Course guide

2500033 - GECSINGETE - Instrumentation and Remote Sensing

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.
Degree: BACHELOR'S DEGREE IN CIVIL ENGINEERING (Syllabus 2020). (Optional subject).
Academic year: 2022 ECTS Credits: 4.5 Languages: Spanish

LECTURER

Coordinating lecturer: CAROLINA PUIG POLO
Others: MARIA DE LAS NIEVES LANTADA ZARZOSA, CAROLINA PUIG POLO

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
14406. Ability to analyze the problem of safety and health in construction sites. (Common module to the Civil branch)
14410. Knowledge of the typology and calculation bases of prefabricated elements and their application in manufacturing processes. (Specific technology module: Civil Construction)
14411. Knowledge about the project, calculation, construction and maintenance of building works in terms of structure, finishes, facilities and own equipment. (Specific technology module: Civil Construction)
14413. Capacity for the construction and conservation of roads, as well as for the dimensioning, the project and the elements that make up the basic road equipment. (Specific technology module: Civil Construction)
14414. Capacity for the construction and conservation of railway lines with knowledge to apply specific technical regulations and differentiating the characteristics of the mobile material. (Specific technology module: Civil Construction)
14415. Ability to apply construction procedures, construction machinery and construction planning techniques. (Specific technology module: Civil Construction)
14416. Capacity for the construction of geotechnical works. (Specific technology module: Civil Construction)

TEACHING METHODOLOGY

The course consists of 1.5 hours per week of classroom activity (large size group) and 1.2 hours weekly with half the students (medium size group).

The 1.5 hours in the large size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

The 1.2 hours in the medium size groups is devoted to solving practical problems with greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.

The rest of weekly hours devoted to laboratory practice.

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

- Database. Data introduction and query in GIS. Spatial, vector and raster analysis. 3D information management (Digital terrain models).

1 Ability to apply the concepts of passive and active remote sensing and to know the main existing sensors, as well as satellite missions of greater interest.
2 Ability to apply the basic concepts of Geographic Information Systems, studying the main formats and software.
3 Ability to perform spatial analysis of remote sensing information and its application through GIS tools to Civil Engineering.

Knowledge about the most modern methods of taking and processing spatial data, delving into acquisition methods and techniques for treating and interpreting remote sensing data. Know the basic concepts of data structure and the operation of Geographic Information Systems.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Hours medium group</td>
<td>18,0</td>
<td>16.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>4,5</td>
<td>4.00</td>
</tr>
<tr>
<td>Self study</td>
<td>63,0</td>
<td>56.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>22,5</td>
<td>20.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>4,5</td>
<td>4.00</td>
</tr>
</tbody>
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Total learning time: 112.5 h

CONTENTS

General concepts of remote sensing and GIS

Description:
Basic description of the theoretical topics and activities to be carried out during the course Basic concepts of Geographic Information Systems and remote sensing, applications and software.

Specific objectives:
Give the student an overview of the subject Introduction to the basic fundamentals of Geographic Information Systems

Full-or-part-time: 2h 24m
Theory classes: 1h
Self study: 1h 24m
Geoinformation or geographic information (GI)

**Description:**
Data model: raster and vector and its structure in GIS. Creation of topology, topological properties and possible topological errors
Creation of the raster and vector structure in GIS
Spatial Data Infrastructures (SDI)
Exercises for changing image header file formats, from raster to vector and from vector to raster.
Creation of 3D surfaces and digital elevation models
Conversion of data formats and structures.
Transformations of coordinate reference systems (datums and projections).
Editing symbology to create thematic maps using the information associated to the map.

**Specific objectives:**
Transformation and adaptation of geographic data, its integration and correct visualization in the GIS (eg from CAD to GIS)

**Full-or-part-time:** 21h 36m
Theory classes: 3h
Practical classes: 2h
Laboratory classes: 4h
Self study : 12h 36m

Geoprocessing or spatial analysis

**Description:**
GIS tools and techniques for combining vector maps and rasters: connectivity, proximity, inclusion.
Identification of sinks and their correction to the digital model dell terrain.
Creating flow direction and flow accumulation models
Obtaining the hierarchical drainage network and hydrological basins
Vector and raster spatial analysis tools with different quantitative or qualitative variables, which were necessary for decision making.

**Specific objectives:**
From a series of initial maps, obtain derived thematic maps using GIS spatial analysis tools
Obtaining the hierarchical drainage network with a specific density and the hydrological basins of a certain size
From a series of initial maps, obtain derived thematic maps using GIS spatial analysis tools, necessary for the proposed decision-making. Knowledge of GIS techniques and ability to apply them to the solution of basic and applied technological problems.

**Full-or-part-time:** 28h 47m
Theory classes: 4h
Practical classes: 4h
Laboratory classes: 4h
Self study : 16h 47m
Remote sensing

Description:

Specific objectives:
Acquisition of basic remote sensing knowledge. Creation of thematic maps from satellite images, through supervised classification. Creation of new geoinformation from different geomatic and remote sensing techniques (radar, GNSS, LIDAR, etc.). Integrate layers from different data sources and formats into GIS.

Full-or-part-time: 55h 12m
Theory classes: 9h
Laboratory classes: 14h
Self study: 32h 12m

GRADING SYSTEM
The mark of the course is obtained from the ratings of continuous assessment and their corresponding laboratories and/or classroom computers.

Continuous assessment consist in several activities, both individually and in group, of additive and training characteristics, carried out during the year (both in and out of the classroom).

The teachings of the laboratory grade is the average in such activities.

The evaluation tests consist of a part with questions about concepts associated with the learning objectives of the course with regard to knowledge or understanding, and a part with a set of application exercises.

EXAMINATION RULES.
If you do not perform any of the laboratory activities or continuous assessment during the period scheduled, will be considered as zero score.
The attendance at some labs and field practices (DGPS or GPS for GIS) is mandatory in order to obtain a mark greater than zero.

BIBLIOGRAPHY

Basic:

Complementary: