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

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

## 1. Introduction

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

**Learning 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.

**Learning 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

**Learning time:** 4h
- Theory classes: 4h

## 4. RADAR sensors

**Description:**
4.1 Radar backscattering
4.2 Radar polarimetry. Calibration
4.3 Real 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

**Learning 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

**Learning time:** 12h  
Theory classes: 12h

## 6. Microwave radiometers

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

**Learning time:** 12h  
Theory classes: 12h

## 7. Image characteristics and post-processing

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

**Learning 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

**Learning time:** 4h  
Theory classes: 4h
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: