

26425 - Geotechnics and Geophysical Prospecting

Syllabus Information

Academic Year: 2020/21

Subject: 26425 - Geotechnics and Geophysical Prospecting

Faculty / School: 100 - Facultad de Ciencias

Degree: 296 - Degree in Geology

ECTS: 7.0

Year: 4

Semester: First semester

Subject Type: Compulsory

Module: ---

1.General information

1.1.Aims of the course

In this course the main objectives are that the prospective student acquires a series of professional competencies in the field of Geotechnics, with appreciation of the importance of geology in civil engineering, whilst embracing the ethical compromise of a fully fledged professional geologist. After successfully completing the course the student will be able to collect data and samples, order tests and perform calculations in for building foundations, slope stability analysis etc. The student will be able to distinguish the applications and drawbacks of several methods of geophysical proving.

1.2.Context and importance of this course in the degree

This course is usually undertaken in the fourth year of the degree. Therefore, the students are expected to already have wide geological knowledge, and to be skilled at using the necessary tools -both physical and conceptual- usually fielded in geology.

1.3.Recommendations to take this course

This course is among the courses devoted to those applied aspects of Geology. It requires some familiarity with solving numerical problems, as usual in Physics or Mathematics, and the ability to integrate the studied topics within the wider scope of matters learned in other courses. It is recommended to have successfully passed courses on physics and structural geology in previous years. It is recommended, as well, to assist to all lectures and the rest of activities, to keep a daily routine of work in order to fulfil the deadlines for papers and questionnaires, and to make use of tutorial times.

2.Learning goals

2.1.Competences

Upon completion of this course, students will be able to:

- solve usual problems in geotechnics.
- know the main methods of geophysical surveying.

2.2.Learning goals

To successfully pass this course the student will achieve to...

Fundamentals of Soil Mechanics

- ... know concepts and basic terminology.
- ... know and apply the Unified Soil Classification System.
- ... know how to calculate stress by the self weight of soil: effective stress, total stress, and pore water pressure.
- ... know how to calculate the underground increase in stress due to surface loading.
- ... know and use the concept of normally consolidated and overconsolidated soils.
- ... know and use the Mohr Circle and the failure law of Mohr-Coulomb for the shear strength of soils.
- ... understand the workings and goals of the different failure tests.
- ... appreciate the importance of detecting trouble soils, and to integrate other geological sciences into geotechnics.

Fundamentals of Rock Mechanics

- ... know the difference between rock matrix and rock mass and its implications.
- ... know the main failure criteria for rock matrix and rocks masses.
- ... know how to characterise a rock mass.

Applications of Soil Mechanics

- ... know the different kind of foundations.
- ... know how to calculate bearing capacity of soils.
- ... know how to estimate settlement and time of settlement.
- ... know how to plan and perform the geotechnical report for a construction site.
- ... know how slopes fail, and how to calculate their stability.

Methods and Applications of Geophysical Surveying

- ... know the physical fundamentals of the main methods.
- ... know their applications and drawbacks.

2.3.Importance of learning goals

This course seeks not only to introduce students to the concepts and methods of this discipline, but also to instill a procedural style in problem solving in such a way that it increases their ability to provide solutions to geological problems in applied geology and engineering, knowing the usual nature of these problems and identifying the most appropriate procedures to solve them.

3.Assessment (1st and 2nd call)

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

Assessment activities

Continuous evaluation

1. *Questionnaires* (running test): at the end of each lecture the student must answer one or more questions related to the topic at hand.
2. *Practicals*: Each practical session includes additional problems that must be solved and presented before the next session.
3. *Written test*. Near the end of the term there will be a test (4-5h long) with question and/or problems to evaluate the understanding of the course. The student may consult books, course notes, etc.
- 4) *Field report*. The student will produce a properly structured report from data and observations collected in a geophysical survey in the field.

Global Evaluation test

Students that failed to follow the course, and those that wish to, have the right to a global evaluation test. It consist on a *written test*, alike the previously described, and an it may include *additional test* where the student will show his/her skills with geophysical instruments.

Assessment criteria or Course Grade Distribution

1. Continuous evaluation mode: $\text{grade} = (\text{test} \times 0.7) + (\text{continuous ev.} \times 0.3)$, where ?continuous ev.? referees to (classroom questions + additional problems + field report) / 3
2. Global test. $\text{grade} = (\text{written test} \times 0.7) + (\text{additional test} \times 0.3)$

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

This module consists of lectures, practical laboratories, tutorial exercises, may include case histories and coursework exercises.

4.2.Learning tasks

Activity 1. Learning of concepts, descriptions and calculations bases.

Lectures (2.8 ECTS)

Seminars (0.9 ECTS)

Activity 2. Learning of procedures and tools

Laboratory practices: management of geophysical devices (0.2 ECT) and external visit to a laborator (0.8 ECTS)

Field work (0,3 ECTS; two half-days)

Practicals: solving numerical problems in geotechnics (2 ECTS)

Teaching and assessment activities will be carried out on site for as long and as much as possible. This scenario could change if safety regulations related to the covid19 crisis recommended online activities.

4.3.Syllabus

Course syllabus

Unit 1. Fundamentals of soil mechanics

T1. Soil propertieess and classification

T2. Soil stress: self weight and induced stress by loading

T3. Soil consolidation.

T4. Conditions of failure. Soil shear and failure.

Unit 2. Fundamentals of rock mechanics

T5. Rock and rock mass. Conditions of failure.

T6. Characterisation and classification of rock masses

Unit 3. Applied geotechnics

T7. Bearing capacity of soil

T8. Deep foundations

T9. Geotechnic surveying and report

T10. Soil slopes

T11. Rock slopes

T12. Lateral earth pressure

Unit 4. Geophysical surveying

T13. Electrical methods

T14. Seismic refraction

T15. Ground Probing Radar

4.4.Course planning and calendar

This course is a first semester course and consists of lectures, laboratory exercises, one-morning of field work with geophysical instruments, and one-morning of geotechnical lab visit. Classes will start the first academic week.

Students can refer to the Faculty of Sciences and Earth Sciences Department websites (<https://ciencias.unizar.es>; <https://cienciatierra.unizar.es/>) for timetable, classroom or assessment dates.

Further information regarding this course (examination, individual or group assignments...) will be provided on the first day of class.

Date for field trip will be published at the Earth Sciences Department website.

Tutorials: Office hours will be also provided the first day of class.

4.5.Bibliography and recommended resources

http://biblos.unizar.es/br/br_citas.php?codigo=26425&year=2020