

230671 - US - Ultrasonic Systems. Instrumentation and Applications

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| Coordinating unit: | 230 - ETSETB - Barcelona School of Telecommunications Engineering |
| Teaching unit: | 710 - EEL - Department of Electronic Engineering |
| Academic year: | 2017 |
| Degree: | DEGREE IN ELECTRONIC ENGINEERING (Syllabus 1992). (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 2009). (Teaching unit Optional) MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Teaching unit Optional) |
| ECTS credits: | 5 |
| Teaching languages: | English |

Teaching staff

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| Coordinator: | 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.

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- Ability to develop and evaluate ultrasonic measurement techniques for new applications.

Study load

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|---------------------------|---------------------|-----|--------|
| Total learning time: 125h | Hours large group: | 26h | 20.80% |
| | Hours medium group: | 0h | 0.00% |
| | Hours small group: | 13h | 10.40% |
| | Guided activities: | 0h | 0.00% |
| | Self study: | 86h | 68.80% |

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Content

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| <p>1. Introduction</p> | <p>Learning time: 4h Theory classes: 2h Self study : 2h</p> |
| <p>Description: Overview and history of ultrasound</p> | |
| <p>2. Ultrasound physics</p> | <p>Learning time: 31h Theory classes: 6h Laboratory classes: 4h Self study : 21h</p> |
| <p>Description: Vibrations and waves. Elastic properties of solids. Acoustic waves in solids</p> | |
| <p>3. Ultrasonic transducers</p> | <p>Learning time: 31h Theory classes: 6h Laboratory classes: 4h Self study : 21h</p> |
| <p>Description: Types (piezoelectric, capacitive, EMAT, SAW, micromachined, composite...). Modelling and simulation of electromechanical devices. Transducer characterization (electrical, acoustical, optical). Ultrasonic beam focusing and steering</p> | |
| <p>4. Ultrasonic systems</p> | <p>Learning time: 32h Theory classes: 6h Laboratory classes: 5h Self study : 21h</p> |
| <p>Description: Main performance characteristics (dynamic range, impedance matching, bandwidth, propagation medium). Ultrasonic generators (pulsers, burst generators). Conditioning of ultrasonic signals. Measurement techniques</p> | |

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| 5. Applications | Learning time: 27h Theory classes: 6h Self study : 21h |
| Description: Non-destructive testing and evaluation. Ultrasonic imaging. Sensors. Piezoelectric generators. Ultrasound therapy. Other industrial applications | |

Planning of 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

Qualification system

Final work: 40%

Exercises: 30%

Laboratory assessments: 30%

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Bibliography

Basic:

Cheeke, J.D.N. Fundamentals and applications of ultrasonic waves. 2nd ed. CRC Press, 2012. ISBN 9781439854945.

Complementary:

Rose, J.L. Ultrasonic waves in solid media. Cambridge: Cambridge University Press, 1999. ISBN 0-521-54889-6.

Schmerr, L.W.; Song, S.-J. Ultrasonic nondestructive evaluation systems: models and measurements [on line]. New York: Springer, 2007 [Consultation: 18/07/2017]. Available on: <<http://dx.doi.org/10.1007/978-0-387-49063-2>>. ISBN 9780387490618.

Papadakis, E.P. Ultrasonic: instruments and devices: reference for modern instrumentation, techniques, and technology. Academic Press, 2000. ISBN 9780125319515.