13963 - ORSA - Optical Remote Sensing I: Active

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

Prior skills

Requirements

Teaching methodology
Oral-exposition classes combined with problems and/or computer-based classes. Review of journal papers or others.

Learning objectives of the subject
To introduce the main techniques, systems and subsystems on laser-radar (LIDAR) remote sensing. The course presents the grounds of the technological, physical, and signal-processing keys 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.
## Content

| 1. Introduction to LIDAR, electro-optical and technological considerations | **Learning time:** 1h  
Theory classes: 1h |
|---|---|
| **Description:**  

| 2. Elastic LIDAR Systems | **Learning time:** 3h  
Theory classes: 3h |
|---|---|
| **Description:**  
1. Architecture and receiver chain [(optical and electro-optical sub-systems (lasers, detectors), signal acquisition sub-systems (analog and photon counting)]. 2. Examples of real systems 3. Applications and satellite/space missions. 4. Pseudo-random systems. | |

| 3. LIDAR Link-Budget / Project coaching I | **Learning time:** 4h  
Theory classes: 1h 30m  
Practical classes: 2h 30m |
|---|---|
| **Description:**  
1. Receiving chain. 2. Assessment of power levels in the chain. 3. Generalised signal-to-noise ratio. 4. Lidar range estimation and simulation. 5. Problem discussion I | |

| 4. LIDAR Inversion Algorithms | **Learning time:** 2h  
Theory classes: 1h  
Practical classes: 1h |
|---|---|
| **Description:**  
1. Inversion of opto-atmospheric parameters. 2. Examples | |

| 5. Raman LIDAR Systems / Project coaching II | **Learning time:** 6h  
Theory classes: 4h 30m  
Practical classes: 1h 30m |
|---|---|
| **Description:**  
1. Raman lidar (temperature and gas detection). 2. Elastic-Raman lidar systems. 3. Problem discussion II | |
### 6. Wind LIDAR Systems

**Description:**

**Learning time:** 4h  
- Theory classes: 3h 30m  
- Practical classes: 0h 30m

### 7. Other Laser-Radar Systems

**Description:**
1. DIAL (Differential Absorption Lidar, trace gas detection). 2. Other systems (fluorescence, active vision, etc.)

**Learning time:** 2h  
- Theory classes: 1h 30m  
- Practical classes: 0h 30m

### 8. Exam

**Learning time:** 2h  
- Theory classes: 2h

### 9. Project exposition

**Learning time:** 2h  
- Theory classes: 2h

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### Qualification system

50 % final exam (multiple answer test), 50 % Guided research work (computer based).

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### Regulations for carrying out activities

A minimum attendance of 80% is required. Exam duration: 2h. Guided research work: Oral exposition or interview (depending on the number of students).

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### Bibliography

6. Wind LIDAR Systems  
7. Other Laser-Radar Systems  
8. Exam  
9. Project exposition