Course guide
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).
MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Optional subject).
MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2022). (Optional subject).
Academic year: 2022  ECTS Credits: 5.0  Languages: English

LECTURER
Coordinating lecturer: Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/responsables-assignatura
Others: Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/professorat-assignat-idioma

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
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.

**Full-or-part-time:** 12h  
Laboratory classes: 12h

#### EXERCISES

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

**Full-or-part-time:** 16h  
Guided activities: 16h
ORAL PRESENTATION

Description:
Presentation of an individual work.

Full-or-part-time: 30h
Guided activities: 30h

GRADING SYSTEM

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

BIBLIOGRAPHY

Basic:

Complementary: