Course guide
250805 - 250805 - Rock Mechanics

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 ENGINEERING (Syllabus 2015). (Compulsory subject).

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

LECTURER

Coordinating lecturer: IGNACIO CAROL VILARASAU

Others: IGNACIO CAROL VILARASAU

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
13308. To conceive soils and rocks as porous media governed by Solid and Fluid Mechanics.
13309. To characterize the geological environment and its interaction with civil works.
13310. To interpret laboratory tests and field observations so as to identify the mechanisms responsible for soil response. To propose laboratory testing programmes.
13311. To formulate and implement Finite Element and Finite Differences numerical models with the objective to analyze the processes that govern ground response, to interpret field information and to predict soil response.

Generical:
13300. To apply advanced knowledge in sciences and technology to the profesional or research practice.
13305. To conceive Geo-engineering as a multi-disciplinary field that includes relevant aspects from geology, sismology, hydrogeology, geotechnical and earthquake engineering, geomechanics, physics of porous media, geophysics, geomatics, natural hazard, energy and climate interactions.
13306. To promote innovation for the development of methodology, analyses and solutions in Geo-engineering
13307. To tackle and solve advanced mathematical problems in engineering from the drafting of the problem to the development of formulation and further implementation in computer programs. Particularly, to formulate, code and apply analytical and numerical advanced computational tools to project calculations in order to plan and manage them as well as to interpret results in the context of Geo-engineering and Mining engineering.

TEACHING METHODOLOGY

The course consists of 3 hours per week of classroom sessions

A visit to the lab will be scheduled.

If possible, a field trip will also be scheduled in combination with students from similar courses in other degrees offered by the same school.

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

To conceive soils and rocks as porous media governed by Solid and Fluid Mechanics.
To characterize the geological environment and its interaction with civil works.
To interpret laboratory tests and field observations so as to identify the mechanisms responsible for soil response. To propose laboratory testing programmes.
To formulate and implement Finite Element and Finite Differences numerical models with the objective to analyze the processes that govern ground response, to interpret field information and to predict soil response.

* To apply the theoretical concepts of flow and transportation on porous media.
* To characterize soils.
* To apply the theoretical concepts of deformation and flow in soils.
* To characterize rock massifs and their discontinuities.
* To apply the concepts of mechanical stability and flow in cracks.
* To apply the theoretical problems of elastic and electromagnetic wave propagation in soils and rocks.
* To interpret and process wave signals.

- Characterization of rock mass.
- Application of continuum concepts to rock mass.
- Mechanics of discontinuities.
- In situ stress: significance and measurements.
- Fluid flow in rock mass. Uncoupled analysis.
- Hydro-mechanical coupling in rock mass.
- Modelling of rock mass behaviour.

STUDY LOAD

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

Total learning time: 125.1 h

CONTENTS

Introduction

Description:
Introduction, Geomechanical Rock Mass Classifications

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

Intact rock

Description:
Intact rock

Full-or-part-time: 14h 23m
Theory classes: 6h
Self study : 8h 23m

Discontinuities

Description:
Discontinuities

Full-or-part-time: 14h 23m
Theory classes: 6h
Self study : 8h 23m

In-situ stress

Description:
In-situ stress

Full-or-part-time: 14h 23m
Theory classes: 6h
Self study : 8h 23m

Water in the rock mass

Description:
Water in the rock mass

Full-or-part-time: 14h 23m
Theory classes: 6h
Self study : 8h 23m

Fracture Mechanics

Description:
Introduction to Fracture Mechanics

Full-or-part-time: 14h 23m
Theory classes: 6h
Self study : 8h 23m

Numerical methods in Rock Mechanics, exercises

Description:
Numerical methods in Rock Mechanics
Numerical methods, exercises

Full-or-part-time: 21h 36m
Theory classes: 6h
Practical classes: 3h
Self study : 12h 36m

Laboratory and evaluation

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

GRADING SYSTEM

The procedure to assign a grade for the course will be announced the first day of class.

EXAMINATION RULES.

The rules to assign grades will be announced the first day of class.

BIBLIOGRAPHY

Basic:
- Hudson, J,.A.; Harrison, J.P. Engineering rock mechanics [on line]. Oxford [etc.]: Pergamon, cop. 1997 [Consultation: 15/02/2021]. Available on: https://www.sciencedirect.com/science/book/9780080438641. ISBN 0080430104.

Complementary:
- Goodman, Richard E. Introduction to rock mechanics. 2nd ed. New York [etc.]: John Wiley and Sons, 1989. ISBN 0471812005.