Degree competences to which the subject contributes

Basic:
CB6. Ability to apply the acquired knowledge and capacity for solving problems in new or unknown environments within broader (or multidisciplinary) contexts related to their area of study.
CB9. Possession of the learning skills that enable the students to continue studying in a way that will be mainly self-directed or autonomous.

Specific:
CTE7. Capability to understand and to apply advanced knowledge of high performance computing and numerical or computational methods to engineering problems.
CTE12. Capability to create and exploit virtual environments, and to the create, manages and distribute multimedia content.
CTE11. Capability to conceptualize, design, develop and evaluate human-computer interaction of products, systems, applications and informatic services.

General:
CG4. Capacity for mathematical modeling, calculation and simulation in technology and engineering companies centers, particularly in research, development and innovation tasks in all areas related to Informatics Engineering.
CG8. Capability to apply the acquired knowledge and to solve problems in new or unfamiliar environments inside broad and multidisciplinary contexts, being able to integrate this knowledge.
CG6. Capacity for general management, technical management and research projects management, development and innovation in companies and technology centers in the area of Computer Science.

Transversal:
CTR4. INFORMATION LITERACY: Capability to manage the acquisition, structuring, analysis and visualization of data and information in the area of informatics engineering, and critically assess the results of this effort.
CTR6. REASONING: Capacity for critical, logical and mathematical reasoning. Capability to solve problems in their area of study. Capacity for abstraction: the capability to create and use models that reflect real situations. Capability to design and implement simple experiments, and analyze and interpret their results. Capacity for analysis, synthesis and evaluation.

Teaching methodology
The course will consist of presentations of the main theoretical topics, followed by a discussion of the more practical aspects associated with them, and the presentation of practical tools to address them.

Learning objectives of the subject
1. Learn what geographic information systems (GIS) are.
2. Analyze concrete problems that a GIS must be able to solve.
3. Study some of the algorithms behind GIS.
4. Learn different ways to represent and process geographic and spatial data.
## Study load

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total learning time:</strong> 75h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hours large group:</td>
<td>27h</td>
<td>36.00%</td>
</tr>
<tr>
<td>Hours medium group:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td>Hours small group:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td>Guided activities:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td>Self study:</td>
<td>48h</td>
<td>64.00%</td>
</tr>
</tbody>
</table>
# Introduction to geographic information systems, spatial information, and geometric algorithms.

**Degree competences to which the content contributes:**

**Description:**
Principios básicos de la información espacial y los sistemas de información geográfica. Ejemplos de aplicaciones de GIS. Introducción a los algoritmos geométricos. Relación entre la implementación de un GIS y los algoritmos geométricos.

# Map representation, combination and overlay of geographic subdivisions.

**Degree competences to which the content contributes:**

**Description:**

# Digital terrain models, vector and raster terrains

**Degree competences to which the content contributes:**

**Description:**

# Algorithms for terrain analysis: visibility and hydrology problems

**Degree competences to which the content contributes:**

**Description:**
Aplicaciones de análisis de terrenos en visibilidad e hidrografía. Cálculo de viewsheds y watersheds en rasters y TINs. Eliminación de mínimos locales y otros artifacts.

# Voronoi diagrams applied to facility location and pattern analysis problems

**Degree competences to which the content contributes:**

**Description:**

# Basic algorithms for digital cartography: map generalization and labeling
Degree competences to which the content contributes:

Description:

Extra topics to be chosen by the students.

Degree competences to which the content contributes:

Description:
Los temas específicos serán definidos por los estudiantes y los docentes durante la primer mitad del curso.
## Planning of activities

<table>
<thead>
<tr>
<th>Introduction</th>
<th>Hours: 4h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 2h</td>
<td></td>
</tr>
<tr>
<td>Practical classes: 0h</td>
<td></td>
</tr>
<tr>
<td>Laboratory classes: 0h</td>
<td></td>
</tr>
<tr>
<td>Guided activities: 0h</td>
<td></td>
</tr>
<tr>
<td>Self study: 2h</td>
<td></td>
</tr>
</tbody>
</table>

### Specific objectives:

1

<table>
<thead>
<tr>
<th>Map representation, combination and overlay of geographic subdivisions</th>
<th>Hours: 8h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 4h</td>
<td></td>
</tr>
<tr>
<td>Practical classes: 0h</td>
<td></td>
</tr>
<tr>
<td>Laboratory classes: 0h</td>
<td></td>
</tr>
<tr>
<td>Guided activities: 0h</td>
<td></td>
</tr>
<tr>
<td>Self study: 4h</td>
<td></td>
</tr>
</tbody>
</table>

### Specific objectives:

2, 3, 4

<table>
<thead>
<tr>
<th>Digital terrain models</th>
<th>Hours: 7h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 5h</td>
<td></td>
</tr>
<tr>
<td>Practical classes: 0h</td>
<td></td>
</tr>
<tr>
<td>Laboratory classes: 0h</td>
<td></td>
</tr>
<tr>
<td>Guided activities: 0h</td>
<td></td>
</tr>
<tr>
<td>Self study: 2h</td>
<td></td>
</tr>
</tbody>
</table>

### Specific objectives:

2, 3, 4

<table>
<thead>
<tr>
<th>Voronoi diagrams</th>
<th>Hours: 6h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 4h</td>
<td></td>
</tr>
<tr>
<td>Practical classes: 0h</td>
<td></td>
</tr>
<tr>
<td>Laboratory classes: 0h</td>
<td></td>
</tr>
<tr>
<td>Guided activities: 0h</td>
<td></td>
</tr>
<tr>
<td>Self study: 2h</td>
<td></td>
</tr>
</tbody>
</table>

### Specific objectives:

2, 3, 4
### Algorithms for terrain analysis

**Hours:** 6h  
Theory classes: 4h  
Practical classes: 0h  
Laboratory classes: 0h  
Guided activities: 0h  
Self study: 2h

**Specific objectives:** 2, 3

### Basic algorithms for digital cartography

**Hours:** 5h 30m  
Theory classes: 4h  
Practical classes: 0h  
Laboratory classes: 0h  
Guided activities: 0h  
Self study: 1h 30m

**Specific objectives:** 2, 3

### Extra topics to be defined during the course

**Hours:** 4h  
Theory classes: 4h  
Practical classes: 0h  
Laboratory classes: 0h  
Guided activities: 0h  
Self study: 0h

**Specific objectives:** 2, 3

### Qualification system

Evaluation will be based on a final project that will consist of theory and bibliography research tasks about a concrete GIS problem, and in class participation.
270532 - DSIGE - Software Development for Geographic Ans Spacial Information

Bibliography

Basic:


Complementary:

