Course guide
2500209 - GEAGEOEDAF - Geology and Edaphology

Last modified: 20/06/2024

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.
745 - DEAB - Department of Agri-Food Engineering and Biotechnology.

Degree: BACHELOR'S DEGREE IN ENVIRONMENTAL ENGINEERING (Syllabus 2020). (Compulsory subject).
BACHELOR'S DEGREE IN ENVIRONMENTAL ENGINEERING / BACHELOR'S DEGREE IN MINERAL RESOURCE ENGINEERING AND MINERAL RECYCLING (Syllabus 2024). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: JOSEP SALVADOR BLANCH ROURE - JOSE MOYA SANCHEZ

Others: José Moya Sánchez
Josep Salvador Blanch Roure
Marcel Hürlimann

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
14446. Solve mathematical problems that may arise in engineering by applying knowledge about: linear algebra, geometry, differential geometry, differential and integral calculus, optimization, ordinary differential equations.
14447. Obtain basic knowledge about the use and programming of computers, operating systems, databases and basic numerical calculation and applied to engineering.
14448. Manage the basic concepts about the general laws of mechanics and thermodynamics, concept of field and heat transfer, and apply them to solve engineering problems.
14449. Apply the basic principles of general chemistry, organic and inorganic chemistry and their applications in engineering.
14450. Describe the global functioning of the planet: atmosphere, hydrosphere, lithosphere, biosphere, anthroposphere, biogeochemical cycles (C, N, P, S), soil morphology and apply it to problems related to geology, geotechnics, edaphology and climatology.

Generical:
14440. Identify, formulate and solve problems related to environmental engineering.
14441. Apply the functions of consulting, analysis, design, calculation, project, construction, maintenance, conservation and exploitation of any action in the territory in the field of environmental engineering.
14444. Apply business management techniques and labor legislation.

TEACHING METHODOLOGY

The subject consists of the following activities in classroom:
1) Sessions in large groups that include theory lessons and theory quizz discussion workshops (30 h).
2) Intermediate group sessions on practices and problems in geology and pedology (24 hours).
3) Evaluation activities (exams) (6 h).

Specific optional sessions are held to resolve and discuss the exams.
The subject calendar and detailed support material are provided on the ATENEA virtual campus.

LEARNING OBJECTIVES OF THE SUBJECT

Environmental engineering problems are very often located in a geological framework and in contact with the fluid layers of the Earth, where edaphic soils are formed.
The products of geological activity (geological materials -minerals, rocks and soils-, geological structures and landforms) and the most important geological processes (magmatism, tectonics, erosion-sedimentation) are studied, including those that are potentially dangerous for the society.
The objective of soil science is the edaphic soils, which form the skin of the earth's crust and which are essential for life. This module studies the different characteristics of soils (mineralogy, chemistry, texture and structure, physical properties, biology and ecology), the typology of soils, their formation and evolution processes, and degradation problems.

The targets are:
1. Identify the different types of materials and geological structures, as well as infer some basic mechanical or hydraulic properties.
2. Interpret geological maps and make simple geological cuts from cartographic information.
3. Characterize active geological environments and identify the processes that occur in them, particularly dangerous ones.
4. Recognize and characterize the edaphic soils on the ground.
5. Ability to characterize physical, chemical and geological properties of edaphic soils.

STUDY LOAD

Type	Hours	Percentage
Hours large group	40,0	26.67
Self study	90,0	60.00
Hours small group	20,0	13.33

Total learning time: 150 h

CONTENTS

Topic 1. Introduction to the geology

Description:
Basic geological concepts. Basic geological products and processes: basic geological materials, basic geological structures, relief forms. Large internal geodynamic processes. The rock cycle. The energy of the Earth.

Specific objectives:
Know the basic geological and geodynamic concepts at the beggining of the subject.

Full-or-part-time: 5h
Theory classes: 2h
Self study : 3h

Topic 2. Geological materials: mineralogy and texture of rocks

Description:
Definition of mineral, crystalline matter and amorphous matter. Crystalline structure. Physical properties of minerals. Mineral identification methods. Classification and basic characteristics of petrogenetic minerals. Macroscopic identification of petrogenetic minerals. Textures. (2 h)

Specific objectives:
Know the basic characteristics of minerals, as elementary geological material.

Full-or-part-time: 5h
Theory classes: 2h
Self study : 3h

Topic 3. Igneous rocks

Description:
Definitions. Site forms and general classification. Texture. Mineralogy. Classification.Distribution of igneous rocks in the lithosphere. Conditions and mechanisms of magma generation.

Related activities:
Rock identification practice I: igneous rocks (2 h)

Full-or-part-time: 7h
Theory classes: 2h
Laboratory classes: 2h
Self study : 3h

Topic 4. Sediments and sedimentary rocks (4 h).

Description:
Basic types of sediments. General classification of sedimentary rocks. Detrital rocks. Carbonate rocks. Evaporitic rocks. Deposit forms and sedimentary structures. Distribution of sedimentary rocks. Tipus bàsics de sediments.

Related activities:
Rock identification practice II: Sedimentary Rocks (2 h)

Full-or-part-time: 15h
Theory classes: 4h
Practical classes: 2h
Self study : 9h

Topic 6. Metamorphic rocks

Description:
Texture, mineralogy and classification. Deposit forms. Mineralogy and classification. Depositional forms. Metamorphic processes. Types of metamorphism. Distribution of metamorphic rocks. (2 h)

Specific objectives:

Related activities:
Practice of rock identification III: metamorphic rocks. (2 h)
Practice of rock identification IV: metamorphic rocks. (2 h)
Rocks exam (0,5 h)

Full-or-part-time: 13h
Theory classes: 2h
Laboratory classes: 4h 30m
Self study : 6h 30m

Topic 7. Geological structures

Description:
Basic types of structures. Orientation of geological plans and geological lines. Ductile deformation structures: folds. Fragile deformation structures: fractures (faults and joints). Shear zones, fault zones and fault rocks. Mechanical behavior of rocks. (2 h)

Related activities:
Practice of geological maps 1: The topographic map, maps with monoclinal structure. (2 h)
Geological map practice 2: maps with unconformities, apparent cabusation. (2 h)
Practice of geological maps 3: maps with faults. (2 h)
Exam of geological maps (2 h)

Full-or-part-time: 20h
Theory classes: 2h
Practical classes: 6h
Self study : 12h

Topic 8. Geological hazards

Description:
River floods. Flash floods. Landslides. Active faults and earthquakes. Explosive volcanic eruptions.

Full-or-part-time: 5h
Theory classes: 2h
Self study : 3h

Topic 9. Introduction to soil science

Description:
1. Components and organization of soils 2. Soil formation: soil phases, solid phase, liquid phase 3. Gas phase 4. Soil as a natural system: functions

Full-or-part-time: 5h
Theory classes: 2h
Self study : 3h

Topic 10. Soil morphology

Description:
1. Genetic horizons: nomenclature and types. 2. Physical properties of soils (1): color 3. Physical properties of soils (2): texture and granulometry 4. Physical properties of soils (3): structure, real and apparent density, porosity 5. Taxonomy and classification of soils: diagnostic horizons

Related activities:
Soil science practice I: Granulometry, texture and porosity. (2 h)

Full-or-part-time: 10h
Theory classes: 2h
Practical classes: 2h
Self study : 6h

Topic 11. The organic matter and biologic activity in the soil

Description:
1. Composition of organic matter
2. Biological activity of the soil: edaphic fauna
3. The Carbon cycle and organic matter in the soil: processes of decomposition, mineralization and humification
4. Organic matter as a component of an ecosystem: factors that influence the dynamics of organic matter, ecosystem functions of organic matter.
5. The soil as a Carbon reservoir

Related activities:
Soil science practice II: Organic matter. (2 h)

Full-or-part-time: 12h 30m
Theory classes: 3h
Practical classes: 2h
Self study : 7h 30m

Topic 12. Water in the soil

Description:
1. Chemical properties of water 2. Water retention in the soil: states of saturation, field capacity, and permanent wilting point 3. Water potential 4. Water flow in the soil: available water, gravitational water, hygroscopic water 5 Soil water balance 6. Soil moisture and temperature regimes 7. Irrigation and drainage: redoximorphic features.

Specific objectives:
Soil science practices III: Water in the soil: availability calculations. (2 h)

Full-or-part-time: 10h
Theory classes: 2h
Practical classes: 2h
Self study : 6h

Topic 13. Chemical propierties of the soil

Description:
1. Cation exchange and exchange complex 2. pH 3. Salinity and sodicity 4. Nutrients in the soil

Related activities:
Soil science practice IV: Change complex, salinity and sodicity. (2 h)

Full-or-part-time: 10h
Theory classes: 2h
Practical classes: 2h
Self study : 6h

Topic 14. The problems of soil degradation

Description:
1. Loss of soil resources: water erosion, wind erosion and mass movements. 2. Soil degradation: physical, chemical and biological. 3. Actions on the territory to avoid/correct the degradation and loss of soil.

Related activities:
Edaphology practice V: Soil mapping. (2 h)

Full-or-part-time: 10h
Theory classes: 2h
Practical classes: 2h
Self study : 6h

GRADING SYSTEM

The assessment includes:
1) Two partial exams, with a weight of 80% of the subject's grade (40% each partial).
2) Deliverables from practices and problems, with a total weight of 20% (10% geology and another 10% edaphology).

Delivery of any assessable activity is mandatory. In case of failure to hand in an exam or two or more practice deliverables within the deadline indicated by the teaching staff, the student will be graded 'not presented' in the subject.

- Criteria for qgrading and admission to the re-evaluation exam.
Students suspended from the ordinary evaluation who have appeared regularly in the evaluation tests of the suspended subject will have the option to take a re-evaluation test in the period set in the academic calendar Students who have already passed or students classified as not present will not be able to take the revaluation test of a subject. The maximum grade in the case of taking the reassessment exam will be five (5.0). The non-attendance of a student called to the re-evaluation test, held in the fixed period, cannot give rise to the completion of another test with a later date. Extraordinary assessments will be carried out for those students who, due to accredited force majeure, have not been able to take any of the ordinary assessment tests. These tests must be authorized by the corresponding head of studies, at the request of the teacher responsible for the subject, and will be carried out within the corresponding teaching period.

EXAMINATION RULES.

Practice sessions are held in medium groups. Each week the schedule of the practice group alternates so that the same group does not always have the last hour of the afternoon. This schedule is indicated in the subject calendar that is published at the beginning of the semester in Atenea.

It is mandatory to respect the schedule of the practice group. Access to the classroom will not be allowed outside the hours of the assigned practice group. If you do not show up for a practice at the assigned time, it will be classified as "no show".

BIBLIOGRAPHY

Basic:
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- Porta, J.; López-Acevedo, M.; Roquero de Luburu, C. Edafología : para la agricultura y el medio ambiente [on line]. 3ª ed. rev. y ampl. Madrid: Mundi-Prensa, 2003 [Consultation: 10/10/2023]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=3175768. ISBN 8484761487.
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- Weil, R.R., Brady, N.C. The nature and properties of soils. 15th ed., Global ed. Harlow, England: Pearson, 2017. ISBN 9781292162232.