250805 - Rock Mechanics

Coordinating unit: 250 - ETSECCPB - Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering
Academic year: 2019
Degree: MASTER'S DEGREE IN GEOTECHNICAL ENGINEERING (Syllabus 2015). (Teaching unit Compulsory)
ECTS credits: 5  
Teaching languages: Catalan, Spanish, English

Teaching staff

Coordinator: IGNACIO CAROL VILARASAU
Others: IGNACIO CAROL VILARASAU

Opening hours

Timetable: To be agreed with the instructor

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.

General:
13300. To apply advanced knowledge in sciences and technology to the professional or research practice.
13305. To conceive Geo-engineering as a multi-disciplinary field that includes relevant aspects from geology, seismology, 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.
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 masses 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

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<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Theory classes: 19 h 30m 15.60%</th>
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<tbody>
<tr>
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<td>Practical classes: 9 h 45m 7.80%</td>
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<tr>
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<td>Laboratory classes: 9 h 45m 7.80%</td>
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<td>Guided activities: 6 h 4.80%</td>
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<td>Self study: 80 h 64.00%</td>
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# 250805 - Rock Mechanics

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<thead>
<tr>
<th>Content</th>
<th>Learning time: 7h 11m</th>
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| **Introduction, Geomechanical Rock Mass Classifications** | Theory classes: 3h  
|                                 | Self study : 4h 11m   |

**Description:**
Introduction, Geomechanical Rock Mass Classifications

<table>
<thead>
<tr>
<th>Content</th>
<th>Learning time: 14h 23m</th>
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<tbody>
<tr>
<td><strong>Intact rock</strong></td>
<td>Theory classes: 6h</td>
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<tr>
<td></td>
<td>Self study : 8h 23m</td>
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**Description:**
Intact rock

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<th>Content</th>
<th>Learning time: 14h 23m</th>
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<tr>
<td><strong>Discontinuities</strong></td>
<td>Theory classes: 6h</td>
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<tr>
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<td>Self study : 8h 23m</td>
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**Description:**
Discontinuities

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<th>Content</th>
<th>Learning time: 14h 23m</th>
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<tr>
<td><strong>In-situ stress</strong></td>
<td>Theory classes: 6h</td>
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<td>Self study : 8h 23m</td>
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**Description:**
In-situ stress

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<th>Content</th>
<th>Learning time: 14h 23m</th>
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<tr>
<td><strong>Water in the rock mass</strong></td>
<td>Theory classes: 6h</td>
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<tr>
<td></td>
<td>Self study : 8h 23m</td>
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**Description:**
Water in the rock mass
250805 - Rock Mechanics

**Numerical methods in Rock Mechanics, exercises**

**Learning time:** 21h 36m
- Theory classes: 6h
- Practical classes: 3h
- Self study: 12h 36m

**Description:**
Numerical methods in Rock Mechanics
Numerical methods, exercises

**Laboratory and evaluation**

**Learning time:** 7h 11m
- Laboratory classes: 3h
- Self study: 4h 11m

**Qualification system**

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

**Regulations for carrying out activities**

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

**Bibliography**

**Basic:**


**Complementary:**