Course guides
250677 - 250677 - Environmental Geology

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.
Degree: MASTER'S DEGREE IN ENVIRONMENTAL ENGINEERING (Syllabus 2014). (Optional subject).
Academic year: 2020  ECTS Credits: 5.0  Languages: Catalan, Spanish

LECTURER

Coordinating lecturer: ALBERT FOLCH SANCHO
Others: ALBERT FOLCH SANCHO

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
13340. Apply scientific concepts to environmental problems and their correlation with technological concepts.
13348. Perform, present and defend before a university tribunal an original exercise performed individually, consisting of a comprehensive study or project in the field of environmental engineering, in which the skills acquired in the lessons are synthesized by adopting the advances and developments in this field and many innovative ideas.

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.

8563. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

TEACHING METHODOLOGY

The course consists of 3 hours per week of classroom activity. Half of the time is for theory sessions and the other half is dedicated to solving of problems and the study of real cases.

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.
LEARNING OBJECTIVES OF THE SUBJECT

CE01 - Apply scientific concepts to environmental problems and their correlation with technological concepts.
CE08-Dimension unconventional systems and advanced treatment and raise their mass balance and energy.

Explore scientific concepts and technical principles of quality management of the receiving means, atmosphere, water and soil, and applied to problem solving.
Explore scientific concepts and technical principles of management and treatment of gaseous emissions, water supply, sewage and waste and remediation techniques for groundwater and contaminated soils.
Sized systems for the treatment of major pollutants vectors in specific sectors of activity.
Interprets rules, identifies goals, assesses technical alternatives proposed unconventional solutions and priority actions.

The river basin: surface water system and water systems. Deltas. Water resources, vulnerability and protection.
Impact on the physical environment of urban expansion and major infrastructures (road works, tunnels, dams, reservoirs, ...).
Alteration of natural physical systems.
Resources use and extraction. Spills and waste dumps. Impacts and restoration.
Geological aspects of waste storage.

Environmental geology is an applied science that deals with the practical application of the principles of geology in solving environmental problems. It is a multidisciplinary field that is closely related to geological engineering and, to a lesser extent, to environmental geography. Each of these fields involves the study of the interaction of human activities with geology, including the biosphere, the lithosphere, the hydrosphere and in some cases also the atmosphere.

In this subject, some specific topics within this broad field will be dealt with in order to expand the knowledge acquired during the master and complement the skills necessary for the profession of environmental engineer. In this sense, topics will be discussed and examples of how geology conditions certain human activities and intervenes in different environmental processes will be explained. The focus of the different topics and problems will be from a multi and interdisciplinary point of view, necessary for the correct management of natural resources. In addition, different traditional and newly developed tools for the study and monitoring of the subsoil, water resources and natural resources will also be discussed.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guided activities</td>
<td>6,0</td>
<td>4.80</td>
</tr>
<tr>
<td>Hours small group</td>
<td>9,8</td>
<td>7.83</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>9,8</td>
<td>7.83</td>
</tr>
<tr>
<td>Hours large group</td>
<td>19,5</td>
<td>15.59</td>
</tr>
<tr>
<td>Self study</td>
<td>80,0</td>
<td>63.95</td>
</tr>
</tbody>
</table>

Total learning time: 125.1 h
Block 1: Management and planning of water resources and derived impacts

Description:
1.1. Impacts to the hydrological cycle and determination of water budget as a basic management tool
Castellano water balance calculation
1.2. Impacts on rivers and river environments: importance of water and sediment transport
Flood return period calculation exercise
1.3. Importance of groundwater in the good health of continental aquatic ecosystems
1.4. Land-sea interaction 1: Problems of marine intrusion in aquifers and their importance for water supply in coastal areas.
1.5. Land-sea interaction 2: The discharge of groundwater into the sea and its importance in marine ecosystems
1.6. Impacts derived from hydrological planning: the case of an international study of the Ebro basin.

Debate on hydrological planning

Real cases

Specific objectives:
This topic will explain how anthropic activities can alter the natural water cycle and the concept of the Water Budget or water balance, as a basic tool for managing water resources. It will also be explained in a simplified way how to estimate the different parts of the balance, both natural (precipitation, evapotranspiration, etc.) and anthropic (extractions, diversions, etc.)
A basin water balance will be estimated
Rivers are a fundamental part of the hydrological cycle where not only water transport but also sediment takes place, which affects natural systems such as Deltas and beaches, but can also become a geological irrigation during floods. This topic will explain different methods for the measurement of flows, and estimation of the risk of flooding, as well as the natural and anthropic variables that affect and / or alter the transport of water and sediments in river courses.
The return period will be calculated for a type of

Although in many cases groundwater passes unnoticed due to its low “visibility”, groundwater can lead to a very significant indication of the good state of aquatic ecosystems. This topic will explain how this interaction occurs in continental aquatic ecosystems, from rivers to wetlands.

More than 50% of the world population lives in coastal areas. This high population density gives rise to a high demand for water resources, which in most cases gives rise to significant impacts on coastal aquifers, where due to the intrusion of seawater, not only the quantity of water is affected, but its quality. This topic will explain how the hydrodynamics of coastal aquifers works and the different factors, both natural and anthropic, that affect saline / marine intrusion.

The concentration of nutrients in groundwater is generally much higher than in rivers. Therefore, despite the fact that groundwater discharge flows to the sea may be quantitatively much lower than that of surface waters, its high concentration of nutrients, generally much greater than surface waters, has important implications for coastal ecosystems. This topic will explain how groundwater discharge to the sea works, its importance and quantification methods, both from a hydrogeological and oceanographic approach.

The Ebro basin, with its more than 1000 km in length, is the longest in the Iberian Peninsula. Its great geological, climatic, hydrological, ecological and social diversity has made it an international case study. This topic will explain the different impacts derived from the planning and management of water resources from an environmental and social point of view, starting at the head reservoirs until ending at the mouth of the Ebro Delta.

Based on the above for the Ebro basin, you will discuss the most appropriate way to manage a river basin.

Real cases will be explained where you can see what has been explained in the theory part

Full-or-part-time: 43h 12m
Theory classes: 12h
Practical classes: 6h
Self study : 25h 12m
Block 2: Basic tools of Geographic Information Systems (GIS)

Description:
Topic 2.1: Introduction to GIS and basic QGIS course (free software)
Topic 2.2: Application of QGIS to practical cases

Specific objectives:
GIS are computer systems that allow us to integrate, store, analyze, share and display widely varied information in a geo-referenced way. The appearance of GIS has marked a before and after in many fields of knowledge and is a fundamental tool for environmental management. This block will explain what GIS is and will provide the necessary bases to be able to use free QGIS software at a basic level.
Real cases will be worked with the QGIS tool

Full-or-part-time: 14h 23m
Theory classes: 3h
Practical classes: 3h
Self study : 8h 23m

Block 3: Study, characterization and monitoring of the subsoil and natural resources

Description:
3.1. Traditional tools in geological and geophysical prospecting
3.2. New on-site application tools: multi-parameter surveys and profiles, recently developed water sensors, new geophysical prospecting methods and fiber optics.
3.3. New remote tools: drones and satellite remote sensing.
3. Analysis of real cases

Specific objectives:
This topic will explain what are the most common tools for conducting geological prospecting, as well as the most widely used geophysical methods (non-invasive methods) for underground exploration.
Technological advances in recent years are revolutionizing existing options for characterizing and monitoring the subsoil. This topic will explain some recently developed methods for characterizing the subsoil in situ with some real examples. These advances have not occurred only in on-site tools, but especially through new remote sensing tools. In this class, an introduction to the subject will be made, comparing the advantages and disadvantages between the different platforms (drones vs. airborne vs. satellites) as well as some examples of applications for the study of the subsoil and environmental processes. Different examples of application and real case of the methodologies explained in theory will be explained and valued

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

Directed work. evaluation

Description:
Practical work workshop

Specific objectives:
Workshop to prepare and resolve doubts about the realization and delivery of the practical works

Full-or-part-time: 14h 23m
Laboratory classes: 6h
Self study : 8h 23m
GRADING SYSTEM

The mark of the course is obtained from the ratings of continuous assessment on classroom and form the qualification of deliverables for scheduled practical activities.

EXAMINATION RULES.

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

BIBLIOGRAPHY

Basic: