Last update: 24-03-2017

230659 - SIMS - Sensors, Instruments and Measurement Systems

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering

Teaching unit: 710 - EEL - Department of Electronic Engineering

Academic year: 2017

Degree: MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Optional)
MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Teaching unit Optional)

ECTS credits: 5 Teaching languages: English

Teaching staff

Coordinator: Juan Ramos Castro

Others: Juan Ramos Castro, Josep Ma Torrents Dolz

Degree competences to which the subject contributes

Specific:

1. Ability to develop electronic instrumentation, as well as transducers, actuators and sensors.

4. Ability to design, implement and operate high performance laboratory electronic instrumentation, with emphasis on error analysis, calibration and virtual control.
5. Ability to deploy distributed instrumentation systems and advanced sensor networks including self-powered systems based on energy harvesting from the environment.

Transversal:

2. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.
3. 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.

Teaching methodology

- Lectures
- Application classes
- Laboratory classes
- Laboratory practical work
- Group work (distance)
- Individual work (distance)
- Exercises
- Extended answer test (Final Exam)

Learning objectives of the subject

-Ability to perform the specification, implementation, documentation and development of equipment and instrumentation electronics and considering both the technical and related regulatory compliance.
-Ability to apply electronic and assistive technology in other fields and activities, not only in the field of Information Technologies and Communications.
-Ability to design analog electronic circuits and data capture. -Ability to specify and use electronic instrumentation and measurement systems.
-Ability to analyze and solve problems of interference and electromagnetic compatibility in measurement systems

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Study load

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

1.- Introduction to measurement systems.

Learning time: 2h
Theory classes: 1h
Self study : 1h

Description:
Structure of a measurement system. Types of measurement systems

2. Characteristics of a measurement system

Learning time: 12h
Theory classes: 6h
Self study : 6h

Description:
Definition of basic terminology, types of measures. Methods of assessment of uncertainty in the measurement. Magnitude estimation in the time and frequency domain.

3.- Sensors and signal conditioning

Learning time: 16h
Theory classes: 8h
Self study : 8h

Description:
Types of signals. Classification of sensors and analysis of its characteristics. Analysis and circuit design of signal conditioning for sensors.

4.- Signal Acquisition

Learning time: 16h
Theory classes: 8h
Self study : 8h

Description:
Structures and circuits for analog signals multiplexing. Sample and hold circuits. Analog to digital and D/A, conversion architectures.

Laboratory 1: Introduction to the lab and measurement theory.

Learning time: 7h
Laboratory classes: 2h
Self study : 5h

Description:
Introduction to Lab View and measurement automation. Measurements with basic tools, Uncertainty assessment.

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Laboratory 2: Basic sensors applications.	Learning time: 9h Laboratory classes: 4h Self study : 5h

Description:
Design and assembly of signal conditioning circuits for resistive sensors. Sensor linearization, temperature measurements. Variable reactance sensors, and its signal conditioning circuits. The Wheatstone bridge for modulators sensors.

Laboratory 3: Design and implementation of a measurement system.	Learning time: 12h Theory classes: 6h Laboratory classes: 6h

Description:
Project design of a complete system of measurement: Choice of suitable sensors for measuring, design and installation of signal conditioning circuits, the choice of the structure of multiplexing and signal acquisition. Acquisition and processing software design.

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Planning of activities

LABORATORY	Hours: 12h Laboratory classes: 12h

Description:
Classroom sessions in teh lab for the development of different teaching practices included in the agenda. Measures with basic instrumentation, construction of measuring circuits with basic sensors and implementation of a complete measurement system.

WRITTEN WORK	Hours: 6h Theory classes: 6h

Description:
Students prepare and write reports results on laboratory practices proposed.

EXERCISES	Hours: 6h Theory classes: 6h

Description:
The students have a collection of problems of past examinations with solutions to consolidate concepts and analysis /design methodologies. The exercises are for self-evaluation.

FINAL EXAMINATION	Hours: 3h Theory classes: 3h

Description:
Based on short questions and problems.

Qualification system

Final examination: 50%
Laboratory assessments: 25%
Written work: 25%

Bibliography

Basic:

Fraden, J. Handbook of modern sensors : physics, designs, and applications [on line]. 5th ed. Cham: Springer International Publishing, 2016 [Consultation: 14/09/2016]. Available on: <http://dx.doi.org/10.1007/978-3-319-19303-8>. ISBN 9783319193021.

Webster, J.G. The measurement, instrumentation and sensors handbook. Boca Raton: CRC : IEEE, 1999. ISBN 0780347250.

Pallás Areny, Ramón; Webster, John G. Sensors and signal conditioning. 2nd ed. New York [etc.]: John Wiley & Sons, 2001. ISBN 0471332321.