



Course guide

320041 - IE - Electronic Instrumentation

Last modified: 19/04/2023

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Raúl Fernández García

Others: Lluís Ferrer

PRIOR SKILLS

Students might have passed the course of Analog Electronics.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

2. ELO: Applied knowledge of electronic instrumentation

Transversal:

1. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

TEACHING METHODOLOGY

Sessions:

- a) Theoretical sessions. The professor presents the content
- b) Sessions in the laboratory. Students will do a number of practical experiences in a laboratory.
- c) Evaluation sessions.

Class work:

- d) Individual study and solving exercises.
- e) Preparation of work and practical exercises to deliver.
- f) Preparation of the practices carried out in the laboratory sessions.

LEARNING OBJECTIVES OF THE SUBJECT

Knowing devices, equipment and techniques common in measurements electronic systems as its essential knowledge.

Students will acquire the ability to analyze and design a complete system for measuring industrial, environmental, biomedical or other physical magnitudes.

Because of the set of quantities that can be measured and the associated electronic systems is very large, is introduced only the most general and/or common, and are provided for additional references and websites so that students can extend the range of alternatives, if necessary.



STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours small group	15,0	10.00
Hours large group	45,0	30.00

Total learning time: 150 h

CONTENTS

TOPIC 1: Introduction to measurement systems.

Description:

The basic terminology and the types of errors are introduced in the measurement systems.

Specific objectives:

- Measurement systems
- Static feature
- Dynamic characteristic
- Uncertainty in the measure. Mistakes
- Propagation of errors

Related activities:

Laboratory experiments
mi-term exam
Lab. Exam
Final Exam

Full-or-part-time: 24h

Theory classes: 8h
Laboratory classes: 2h
Self study : 14h

TOPIC 2: Sensing technologies

Description:

Study of the main technologies used in the field of electronic instrumentation.

Specific objectives:

- Resistive sensors
- Capacitive and inductive sensors
- Generator Sensors

Related activities:

Laboratory experiments
mid-term exam
Lab. Exam
Final Exam

Full-or-part-time: 33h

Theory classes: 10h
Laboratory classes: 4h
Self study : 19h



TOPIC 3: Conditioning and analog processing of the measurement signal

Description:

This topic deals with the conditioning circuits and analog processing of the measurement signal most used in instrumentation systems.

Specific objectives:

- The differential amplifier
- The Instrumentation Amplifier
- The Isolation Amplifier
- Analog filtering of the measurement signal.

Related activities:

Laboratory experiments
mid-term exam
Lab. Exam
Final Exam

Full-or-part-time: 48h 30m

Theory classes: 14h
Laboratory classes: 5h
Self study : 29h 30m

TOPIC 4: Acquisition and digital processing of the measurement signal

Description:

This topic focuses on the digitalization methods and the digital processing of the measurement signal.

Specific objectives:

- Sampling of the measurement signal
- ADC Converters
- DAC converters
- CDC converters
- Digital filters.
- Digital buses

Related activities:

Laboratory experiments
Lab. Exam
Final Exam

Full-or-part-time: 30h 30m

Theory classes: 9h
Laboratory classes: 4h
Self study : 17h 30m



TOPIC 5: Wireless sensor networks

Description:

Presentation of the different types of wireless sensor networks and their applications.

Specific objectives:

- Sensor nodes
- Network topologies
- Wireless standard
- Applications.

Related activities:

Laboratory experiments

Lab. Exam

Final Exam

Full-or-part-time: 14h

Theory classes: 4h

Self study : 10h

TOPIC 6: New trends in measurement systems

Description:

- Smart sensors.
- Sensor networks.
- Virtual instrumentation.

Specific objectives:

(ENG) Donar a conèixer les darreres tendències en sensòrica, connexió sense fils de sensors i la instrumentació virtual.

Full-or-part-time: 20h

Theory classes: 6h

Laboratory classes: 2h

Self study : 12h

TOPIC 7: Other transducers

Description:

- Flow transducers.
- Level sensors.
- Light sensors and magnetic quantities.
- Quantities of chemical and environmental sensors.

Specific objectives:

(ENG) Donar les bases conceptuals per poder triar adequadament els transductors més idonis per efectuar mesures de cabdal i de nivell, químiques, magnètiques, lumíniques i altres variables en un entorn real, així com per utilitzar-los acuradament.

Full-or-part-time: 15h

Theory classes: 6h

Self study : 9h



GRADING SYSTEM

- 1st test: 30%
- 2nd test: 45%
- Lab: 25% (75% working in lab, 25% test)

The 2nd test will include activities to renew the 1st test.

For those students who meet the requirements and submit to the reevaluation examination, the grade of the reevaluation exam will replace the grades of all the on-site written evaluation acts (tests, midterm and final exams) and the grades obtained during the course for lab practices, works, projects and presentations will be kept.

If the final grade after reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after reevaluation is greater or equal to 5.0, the final grade of the subject will be pass 5.0.

BIBLIOGRAPHY

Basic:

- Pérez García, M. A. Instrumentación electrónica. Madrid: Paraninfo, 2014. ISBN 9788428337021.
- Pérez García, M. A. Instrumentación electrónica: 230 problemas resueltos. Madrid: Garceta, 2012. ISBN 9788415452003.

Complementary:

- Pallás, R.; Bragós, R.; Casas, O. Sensores e interfaces: problemas resueltos. Barcelona: Edicions UPC, 1999. ISBN 8483012421.
- Creus Solé, A. Instrumentación industrial [on line]. 8ª ed. Barcelona: Marcombo, 2011 [Consultation: 09/05/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=9767. ISBN 9788426716682.
- Manuel Lázaro, A. [et al.]. Problemas resueltos de instrumentación y medidas electrónicas. Madrid: Paraninfo, 1994. ISBN 8428321418.

RESOURCES

Other resources:

www.ni.com