Course guides  
230671 - US - Ultrasonic Systems. Instrumentation and Applications

Unit in charge: Barcelona School of Telecommunications Engineering  
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree:  
MASTER’S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Optional subject).  
ERASMUS MUNDUS MASTER’S DEGREE IN PHOTONICS ENGINEERING, NANOPHOTONICS AND BIOPHOTONICS (Syllabus 2010). (Optional subject).  
MASTER’S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Optional subject).

Academic year: 2020  
ECTS Credits: 5.0  
Languages: English

LECTURER

Coordinating lecturer: Salazar Soler, Jorge

Others: Chavez Dominguez, Juan Antonio  
Turo Peroy, Antonio

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. 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.

TEACHING METHODOLOGY

- Lectures
- Application classes
- Laboratory practical work
- Individual work (distance)
- Exercises
- Oral presentations
- Extended answer test (Final Exam)
LEARNING OBJECTIVES OF THE SUBJECT

Learning objectives of the subject

The aim of this course is to train students in the design, dimensioning and evaluation of ultrasonic systems. The course starts with the basics of waves and stops at the detailed treatment of complete ultrasonic systems putting considerable emphasis on the specific instrumentation and the applications.

Learning results of the subject

- Understanding the general principles, the instrumentation involved and the operation of systems based on ultrasonic waves.
- Ability to design, implement and operate ultrasonic systems.
- Ability to conceive and design electronic circuits for generating and processing ultrasonic signals.
- Ability to analyse, design and evaluate the operation of electromechanical devices used in ultrasonic systems.
- Ability to develop and evaluate ultrasonic measurement techniques for new applications.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>26,0</td>
<td>20.80</td>
</tr>
<tr>
<td>Self study</td>
<td>86,0</td>
<td>68.80</td>
</tr>
<tr>
<td>Hours small group</td>
<td>13,0</td>
<td>10.40</td>
</tr>
</tbody>
</table>

Total learning time: 125 h

CONTENTS

1. Introduction

Description:
Overview and history of ultrasound

Full-or-part-time: 4h
Theory classes: 2h
Self study: 2h

2. Ultrasound physics

Description:
Vibrations and waves. Elastic properties of solids. Acoustic waves in solids

Full-or-part-time: 31h
Theory classes: 6h
Laboratory classes: 4h
Self study: 21h
### 3. Ultrasonic transducers

**Description:**
Types (piezoelectric, capacitive, EMAT, SAW, micromachined, composite...). Modelling and simulation of electromechanical devices. Transducer characterization (electrical, acoustical, optical). Ultrasonic beam focusing and steering

**Full-or-part-time:** 31h  
Theory classes: 6h  
Laboratory classes: 4h  
Self study: 21h

### 4. Ultrasonic systems

**Description:**

**Full-or-part-time:** 32h  
Theory classes: 6h  
Laboratory classes: 5h  
Self study: 21h

### 5. Applications

**Description:**
Non-destructive testing and evaluation. Ultrasonic imaging. Sensors. Piezoelectric generators. Ultrasound therapy. Other industrial applications

**Full-or-part-time:** 27h  
Theory classes: 6h  
Self study: 21h

## ACTIVITIES

### LABORATORY

**Description:**
Specification, design, simulation, implementation and characterization of a measurement system based on ultrasonic waves.

### EXERCISES

**Description:**
Exercises to strengthen the theoretical knowledge.

### ORAL PRESENTATION

**Description:**
Presentation of an individual work.
EXTENDED ANSWER TEST (FINAL EXAMINATION):

Description:
FINAL EXAMINATION

GRADING SYSTEM

Final work: 40%
Exercises: 30%
Laboratory assessments: 30%

BIBLIOGRAPHY

Basic:

Complementary: