Course guide
250521 - ESTTALUS - Slope Stability

Last modified: 25/01/2024

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.

Degree: MASTER'S DEGREE IN GEOTECHNICAL AND EARTHQUAKE ENGINEERING (Syllabus 2009). (Optional subject).
MASTER'S DEGREE IN GEOLOGICAL AND MINING ENGINEERING (Syllabus 2013). (Compulsory subject).
MASTER'S DEGREE IN GEOTECHNICAL ENGINEERING (Syllabus 2015). (Optional subject).

Academic year: 2023 **ECTS Credits:** 5.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: JOSE MOYA SANCHEZ

Others: JOSE ANTONIO GILI RIPOLL, JOSE MOYA SANCHEZ, ROGER RUIZ CARULLA

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
8211. The ability to address and solve advanced mathematical problems in engineering, from the scope and context of the problem to its statement and implementation in a computer program. In particular, the ability to formulate, program and apply advanced analytical and numerical calculation models to the design, planning and management of a project, as well as the ability to interpret the results obtained in the of mining engineering.
8217. Ability to conduct land management studies, including the construction of tunnels and other underground infrastructures.
8241. Adequate knowledge of modelling, assessment and management of geological resources, including groundwater, mineral and thermal resources.

Transversal:
8560. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

8561. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

TEACHING METHODOLOGY

The course consists of 3 hours a week of lectures in the classroom.

55% of the time is devoted to theoretical contents, when the teacher explains the basic concepts and discuss real cases of slope instability.

30% of the time is devoted to exercises aimed at solving practical problems and to field work having more interaction with students.

There are also planned activities for mentoring, supervision and assessment of the Case Study

I
Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.

LEARNING OBJECTIVES OF THE SUBJECT

Adequate knowledge of modeling, assessment and management of geological resources, including groundwater, mineral and thermal resources.

Ability to conduct land management studies, including the construction of tunnels and other underground infrastructures.

Ability to address and solve advanced mathematical engineering problems, from problem statement to formulation development and its implementation in a computer program. In particular, the ability to formulate, plan and implement advanced analytical models and numerical calculation, project planning and management, and the ability to interpret the results in the context of mining engineering.

Specialized knowledge on Geotechnics to be able to apply advanced techniques and methodologies. The aim is to deepen the knowledge on geotechnical engineering to design and build any geotechnical structure such as the design of stable slopes and tunnels, as well as to enhance the knowledge related to ground infrastructure engineering and earthquake engineering.

Geomechanics and Geotechnical Engineering, Design and Construction of geotechnical projects, slope stability, geotechnical engineering related to infrastructures, seismic engineering.

Ability to identify instability features in natural slopes and embankments as well as the type of failure mechanism.

Knowledge of procedures and tests to determine the strength parameters of soils and rocks.

Ability to perform the analysis of the landslide runout.

Ability to analyze the stability of a natural slope or artificial cut.

Knowledge of techniques for landslide monitoring as well as the stabilization, retention and protection measures.

Capability to perform the quantitative risk analysis.

STUDY LOAD

Type	Hours	Percentage
Hours small group	9,8	7.83
Self study	80,0	63.95
Hours medium group	9,8	7.83
Hours large group	25,5	20.38

Total learning time: 125.1 h

CONTENTS

Classification and characterization of landslides

Description:
Topic 1. Typology of landslides.

Full-or-part-time: 7h 11m
Theory classes: 3h
Self study : 4h 11m

Resistant properties

Description:
Resistant properties of soils. Tests. Resistant properties of rock joints

Full-or-part-time: 7h 11m
Theory classes: 3h
Self study : 4h 11m

Identification of unstable slopes and embankments

Description:
Criteria and indicators of instability of unstable slopes. Recognition techniques
Workshop 1. Recognition of large landslides: real cases
Workshop on methods for remote capture of geological data

Full-or-part-time: 12h
Theory classes: 1h
Practical classes: 4h
Self study : 7h

Stability Analysis

Description:
Limit equilibrium analysis.
Tutoring limit equilibrium methods
Tutorial stability analysis and trajectrography

Full-or-part-time: 19h 12m
Theory classes: 3h
Practical classes: 5h
Self study : 11h 12m

Dynamics of movements and propagation analysis

Description:
Propagation mechanisms and strength loss. Earthflows and debris flows
Workshop 5. Mobility analysis of large slides: real cases
Topic 6. Analysis of the propagation and run out of rockfalls

Full-or-part-time: 14h 23m
Theory classes: 4h
Practical classes: 2h
Self study : 8h 23m

Instrumentation and monitoring

Description:
Topographic and geodesic surface.
Geotechnical techniques. Remote sensing

Full-or-part-time: 7h 11m
Theory classes: 3h
Self study : 4h 11m

Estabilization and protection techniques

Description:
Stabilization and reinforcement of slopes and cuttings. Protective structures.

Full-or-part-time: 7h 11m
Theory classes: 3h
Self study : 4h 11m

Hazard and Risk Analyses

Description:
Susceptibility and hazard.
Workshop 6. Hazard assessment of real cases
Vulnerability and exposure. Analysis of consequences. Quantitative risk assessment
Observation od different instability mechanisms : rock falls (Montserrat) , landslides (Vallcebre) , as well as monitoring techniques and protection and stabilization works
Problems of quantitative risk assessment

Full-or-part-time: 28h 47m
Theory classes: 4h
Practical classes: 2h
Laboratory classes: 6h
Self study : 16h 47m

Evaluation

Full-or-part-time: 4h 48m
Laboratory classes: 2h
Self study : 2h 48m

GRADING SYSTEM

The mark of the course is based on the oral presentation and the wrtitten report on the analysis of the the stability of a road cut or slope, the runout analysis of rockfalls and landslides, or the risk assessment due to the instability of natural slopes.

EXAMINATION RULES.

Failure to perform a laboratory or continuous assessment activity in the scheduled period will result in a mark of zero in that activity.

BIBLIOGRAPHY

Basic:

- Hoek, E.; Bray, J. Rock slope engineering. Rev. 3rd ed. London: The Institution of Mining and Metallurgy, 1981. ISBN 0419160108.
- Turner, A.K.; Schuster, R.L. (Editors). Landslides: investigation and mitigation. Washington, DC: National Academy Press, 1996. ISBN 030906208X.
- Highland, L.M.; Bobrowsky, P. The Landslide Handbook-A Guide to Understanding Landslides. Reston, Virginia, U.S: US Geological Survey, 2008. ISBN 9781411322264.