Course: Soil Physics

Identification

Code: SOL 845
Credits: 4 (3 hours lecture - 1 hour laboratory)
Level: Master's/Doctorate
Professors: José Miguel Reichert, Dalvan José Reinert, and Paulo Ivonir Gubiani
System: Annual (II Semester)

Discipline objectives

To identify, analyze, and discuss properties and processes of soil as a three-phase, disperse, and heterogeneous system. Provide fundamentals of methods for analyzing the solid, liquid, and gas phases and their interactions; apply the knowledge to problems related to soil management.

Syllabus

In a theoretical and practical context, the course deals with soil physical properties and processes aimed at sustainable soil management.

Methodology and/or teaching instruments

Lectures, practical classes (field and laboratory), group work, group seminars. Overhead projector, multimedia projector, and blackboard.

Forms of evaluation

Written and practical tests, seminars, class participation, and reports.

Program: Title and Breakdown of the Units

Unit 1

Introduction
1.1 - Soil as a three-phase, heterogeneous, and disperse system
1.2 - Solid fraction
1.3 - Clay properties and soil physical behavior

Unit 2

Soil texture
2.1 - Particle size distribution
2.2 - Particle size analysis

Unit 3

Mass and volume ratio of soil constituents
3.1 - Bulk density
3.2 - Particle density
3.3 - Porosity and pore size
3.4 - Soil moisture
3.5 – Soil aeration

Unit 4

Soil consistency
4.1 - Concepts
4.2 - Forms of consistency
4.3 - Atterberg limits
4.4 – Soil trength, deformation, resistance, and compressibility

4.5 - Significance of consistency and Atterberg limits
4.6 - Description and methods of analysis

Unit 5

Soil structure
5.1 - Concept and importance
5.2 - Soil structure genesis
5.3 - Methods for evaluating soil structure
5.4 - Soil structure and plant development
5.5 - Soil aggregation
5.6 - Mechanical soil properties
5.7 - Soil compaction: process, identification, and critical limits

Unit 6

Soil aertation
6.1 - Air composition in the soil
6.2 - Types of pores involved
6.3 - Aeration processes

Unit 7

Soil temperature
7.1 - Thermal properties
7.2 - Modification of the soil thermal regime

Unit 8

Water in the soil
8.1 - Water properties: solid-liquid interface
8.2 - Energy state: water potential
8.3 - Water desorption and sorption curves
8.4 - Water movement in the soil
8.5 - Water availability to plants

Unit 9

Water balance
9.1 - Water storage in the soil profile
9.2 - Water balance in the root zone
9.3 – Water balance analysis

Recommended literature

BAVER, L.D; GARDNER, W.H.; GARNER, W.R. **Soil physics.** 4 ed. Ney York: John Wiley & Sons, 1972. 498p.

DANE, J.H.; TOPP, G.C. **Methods of soil analysis.** Part 4. Physical methods. 2 ed. Madison: ASA, 2002. 1692p.

HILLEL, D. **Fundamentals of soil physics.** London: Academic Press, 1980. 413p.

HILLEL, D. **Applications of soil physics.** London: Academic Press, 1980. 385p.

HILLEL, D. **Environmental soil physics: Fundamentals, applications, and environmental considerations.** New York: Academic Press, 1998. 771p.

JURY, W.A.; GARDNER, W.R., GARDNER, W.H. **Soil physics**. 5 ed. Ney York: John Wiley & Sons, 1991. 328p.

KLUTE, A. **Methods of soil analysis.** Part 1. Physical and mineralogical methods. 2 ed. Madison: ASA, 1986. 1188p.

LIBARDI, P. L. **Dinâmica da água no sistema solo-planta-atmosfera.** Piracicaba: O autor, 1999. 491p.

REICHARDT, K. **Dinâmica da matéria e da energia em ecossistemas.** São Paulo: USP/ESALQ, 1996. 513p.

WARRICK, A.W. **Soil physics companion.** Boca Raton: CRC, 2002. 389p.