310611 - Mathematical Cartography

Coordinating unit: 310 - EPSEB - Barcelona School of Building Construction
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering
Academic year: 2019
Degree: BACHELOR'S DEGREE IN GEOPHYSICS AND GEOMATICS ENGINEERING (Syllabus 2016).
(Teaching unit Compulsory)
ECTS credits: 4.5  Teaching languages: Spanish

Coordinator: M. AMPARO RUBIO CERDÀ

Opening hours
Timetable: 8:30 to 10:30

Degree competences to which the subject contributes

Specific:
1. Knowledge of maths cartography.
2. (ENG) Determinar, mesurar, avaluar i representar el terreny, objectes tridimensionals, punts i trajectòries.
3. (ENG) Planificació, projecte, direcció, execució i gestió de processos de mesura, sistemes d'informació, explotació d’imatges, posicionament i navegació; modelització, representació i visualització de la informació territorial en, sota i sobre la superfície terrestre.

Teaching methodology
Theoretical classes
Participative classes
Workshops of programming
Sessions of problems

Learning objectives of the subject
At the end of the study of this subject, the student must be capable of:
- Define, explain, apply and analyze the fundamental concepts about representation of a surface above another
- Define, explain, apply and analyze the fundamental concepts about cartographic projections
- Use the convenient mathematic tools to solve the problems about representation and projection

Study load

<table>
<thead>
<tr>
<th>Total learning time: 112h 30m</th>
<th>Hours large group:</th>
<th>18h</th>
<th>16.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours medium group:</td>
<td>27h</td>
<td>24.00%</td>
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<tr>
<td>Hours small group:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td>Self study:</td>
<td>67h 30m</td>
<td>60.00%</td>
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# 310611 - Mathematical Cartography

## Content

<table>
<thead>
<tr>
<th>Projection Type</th>
<th>Learning time</th>
<th>Description</th>
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</thead>
</table>
| **General theory of cartographic projections** | 15h           | Theory classes: 10h  
Practical classes: 5h |
| **Classification cartographic projections** | 3h            | Theory classes: 2h  
Practical classes: 1h |
| **Conic Projections**                    | 9h            | Theory classes: 6h  
Practical classes: 3h |
| **Cylindrical projections**              | 6h            | Theory classes: 4h  
Practical classes: 2h |

**Description:**
- General theory of cartographic projections in the sphere
- Ellipsoid projections
- Basic concepts of the UTM projection
- Network of linear coordinates
- Deformations
- Visual and geometric aspect
- General concepts
- Conformal conic projections
- Equivalent conic projections
- Equidistant conic projections
- General concepts
- Conformal cylindrical projections
- Equivalent cylindrical projections
- Equidistant cylindrical projections
### Azimuth projections

**Description:**
- General concepts
- Conformal azimuth projections
- Equivalent azimuth projections
- Equidistant azimuth projections

**Learning time:** 6h
- Theory classes: 4h
- Practical classes: 2h

### UTM projection

**Description:**
- Structure
- Direct equations
- Inverse equations
- Deformations
- Official cartography

**Learning time:** 6h
- Theory classes: 4h
- Practical classes: 2h
# Planning of activities

| **EXAM 1** | **Hours:** 1h  
Theory classes: 1h |
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Evaluation of acquired knowledge</td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td>Paper and optional PC (not provided by the UPC)</td>
</tr>
</tbody>
</table>

| **EXAM 2** | **Hours:** 2h  
Theory classes: 2h |
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Final evaluation of knowledge</td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td>Paper and optional PC (not provided by the UPC)</td>
</tr>
</tbody>
</table>

| **WORKSHOP OF CALCULUS** | **Hours:** 1h  
Practical classes: 1h |
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<thead>
<tr>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Calculus of deformations</td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td>Training in the use of basic calculus techniques (addition, diminish, derivation, etc...)</td>
</tr>
</tbody>
</table>

| **PROGRAMMING WORKSHOP 1** | **Hours:** 2h  
Practical classes: 2h |
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Software of automatic calculus for the construction of conic projections</td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td>PC</td>
</tr>
<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong></td>
<td>Project memory</td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td>Training in basic programation techniques</td>
</tr>
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| **PROGRAMMING WORKSHOP 2** | **Hours:** 2h  
Practical classes: 2h |
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Software of automatic calculus of the UTM projection</td>
</tr>
</tbody>
</table>
Support materials:
- PC

Descriptions of the assignments due and their relation to the assessment:
- Project memory

Specific objectives:
- Training in basic programming techniques

Qualification system

Exam 1: 40% (week of exams)
Exam 2: 40%
Workshop of programming 1: 10% (week 10)
Workshop of programming 2: 10% (week 15)

Bibliography

Basic: