

CIVIL-496

**Rock mass characterization for engineering design**

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Cursus	Sem.	Type
Civil Engineering	MA2, MA4	Opt.

Language of teaching	English
Credits	5
Session	Summer
Semester	Spring
Exam	During the semester
Workload	150h
Weeks	14
<b>Hours</b>	<b>5 weekly</b>
Lecture	3 weekly
Exercises	2 weekly
<b>Number of positions</b>	

**Summary**

This course advances geomechanics knowledge, focusing on lab tests, in situ & geophysical investigations for interpreting geotechnical projects. Practical modules cover rock physics, mechanics, borehole & subsurface geophysics.

**Content****Long Summary**

The evaluation of the geomechanical parameters of rock masses in large projects is a topic of great importance given the geological complexity of these masses and the difficulties in their evaluation. These difficulties are related to the uncertainties associated with the rock mass, whose characterization is normally carried out through in situ and laboratory tests. In this course, the students will learn practical skills to analyse rock masses affected by geological structures, such as discontinuities, folds, fracture and faults at both lab and site scales and understand how rocks deform in geo-engineering projects.

In a first part, we show the fundamental techniques for laboratory measurements of rock physical (i.e., density, permeability, elastic properties, electrical and thermal properties) and mechanical (i.e., USC, triaxial strength, shear strength, frictional properties, fracture toughness) properties.

In a second part, we introduce the most common (borehole and large scale) geophysical methods for site investigation and survey. The methods represent a primary tool for investigation of the subsurface and are applicable to a wide range of problems (e.g., prospecting for natural resources, geological surveying, and engineering investigations).

This course involves student groups conducting laboratory experiments that significantly enhance student understanding of rock mechanics and physics.

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**Keywords**

Experimental rock mechanics, physics, laboratory test

**Learning Prerequisites**

**Required courses**

Géologie (CIVIL-211) ; Mécanique des sols et écoulements souterrains (CIVIL-203), Mécanique des roches et ouvrages souterrains (CIVIL-308), Ouvrages géotechniques (CIVIL-306)

**Recommended courses**

Mécanique des milieux continus (CIVIL-225)

**Important concepts to start the course**

Genesis and nature of dominant geological formations. Force, tension, stress, strain, pressure, mean/deviatoric/differential stress, total and effective stress, pore pressure, flow, hydraulic potential and fluid pressure. Fracture criteria (Mohr coulomb, Hoek and Brown, Griffith), inhomogeneity, anisotropy, alteration. Elasticity theory. Shear strength of joints.

**Learning Outcomes**

By the end of the course, the student must be able to:

- Characterize the mechanical and physical properties of rocks, fractures, faults and rock masses.
- Plan standard and state of the art rock mechanics and physics laboratory and in situ tests and apply them to large scale geotechnical projects.
- Solve problems using cross-disciplinary approaches, in particular using their knowledge in engineering geology, rock mechanics, and soil mechanics.

**Teaching methods**

Lectures, laboratory tests, class exercises, assignments. The course is evaluated by a reference group

**Assessment methods**

Office hours : no

**Supervision**

Office hours	No
Assistants	Yes
Forum	No