Course guide
230252 - TELED - Remote Sensing and Earth Observation Systems

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications.
Degree: BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).
BACHELOR'S DEGREE IN DATA SCIENCE AND ENGINEERING (Syllabus 2017). (Optional subject).

Academic year: 2023  ECTS Credits: 6.0  Languages: Catalan, Spanish, English

LECTURER

Coordinating lecturer: Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/responsables-assignatura
Others: Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/professorat-assignat-idioma

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>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Hours large group</td>
<td>39,0</td>
<td>26.00</td>
</tr>
<tr>
<td>Self study</td>
<td>98,0</td>
<td>65.33</td>
</tr>
<tr>
<td>Hours small group</td>
<td>13,0</td>
<td>8.67</td>
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</tbody>
</table>

Total learning time: 150 h
## CONTENTS

1. **Introduction**

*Description:* The course contents and objectives are presented
1.1 Remote Sensing techniques and technologies

*Full-or-part-time:* 1h
Theory classes: 1h

2. **Air and space platforms. Space missions**

*Description:* 2.1 Mission Phases and Segments
2.2 Types of orbits. Orbital parameters and perturbations
2.3 Polar orbits. Synchronism with the Earth and the Sun.

*Full-or-part-time:* 4h
Theory classes: 4h

3. **Mapping projections. GIS systems**

*Description:* 3.1 Mathematical model of the earth surface. The Geoid
3.2 Global and local ellipsoids. Datum and coordinate transformations
3.3 Mapping projections. UTM and Mercator
3.4 Integration of remote sensing images in GIS systems

*Full-or-part-time:* 4h
Theory classes: 4h

4. **RADAR sensors**

*Description:* 4.1 Radar backscattering
4.2 Radar polarimetry. Calibration
4.3 Real and and Synthetic Aperture Radars (SAR)
4.4 SAR image reconstruction
4.5 Geometric correction and noise reduction (speckle) in SAR images
4.6 Other radar sensors: scatterometers and altimeters

*Full-or-part-time:* 12h
Theory classes: 12h
### 5. Optical and infrared sensors

**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

**Full-or-part-time:** 12h
**Theory classes:** 12h

### 6. Microwave radiometers

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

**Full-or-part-time:** 12h
**Theory classes:** 12h

### 7. Image characteristics and post-processing

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

**Full-or-part-time:** 4h
**Theory classes:** 4h

### 8. The Remote Sensing sector

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

**Full-or-part-time:** 4h
**Theory classes:** 4h

### GRADING SYSTEM

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

### EXAMINATION RULES.

A4 form written both sides can be brought to the exam with formulas, duration 2 h, but no books or class notes.
BIBLIOGRAPHY

Basic:

Complementary:

RESOURCES

Audiovisual material:

Hyperlink:
- Remote Sensing Tutorial In Spanish, French, Portuguese, and English. Recurs

Other resources:
http://www.classic.grss-ieee.org/wp-content/uploads/2015/05/more_tutorials_2016/media/
https://www.grss-ieee.org/cool-videos/