UAB
Universitat Autònoma de Barcelona

Geophysical Methods

Code: 101034
ECTS Credits: 7

2024/2025

Degree	Type	Year
2500254 Geology	OB	3

Contact

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Teachers

Mario Zarroca Hernandez

Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Although there are no official prerequisites, it is advisable for the student to review the Physics's fundamentals. Significant part of the suporting material provided to the student will be in English.

Objectives and Contextualisation

The main objective is to provide students with theoretical and practical knowledge about Geophysical Surveying, with special emphasis on Research - Exploration applied to the resolution of diverse geological problems, relating the knowledge acquired in the Geophysical Methods' matter with the other subjects of the degree in Geology.

As specific objectives, the student is expected to acquire skills in:

1. The use of surveying instruments and geophysical data processing techniques.
2. The integration of diverse disciplines in a multidisciplinary research where the geophysical methods are key for its development.
3. The application of the knowledge acquired to solve simple geological problems.
4. The organization and planning of tasks as well as the development of interpersonal skills that allow students working as a team.
5. Defend in the classroom the works developed as a team.
6. Know how to face oral and written tests.

Competences

- Display knowledge of the applications and limitations of geophysical methods for learning about the Earth.
- Learn and apply the knowledge acquired, and use it to solve problems.
- Process, interpret and present laboratory data using qualitative and quantitative techniques, and suitable computer programmes.
- Recognise, depict and reconstruct tectonic structures and the processes that generate them and relate types of rocks and structures to geodynamic environments.
- Show an interest in quality and incorporate it into practice.
- Suitably transmit information, verbally, graphically and in writing, using modern information and communication technologies.
- Synthesise and analyse information critically.
- Use concepts from physics when solving problems in geology.
- Work independently.

Learning Outcomes

1. Depict geochemical and geophysical data graphically: phase diagrams, compositional diagrams and methods of geophysical representation.
2. Discern the different methods of geophysical prospection and interpret simple profiles according to the level of reliability.
3. Learn and apply the knowledge acquired, and use it to solve problems.
4. Model the subsoil based on seismic, gravimetric, geomagnetic and geoelectrical information, and other geophysical data.
5. Show an interest in quality and incorporate it into practice.
6. Suitably transmit information, verbally, graphically and in writing, using modern information and communication technologies.
7. Synthesise and analyse information critically.
8. Use physical parameters (wave propagation, gravity, temperature, magnetism, etc.) to interpret the internal structure of the Earth and in resource prospection.
9. Work independently.

Content

Geoelectric methods

Electrical conductivity of rocks. Electric geophysical surveying in direct current (DC). Self-potential (SP). Vertical electrical sounding (VES). Resistivity profiling. Electrical resistivity tomography (ERT). Induced polarization (IP).

Seismic methods

Seismic waves. Elastic constants of rocks. Seismic geophysical surveying. Refraction and seismic refraction tomography (SRT). Reflection.

Gravimetric methods

Earth's gravity. Isostasy. Gravimetric surveying.

Geomagnetic methods

Geomagnetic field. Geomagnetic surveying.

Electromagnetic methods

Electromagnetic geophysical surveying. Surveying in the frequency domain (FDEM). Surveying in the time domain (TDEM). Ground Penetrating Radar (GPR).

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Field work	7	0.28	2, 3, 4, 5, 7, 8
Lab practices	22	0.88	1, 2, 3, 4, 5, 7, 8
Master classes	30	1.2	1, 2, 3, 4, 5, 7, 8
Type: Supervised			
Tutorial activities for practical work	8	0.32	4, 5, 7, 8, 9
Tutorial activities in the classroom	3.25	0.13	2, 3, 4, 5, 6, 7, 8
Type: Autonomous			
Cases study, problem solving, and reporting of practices	90	3.6	1, 2, 3, 4, 5, 6, 7, 8, 9

Master classes

Theoretical fundamentals will be transmitted mainly in the classroom during master classes, with support of ICT and debates in a large group. Apart from the selected bibliography, students will be provided with diversified material to follow-up of classes' contents. These support materials will be available for students on the virtual campus and the Sciences Faculty libraries. Significant part of these materials will be in English. Additional virtual-access supporting materials, to those in the bibliography included in this guide, will be proposed during the course.

The theoretical concepts acquired by the students will be evaluated through written tests.

Lab practices

Theoretical fundamentals will be applied to analyze cases studies and solving of basic geophysical problems. Geophysical data will be processed by using analogical and numerical techniques, spreadsheets and specific geophysical processing software. The necessary material for the realization of the practices will be, millimeter paper, logarithmic double paper (62.5 mm), desk material and basic calculator. Timely it will be necessary for students to bring their own laptop. It will not be indispensable but it is very recommended that each student can have their own laptop (windows OS based).

Field practices and collective work

Practical work will focus mainly on acquiring a field work methodology for the implementation of geophysical surveying campaigns.

During the field work day, the student must acquire a transversal and systemic knowledge of various problems in the acquisition of data and validation of data in the field. The tasks will be carried out collectively.

The student practical skills will be evaluated by means of an oral defense of the results obtained by means of the team work. Such work will consist of a proposal for the implementation of a geophysical surveying, designed by the students to solve a specific geophysical problem raised by the students.

The activities will be supported through tutorial in the classroom and at the teacher's office.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Lab practices and collective work (reduced group)	30	9.5	0.38	4, 5, 6, 7, 8, 9
Partial tests and remedial exam	70	5.25	0.21	1, 2, 3, 4, 6, 7, 8

Individual evaluation (80% of final grade):

In this part, the scientific-technical concepts reached by the students are evaluated individually, as well as their analysis and synthesis, and critical reasoning skills.

The evaluation of the theoretical contents is carried out through 2 written tests that are made throughout the course. The contents of each will be eliminatory (the subsequent tests do not include the contents of the previous ones). The qualification of this part is the sum of the 2 written tests (P1 - 30%, P2 - 30%) = 60%.

The other 20% remaining until completing 80% of the overall grade will correspond to resolution of practical exercices.

The qualification obtained in this individual evaluation will represent 80% of the final grade of the matter.

Collective evaluation (20% of the final grade):

In this part, the work carried out by reduced groups (geophysical surveying implementation proposal) is evaluated.

The grade obtained in this collective evaluation represents 20% of the final grade of the matter.

The non-presented:

It will be considered that a student will obtain the grade of No Presented if the evaluation of all the evaluation activities does not allow him to reach the global grade of 5, in the supposition that he/she had reached the maximum grade in all of them.

Remedial exam:

Final exam to remedial the theoretical contents of the subject evaluated to P1 and P2.

Attendance:

The attendance to the theoretical classes and laboratory practices is mandatory. Unjustified nonattendance exceeding 25% rules out the student to attend the partial and final exams.

Attendance at field trips is restricted to those students who have achieved minimal attendance at theoretical classes and lab practices equal or exceeding 75%.

Single evaluation:

The students taking advantageof the single evaluation must carry out the laboratory practices (PLAB) in person, must deliver the mandatory exercises, and must obtain a minimum grade of 5 points out of 10. PLAB grade will be weighted as 30% of the total grade. Attendance at the Field practice (PCAM) will also be mandatory.

The single assessment consists of a single synthesis test (with multiple choice questions and problems), on the contents of the entire theory and practice program of the subject. The grade obtained in the theoretical synthesis test will be 35% and problems 35% of the total final grade.

The single assessment test will be done coinciding with the same date scheduled for the last continuous assessment test and the same reevaluation system will be applied as for the continuous assessment.

It is necessary to obtain a minimum final grade of 5 points out of 10 in each of the parts (synthesis test, PLAB).

Bibliography

Geophysics fundamentals:

LOWRIE, W., 1997, Fundamentals of geophysics. Cambridge University Press, Cambridge.

UDÍAS, A. & MEZCUA, Julio, 1.997, Fundamentos de Geofísica (2a Ed.). Alianza. Universidad, Madrid.

Geophysical surveying:

GIBSON, P.J., GEORGE, D.M., 2013, Environmental applications of geophysical surveying techniques. Nova Science Publishers Inc. New York.

REYNOLDS, J.M., 2011, An Introduction to Applied and Environmental Geophysics, 2nd Edition. John Wiley & Sons, West Sussex.

MILSON, J. J., ERIKSEN, A., 2011, Field Geophysics, Edition 4. Volume 33 of Geological Field Guide, Wiley, West Sussex, UK.

Geophysical numerical problems:

BUFORN, E., et al., 2010, Problemas Resueltos de Geofísica. Ed. Pearson, Madrid.

Software

The software required to carry out the practical work will be provided to the student. This software will be OS Windows based, so students with other operating systems are recommended to install a Windows OS emulator on their laptops.

Language list

Name	Group	Language	Semester	Turn
(PCAM) Field practices	1	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	1	Catalan	second semester	morning-mixed

(PLAB) Practical laboratories	2	Catalan	second semester	morning-mixed
(TE) Theory	1	Catalan	second semester	morning-mixed