

Academic Year/course: 2022/23

28904 - Geology, soil science and climatology

Syllabus Information

Academic Year: 2022/23

Subject: 28904 - Geology, soil science and climatology

Faculty / School: 201 - Escuela Politécnica Superior

Degree: 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) Gender equality, (3) The protection of water ecosystems by controlling the use of chemical products and fertilizers and (4) the restoration of deteriorated soils to avoid desertification.

1.2. Context and importance of this course in the degree

The student will acquire knowledge for courses of the second and third years of the degree such as Plant science and production, Botany, Ecology and management of agroindustrial products, Fruit growing, Drainage systems and Herbaceous crops.

The course 'Applied soil science' of the fourth year is the continuation of this subject in which students increase their knowledge on soil management and erosion mitigation.

1.3. Recommendations to take this course

No previous knowledge in geology or edafology is required to study the subject. However, it is advisable for student that have studied the field of science in the high school since the basics of mathematics, physics and chemistry will be a great help to solve the exercises of groundwater and laboratory sessions.

2. Learning goals

2.1. Competences

The student needs to achieve the following results to pass the subject:

- CG2. Analyse, argue and apply their knowledge to solve problems in a temporal and spatial scale.
- CG3. Properly use techniques and data.
- CG4. Find and use information to study and to solve problems.
- CG8. Acquire the tools to work in a group
- CE6 and CE10. Learn the fundamentals of geology, edafology and climatology to solve engineering problems.

2.2. Learning goals

The student needs to achieve the following results to pass the subject?

-Learn the fundamentals of Geology and Edafology to understand the natural conditions of the environment and the consequences of human alteration on it.

-Identify the main genetic factors of soils and understand the relationships between soil, climate and geology and soil properties.

- Regarding the ODS goals, it is a priority to understand the importance of soils to prevent desertification and mitigate its erosion, salinization and pollution and use the correction measures when they are necessary.

2.3. Importance of learning goals

The learning of the fundamentals of geology will provide the student a better understanding of the geological and soil processes in the configuration and evolution of the natural environment. Besides, it will give the basic knowledge for future subjects of the degree and the ability to use different techniques to solve environmental and engineering problems.

Regarding the aims of the ODS, the students develops their sensitivity and critical capacity to sustain nature and prevent soil erosion and water pollution.

3. Assessment (1st and 2nd call)

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

The students must pass the following assessment activities:

- A final exam of the teaching programme according to the exam calendar of the [Escuela Politécnica Superior](#).
- A report compilation of the laboratory and practice sessions that will be given at the end of the teaching season previously to the final exam.
- Online Course (Curso en Competencias Informacionales) about information data management and application of the acquired knowledge in a personal report.
- Interdisciplinary final report to be done in a 5 people group about a topic related with Geology and Chemistry. The topic will focus on the ODS defined for both subjects.
- Attendance to fieldtrips. The activities focus on the sostenibility of the natural ecosystems following the ODS. The students will learn planning strategies to mainly mitigate soil erosion, pollution of groundwater and geological hazards.

The final mark comes from the next formula:

65% final exam + 20% practice sessions report + 20% final report

It is necessary to get a mark of 5 of 10 in the global exam to average the rest of the activities. The attendance to the fieldtrips are compulsory.

Those students who didn't pass any of these activities, they would have another choice in a second call during the beginning of September. In this case, they would only have to attend to the fail activities.

The exams and practice sessions include the ODS goals, spaeially those related to Groundwater management and pollution (ODS 6) and Soil erosion and desertification (ODS 15).

The average success rate of the course during the last 3 years is 69%

2018/19	2019/20	2020/21	AVERAGE
75.00%	60.00%	72.73%	69.24%

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, soil science and climatology.

- 2. Practical sessions related to the lectures and with the aim of consolidating the explained content. The sessions include the recognition of rocks, groundwater problems in the classroom and laboratory practices to determine soil properties.
- 3. Fieldwork in the surroundings of Huesca to put into practice the acquired knowledge to solve case studies and focus on the preservation of soil and mitigation of groundwater (ODS 6 and 15)
- 4. Own working reports and learning.
- 5. Cooperative learning by the development of a group report and linked with an online course given and run by the library staff about the structure and bibliography search of scientific reports.

4.3. Syllabus

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

THEORICAL 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.

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 / Jaime Porta Casanellas, Marta López-Acevedo Reguerín, Rosa M. Poch Claret. Madrid [etc.] : Mundi-Prensa, 2008
- 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 Boulaïne. 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 ; traduccido 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** Dings, Del. Introductory soil science : laboratory manual / Del Dings. 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 M. 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* / Jaime 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. Berlín [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, Kim H. *Environmental soil science* / Kim H. Tan. 3th. ed. Boca Raton : CRC press, cop. 2009

LISTADO DE URLs:

Agencia Estatal de Meteorología, AEMET
[\[http://www.aemet.es/es/portada\]](http://www.aemet.es/es/portada)

Fotografías de perfiles de suelos
[\[http://jorgemataix.carbonmade.com/projects/47854\]](http://jorgemataix.carbonmade.com/projects/47854)

Instituto Geológico y Minero de España, IGME
[\[http://www.igme.es/\]](http://www.igme.es/)

International Union of Soil Science, IUSS
[\[http://www.iuss.org/\]](http://www.iuss.org/)

Leyenda de mapas de suelos del mundo de la FAO/UNESCO
[\[http://www.fao.org/soils-portal/soil-survey/clasificacion-de-suelos/leyenda-de-la-fao/es/\]](http://www.fao.org/soils-portal/soil-survey/clasificacion-de-suelos/leyenda-de-la-fao/es/)

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

Páginas de la Universidad de Granada con conceptos muy claros y sencillos y buenas fotos que los ejemplifican y aclaran
[\[http://edafologia.ugr.es/index.htm\]](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
[<https://pubs.usgs.gov/gip/dynamic/dynamic.html>]

United States Geological Survey, USGS
[<http://www.usgs.gov/>]

World Soil Information, ISRIC
[<http://www.isric.org/>]

The updated recommended bibliography can be consulted in:
<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=28904>