230737 – INTRODUCTION TO MEASUREMENT SYSTEMS

Credits: 5 ECTS

LECTURER

Coordinating lecturer: Juan Ramos Castro
Others: Miquel Angel Garcia González, Josep Ma. Torrents Dolz

PRIOR SKILLS

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Transversal:

TEAMWORK. Being able to work as a member of an interdisciplinary team, either as a member or carrying out management tasks, in order to contribute to developing projects with pragmatism and a sense of responsibility, assuming commitments taking into account the available resources.

EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialization and critically assessing the results obtained.

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 labor market.

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

Learning objectives of the subject:

Introduce the student to the basics of measurement science, electronic instrumentation, sensors and signal conditioning.
Learning results of the subject:

- Specify, design and use electronic instrumentation and measurement systems. Know the principles of measurement theory and the main estimators. Capacity to adequately express and estimate uncertainty in measurement results. Know the origins and effects of noise and interference in systems of measure. Know the operating principles of sensors. Understand the need and know the structure of conditioning circuits basics.

**STUDY LOAD**

Hours large group: 26  
Hours small group: 13  
Hours self study: 86

**CONTENTS**

**Theory**
1. Introduction to measurement theory  
   Basic terminology, Sources of uncertainty and categories  
   Uncertainty evaluation and management in measurements  
   
   Full-or-part-time: 21h  
   Theory classes: 6h  
   Self study : 15h  

2. Time and frequency domain magnitude estimation  
   Basic descriptions: linear physical systems, statistical principles, random variables  
   Time and frequency estimators  
   
   Full-or-part-time: 21h  
   Theory classes: 6h  
   Self study : 15h  

3. Sensors and signal conditioning  
   Modulating sensors  
   Generating sensors  
   
   Full-or-part-time: 28h  
   Theory classes: 8h  
   Self study : 20h  

4. Data acquisition systems  
   Signal multiplexing  
   A/D D/A conversion  
   
   Full-or-part-time: 14h  
   Theory classes: 4h  
   Self study : 10h

**Lab**

L1. Introduction to the instrumentation laboratory
Familiarization with the laboratory work environment
Use of LabView for signal simulation
Full-or-part-time: 7h
Laboratory classes: 2h
Self study : 5h

L2. Assessment of type A & B uncertainty in measurements with digital multimeters
Evaluation with digital multimeter measuring AC+DC voltage for various types of signal sources
Full-or-part-time: 7h
Laboratory classes: 2h
Self study : 5h

L3. Automatic measurements with digital oscilloscopes in the instrumentation laboratory
Automatically measure a filter frequency response
Full-or-part-time: 7h
Laboratory classes: 2h
Self study : 5h

L4. Characterization and measurement of an NTC thermistor. Application to temperature measurement for drift correction.
Basic conditioning circuit of an NTC
Characterization and calibration of a measurement system
Full-or-part-time: 7h
Laboratory classes: 2h
Self study : 5h

L5. Calibration of a load cell
Conditioning of a load cell
Obtaining the response function
Full-or-part-time: 7h
Laboratory classes: 2h
Self study : 5h

GRADING SYSTEM

- Final examination: 45 %
- Partial examination (control): 15 %
- Exercises : 10 %
- Laboratory assessments: 30 %
BIBLIOGRAPHY

Basic:


