

## **Course: Experimental Soil Physics**

### **Identification**

**Code:** SOL 862

**Credits:** 3 (0 - 3) (0 lecture hours - 3 laboratory hours)

**Level:** Master's/Doctorate

**Professors:** Dalvan José Reinert, Paulo Ivonir Gubiani, and José Miguel Reichert

**System:** Annual (II semester)

### **Discipline objectives**

Apply basic and advanced methods in soil physics to study solids, pores, and fluids and their interactions.

### **Syllabus**

Methods and physical soil analysis; capacity properties: texture and mass-volume relationships of soil phases; intensity properties: conductivity and permeability of fluids (water, gases, and heat), strength, and soil deformation; flow of water, gases, and heat.

### **Methodology and/or teaching instruments**

Practical classes in the laboratory and the field using equipment and methods for soil physical analysis.

### **Forms of evaluation**

Reports and tests.

### **Program: Title and Breakdown of Units**

#### **Unit 1**

##### **Granulometry**

- 1.1 - Pipette, densimeter, and combination methods
- 1.2 - Laser-based method (laser granulometry)

#### **Unit 2**

##### **Consistency**

- 2.1 - Atterberg limits
- 2.2 - Estimated parameters

#### **Unit 3**

##### **Soil bulk density**

- 3.1 - Core, clod, and pycnometer method
- 3.2 - Computer tomography

#### **Unit 4**

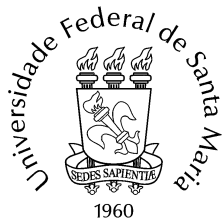
##### **Soil porosity**

- 4.1 - Capillarity method
- 4.2 - Computer tomography

#### **Unit 5**

##### **Soil aggregation**

- 5.1 - Aggregate size distribution: dry and wet sieving
- 5.2 - Aggregate stability and stability indices
- 5.3 - Stability under rainfall and waterdrops



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## **Unit 6**

### **Soil aeration**

- 6.1 - Airspace
- 6.2 - Soil air permeability
- 6.3 - Air flow in the soil

## **Unit 7**

### **Soil heat/temperature**

- 7.1 - Thermal conductivity, thermal diffusivity, and specific heat
- 7.2 - Heat flow in the soil

## **Unit 8**

### **Soil mechanics**

- 8.1 - Compressibility: preconsolidation pressure, compressibility, and relaxation coefficients
- 8.2 - Shearing: cohesion and angle of internal friction

## **Unit 9**

### **Water in the soil**

- 9.1 - Quantitative soil moisture measurements: direct (gravimetry) and indirect (sensors)
- 9.2 - Sorption and desorption curves of water in soil (Haines' funnels, tension and sand tables, porous plates, and psychrometry)
- 9.3 - Fitting equations to moisture-potential data
- 9.4 - Water tension in the field (tensiometry)
- 9.5 - Hydraulic conductivity (field and laboratory) and water infiltration in the soil
- 9.6 - Water flow in the soil

## **Unit 10**

### **Water balance**

- 10.1 - Water storage in the soil profile
- 10.2 - Water balance in the root zone
- 10.3 - Water balance analysis

## **Recommended literature**

BLACK, C.A. (ed.) **Methods of soil analysis**. Part 1. Physical and mineralogical methods, including statistics of measurements and sampling. Madison: ASA, 1965. 770p.

CARTER, M.R. & CREGORICH, E.G. (eds.) **Soil Sampling and Methods of Analysis**. 2 ed. Boca Raton: CRC Press, 2007. 1264p.

TEIXEIRA, P.C., DONAGEMMA, G. K, FONTANA, A. TEIXEIRA, W.G., Manual de métodos de análise do solo. 3. ed. rev. Rio de Janeiro: Embrapa Solos; 2017.

DANE, J.H. & TOPP, G.C. (eds.) **Methods of soil analysis**. Part 4. Physical methods. 2 Soil Science Society of America Book Series, no. 5. Madison: ASA, 2002. 1692 pp.

SMITH, K.A. & CRESSER, M.S (eds.) **Soil and environmental analysis: Physical methods**. 2 ed. New York-Basel: Marcel Dekker, 2001. 637p.