230252 - TELED - Remote Sensing and Earth Observation Systems

**Coordinating unit:** 230 - ETSETB - Barcelona School of Telecommunications Engineering  
**Teaching unit:** 739 - TSC - Department of Signal Theory and Communications  
**Academic year:** 2018  
**Degree:**  
BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2010).  
BACHELOR'S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010).  
BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009).  
BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015).  
**ECTS credits:** 6  
**Teaching languages:** Catalan, Spanish, English

### Teaching staff

**Coordinator:**  
Antoni Broquetas (QP)  
Adriano Camps (QT)

### Prior skills

Remote Sensing is a multidisciplinary subject applied to Earth Observation and uses a large number of technologies and techniques related to Microwaves, Antennas, Optics, Radar, Signal Processing which are studied in other Courses. For this reason it is recommended having notions of these topics. The eventual lack of knowledge of the cited areas can be easily surmountable by consulting basic reference books.

### Teaching methodology

Fundamentals Lectures  
Exercises  
Laboratory practice  
Selected Topic teamwork

### Learning objectives of the subject

The course provides the basic concepts and techniques necessary to work on the development and use of spaceborne and airborne sensors for earth observation.

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>39h</th>
<th>26.00%</th>
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<tr>
<td></td>
<td>Hours small group:</td>
<td>13h</td>
<td>8.67%</td>
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<tr>
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<td>Self study:</td>
<td>98h</td>
<td>65.33%</td>
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## Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Topics</th>
<th>Learning time:</th>
<th>Description:</th>
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<tbody>
<tr>
<td><strong>1. Introduction</strong></td>
<td></td>
<td>1h</td>
<td>The course contents and objectives are presented</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>1.1 Remote Sensing techniques and technologies</td>
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<td><strong>2. Air and space platforms. Space missions</strong></td>
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<td>4h</td>
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<td>2.1 Mission Phases and Segments</td>
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<td>2.2 Types of orbits. Orbital parameters and perturbations</td>
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<td>2.3 Polar orbits. Synchronism with the Earth and the Sun.</td>
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<td><strong>3. Mapping projections. GIS systems</strong></td>
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<td>4h</td>
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<td>3.1 Mathematical model of the earth surface. The Geoid</td>
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<td>3.2 Global and local ellipsoids. Datum and coordinate transformations</td>
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<td>3.3 Mapping projections. UTM and Mercator</td>
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<td>3.4 Integration of remote sensing images in GIS systems</td>
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<td><strong>4. RADAR sensors</strong></td>
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<td>12h</td>
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<td>4.1 Radar backscattering</td>
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<td>4.2 Radar polarimetry. Calibration</td>
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<td>4.3 Real and and Synthetic Aperture Radars (SAR)</td>
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<td>4.4 SAR image reconstruction</td>
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<td>4.5 Geometric correction and noise reduction (speckle) in SAR images</td>
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<td>4.6 Other radar sensors: scatterometers and altimeters</td>
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</table>
| 5. Optical and infrared sensors | **Learning time:** 12h  
| | Theory classes: 12h |

**Description:**
- 5.1 The impact of atmosphere
- 5.2 Spectral signatures of materials
- 5.3 Sensor Technology
- 5.4 Cameras and hyperspectral classification
- 5.5 Geometric correction of optical images
- 5.6 Examples of space programs: NOAA, Meteosat, Landsat, etc.
- 5.7 Laser sensors (LIDAR) and applications

| 6. Microwave radiometers | **Learning time:** 12h  
| | Theory classes: 12h |

**Description:**
- 6.1 Radiation Laws
- 6.2 Brightness, Apparent and Antenna Temperatures
- 6.3 Total power and Dicke radiometers
- 6.4 Calibration and Applications

| 7. Image characteristics and post-processing | **Learning time:** 4h  
| | Theory classes: 4h |

**Description:**
- 7.1 Quality parameters and evaluation
- 7.2 Radiometric and geometric distortions

| 8. The Remote Sensing sector | **Learning time:** 4h  
| | Theory classes: 4h |

**Description:**
- 8.1 Main agencies and institutions
- 8.2 Final users categories. Business and Careers
Qualification system

- Final examination 60%
- Written group assignment 20%
- Practical laboratory work (1h per week on average): 20%

Regulations for carrying out activities

A4 form written both sides can be brought to the exam with formulas, duration 2 h.

Bibliography

Basic:


Complementary:


Others resources:

http://www.grss-ieee.org/cool-videos/

Hyperlink

Remote Sensing Tutorial In Spanish, French, Portuguese, and English

Remote Sensing Video Tutorials in Spanish & English

Audiovisual material

Remote Sensing Cool Videos (for K-12)

Remote Sensing Introductory Videos for K-12