250813 - Quaternary Geology

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 Optional)  
ECTS credits: 5  
Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: JOSE MOYA SANCHEZ  
Others: JOSE MOYA SANCHEZ

Opening hours

Timetable: Thursday from 18 to 20 h.

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.

13312. To analyze, discriminate and integrate geological and geotechnical information in studies and projects.

13322. To realize studies of land management and urban spaces, including construction of tunnels and other underground infrastructures. (Specific competence of the specialization in Geotechnical Engineering).

General:

13300. To apply advanced knowledge in sciences and technology to the profesional or research practice.

13303. To evaluate the impact of Geo-engineering on environment, sustainable social development and the significance of working within reliable and conscionous profesional environment.

13304. To incorporate new technologies and advanced tools in Geo-engineering into profesional and research activities.

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.
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Teaching methodology

Three types of activities are performed: lectures (16 hours), practical sessions for solving problems (9 hours), field trips (11 h),

The teaching material is provided by the virtual campus Athena.

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 testing programmes.
To analyze, discriminate and integrate geological and geotechnical information in studies and projects.
To apply the knowledge on soil and rock mechanics to the development of the study, design, construction and exploitation of foundations, excavations, embankments, tunnels and other constructions on or through the soils, regardless of their nature and state or the finality of the works under study (Specific competence of the specialties in Geotechnical Engineering and Earthquake Engineering and Geophysics).
To analyze, from the perspective of an expert, cases of failure in Geotechnical Engineering. To report the evidences, identify the mechanisms responsible for the failure and verify using back-analysis models. Eventually provide solutions to risk reduction. (Specific competence of the specialization in Geotechnical Engineering).
To realize studies of land management and urban spaces, including construction of tunnels and other underground infrastructures. (Specific competence of the specialization in Geotechnical Engineering).
To use, in a discriminate manner, commercial software for numerical calculations in order to design and eventually monitor geotechnical structures. (Specific competence of the specialization in Geotechnical Engineering).

* To identify and characterize the materials and forms resulting from current and quaternary geological processes (flooding, flash floods, slides, fault activity), to determine the mechanisms operating, to estimate the intensity and frequency of the processes.
* To know the instrumentation and ground movement auscultation techniques and to correctly use the auscultation results.
* To be able to analyze the stability of an excavation or natural slope.
* To know the measures of stabilization, containment and protection of slope movements.
* To be able to carry out the quantitative evaluation of the risk of instability of slopes and excavations.

- External Geodynamics and controlling factors.
- Determination of the frequency of geological processes.
- Processes and sedimentary deposits: properties, geometry and morphology of colluvial, fluvial, torrential, glacial and coastal deposits.
- Weathering and auchoctonous and para auchoctonous surface formations.
- Processes of recent and active deformation and associated geological structures: neotectonics, collapses and subsidence.

The design of works of civil engineering requires knowledge of the superficial formations and of the geological processes that may occur during the life of the works. The subject provides tools for predicting the geometry and properties of the superficial formations and intensity and temporal activity of these processes. Identification and solving of problematic cases of reconnaissance of quaternary deposits and processes is stressed in the subject.

The objectives are:

- Identify and characterize the materials and landforms resulting from active and quaternary geological processes (floods, torrential floods, landslides, displacement in tectonic faults) and determine the operating mechanisms.
- Reconstruct the geometry of the superficial formations and predict their mechanic behavior. Planning of efficient
campaigns of reconnaissance superficial formations.

- Quantify the intensity and frequency of recent or active geological processes.

- Identify of problematic cases for civil engineering linked to the reconnaissance of quaternary de

<table>
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<tr>
<th>Study load</th>
<th>Theory classes:</th>
<th>Practical classes:</th>
<th>Laboratory classes:</th>
<th>Guided activities:</th>
<th>Self study:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total learning time: 125h</td>
<td>19h 30m 15.60%</td>
<td>9h 45m 7.80%</td>
<td>9h 45m 7.80%</td>
<td>6h 4.80%</td>
<td>80h 64.00%</td>
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Introduction to Quaternary Geology

Learning time: 6h
Theory classes: 2h 30m
Self study: 3h 30m

Description:
Scales of instrumental record, the historical record and the geological record. Basic dating techniques: relative dating, numerical dating, calibrated dating and dating by correlation. Dating of deposits and surfaces.

Specific objectives:
Determine the frequency, duration and extent of the climate changes occurred during the Quaternary and present, and its causes and consequences on geological processes.
Fundamentals of dating geological processes and soils.
Geomorphological processes. Landforms and associated deposits

**Learning time:** 73h 12m
- Theory classes: 11h 30m
- Practical classes: 8h
- Laboratory classes: 11h
- Self study: 42h 42m

**Description:**

Location and mapping of a landslide in aerial photography. Identifying of the mechanism. Inference of the state of activity by geomorphological criteria. Analysis of the possible mechanisms of reactivation and its reactivation potential by a method of limit equilibrium.

Identification of deposits colluvial methods for dating landslides, geomorphological recognition of the casting floor La Coma and mechanisms of displacement.


Preparation of a geological cross-section of a simple system of fluvial terraces and deposits from a geomorphological map and borehole data. Defining the geometry of the depositional units and interpretation of its chronology from dating results.

Preparing a geological cross-section of a complex system of terraces and fluvial deposits from borehole data. Defining the geometry of depositional units, morphological units and lithological units.

Conventional methods for determining the

Types of torrential processes. Features and differentiation of torrential deposits. Pyrenean examples: Senet, the Beach BarLa Guingueta and Biescas. Frequency of torrential phenomena and their controls.

Analysis of basins susceptible to torrential phenomena. Determination of frequency. Identifying the factors determining the frequency and the process type.

Types of glaciers. Glacier dynamics and glacial sub-environments. Mechanisms of erosion and deposition.

Depositional and erosional landforms. Texture and geometry of the glacial deposits.

Location of the contact in the ground surface. Location of the contact in boreholes. Preparation the geological cross-section.

Weathering processes and weathering degrees. Texture, structure and properties of weathering materials: weathered rocks, residual soils, pedogenic soils. Pedogenic development index. Use of pedogenic soils for dating of surfaces.

**Specific objectives:**
Recent and active deformation processes

**Description:**

**Specific objectives:**
Identify and determine the activity in faults.
Workshops and evaluation activities

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<th>Learning time: 9h 36m</th>
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<tr>
<td>Practical classes: 3h</td>
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<tr>
<td>Laboratory classes: 1h</td>
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<tr>
<td>Self study: 5h 36m</td>
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Description:
Discussion of the questionnaire of the course
Oral presentation of the bibliographic report

Specific objectives:
Discussion of questions and problems of Quaternary geology, prior to the exam.
Oral presentation of the bibliographic report

Qualification system

The evaluation consists of three activities:

- Four years delivered during the year (40% of the final mark).
- Bibliographic work, done in groups, with oral presentation (5%) and delivery of written report (15%).
- Individual examination (40%).

Regulations for carrying out activities

All evaluation activities are required.

Bibliography

Basic: