

## 28904 - Geology, soil science and climatology

### Syllabus Information

**Academic Year:** 2019/20

**Subject:** 28904 - Geology, soil science and climatology

**Faculty / School:** 201 - Escuela Politécnica Superior

**Degree:** 437 - Degree in Rural and Agri-Food Engineering  
583 - Degree in Rural and Agri-Food Engineering

**ECTS:** 6.0

**Year:** 1

**Semester:** First semester

**Subject Type:** Basic Education

**Module:** ---

## 1.General information

### 1.1.Aims of the course

This 6 ECTS course gives a solid theoretical and practical basis in the genesis, properties and productivity of soils and their relationships with geological processes and climate from an ecological point of view.

The practical sessions provide the students with the knowledge to deal with and solve agricultural problems (swelling soils, fertilizers, groundwater conductivity and aquifer pollution).

These aims include the following Sustainable Development Goals of FAO: (1) the implementation of efficient farming techniques to fight against hunger, (2) The protection of water ecosystems by controlling the use of chemical products and fertilizers and (3) the restoration of deteriorated soils to avoid desertification.

### 1.2.Context and importance of this course in the degree

### 1.3.Recommendations to take this course

## 2.Learning goals

### 2.1.Competences

### 2.2.Learning goals

### 2.3.Importance of learning goals

## 3.Assessment (1st and 2nd call)

### 3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

## 4.Methodology, learning tasks, syllabus and resources

### 4.1.Methodological overview

Learning methodology is based on a close relationship between teachers and students. The teacher will explain the basic principles of geology and edaphology taking into account the level of students' participation in the lecture. When participation is lower than required, the teacher will encourage it asking the students.

## 4.2. Learning tasks

The course includes the following learning tasks:

- 1. Lectures. The teacher will explain the basics of geology, edaphology and climatology.
- 2. Practical sessions related to the lectures and with the aim of consolidating the explained content.
- 3. Fieldwork in the surroundings of Huesca to put into practice the acquired knowledge to solve case studies.
- 4. Own working reports and learning
- 5. Cooperative learning by the development of a group report.

## 4.3. Syllabus

The subject will address the following sections and topics: (1) Geology and (2) Edaphology/Climatology.

### THEORETICAL PROGRAMME

#### Geology

##### Topic 1. - INTRODUCTION

1. The Earth sciences.
2. The importance of geology to Food and Agricultural Engineering.
3. Geology as a science.
4. Stratigraphy (strata, fossils, evolution, historical geology).
5. Geological time.

##### Topic 2. - INTERNAL GEODYNAMICS AND PLATE TECTONICS

1. Geochemical structure and the composition of the Earth.
2. Plate tectonics.
3. Deformation of the crust: folds, faults, joints.

##### Topic 3. - MINERALOGY.

1. Concepts of mineral and crystal.
2. Properties of minerals.
3. Classification of minerals.
4. Descriptive mineralogy.

##### Topic 4. - PETROLOGY.

1. Concept of rock. Processes of rock formation.
2. Igneous rocks. Bowen's series. The most important igneous rocks.
3. Metamorphic rock. Metamorphic facies The most important metamorphic rocks.
4. Sedimentary rocks and their classification. The most important sedimentary rocks.

##### Topic 5. - HYDROGEOLOGY

1. The water cycle.
2. Surface waters.
3. Underground waters.
4. Aquifers, Types. Hydraulic Conductivity. Transmissivity.
5. Darcy's law.
6. Water extraction methods.

#### Edaphology

##### Topic 1. - Introduction to Edaphology

1. The soil: concept and definition
2. Components of the soil
3. Factors of formation
4. The concern of the study of the soil
5. Edaphology as a science

##### Topic 2. - The soil profile

1. Basic concepts: profile, horizon, pedion, polipedion
2. The pedion and the genetic horizons
3. Nomenclature of the genetic horizons.

Topic 3. - Mineral components of the soil

1. The mineral fraction
2. Minerals of the soil
3. Silicated minerals
  1. Phyllosilicates: the clays
5. Non-silicated minerals
6. Stability of the minerals in the soil
  1. Factors which affect the stability
8. Origin of the minerals
9. Granulometric fractions

Topic 4. - ORGANIC COMPONENTS OF THE SOIL

1. The organic matter of the soil: components
2. The organic content of the soil
3. Evolution of the organic matter in the soil
4. Properties of the organic matter in the soil
5. Humic substances
6. Types of humus
7. Organ-mineral compounds

Topic 5. - PHYSICAL PROPERTIES OF THE SOIL

1. Texture
2. Structure
3. Porosity
4. Density
5. Consistency
6. Colour
7. Depth of soil
8. Water retention capacity
9. Movement of water in the soil

Topic 6. - SOIL CHEMICAL PROPRIETIES

1. Soil chemistry
2. Ion exchange capacity
3. Ions in soil solution. Base saturation theory
4. Soil reaction

**Climatology**

Topic 1. - Fundamentals of climatology

1. The Earth in space
2. Reception and emission of radiant energy
3. Distribution of the energy
4. The atmosphere

**PRACTICAL PROGRAMME**

**Geology practicals**

Practical 1. - Visual recognition of minerals.

Practical 2. - Visual recognition of igneous, sedimentary and metamorphic rocks.

Practical 3. - Geological mapping. Dip and strike. Thickness.

Practical 4-8. - Development of geological cross-sections in horizontal, dipping and folded strata.

**Edaphology Practicals**

Practical 1: Taking field samples.

Practical 2: Sample preparation. Sieved, calculation of fine and thick fractions.

Practical 3: Effects of the structure of the soil.

Practical 4: Soil colour.

Practical 5: Soil texture

Practical 6: Soil chemical test on structural stability

Practical 7-8: Open laboratory for group work in the examination and determination of soil core samples

**Climatology Practical**

- Practical 1: Consequences of atmospheric dynamics, information and prediction.

**FIELDWORK**

During the first or second week of December, it is compulsory to attend to a full-day field trip in the surroundings of Huesca. The final date of the field trip will be communicated to the students during the lectures and in the digital Moodle Platform. The first part deals with hydrogeological problems that may arise on farming activities while the second part is focused on the identification, description and classification of soils.

**ONLINE COURSE**

During October, the student is asked to carry out a Bibliography search online course in collaboration with the library staff.

**GROUP REPORT**

The students in groups of two/three people must study a soil cut, describing its main properties and identifying horizons.

**4.4.Course planning and calendar**

Type of activity / Week	1 16-22 sep	2 23-29 sep	3 30 sep-6 oct	4 7-13 oct Festivo 12 oct (sab) No lectivo 11 oct (vie)	5 14-20 oct	6 21-27 oct	7 28 oct-3 nov Festivo 1 nov (vie)	8 4-10 nov	9 11-17 nov
<i>On-site activity</i>									
Theory	2	2	2	2	2	2	2	2	
Problems					2	2	2		
Laboratory practice		2	2					2	
Group work									
Fieldwork									
Tutorials ECTS									
Evaluation									
<i>Off-site activity</i>									
Autonomous task	4	4	4	3	4	2.5	4	2.5	
Group task				3		1.5		1.5	

#### 4.5. Bibliography and recommended resources

- BB** Brady, Nyle C.. Elements of the nature and properties of soils / Nyle C. Brady, Ray R. Weil . 3rd ed. Upper Saddle River, NJ : Prentice Hall, cop. 2010
- BB** Breemen, Nico van.. Soil formation / by Nico van Breemen and Peter Buurman. 2nd ed. Dordrecht ; London : Kluwer Academic, cop. 2002
- BB** Porta Casanellas, Jaime. Introducción a la edafología : uso y protección del suelo / Jaume Porta Casanellas, Marta López-Acevedo Reguerín, Rosa M. Poch Claret Madrid, [etc.] : Mundi-Prensa, 2008
- BB** Press, Frank. Earth / Frank Press, Raymond Siever . 4th ed., 10th rep. New York : W.H. Freeman and Company, cop. 1986 (rep. 20??)
- BB** Tarbuck, Edward J.. Ciencias de la tierra : una introducción a la geología física / Edward J. Tarbuck, Frederick K. Lutgens ; ilustrado por, Dennis Tasa; traducción AMR Traducciones científicas; revisión técnica y adaptación, Manuel Pozo Rodríguez, José Manuel González Casado . 8ª ed. Madrid : Prentice Hall, D.L. 2005
- BB** Understanding earth / Frank Press ... [et al.] . 4th ed New York : W.H. Freeman, [2003]
- BB** Wicander, Reed. Fundamentos de geología / Reed Wicander & James S. Monroe ; [traducción, Enrique Palos ; revisión técnica, Javier Arellano Gil] . 2a. ed. México [etc.] : International Thomson Editores, 2000
- BC** Anguita Virella, Francisco. Biografía de la tierra : historia de un planeta singular / Francisco Anguita . 1a. ed. Madrid : Aguilar, 2002
- BC** Anguita Virella, Francisco. Origen e historia de la Tierra / Francisco Anguita Virella . Alcorcón, Madrid : Rueda, D.L. 1988
- BC** Aubert, Georges. La edafología : el suelo en el que vivimos / Georges Aubert, Jean Boulaine . Barcelona : Orbis, D.L.1986
- BC** Bloom, Arthur L.. La superficie de la tierra / Arthur L. Bloom ; [traducido por Juan Carlos M. Turner] . [2a. ed.] Barcelona : Omega, D.L. 1981
- BC** Brady, Nyle C.. The Nature and properties of soils / Nyle C. Brady, Ray R. Weil . - Rev. 14th ed. Upper Saddle River, N.J. : Pearson/Prentice Hall, cop. 2008
- BC** Buckman, Harry O.. Naturaleza y propiedades de los suelos : texto de edafología para enseñanza / Harry O. Buckman y Nyle c. Brady ; traducido por R. Salord Barceló ; texto revisado por José Mª Vives de Quadras . Barcelona [etc.] : UTEHA, D.L. 1965
- BC** Cobertera Laguna, Eugenio. Edafología aplicada : Suelos, producción agraria, planificación territorial e impactos ambientales / Eugenio Cobertera Laguna . Madrid : Cátedra, 1993
- BC** Dingus, Del. Introductory soil science : laboratory manual / Del Dingus . Upper Saddle River : Prentice Hall, cop. 1999
- BC** Duchaufour, Philippe. Atlas ecológico de los suelos del mundo / por Philippe Duchaufour ; con la colaboración de Pierre Faivre, Michel Gury ; versión castellana de Ma. Tarsy Carballas Fernández. Barcelona : Toray-Masson, 1977
- BC** Duchaufour, Philippe. Edafología. Vol.1, Edafogénesis y clasificación / por Philippe Duchaufour; versión española de los doctores Mª Tarsy Carballas Fernández y Modesto Carballas Fernández . Barcelona : Masson, 1984
- BC** Duchaufour, Philippe. Manual de edafología / por Philippe Duchaufour ; versión española de los doctores Ma. Tarsy Carballas Fernández y Modesto Carballas Fernández . Barcelona [etc.] : Masson, 1987
- BC** Ferreras Chasco, Casildo. Biogeografía y edafogeografía / C. Ferreras Chasco, C. Fidalgo Hijano . [3ª reimp.] Madrid : Síntesis, D.L. 1991 (reimp. 2009)
- BC** FitzPatrick, E. A.. Suelos : su formación, clasificación y distribución / E.A. FitzPatrick ; [traducido por Antonio Marino Ambrosio] . [1a. ed., 3a. reimp.] México : Compañía Editorial Continental, 1987

- BC** Gutiérrez Elorza, Mateo. Geomorfología climática / Mateo Gutiérrez Elorza . Barcelona : Omega, 2001
- BC** Kohnke, H. (1995). Soil science simplified. Illinois: Waveland Press
- BC** Kononova, M. M.. Materia orgánica del suelo : su naturaleza, propiedades y métodos de investigación / M. M. Kononova ; [traducción castellana de Enriqueta Bordas de Muntan] . Barcelona : Oikos-Tau, D.L. 1981
- BC** Kubiëna, Walter L.. Claves sistemáticas de suelos : diagnóstico y sistemática ilustrados de los suelos más importantes de Europa con sus sinónimos más usuales / por W. L. Kubiëna ; traducido al español por Ángel Hoyos de Castro . Madrid : Consejo Superior de Investigaciones Científicas, 1952
- BC** López Ritas, Julio. El diagnóstico de suelos y plantas : (métodos de campo y laboratorio) / por Julio López Ritas y Julio López Melida. 4ª ed., rev. y amp. Madrid : Mundi-Prensa, 1990
- BC** Palmer, Robert G.. Introductory soil science : laboratory manual / Robert G. Palmer, Frederick R. Troeh . 3rd ed. New York [etc.] : Oxford University Press, 1995
- BC** Pedraza Gilsanz, Javier de. Geomorfología : principios, métodos y aplicaciones / Javier de Pedraza Gilsanz ; colaboradores Rosa María Carrasco González...[et al.] . Alcorcón, Madrid : Rueda, D.L. 1996
- BC** Porta Casanellas, Jaime. Agenda de campo de suelos : información de suelos para la agricultura y el medio ambiente / Jaume Porta Casanellas, Marta López-Acevedo Reguerín . Madrid : Mundi-Prensa, 2005
- BC** Porta Casanellas, Jaime. Edafología para la agricultura y el medio ambiente / Jaime Porta Casanellas, Marta López-Acevedo Reguerín, Carlos Roquero de Laburu . - 3ª ed., rev. y amp. Madrid [etc.] : Mundi-Prensa, 2003
- BC** Rice, Roger John. Fundamentos de geomorfología / R.J. Rice ; [traducido por Guillermo Meléndez Hevia, María Pilar Villar Saldaña ; revisado por Mateo Gutierrez Elorza] . Madrid : Paraninfo, 1983
- BC** Robinson, Gilbert Wooding. Los suelos : su origen, constitución y clasificación, introducción a la edafología / Gilbert Wooding Robinson ; traducción de la tercera edición inglesa por José Luis Amorós . 2ª ed. Barcelona : Omega, 1967
- BC** Seibold, Eugen. The sea floor : an introduction to marine geology / E. Seibold, W.H. Berger. . 3rd edition. Berlin [etc.] : Springer-Verlag, cop. 1996
- BC** Selby, M.J.. Earth's changing surface : an introduction to geomorphology / M.J. Selby . Oxford : Clarendon Press, 1985
- BC** Soil genesis and classification / S.W. Buol ... [et al.] . 5th. ed. Ames, Iowa : Iowa State Press, 2003
- BC** Strahler, Arthur N.. Geografía física / Arthur n. Strahler, Alan H. Strahler ; [trad. por Marta Barrutia y Pere Sunyer] . - 3ª ed., 4ª reimp. Barcelona : Omega, cop. 1989 (reimp. 2005)
- BC** Tan, K.H. (2009). Environmental soil science. Boca Raton: CRC Press

#### LISTADO DE URLs:

Agencia Estatal de Meteorología, AEMET  
[<http://www.aemet.es/es/portada>]

Fotografías de perfiles de suelos  
[<http://jorgemataix.carbonmade.com/projects/47854>]

Instituto Geológico y Minero de España, IGME  
[<http://www.igme.es/>]

International Union of Soil Science, IUSS  
[<http://www.iuss.org/>]

Leyenda de mapas de suelos del mundo de la FAO/UNESCO  
[<http://www.fao.org/soils-portal/levantamiento-de-suelos/clasificacion-de-suelos/leyenda-de-la-fao/es/>]

Página de la USDA para usar y aprender su taxonomía, en inglés  
[<http://soils.usda.gov/>]

Páginas de la Universidad de Granada con conceptos muy claros y sencillos y buenas fotos que los ejemplifican y aclaran

[<http://edafologia.ugr.es/index.htm>]

Se explican e ilustran suelos difíciles de encontrar en nuestro entorno

[<http://www.unex.es/edafo/>]

Sociedad Española de la Ciencia del Suelo, SECS

[<http://www.secs.com.es/>]

This dynamic Earth on-line, USGS

[<http://pubs.usgs.gov/gip/dynamic/dynamic.htm>]

United States Geological Survey

[<http://www.usgs.gov/>]

World Soil Information, ISRIC

[<http://www.isric.org/>]

The updated recommended bibliography can be consulted in:

<http://psfunizar7.unizar.es/br13/egAsignaturas.php?codigo=28904&Identificador=12468>