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: