Code: 1766 **Soils**
Degree: 1st cycle – Agriculture; Forestry and Natural Resources
Curricular Year: 2nd **Semester Course: 1st**
Credits: 6 ECTS **Compulsory**
Language: Portuguese/English
Prerequisites: Chemistry
Responsible: Manuel Armando Valeriano Madeira
Other lecturer(s): Carlos Manuel Arruda Pacheco and Fernando Manuel Girão Monteiro
Web Site: http://www.isa.utl.pt/home/node/3994

1. Contact hours:
Lectures 28 **Lecture/Praticals** 22 **Practicals/Laboratory** 20 **Others** 14 **Total** 84

2. Objectives:

General overview of basic soil concepts:
(i) soil constituents and characteristics,
(ii) formation and distribution of soils and
(iii) soil classification and soil evaluation.

3. Programme:

Lectures
Soil concept and soil functions in ecosystems. Soil constitution and properties.
Soil texture and soil mineral constituents.
Soil organic matter components and fractionation. Humic substances: properties and interaction with soil mineral constituents.
Cation and anion exchange capacity.
Soil reaction: acidity and alkalinity.
Soil architecture: formation and stabilization of soil aggregates.
Soil density and porosity.
Soil water retention. Soil water energy concepts. Soil water characteristic curves. Measurement of soil water potential and content. Water movement in saturated and unsaturated soils.
Factors and processes of soil formation and distribution at global and local scale.
Universal soil classificartion ("World Reference Base for Soil Resources"). Classification of soils occurring in Portugal and factors determining their distribution and characteristics.
Analysis of soil maps and general soil evaluation.

Praticals
Soil constituents. Soil horizons.
Soil moisture determination. Field texture and laboratory particle-size analyses.
Total organic matter determination; organic matter fractionation.
Soil complex exchange: Cation and anion exchange capacity; soil reaction measurement.
Characterization and stability of soil structure. Soil colour.
Soil density and porosity. Soil dynamic properties.
Soil water retention and soil water potential measurement. Soil water characteristic curves.
Water movement in saturated soils.
Morphology and description of soil horizons and profiles.
Identification of horizons and of soil types.
Soil classification.
Analyses of soil maps.
Soil evaluation.

4. Bibliography:

Main Bibliography

Brady, N. C. & Weil, R.R. 1999. *The Nature and Properties of Soil* (12th edition). New Jersey, Prentice Hall (Chapters: 1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 17, 18, 19,2 0.). Library: P30-81/P30 – 82/P30-83.
Hillel, Daniel. 2004. *Introduction to Environmental Soil Physics*. Elsevier Academic Press, Amsterdam. (Chapters: 1, 2, 3, 4, 5, 7, 8, 14, 16). Library: [P33-279].
White, R.E. 1997. *Principles and Practice of Soil Science, (3rd edition)*. Oxford, Blackwell Science. Library: [UA-P30-2].
FAO, 2006. World Reference Base for Soil Resources, 2006. World Soil Resources Reports 103, FAO, Rome

Other Bibliography

Botelho da Costa, J. V. 1975. *Caracterização e Constituição do Solo*. Lisboa, Fundação Calouste Gulbenkian.
Dixon, J.B. & Weed, S.B. (eds). 1977. *Minerals in soil Environments*. [UA-P33-66].
Sposito, G. 1989. *The Chemistry of Soils*. Oxford University Press, Oxford. [P33-272].
FAO, 1976. A framework for Land Evaluation. FAO Soils Bulletin 32, FAO.
FAO, 2001. Lecture Notes on the Major Soils of the World. World Soil Resources Reports 94, FAO, Rome
Buol, S.W., Hole, F.D., Mc Cracken, R.J., Southard, R.J. 1997. Soil Genesis and Classification (4th ed). Iowa State University Press, Ames.

5. Assessment:

Two questionnaires covering the program course. With a classification of 10/20 the student will be excused to attend final examination, or
Final examination covering the overall program course. The final classification must be 10/20.

6. Estimated Workload: 168 Hours

7. Last Update: 9/3/2011