26418 - Geophysics and Global Tectonics

Información del Plan Docente

Academic Year	2018/19
Subject	26418 - Geophysics and Global Tectonics
Faculty / School	100 - Facultad de Ciencias
Degree	296 - Degree in Geology
ECTS	6.0
Year	3
Semester	First semester
Subject Type	Compulsory
Module	---

1.General information

1.1.Aims of the course

The expected results of the course respond to the following general aims:

1. To provide knowledge about the methods to explore the Earth.
2. To understand the structure of the Earth and the Lithosphere.
3. To interpret geophysical data coming from potential fields (gravimetry and magnetometry).
4. To understand processing of seismic reflection profiles.
5. To relate physical properties of rocks to their behaviour at depth.
6. To apply geophysical data to the interpretation of geological bodies.
7. To understand the rheology of the lithosphere and mechanisms of deformation at different depths.

1.2.Context and importance of this course in the degree

This course is part of a group of subjects in the Degree in Geology that constitute the basin background for geologists to understand the Earth as a whole and to apply geophysical techniques to geological problems.

1.3.Recommendations to take this course

This module requires comprehension of tectonic structures and Geology and basic Physics and Mathematics knowledge to understand the fundamentals of Geophysics. Abilities to work with contour

maps, cross-sections and a minimum background of informatics are not compulsory but can help.

2.Learning goals

2.1.Competences

After completing the course, the student will be competent in the following skills:

- Ability to transfer geophysical information to geological features.
- Capacity to understand the Earth as a whole and the implications that its structure has for the different disciplines in Earth Sciences.
- Skills to work with contour maps of potential fields.
- Ability to solve elementary problems in geophysics.
- Capacity to interpret seismic reflection profiles in terms of geological cross-sections.
- Skills to obtain information from earthquake parameters.
- Capacity to solve questions of plate kinematics by means of vectorial calculations, paleomagnetism and magnetic anomalies of the ocean floor.
- Ability to understand mechanisms of heat transfer within the Earth and their implication in plate tectonics.

2.2.Learning goals

During this module the student will develop:

- Knowledge of the main methods in geological surveying and their use for the understanding of the internal structure of the Earth and for solving geological problems.
- Ability to work with gravimetric and magnetic anomaly maps and interpret them according to the geological background.
- Ability to derive and solve problems related to seismic surveying (refraction and reflection).
- Ability to analyse plate kinematics and to interpret associated geological structures in plate boundaries.
- Understanding of the main processing methods in geophysics.
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Basic understanding of rheological models of the oceanic and continental lithospheres, and mechanisms of deformation at different levels within the crust.

- Intellectual skills to integrate her/his geological knowledge within the frame of Global Tectonics.

2.3.Importance of learning goals

The understanding of the structure of the Earth as a whole, the meaning of geophysical data, the kinematics of tectonic plates, and the application of geophysical methods to Geology is a basic part of the background in Earth Sciences for all geologists, whatever their field of specialization.

3.Assessment (1st and 2nd call)

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

The student will prove that she/he has achieved the expected learning results by means of the following assessment tasks:

Continuous assessment

1. Resolution of 3 tests during the semester, using skills and basic knowledge acquired in the lectures and lab sessions. Minimum score 5 out of 10. Slightly lower scores can be balanced between different assessments.

Categorising performance levels:

- Excellent performance (9-10 points): knowledge and problem resolution based on the taught programme
- Typical performance (7-8 points)
- Threshold performance (5-6 points)
- Compensable (4-4.9 points)
- Failure (0-4 points)

Final assessment

1. In case of failure of one or more of the continuous assessment tests (minimum score 5 out of 10), the final assessment is a second-chance examination, also for students that cannot attend the normal development of the module.

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

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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, laboratory sessions, seminars, tutorials and assessment tasks.

4.2.Learning tasks

This 6 ECTS course is organized as follows:

- **Lectures** (24 hours). Two weekly hours. The students will have class notes given by the professor as the basis for their learning, that must be completed with important remarks during the lectures and the laboratory sessions. Study of basic handbooks is strongly recommended.
- **Laboratory sessions and seminars** (36 hours). Two weekly hours.
- **Tutorials**. The tutorials will be considered as another academic activity where the students will be free to ask about any topic concerning the course.
- **Assessment tasks** (8 hours). It includes assessments and comments about them, which serves as a powerful learning tool (3 assessments in continuous evaluation modality). There are also two final resit exams. Exams include laboratory and theoretical questions, typically 13.

4.3.Syllabus

This course will address the following topics:

Lectures

1. Introduction to Global Geophysics.
2. Elastic properties. Seismic waves.
3. Fundamentals of seismic refraction.
4. Structure of the Earth from seismic data.
5. The lithosphere.
6. Earthquake seismology.
7. Focal mechanisms. Palaeoseismology.
8. Plate tectonics. Dynamics of plate margins.
9. Divergent, transform and convergent margins.
10. Fundamentals of seismic reflection surveying.
11. Seismic data processing.
12. Structures associated with plate margins. Divergent margins.
13. Structures in convergent and transform plate margins.
14. The Earth's magnetic field.
15. Magnetic properties of rocks and minerals.
16. Magnetic surveying. Paleomagnetism.
17. Magnetic anomalies of the ocean floor. Plate kinematics.
18. Gravimetry. Gravity field. Geoid.
19. Processing of gravimetric data.
20. Isostasy.
21. Thermal properties of rocks.
22. Thermal flow. Distribution and causes.
23. Mechanisms for plate movement.
24. Plate tectonics in Earth's history.
25. Planetary tectonics.

Laboratory sessions

1. Seismic refraction interpretation.
2. Modelling of seismic rays within the Earth.

3. Focal mechanisms. Interpretation.
4. Plate boundaries. Vulcanism and seismicity.
5. Topography of plate boundaries and interiors.
6. Interpretation of seismic reflection profiles.
7. Kinematics of plates.
8. Interpretation of magnetic anomalies in the ocean floor.
9. Exercises on plate boundaries, seismicity, paleomagnetism and plate kinematics.
10. Computer-based modelling of gravimetric and magnetic anomalies.
11. Isostasy.
12. Interpretation of tectonic structures in Mars and Venus.

4.4.Course planning and calendar

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 and Earth Sciences Department websites (https://ciencias.unizar.es, https://cienciastierra.unizar.es) and Moodle.

4.5.Bibliography and recommended resources