampling. The field moist samples are then homogenized, dried and sieved in the laboratory and water content (WC), pH and electrical conductivity (EC) of aqueous extracts and other results are to be determined in the laboratory. Each group will choose a project related to soil analysis and another field (agriculture, ecology, hydrology, geology, pollution, etc) and use the knowledge required in the lab, to do a series of analysis and write a report.

Course Requirements

The course will include laboratory and field work (soil sampling and field analysis), worksheets, exercises, readings, etc. In addition to participating in the lab and class discussions, students will have a midterm exam. The main reading of this course will be provided by the instructor.

Grade Components

- Attendance and Punctuality 15%
- Quizzes 10%
- Midterm exam 15%
- Laboratory work and reports 30%
- Final exam 30%

Course Schedule

#	Date	Topics	Lab
1	15.02.24	**The Earth's Crust Origin of Soil** Terminology used in describing soils What is a Soil? Soil definition Components of soils	**Safety manual** **Hand outs** - Lab safety policy
2	22.02.24	What is soil genesis? Why study soil genesis? How to study soil genesis? **N.van Breemen, P.Buurman - Soil Formation. 2nd edition (pages 7 – 12)**	- Field experimental design - Interpreting Soil data and reporting
3	29.02.24	Definition and expression of soil acidity	Experimental setup - Soil sampling - Soil pH and Al
4	07.03.24	Definition and expression of soil salinity	Experimental setup - Soil EC
5	14.03.24	Soil texture, Soil structure, Profile variability Soil Temperature and Soil color, Particle Size Distribution (PSD) **1. N.van Breemen, P.Buurman - Soil Formation. 2nd edition (pages 15 -26)** **2. Soil Pollution: origin, Monitoring & Remediation by Ibrahim A. Mirsal. Second edition, 2004, page 47**	Soil texture: a. soil type by feel and appearance method. b. Soil texture dry method - Sieving and determination of coarse fraction.
6	21.03.24	**Organic pollutants in soil: remediation in different soil types using analytical methods**	**Guest lecturer – Dr Ahmad Nasir**
7	28.03.24	**Mid-term exam**	Standardization and calibration carve (**Na and K minerals in soil)** - Soil texture wet method - Soil Bulk Density
8	04.04.24	**Soil organisms and organic matter** Soil Organisms (types, functions, processes such as nitrification, ammonification, N-fixation). Organic matter (definition, composition of plants, decomposition).	- Carbonate in soil - NO3, - PO4, - SO4
9	02.05.24	Sources of nutrients in soils (organic matter and soil minerals).	1. Water Drop Penetration Time (WDPT) 2. Drop Angle Contact test

		C:N ratio of materials returned to soil. Input of plant litter (Compost) and animal manor into soils and nutrient cycling within the soil profile **N.van Breemen, P.Buurman - Soil Formation. 2nd edition**	3. Critical Surface Tension (CST)
10	09.05.24	Filed trip – to be determined Soil moisture condition of a horizon (field)	
11	16.05.24	Soil Water Interaction. Soil's Moisture Content. Soil-Moisture Potential. Water Flow in Saturated Soils **Principles of soil physics by Rattan Lal and Manoj K. Shukla, 2004.page 234**	Soil moisture (water) content (lab) Infiltration capacity
12	23.05.24	Flow in Unsaturated Soils. Water Infiltration in Soil. Soil Water Evaporation. **Principles of soil physics by Rattan Lal and Manoj K. Shukla, 2004.**	**Review** Lab and field Review
13	TBA	**Final exam**	

Text Book:

1. Soil and the environment: An introduction by Alan Wild. First Edition, 1993.
2. Fundamentals of soil science by Henry D. Foth. Sixth edition, 1978.
3. Principles of soil physics by Rattan Lal and Manoj K.Shukla, 2004.
4. Soil Pollution: origin, Monitoring & Remediation by Ibrahim A. Mirsal. Second edition, 2004.