25202 - Introductory geology for environmental science

Información del Plan Docente

Academic Year	2018/19
Subject	25202 - Introductory geology for environmental science
Faculty / School	201 - Escuela Politécnica Superior
Degree	277 - Degree in Environmental Sciences 571 - Degree in Environmental Sciences
ECTS	6.0
Year	1
Semester	First Four-month period
Subject Type	Basic Education
Module	

1.General information

1.1.Aims of the course

The main goal is to provide the fundamental scientific knowledge so that the student can understand internal and external geological processes and their interaction with the environment.
This subject represents a basic foundation for future subjects such as Edafology, Natural Risks and Environmental Remote Sensing.

1.2.Context and importance of this course in the degree

Understand physical, chemical and geological processes that control, modify and hold the natural environment. This subject is taught in the first year of the degree and it is a compulsory subject. Requieres a minimum knowledge of Mathematics, Physics, Chemistry and Biology and its learning is needed in other subjects (Edafology, Mapping and GIS softwares, Ecology, Natural Risks, Environmental Hydrology,.....)

1.3.Recommendations to take this course

There is no need of previous geological knowledge to study this subject. Any student can pass the required level without problems.

2.Learning goals

2.1.Competences

The learning of the basics of Geology will make the student able to:

- Interpret the factors, processes and relationships that work in the natural environment.
- Analyse the geological hazards spatially and temporally affecting a region.
- Determine the future sceneraio of a hazard and propose future preventive and corrective measures.
- Achieve the scientific language skills for oral and reading communication in environmental and geologic topics.
- Argue opinions and give constructive comments.

- Organize and plan tasks and manage information data.
- Group-working in interdisciplinar affairs.
- Get self-learning skills and sensitivity for environmental problems.

2.2.Learning goals

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

Analyse, argue and apply the basics of geology in environmentals problems in a temporal and spatial scale.

Properly use geological techniques.

Find and use geological information to study an area and to solve enviormnetal problems.

2.3.Importance of learning goals

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

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.

- Interdisciplinar final report to be done in a 5 people group about a topic related with Geology and Chemistry.

- Attendance to fieldtrips.

4.2 Criterios de Evaluación

The final mark comes from this formula:

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65% final exam + 10% practice sessions report + 15% final report + 10% fieldtrip attendance

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

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures, practice sessions, seminars and fieldwork.

4.2.Learning tasks

This course is organized as follows:

Face-to-face sessions (40% of the course):

- **Lectures** (3 ECTS). Lectures are given following an interactive exposition of the theoretical contents. At the end of every unit, the teacher will propose further reading/writing related with the explained geological content in order to solve environmental problems. The solution to those problems will be discussed and defended at the end of the lectures. The teacher may provide short-answer tests throughout the lectures so as to determine the comprehension level and knowledge of the students.
- **Practice sessions and seminars** (2 ECTS). Practice sessions will be carried out in the laboratory and classroom. At the end of every class, the students are asked to write a short report in which they have to include the methodology and the most outstanding results. The reports will be collected and given to the teacher at the beginning of the final exam.
- **Fieldwork** (1 ECTS). Fieldwork is an important part of the subject in order to consolidate the theoretical contents shown in lectures. It has been planned a total of 2 full-day sessions and a two-days camp. Fieldwork focus on lithology recognition, geological structure, development of geological cross-sections and the recognition of landforms. It requires maximum dedication of the student who is asked to write a personal report that has to be given at the end of every field session.
- **Moodle**. In collaboration with the library staff, the students receive a 50-minute explanation about Moodle and its application on the course, and information on how to make a compulsory online course about the structure and bibliography on scientific reports. The achieved knowledge will be put into practice in an interdisciplinary tutorized group coursework (see explanation below).

Autonomous work (60% of the course).

- **Lectures**: The students will need to dedicate 1.5 hour per lecture in order to learn the course contents.
- **Practice sessions report:** The students will need 0.75 hours per session. At least, the report must include the methodology and the results.
- **Fieldwork report:** The student will need 1 hour per field trip. The report must include the cross-sections, drawings and geomorphological maps.
- **Exams**: The student will need a minimum of 15 hours to review the contents of the course. The exam is divided into three parts. In the first one, the students have to recognize and describe images of different landforms seen during the lectures or mapped in the field trips. The second part is made up of short-answer questions. In the last one, the

student has to make a geological cross-section.
- **Supervised activities and tutorials:** It is elaborated in collaboration with the Chemistry course about an environmental problem that requires to be solved with geological and chemical knowledge. It consist of four tasks:
  - Online Course (supported by the library staff)
  - Personal index and brief report
  - Group writing research work
  - Powerpoint assignment and oral presentation of it.

4.3.Syllabus

This course will address the following topics:

Lectures

- **Topic I: Introduction to geology**
  - 1. Introduction to Geology. History of Geology. Concepts catastrophists and creationists. Uniformitarianism of Hutton and Lyell. The models of landscape evolution of Davis, Penck and King. Geological time.
- **Topic II: Structure and composition of the Earth**
  - 2. The interior of the Earth. Methods of study. Seismic waves and the structure of the Earth. Principal discontinuities of the Earth. The crust. The mantle, The lithosphere and the asthenosphere. The core. Earth materials: minerals and rocks.
- **Topic III: Minerals**
  - 3. Properties of minerals.. Minerals. Basic components of rocks. Composition of minerals. Structure of minerals. Physical properties of minerals. The crystalline form. Lustre, colour, streak, hardness, cleavage, fracture, specific gravity, Other properties of minerals. Principal mineral groups.
- **Topic IV: Rocks**
  - 4. The concept of rock. Igneous, sedimentary and metamorphic rocks. The geological cycles.
  - 5. Igneous rocks. Concept of magma. Crystallization of magma. Evolution of magmas. Bowen's Series of Reaction. Magmatic differentiation. Textures: aphanitic, phaneritic, porphidic, vitreous, pyroclastic and pegmatitic. Assimilation and mixing of magmas. Origin of magmas. Types of igneous rocks.
  - 6. Metamorphic rocks. Metamorphic environments. Factors of metamorphism: temperature, pressure and chemical activity. Metamorphic changes: textural and mineralogical. Types of metamorphism. Contact metamorphism: cataclastic and regional. Factors of metamorphism. Pizzarosity and schistosity. Typology. Classification of metamorphic rocks and principal types. Concept of metamorphic facies and mineral index.
  - 7. Sedimentary rocks. Introduction. Definition of sediment. Types of sedimentation and types of sediments. Sedimentary environments. Properties of sediments and sedimentary rocks. Types of sedimentary rocks. Detritic rocks. Conglomerate, breccia, sandstone, limonite and lutite..Chemical rocks. Limestone, dolomites, siliceous, evaporates and carbonates. Lithification, compaction and cementation. Classification.
- **Topic V.- Internal Processes**
  - 8. Plate tectonics. Continental drift. Concept of lithospheric plates and physical properties. Plate boundaries. Palaeo-magnetism. Convection in the mantle. Causes of movement. The ocean deep. Continental margins. Ocean basins and dorsals of oceanic growth. Formation of orogenies. Types of orogeny. Evolution of the continents.
  - 9. Deformation of the crust. Rheology of the materials. Regimens of force (extension, compression and shearing), mechanisms and structures of deformation. Isostacy and variations of the lithosphere. Structural geology. Situation of a plane in space. Orientation, direction, dip and strike. Normal, reverse and transform faults. Horst and rift. Folds: anticline, syncline, monocline and recumbent.
  - 10. Earthquakes. Cause of earthquakes, theory of elastic rebound. Parameters of earthquakes and focal mechanisms. Seismicity and plate tectonics. Seismic and tsunami risk.
- **Topic VI.- External Processe**s
  - 11. Sedimentary processes. Factors of control. Concept of facies. Stratigraphy. Evolution and geological time. Classification of sedimentary environments.
  - 12. Water as an external agent. Global water balance. The hydrological cycle and its phases. Evaporation and condensation. Precipitation. Infiltration Run-off. The drainage basin. Morphometric analysis. Types of drainage network. Evolution of drainage basins. Base level.
  - 13. Weathering. Importance of climate in weathering. Physical weathering. Chemical weathering. Biological

weathering. Indices of weathering. Forms of alteration. Soil.
- 14. Karstic processes. Characteristics of karstic solution. Classification and description of endokarstic and exokarstic forms. Destructive and constructive forms.
- 15. Forms and processes of slopes. Hydrology of slopes. Water erosion of slopes. Concepts and basic principles en soil and rock mechanics. Slope movements. Types of fall: collapse, slides, flows and complex movements. Determinant and triggering factors.
- 16. The fluvial environment. Current flow. Base level, Erosion by river currents. Transport of sediment by river currents. Sediment deposition by river currents. River valleys. Meanders and river terraces. Floods and flood control. Alluvial fans. Characteristics and morphological elements. Morphometric aspects and factors of control. The environment of lakes.
- 17. The marine environment. Coastal processes. Waves, Tides. Drift currents. Storms. Cliffs and rocky coasts. Beaches: processes and forms. Barriers and groynes. Salt marshes, estuaries and lagoons. Deltas. Reefs of seaweed and coral. Geomorphology and variations of sea level. Continental platform. Continental slope. Pelagic deep.
- 18. The desert environment. Wind movement of particles. Processes and forms of aeolic (wind) erosion. Deflation and abrasion. Forms of Aeolic erosion. Deflation bowls, yardangs, regs and ventifacts. Aeolic accumulations. Dunes and ergs. Mantles of sand. Loess deposits. Palaeo-environmental aspects.
- 19. The Glacial environment. The glacial domain, factors and distribution. The balances of masses in glaciers. Classification of glaciers. Mechanisms of movement of glacial masses. Processes of glacial erosion. Forms of glacial erosion. Transport of particles by ice. Forms and deposits of glacial accumulation. Fluvio-glacial, glacial-lacustrine and glacial-marine accumulations.

Practice sessions

- **P1**: Visual recognition of the principal minerals. Identification of physical properties of minerals.
- **P2**: Visual recognition of the principal rocks. Classification of the principal rocks.
- **P3**: The representation of relief: the topographic map. Scale. Surveying and levelling. Basic forms of relief. Identification of different units of landscape and modeling on the topographic map. Calculations and sections with the topographic map.
- **P4-P8**: Geological maps. Interpretation of Geological maps and symbols. Dip and thickness calculation. Geological cross-sections in horizontal, dipping, folded and faulted strata.
- **P9-P10**. Introduction to work with aerial photographs. Exercises of photointerpretation in lithological and structural landscapes, in the fluvial environment and in the aeolic environment.

Fieldwork

- **Trip to the Pyrenees**. 4th week (departure at 7:00 a.m. from Huesca)
- **Trip to Sierra de Guara Range.** 7th week (departure at 7.00 a.m. from Huesca)
- **Trip to the Ebro Depression and the Iberian Range.** 11 week (departure at 7.00 a.m. from Huesca and at 8:00 a.m. from Zaragoza).

4.4.Course planning and calendar

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Activity / Weeks	1 17-23 Sept	2 24-30 Sept	3 1-7 Oct	4 8-14 Oct	5 15-21 Oct	6 22-28 Oct	7 29 Oct-4 Nov	8 5-11 Nov	9 12-18 Nov	10 19-25 Nov	11 26 Nov-2 Dec	12 3-9 Dec	13 10-16 dec	14 17-23 Dec	15 24-30 Dec	16 31 Dec-6 Jan	17 7-13 Jan	18 14-20 Jan	19 21-27 Ene	20 28 Ene-3 Feb	21 4-10 Feb	Total
				Public holiday 12 Oct (Fri) Non-school day 11 Oct (Thu)				Public holiday 1 nov (Thu)	Public holiday 16 nov (Vie)			Public holiday 6 (Thu) and 8 (Sat) Non-school day 7 (Fri)		Christmas from 21 Dec (Fri)		Christmas until 6 Jan (Sun)		End of semester Week 1:16 Jan (Wed). Start of exams 17 Jan (Thu)	Public holiday 22 Jan (Tue)		End of exams 9 Feb (Sat)	
Face-to-face sessions																						60
Lectures	2	2	2	1	2	3	1	2	3	2	2	1	1	2			2					28
Problem-solving				2	2	2	2	2	2	2	2	2										16
Laboratory sessions	2	2																				4
Group work																						0
Fieldwork					2,5			2,5		5												10
Tutorials																						0
Evaluation																			2			2
Non face-to-face work																						90
Autonomous work	4	4	4	4,5	3	3	3	2,5	3	3	2,5	4	3,5	4	4	4	5	6	5			72
Group work					2	1,5	2	1,5	2	2	1,5	2	1,5	2								18
TOTAL	8	8		5,5	11,5	9,5	8	10,5	10	14	8	9	6	8	4	4	7	6	7			150

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the Faculty of Sciences website and Moodle (http://moodle.unizar.es/).

4.5.Bibliography and recommended resources

BB Gutiérrez Elorza, Mateo. Climatic geomorphology / Mateo Gutiérrez ; translated by G. Benito ... [et al.] . Amsterdam [e Elsevier, 2005

BB Gutiérrez Elorza, Mateo. Geomorfología / Mateo Gutiérrez . Madrid [etc.] : Pearson Educación, 2008

BB Gutiérrez Elorza, Mateo. Geomorfología climática / Mateo Gutiérrez Elorza Barcelona : Omega, 2001

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BB	Pedraza Gilsanz, Javier de. Geomorfología : principios, mé y aplicaciones / Javier de Pedraza Gilsanz ; colaboradores María Carrasco González...[et al.] Alcorcón, Madrid : Rued 1996
BB	Tarbuck, Edward J.. Ciencias de la tierra : una introducción 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
BC	Anguita Virella, Francisco. Origen e historia de la Tierra / Francisco Anguita Virella . Alcorcón, Madrid : Rueda, D.L.
BC	Anguita Virella, Francisco. Procesos geológicos externos y geología ambiental / Francisco Anguita Virella, Fernando M Serrano . Madrid : Rueda, D.L. 1993
BC	Geología / José A. Agueda Villar...[et al.] . 2a. ed. Madrid : Rueda, 1983
BC	Geología en imágenes : ejercicios y cuestiones didácticas Angeles Aguilera Cascales ... [et al.] . Alcorcón (Madrid) : F 1995
BC	Geomorfología práctica : ejercicios de fotointerpretación y planificación geoambiental / Juan de Dios Centeno ... [et al Madrid : Rueda, D.L. 1994
BC	Hamblin, William Kenneth. Earth's dynamic systems / W. K Hamblin, Eric H. Christiansen . 8th. ed. Upper Saddle Rive Jersey) : Prentice Hall, 1998
BC	Pozo Rodríguez, Manuel. Geología práctica : introducción reconocimiento de materiales y análisis de mapas / Manue Rodríguez, Javier González Yélamos, Jorge Giner Robles Última reimp. Madrid [etc.] : Pearson Educación, D. L. 200 (reimp.2008)
BC	Selby, M.J.. Earth's changing surface : an introduction to geomorphology / M.J. Selby . Oxford : Clarendon Press, 19
BC	Strahler, Arthur N.. Geografía física / Arthur n. Strahler, Ala Strahler ; [trad. por Marta Barrutia y Pere Sunyer] . 3ª ed., reimp. Barcelona : Omega, cop. 1989 (reimp. 2005)
BC	Summerfield, Michael A.. Global geomorphology : An introd to the study of landforms / Michael A. Summerfield . 1st pu Harlow : Prentice Hall, 1991 [reimp. 1996]

The updated recommended bibliography can be consulted in:
http://psfunizar7.unizar.es/br13/egAsignaturas.php?id=10965