

230568 - PHSTELE - Photonics Systems in Telecommunications

Coordinating unit:	230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit:	739 - TSC - Department of Signal Theory and Communications
Academic year:	2015
Degree:	MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2009). (Teaching unit Optional) MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Optional) MASTER'S DEGREE IN PHOTONICS (Syllabus 2013). (Teaching unit Optional) ERASMUS MUNDUS MASTER'S DEGREE IN PHOTONICS ENGINEERING, NANOPHOTONICS AND BIOPHOTONICS (Syllabus 2010). (Teaching unit Optional) MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Teaching unit Optional)
ECTS credits:	3
Teaching languages:	English

Teaching staff

Coordinator:	Francesc Rocadenbosch, UPC.
Others:	Alejandro Rodríguez, UPC. Michaël Sicard, UPC.

Opening hours

Timetable:	roca@tsc.upc.edu (coordinator) alejandro@tsc.upc.edu msicard@tsc.upc.edu
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Degree competences to which the subject contributes

Transversal:

1. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.
2. ENTREPRENEURSHIP AND INNOVATION: Being aware of and understanding how companies are organised and the principles that govern their activity, and being able to understand employment regulations and the relationships between planning, industrial and commercial strategies, quality and profit.
3. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.
4. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

Teaching methodology

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Learning objectives of the subject

The course focuses on a tutorial discussion of the main techniques, systems and subsystems related to laser-radar (LIDAR) remote sensing. The course presents the grounds of the technological, physical, and signal-processing keys

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involved as well as the applications of these remote sensing systems. Present-day fields of application comprise the detection and monitoring of chemical species, atmospheric observation, pollution concentration and physical variables, and others, in the industrial field.

The teaching and learning methodology combines expositive classes with more interactive ones, where systems and case problems are simulated and/or discussed based on literature reviews. A guided research work (computer based) is progressively introduced during course.

BIBLIOGRAPHY:

Guidelines with specific bibliography available at ATENEA web page, <https://atenea.upc.edu/moodle/login/index.php>

¿ Basic

LASER REMOTE SENSING, Takashi Fujii, Tetsuo Fukuchi (Editors), CRC, Taylor&Francis, Florida, 2005.

LASER MONITORING OF THE ATMOSPHERE, E.D. Hinkley (Editor), Springer-Verlag, 1976.

¿ Advanced

LASER REMOTE SENSING: FUNDAMENTALS AND APPLICATIONS, R. M. Measures, John Wiley& Sons, 1984 (Reprint de Krieger Publishing Company, 1992).

Study load

Total learning time: 75h	Hours large group:	22h 30m	30.00%
	Hours medium group:	0h	0.00%
	Hours small group:	0h	0.00%
	Guided activities:	2h 15m	3.00%
	Self study:	50h 15m	67.00%

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Content

1.- Elastic lidar systems.

Degree competences to which the content contributes:

Description:

- 1.1.- Foundations and architecture.
- 1.2.- Basic design parameters: Elastic lidar equation. Optical overlap factor. Background radiance considerations.
- 1.3.- Examples of real systems.

2.- Link budget.

Degree competences to which the content contributes:

Description:

- 2.1.-Receiving chain: Opto-electronic conversion. Temporal and spatial resolution. Signal conditioning and acquisition (transient recorders and photon counters).
- 2.2.- Generalised signal-to-noise ratio (noise-dominant modes).
- 2.3.- Example problem I.
- 2.4.- Lidar range estimation: Simulation.
- 2.5.- Elastic-Raman link budget (problem proposal).

3.- Raman systems.

Degree competences to which the content contributes:

Description:

- 3.1.- Raman Lidar. Basics about the Raman effect. Atmospheric probing and system layout (temperature measurement, molecular species (gas) detection, and water-vapor measurement).
- 3.2.- Elastic-Raman systems (aerosol detection). Problem revision (Sect. 2.5).

4.- Wind lidar systems.

Degree competences to which the content contributes:

Description:

- 4.1.- Coherent Doppler Lidar: Architecture and design considerations.
- 4.2.- Direct-detection Doppler systems: Edge technique and double-edge technique. Fringe technique.
- 4.3.- Wind measurement using incoherent techniques.

5.- Lidar data inversion.

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Degree competences to which the content contributes:

Description:

5.1.- Inversion of opto-atmospheric parameters: Elastic data inversion (range-corrected semi-quantitative methods, from the slope method to Klett's method, multi-angle inversion). The combined elastic/Raman lidar technique.

5.2.- Examples: Inversion of physical parameters (atmospheric-boundary-layer height retrieval, ceilometry, chimney-stack emission flux).

6.- Other laser-radar systems

Degree competences to which the content contributes:

Description:

6.1.- DIAL: Detection of molecular pollutants.

6.2.- Other systems.

Qualification system

- 50 % Final exam (multiple answer test)

- 50 % Guided research work (computer based prob. 2.5 + interview).

Special weight will be given to the continuous assessment of student's progress in the discussion sessions as well as to course attendance (80% minimum).

Bibliography