Last update: 06-05-2019

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: 2019

Degree: BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2010). (Teaching unit Optional)
BACHELOR'S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010). (Teaching unit Optional)
BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Teaching unit Optional)

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

Total learning time: 150h	Hours large group:	39h	26.00%
	Hours small group:	13h	8.67%
	Self study:	98h	65.33%

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Content

1. Introduction

Learning time: 1h
Theory classes: 1h

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

2. Air and space platforms. Space missions

Learning time: 4h
Theory classes: 4h

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.

3. Mapping projections. GIS systems

Learning time: 4h
Theory classes: 4h

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

4. RADAR sensors

Learning time: 12h
Theory classes: 12h

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

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5. Optical and infrared sensors	Learning time: 12h Theory classes: 12h

Description:
5.1 The imact 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

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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:

Fortescue, P.; Swinerd, G.; Stark, J. (eds.). Spacecraft systems engineering. 4th ed. Chichester ; New York: Wiley, 2011. ISBN 9780470750124.

Elachi, C.; Van Zyl, J. Introduction to the physics and techniques of remote sensing. 2nd ed. New York [etc.]: John Wiley and Sons, 2006. ISBN 0471475699.

Ulaby, F.T.; Moore, R.K.; Fung, A.K. Microwave remote sensing: active and passive. Norwood, MA.: Artech House, 1981-1986. ISBN 0890061939.

Schott, J.R. Remote sensing: the image chain approach [on line]. 2nd ed. Oxford: Oxford University Press, 2007 [Consultation: 10/10/2018]. Available on: <https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=415718>. ISBN 9780199724390.

Emery, W.; Camps, A.J. Introduction to satellite remote sensing: atmosphere, ocean, land and cryosphere applications. Amsterdam: Elsevier, 2017. ISBN 9780128092545.

Complementary:

Szekielda, K.-H. Satellite monitoring of the earth. New York: Wiley, 1988. ISBN 0471613304.

Curlander, J.C.; McDonough, R.N. Synthetic aperture radar: systems and signal processing. New York [etc.]: John Wiley and Sons, 1991. ISBN 047185770X.

Measures, R.M. Laser remote sensing: fundamentals and applications. Malabar, Fla.: Krieger, 1992. ISBN 0894646192.

Others resources:

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

Hyperlink

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

Recurs

Remote Sensing Video Tutorials in Spanish & English

Remote Sensing Video Tutorials in Spanish & English

Audiovisual material

Remote Sensing Cool Videos (for K-12)

Remote Sensing Introductory Videos for K-12