230122 - ISDM - Instrumentation and Measurement Systems

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering
Academic year: 2018
Degree: BACHELOR’S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Teaching unit Optional)
ECTS credits: 6 Teaching languages: Spanish

Requirements
To have passed
Functions and Electronic Systems (2A)
Signals and Systems (2A)

Degree competences to which the subject contributes

Generical:
10 ECI N3. They will have acquired knowledge related to experiments and laboratory instruments and will be competent in a laboratory environment in the ICC field. They will know how to use the instruments and tools of telecommunications and electronic engineering and how to interpret manuals and specifications. They will be able to evaluate the errors and limitations associated with simulation measures and results.

Teaching methodology
Lectures
Laboratory classes
Problem classes
Group work (Home)
Individual work (Home)
Long answer tests (Control)
Long answer tests (Final Exam)
Lab

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.
## Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>39h</th>
<th>26.00%</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Hours small group:</td>
<td>26h</td>
<td>17.33%</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>85h</td>
<td>56.67%</td>
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## Content

<table>
<thead>
<tr>
<th>Unit 1. Measuring system characteristics</th>
<th>Learning time: 24h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 12h</td>
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<tr>
<td></td>
<td>Self study: 12h</td>
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**Description:**
Definition of basic terminology, types of measures. Methods of evaluation of uncertainty in the measurement. Magnitude estimation in time and frequency domains.

<table>
<thead>
<tr>
<th>Unit 2.- Sensors and signal conditioning</th>
<th>Learning time: 22h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 10h</td>
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<tr>
<td></td>
<td>Guided activities: 2h</td>
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<tr>
<td></td>
<td>Self study: 10h</td>
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**Description:**
Types of signals. Classification of sensors and analysis of its characteristics. Analysis and circuit design of signal conditioning for sensors.

<table>
<thead>
<tr>
<th>Unit 3.- Signal Acquisition</th>
<th>Learning time: 20h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 10h</td>
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<tr>
<td></td>
<td>Self study: 10h</td>
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</table>

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

<table>
<thead>
<tr>
<th>Unit 4.- The measuring system in its environment</th>
<th>Learning time: 14h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 7h</td>
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<tr>
<td></td>
<td>Self study: 7h</td>
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</tbody>
</table>

**Description:**
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## Planning of activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Hours</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Laboratory practices</strong></td>
<td>9h</td>
<td>9h Self study: 9h</td>
</tr>
<tr>
<td><strong>Long answer tests (Control)</strong></td>
<td>1h</td>
<td>1h Theory classes: 1h</td>
</tr>
<tr>
<td><strong>Long answer tests (Final Exam)</strong></td>
<td>3h</td>
<td>3h Theory classes: 3h</td>
</tr>
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## Laboratory 1: Introduction to the lab and measurement theory.

**Learning time:** 20h  
Laboratory classes: 8h  
Self study: 12h

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

## Laboratory 2: Basic sensors applications.

**Learning time:** 24h  
Laboratory classes: 9h  
Self study: 15h

**Description:**  

## Laboratory 3: Design and implementation of a measurement system.

**Learning time:** 24h  
Laboratory classes: 9h  
Self study: 15h

**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.
Qualification system

50% Final Exam
30% Lab work
20% Exercises and controls

Bibliography

Basic:


Complementary: