

## **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**

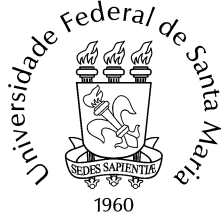
##### **Mass and volume ratio of soil constituents**

- 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 strength, deformation, resistance, and compressibility



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- 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 aeration**

- 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**

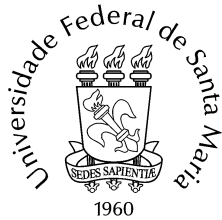
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DANE, J.H.; TOPP, G.C. **Methods of soil analysis**. Part 4. Physical methods. 2 ed. Madison: ASA, 2002. 1692p.

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.



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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.