250258 - SIGT - Geographical Information Systems and Teledetection

Coordinating unit: 250 - ETSECCPB - Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering
Academic year: 2018
Degree: BACHELOR’S DEGREE IN PUBLIC WORKS ENGINEERING (Syllabus 2010). (Teaching unit Optional)
ECTS credits: 4,5  
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: MARIA DE LAS NIEVES LANTADA ZARZOSA
Others: MARIA DE LAS NIEVES LANTADA ZARZOSA, CAROLINA PUIG POLO

Degree competences to which the subject contributes

Specific:
3067. Knowledge of the essential topography techniques for obtaining measurements, drawing up plans, determining layouts, taking defined geometries onto the terrain and controlling the movements of structures and earthworks.

Teaching methodology
The course consists of 3 hours a week of classes in a classroom (group median). They are devoted to lectures about 1 hour, in which the teacher explains the concepts and basic materials of the subject, provides examples and practical exercises to consolidate the objectives of general and specific learning. The remaining time is devoted to hands-on labs with different tools. These practices are intended to apply theoretical concepts to solve practical problems with greater student interaction. It uses material support in the form of detailed teaching plan using the virtual campus ATENEA: theoretical content, practical guidelines for evaluation and directed learning, educational videos and literature.

Learning objectives of the subject
Conéixer els mètodes més moderns de presa i tractament de dades espacials. Aprofundint en els mètodes d’adquisició i les tècniques de tractament i interpretació de les dades de teledetecció.
Conocer los métodos más modernos de toma y tratamiento de datos espaciales. Profundizando en los métodos de adquisición y las técnicas de tratamiento e interpretación de los datos de teledetección.
Conhecer los conceptos básicos de la estructura de datos y el funcionamiento de los Sistemas de Información Geográfica. Learn the latest methods of collection and processing of spatial data. Deepening the acquisition methods, interpretation and treatment techniques of remote sensing data.
Learn the basics of the data structure and possibilities of Geographic Information Systems.
### Study load

<table>
<thead>
<tr>
<th></th>
<th>Total learning time: 112h 30m</th>
<th>Hours large group: 19h</th>
<th>16.89%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group: 4h</td>
<td></td>
<td>3.56%</td>
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<tr>
<td></td>
<td>Hours small group: 22h</td>
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<td>19.56%</td>
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<td></td>
<td>Guided activities: 4h 30m</td>
<td></td>
<td>4.00%</td>
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<tr>
<td></td>
<td>Self study: 63h</td>
<td></td>
<td>56.00%</td>
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</tbody>
</table>
## Content

### Item 01. Introduction to GIS

**Learning time:** 2h 24m  
- Theory classes: 1h  
- Self study: 1h 24m  

**Description:**  
Basic description of the theoretical issues and activities undertaken during the course  
Basics of Geographic Information Systems. Applications and software  

**Specific objectives:**  
- Give the student an overview of the subject  
- Introduction to the basics of Geographic Information Systems

### Item 02. Metadata and Reference Systems

**Learning time:** 12h  
- Theory classes: 2h  
- Laboratory classes: 3h  
- Self study: 7h  

**Description:**  
- Metadata  
- Data Infrastructure  
- Inspire and services OGC: WMS, WFS, WCS  
- Reference Systems and Cartographic Projections  
- Explanation of the basic functions for displaying spatial data and metadata through a number of different GIS tools.

**Specific objectives:**  
- Knowing the major differences in the modules, formats and function of different GIS tools

### Item 03. Raster and vectorial models

**Learning time:** 14h 23m  
- Theory classes: 3h  
- Laboratory classes: 3h  
- Self study: 8h 23m  

**Description:**  

**Specific objectives:**  
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### Item 04. Georreferencing

**Description:**
Georeferencing of maps and images. Transformation and resample methods.
Scanning a paper map on which are drawn geologic features interpreted in the field. Georeferencing and digitization of these elements in the GIS.

**Specific objectives:**

**Learning time:** 7h 11m
- Theory classes: 1h
- Laboratory classes: 2h
- Self study: 4h 11m

### Item 05. Databases

**Description:**
Practical problems in relational databases.
Structuring information in the GIS. Join of additional information to the maps. Query and selection by attributes of information associated to the maps.

**Specific objectives:**

**Learning time:** 9h 36m
- Theory classes: 1h
- Practical classes: 1h
- Laboratory classes: 2h
- Self study: 5h 36m

### Item 06. Spatial Analysis

**Description:**
Tools and techniques of combining GIS vector and raster maps: connectivity, proximity, inclusion.
From a series of maps, obtain thematic maps using spatial GIS tools.

**Specific objectives:**

**Learning time:** 14h 23m
- Theory classes: 2h
- Laboratory classes: 4h
- Self study: 8h 23m
### Item 07. 3D Information Management

**Learning time:** 12h  
Theory classes: 2h  
Practical classes: 1h  
Laboratory classes: 2h  
Self study: 7h

**Description:**
Elements for creating models and digital elevation models and digital terrain in vector format (TIN) and raster (GRID)  
Generation of a DEM in TIN format, viewing and subsequent conversion to raster format. 3D spatial analysis tools in order to obtain profiles, histograms, slope maps, aspect maps, flow accumulation maps, etc...  
To solve a problem with the GIS from some available maps and tables.

**Specific objectives:**
- Technical knowledge and ability to apply GIS to solve basic and applied technological problems.  
Get information or thematic maps required for decision-making raised.

### Item 08. Remote Sensing Introduction

**Learning time:** 7h 11m  
Theory classes: 1h  
Laboratory classes: 2h  
Self study: 4h 11m

**Description:**
Introduction and physical foundations of Remote Sensing: the spectrum and radiometric terminology.  
Systems acquisitions. Platforms and sensors  
Combination of spectral bands  
Visual image interpretation.  
Criteria for interpretation

**Specific objectives:**
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### Item 09. Analysis and classification of images

**Learning time:** 14h 23m  
Theory classes: 2h  
Laboratory classes: 4h  
Self study : 8h 23m

**Description:**  
Analysis tools, image filters and supervised classification of images for obtaining thematic maps.  
Supervised classification of satellite image that allows to create a thematic map in GIS format.

**Specific objectives:**  
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### Item 10. Applications and Projects

**Learning time:** 14h 23m  
Theory classes: 3h  
Laboratory classes: 3h  
Self study : 8h 23m

**Description:**  
Radar images (Radio Detection and Ranging) and applications (subsidence estimations)  
GOCE Project, for obtaining the geoid model.  
New sensors in orbit and its applications  
Description and application of new geomatics.  
Especially the developments in the data acquisition sources: GNSS (GPS, GLONASS, Galileo, etc), LIDAR and photogrammetry

**Specific objectives:**  
New sensors for measuring and Earth observation. Applications  
Show the latest advances in geomatics
Qualification system

The rating of the course grades obtained from various activities both individual and group practices, and training of additive. Its realization will throughout the course (in the classroom and outside it) and deliveries to be ATENEA.

Final grade will be \( N_f = N_{GIS} \) or GIS project (65%) + \( N_{TEL} \) of remote sensing activity (20%) + DGPS or GPS for GIS activity (10%) + others activities at classroom (5%)

Criteria for re-evaluation qualification and eligibility: Students that failed the ordinary evaluation and have regularly attended all evaluation tests will have the opportunity of carrying out a re-evaluation test during the period specified in the academic calendar. Students who have already passed the test or were qualified as non-attending will not be admitted to the re-evaluation test. The maximum mark for the re-evaluation exam will be five out of ten (5.0). The non-attendance of a student to the re-evaluation test, in the date specified will not grant access to further re-evaluation tests. Students unable to attend any of the continuous assessment tests due to certifiable major force will be ensured extraordinary evaluation periods.

These tests must be authorized by the corresponding Head of Studies, at the request of the professor responsible for the course, and will be carried out within the corresponding academic period.

In the case of justified not attendances to the regular evaluation tests that prevent the assessment of some parts of the contents of the subject, with prior approval of the Head of Studies, students can be evaluated by the re-evaluation test of the contents that have not been previously examined. The limitation on the maximum mark shall not apply to the parts assessed for the first time.

Regulations for carrying out activities

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: