320041 - IE - Electronic Instrumentation

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering
Academic year: 2019
Degree: BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: Raúl Fernández García
Others: Lluis Ferrer

Opening hours
Timetable: arranged hours: raul.fernandez-garcia@upc.edu

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

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>45h</th>
<th>30.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Hours small group:</td>
<td>15h</td>
<td>10.00%</td>
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<td></td>
<td>Guided activities:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>90h</td>
<td>60.00%</td>
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### TOPIC 1: Introduction to measurement systems

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

**Related activities:**
- Laboratory experiments
- mi-term exam
- Lab. Exam
- Final Exam

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

**Learning 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.

**Related activities:**
- Laboratory experiments
- mid-term exam
- Lab. Exam
- Final Exam

**Specific objectives:**
- Resistive sensors
- Capacitive and inductive sensors
- Generator Sensors

**Learning time:** 33h

- Theory classes: 10h
- Laboratory classes: 4h
- Self study: 19h
### TOPIC 3: Conditioning and analog processing of the measurement signal

<table>
<thead>
<tr>
<th>Learning time: 48h 30m</th>
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<tbody>
<tr>
<td>Theory classes: 14h</td>
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<tr>
<td>Laboratory classes: 5h</td>
</tr>
<tr>
<td>Self study: 29h 30m</td>
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**Description:**
This topic deals with the conditioning circuits and analog processing of the measurement signal most used in instrumentation systems.

**Related activities:**
- Laboratory experiments
- Mid-term exam
- Lab. Exam
- Final Exam

**Specific objectives:**
- The differential amplifier
- The Instrumentation Amplifier
- The Isolation Amplifier
- Analog filtering of the measurement signal.

### TOPIC 4: Acquisition and digital processing of the measurement signal

<table>
<thead>
<tr>
<th>Learning time: 30h 30m</th>
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</thead>
<tbody>
<tr>
<td>Theory classes: 9h</td>
</tr>
<tr>
<td>Laboratory classes: 4h</td>
</tr>
<tr>
<td>Self study: 17h 30m</td>
</tr>
</tbody>
</table>

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

**Related activities:**
- Laboratory experiments
- Lab. Exam
- Final Exam

**Specific objectives:**
- Sampling of the measurement signal
- ADC Converters
- DAC converters
- CDC converters
- Digital filters.
- Digital buses
TOPIC 5: Wireless sensor networks

Learning time: 14h
- Theory classes: 4h
- Self study: 10h

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

Related activities:
- Laboratory experiments
- Lab. Exam
- Final Exam

Specific objectives:
- Sensor nodes
- Network topologies
- Wireless standard
- Applications.

Qualification 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.
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Bibliography

Basic:


Complementary:


Others resources:

www.ni.com