Course guide
480051 - GSIG - Fundamentals of Geosciences and Geographic Information Systems

Last modified: 13/06/2025

Unit in charge:	Barcelona School of Civil Engineering
Teaching unit:	751 - DECA - Department of Civil and Environmental Engineering.
Degree:	MASTER'S DEGREE IN SUSTAINABILITY SCIENCE AND TECHNOLOGY (Syllabus 2013). (Compulsory subject).

Academic year: 2025   **ECTS Credits:** 5.0   **Languages:** Spanish

LECTURER

Coordinating lecturer:	NÚRIA FERRER RAMOS
Others:	Barba Ferrer, Maria Del Carme Trabucchi, Michela Folch Sancho, Albert

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
4. The ability to apply, critically and effectively, conceptual frameworks, data collection and processing techniques, applied statistics, mathematical modelling, systems analysis, geographic information systems, information and communication technologies and industrial ecology to meeting the challenges of sustainability and sustainable development.
5. The ability to integrate knowledge of integrated management of the natural environment and natural resources, particularly water and energy resources, in the development and proposal of scientific and technological solutions to challenges to sustainability.
CE03. The ability to critically analyse theories and perspectives on the traits and properties of the geosphere and biosphere that facilitate and frame the development of socio-environmental systems, as well as the main challenges posed by climate change.

Generical:
CG04. Describe, resolve, prevent and / or alleviate the problems and dysfunctions associated with the processes of development of environmental socio-economic systems with their own approaches to science and technologies of sustainability.

Transversal:
2. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

1. 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.

Basic:
CB8. Students should be able to intregrar knowledge and handle complexity, and formulate judgments based on information that was incomplete or limited, include reflecting on social and ethical responsibilities linked to the application of its conocimienttos and judgments.

TEACHING METHODOLOGY

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LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course, the student:

Develops and applies geoscience concepts with originality to the description of problems and situations with environmental impacts, identifying and formulating hypotheses or innovative ideas and submitting them to the test of objectivity, coherence and viability.

He knows and understands the characteristics of the geosphere that facilitate and frame the development of socio-ecological systems as well as the main challenges of climate change.

Efficiently obtain, process and analyze geospatial information.

It is able to visualize and manipulate data and to extract information in a Geographic Information Systems environment.

STUDY LOAD

Type	Hours	Percentage
Hours medium group	10,0	7.99
Hours small group	6,7	5.36
Self study	88,4	70.66
Hours large group	20,0	15.99

Total learning time: 125.1 h

CONTENTS

(ENG) 1. Introducción a las geociencias y a los SIG

Description:
Introduction: the elements that make up the geosciences. Interrelationships. Connections with other sciences. Introduction to spatial and temporal data analysis.

Specific objectives:
-Identify potential future problems and frame them within the field of geosciences.
-Recognize aspects of the spatial and temporal variability of variables and parameters of interest in geosciences

Full-or-part-time: 3h
Theory classes: 3h

(ENG) 2. Geología: rocas, suelos y procesos litorales

Description:
Stratigraphy and Petrology: Rocks and their properties. Stratigraphic columns. The column in Catalonia. Geological maps.
Geomorphology: Erosive processes: description and quantification; alluvial deposits, fluvial valleys.
Coastal processes: Driving agents (waves, tides, ad hoc action). Coastal response: sediment transport and coastal evolution.
Impact of coastal infrastructures.

Specific objectives:
Understand the foundations that support Earth's processes.

Distinguish between different types of rocks and soils.

Recognize how landscape-shaping elements reveal their formation processes and how this has implications for hydrology or soil science

Related activities:
Geological maps and cartography

Full-or-part-time: 16h
Theory classes: 3h
Guided activities: 3h
Self study : 10h

(ENG) 3. Meteorología, climatología e hidrología

Description:
Water cycle: Meteorology. Climate change.
Rivers: Rainfall–infiltration; Flood events; Flow attenuation; Basic calculations

Specific objectives:
- Relate concepts of climate and climate change.
- Associate meteorology with hydrology.
- Be able to perform basic hydrological calculations.

Related activities:
Flood calculation

Full-or-part-time: 8h
Theory classes: 2h
Guided activities: 1h
Self study : 5h

(ENG) 4. Edafología

Description:
Groundwater. Hydrochemistry. Soil sciences

Specific objectives:
Complete the water cycle
Introduce geochemical concepts
Develop the concepts of the carbon cycle and its implications for climate change

Related activities:
carbon cycle

Full-or-part-time: 11h
Theory classes: 3h
Guided activities: 3h
Self study : 5h

(ENG) 5. Contaminación de agua y suelo

Description:
soil and water pollution

Specific objectives:
Introduce concepts from engineering, chemistry, and ecology to complete the overview

Understand natural and engineering-based purification techniques that enable the restoration of the natural environment

Full-or-part-time: 31h
Theory classes: 3h
Guided activities: 3h
Self study : 25h

(ENG) 6. Tratamiento de datos georeferenciados

Description:
GIS

Specific objectives:
Understand aspects of spatial and temporal variability

Recognize the nature of uncertainty in data (random vs epistemic)
Operate a GIS and understand its capabilities and limitations
Perform spatial data processing with georeferenced information

Related activities:
-Data analysis
-SIG

Full-or-part-time: 56h
Guided activities: 16h
Self study : 40h

ACTIVITIES

> ### (ENG) MAPAS GEOLÒGICOS Y CARTOGRÀFICOS

> ### (ENG) 2. DATA ANALYSIS AND SIG
>
> **Full-or-part-time:** 30h
> Self study: 30h

> ### 3. Aplication vectorial tool in a basin
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> **Description:**
> Learning and development of vector geoprocessing tools applied to a case study of a river basin.
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> **Delivery:**
> QGIS project and pdf
>
> **Full-or-part-time:** 5h
> Self study: 5h

> ### 4. Study case about aquífer pollution
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> **Description:**
> Spatial data representation of an aquifer contamination case and study of possible remediation solutions.
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> **Full-or-part-time:** 3h
> Guided activities: 3h

> ### (ENG) 5. CONTROL ESCRITO

GRADING SYSTEM

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EXAMINATION RULES.

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