310622 - Remote Sensing

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).
(Teaching unit Compulsory)
ECTS credits: 4.5

Teaching staff
Coordinator: Puig Polo, Carolina
Others: Prades Valls, Albert

Degree competences to which the subject contributes

Specific:
1. Knowledge, application and analysis of the processes of treatment of digital images and special information, proceding from airborne and satellite sensors.
2. Knowledge, use and application of the treatment techinques. Analysis of special data. Study of models applied to the engineering and architecture.

Transversal:
3. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
4. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

Teaching methodology

The learning methodology is based in a practical application and ammediately of the concepts developed in the classes of theory

Learning objectives of the subject

Basic knowledge of Remote Sensing
Treatment of efficient space and airborne images

Study load

<table>
<thead>
<tr>
<th>Total learning time: 112h 30m</th>
<th>Hours large group: 18h 16.00%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group: 27h 24.00%</td>
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<tr>
<td></td>
<td>Self study: 67h 30m 60.00%</td>
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</tbody>
</table>
## 310622 - Remote Sensing

### Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Learning time</th>
<th>Description</th>
<th>Related activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Introduction to remote sensing</strong></td>
<td>2h</td>
<td>History of remote sensing, Remote sensing active-passive, Aerotransported remote sensing and by satellite, Orbits</td>
<td>LABORATORY 1</td>
</tr>
<tr>
<td><strong>2. Physic principles of remote sensing in the optic</strong></td>
<td>4h</td>
<td>Remote sensing in the optic (visible, proximus infrared), Reflectance and spacial signature, Macroscopsics effects: reflection, refraction, absorption, diffusion and transmission, Spacial resolution, radiometry, spectral and temporal</td>
<td></td>
</tr>
<tr>
<td><strong>3. Platforms and sensors</strong></td>
<td>2h</td>
<td>Types of sensors, Satellites and sensors of terrestrial observation, meteorologics, naval and other type of sensors</td>
<td></td>
</tr>
<tr>
<td><strong>4. Geometry correction and image radiometry</strong></td>
<td>4h</td>
<td>Methods of geometric correction and image radiometry by satellite</td>
<td></td>
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</tbody>
</table>
### 5. Interpretation and analysis of the images

**Description:**
- Transformation (indexes of water, snow, vegetation, ...)
- Supervised classification
- Non-supervised classification
- Validation of a classification

**Learning time:** 12h  
- Theory classes: 6h  
- Self study: 6h

### 6. Remote sensing by microwaves

**Description:**
- Radar  
- Effects of frequency, polarization, angle of incidence and humidity  
- Radar section, equation of the radar, speckle  
- Radar of real opening  
- Geometric effects of the radar images  
- The Opening Synthetic Radar OPR  
- Radial resolution. Slant-range and ground-range  
- Doppler effect  
- Radar of real amplitude

**Learning time:** 6h  
- Theory classes: 3h  
- Self study: 3h
## Planning of activities

| LAB1: Visualization and interpretation of satellite images. Tools of work | Hours: 12h  
Laboratory classes: 4h  
Self study: 8h |
<table>
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<tr>
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</thead>
<tbody>
<tr>
<td><strong>Support materials:</strong></td>
<td>Optic and radar images</td>
</tr>
<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong></td>
<td>Descriptive report</td>
</tr>
</tbody>
</table>

| LAB2: Preprocessing I: Geometric corrections of optic images | Hours: 6h  
Practical classes: 2h  
Self study: 4h |
<table>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Application of the rectification and register of image processing through the control points, obtaining the transformation by polinomic adjustment and sampling. Evaluation of the applied transformation.</td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td>Optic images</td>
</tr>
<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong></td>
<td>Geometric correction of a multispectral image</td>
</tr>
</tbody>
</table>

| LAB3: Preprocessing II: Radiometric corrections optic | Hours: 6h  
Practical classes: 2h  
Self study: 4h |
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Application of radiometric correction techniques: correction of atmospheric dispersion, correction, conversion to reflectivities</td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td>Optic images</td>
</tr>
<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong></td>
<td>Radiometric correction of a multispectral image</td>
</tr>
</tbody>
</table>

| LAB 4: Transformations and highlighting | Hours: 12h  
Practical classes: 4h  
Self study: 8h |
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<tr>
<td><strong>Description:</strong></td>
<td>Knowledge of techniques to extract information of a satellite image, spectral indexes (vegetation, water,...). Highlighting of images through compositions of color, contrast adjustment, filters.</td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td>Optic images</td>
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</table>
### Descriptions of the assignments due and their relation to the assessment:

- Extraction of water sheets, vegetal covers of different typologies of multispectral images with improvements of visualization.

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<table>
<thead>
<tr>
<th>LAB 5: Supervised and non supervised classification</th>
<th>Hours: 24h</th>
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<tbody>
<tr>
<td>Description</td>
<td>Laboratory classes: 8h</td>
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<td>Self study: 16h</td>
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</table>

**Description:**
Application of the classification methodology of multispectral images for the obtention of a qualitative or theme image. Familiarization with the use of tools for the definition of learning areas, selection of the classification method and evaluation by confusion matrix.

**Support materials:**
Optic images

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<table>
<thead>
<tr>
<th>LAB 6: Remote sensing by microwaves</th>
<th>Hours: 18h</th>
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<tbody>
<tr>
<td></td>
<td>Practical classes: 6h</td>
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<td>Self study: 12h</td>
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<table>
<thead>
<tr>
<th>LAB7: Applications of remote sensing</th>
<th>Hours: 8h</th>
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<tbody>
<tr>
<td></td>
<td>Practical classes: 4h</td>
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<tr>
<td></td>
<td>Self study: 4h</td>
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### Qualification system

The subject has a theoretical and practical component. The part of practices of the subject has an important weight by the number of hours and also by its significance in order to assimilate correctly the concepts explained in the theoretical classes.

To be evaluated the student must deliver, in the established schedules, all the projects that are proposed.

The final mark of the subject (FM) will be calculated like:

\[
\text{FM} = 30\% \ \text{theoretical mark} + 70\% \ \text{practices mark}
\]

The theoretical mark (30%) will be evaluated by written exams.

The practices mark (70%) will be evaluated with the delivery of the practices (40%) and a practical exam (60%).

### Regulations for carrying out activities

To be able to carry out the exams of the subject the student must have delivered in the established schedule the proposed projects.
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Bibliography

Basic: