310611 - Mathematical Cartography

Coordinating unit: 310 - EPSEB - Barcelona School of Building Construction
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering
Academic year: 2018
Degree: BACHELOR'S DEGREE IN GEOPHYSICS AND GEOPHYSICS ENGINEERING (Syllabus 2016).
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></td>
<td>Hours medium group:</td>
<td>27h</td>
<td>24.00%</td>
</tr>
<tr>
<td></td>
<td>Hours small group:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>67h 30m</td>
<td>60.00%</td>
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</tbody>
</table>
# 310611 - Mathematical Cartography

## Content

<table>
<thead>
<tr>
<th>General theory of cartographic projections</th>
<th>Learning time: 15h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 10h</td>
</tr>
<tr>
<td></td>
<td>Practical classes: 5h</td>
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</tbody>
</table>

**Description:**
- General theory of cartographic projections in the sphere
- Ellipsoid projections
- Basic concepts of the UTM projection

<table>
<thead>
<tr>
<th>Classification cartographic projections</th>
<th>Learning time: 3h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Practical classes: 1h</td>
</tr>
</tbody>
</table>

**Description:**
- Network of linear coordinates
- Deformations
- Visual and geometric aspect

<table>
<thead>
<tr>
<th>Conic Projections</th>
<th>Learning time: 9h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td></td>
<td>Practical classes: 3h</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Cylindrical projections</th>
<th>Learning time: 6h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 4h</td>
</tr>
<tr>
<td></td>
<td>Practical classes: 2h</td>
</tr>
</tbody>
</table>

**Description:**
- General concepts
- Conformal cylindrical projections
- Equivalent cylindrical projections
- Equidistant cylindrical projections
# Azimuth projections

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

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

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# UTM projection

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

**Description:**  
Structure  
Direct equations  
Inverse equations  
Deformations  
Official cartography
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### Planning of activities

| EXAM 1 | Hours: 1h  
Theory classes: 1h |
<table>
<thead>
<tr>
<th></th>
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</thead>
<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 |
<table>
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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 |
<table>
<thead>
<tr>
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</thead>
<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>
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</tbody>
</table>
Support materials:

PC

Descriptions of the assignments due and their relation to the assessment:

Project memory

Specific objectives:

Training in basic programation 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: