Course guide
320014 - SEL - Electronic Systems

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

Degree:
BACHELOR’S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR’S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR’S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR’S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR’S DEGREE IN TEXTILE TECHNOLOGY AND DESIGN ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2022   ECTS Credits: 6.0   Languages: Catalan, Spanish, English

LECTURER

Coordinating lecturer: Daniel Arumí
Others: Lluís Ferrer, Víctor Suñé, Llorenç Marín, Daniel Pérez.

PRIOR SKILLS

Students must have passed Physics in the first year. They will also be expected to have passed Electrical Systems in the third semester.
Students must also be sufficiently fluent in spoken and written English to follow the subject in English. As a guideline, they should have passed the First Certificate in English, the English Aptitude Certificate awarded by the Escola Oficial d’Idiomes or an equivalent qualification.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. IND_COMMON: Basic electronic knowledge

Transversal:
2. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.
3. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.
4. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
TEACHING METHODOLOGY

Theory lectures: Expository sessions where the lecturer will introduce the theoretical fundamentals of the subject, explain the content and how it ties in with previous or subsequent topics in the subject. Concepts and their development will be presented clearly and concisely with examples to illustrate them so that they are fully understood. The lectures will be held using a whiteboard and / or computer resources. When slides are used, they will be available in Atenea. Short-term activities will be introduced to encourage students participation.

Problem solving lectures: The aim of these sessions is to consolidate theoretical knowledge, as well as to introduce specific applications in professional and academic environments. The learning process is focused on the student. The different stages in problem solving: initial approach, development and results will be tackled. The concepts of critical thinking and coherent analysis will be looked at in depth for their application to problems and their results.

Laboratory session

LEARNING OBJECTIVES OF THE SUBJECT

Students who pass the subject will have learnt to understand, analyse and use the electronic systems typically employed in the field of industrial engineering.

Therefore, students must have acquired the theoretical and practical knowledge, abilities and skills required to understand and analyse digital and analogue systems and their connections using the relevant conversions.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours medium group</td>
<td>15,0</td>
<td>10.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>15,0</td>
<td>10.00</td>
</tr>
</tbody>
</table>

**Total learning time:** 150 h

CONTENTS

**TOPIC 0: INTRODUCTION TO THE SUBJECT**

**Description:**
Introduction to the subject and presentation of the syllabus. Assessment regulations and and recommended reading list, Definitions. Electronic Systems. Electronic Instrumentation System.

Fields of application of digital and analogue electronic systems (the world of industrial engineering in the textile sector, mechanics, chemistry, electricity and electronics, and automation)

**Related activities:**
ACTIVITY 1: Theory lectures
ACTIVITY 4.1: First exam.

**Full-or-part-time:** 0h 30m
Theory classes: 0h 30m
**TOPIC 1: BASIC CONCEPTS OF DIGITAL SYSTEMS**

**Description:**
Concept of bit, 'nibble', 'byte' and 'word'. Binary numbers. Other number systems. Conversion between binary systems.

**Related activities:**
ACTIVITY 1: Theory lectures
ACTIVITY 2: Problem solving lectures.
ACTIVITY 4.1: First exam.

**Full-or-part-time:** 3h 30m
- Theory classes: 1h
- Practical classes: 0h 30m
- Self study: 2h

---

**TOPIC 2: INTRODUCTION TO MICROPROCESSOR-BASED SYSTEMS**

**Description:**

**Related activities:**
ACTIVITY 1: Theory lectures
ACTIVITY 3.2: Microcontroller based applications.
ACTIVITY 4.1: First exam.

**Full-or-part-time:** 15h
- Theory classes: 2h
- Laboratory classes: 5h
- Self study: 8h

---

**TOPIC 3: INTRODUCTION TO DIGITAL ELECTRONICS**

**Description:**

**Related activities:**
ACTIVITY 1: Theory lectures
ACTIVITY 3.1: Introduction to the lab.
ACTIVITY 3.2: Microcontroller based applications.
ACTIVITY 4.1: First exam.

**Full-or-part-time:** 21h
- Theory classes: 4h 30m
- Practical classes: 2h 30m
- Laboratory classes: 2h
- Self study: 12h
### TOPIC 4: COMBINATIONAL LOGIC

**Description:**
Multiplexer (MUX) and Demultiplexer (DEMUX). Decoders and encoders

**Related activities:**
- ACTIVITY 1: Theory lectures
- ACTIVITY 2: Problem solving lectures.
- ACTIVITY 3.2: Microcontroller based applications.
- ACTIVITY 4.1: First exam.

**Full-or-part-time:** 18h 30m
- Theory classes: 3h 30m
- Practical classes: 2h
- Laboratory classes: 1h
- Self study: 12h

### TOPIC 5: SEQUENTIAL SYSTEMS

**Description:**

**Related activities:**
- ACTIVITY 1: Theory lectures
- ACTIVITY 2: Problem solving lectures.
- ACTIVITY 3.2: Microcontroller based applications.
- ACTIVITY 4.1: First exam.

**Full-or-part-time:** 19h
- Theory classes: 4h
- Practical classes: 2h
- Laboratory classes: 1h
- Self study: 12h

### TOPIC 6: OPERATIONAL AMPLIFIERS

**Description:**

**Related activities:**
- ACTIVITY 1: Theory lectures
- ACTIVITY 2: Problem solving lectures.
- ACTIVITY 3.3: Experimentation based on op-amps and semiconductor devices circuits.
- ACTIVITY 4.2: Second exam.

**Full-or-part-time:** 30h
- Theory classes: 5h 30m
- Practical classes: 3h 30m
- Laboratory classes: 3h
- Self study: 18h
### TOPIC 7: CIRCUITS WITH DIODES AND TRANSISTORS

**Description:**
Introduction to, general characteristics and operation of an ideal diode.
Introduction to, general characteristics and operation of an ideal bipolar and field-effect transistor.

**Related activities:**
ACTIVITY 1: Theory lectures
ACTIVITY 2: Problem solving lectures.
ACTIVITY 3.3: Experimentation based on op-amps and semiconductor devices circuits.
ACTIVITY 4.2: Second exam.

**Full-or-part-time:** 26h 30m
- Theory classes: 5h 30m
- Practical classes: 3h
- Laboratory classes: 2h
- Self study: 16h

### TOPIC 8: INTRODUCTION TO SIGNAL PROCESSING

**Description:**
Sensors.
Analog-to-digital conversion.
Digital-to-analog conversion.
Data acquisition boards.

**Related activities:**
ACTIVITY 1: Theory lectures
ACTIVITY 2: Problem solving lectures.
ACTIVITY 3.3: Experimentation based on op-amps and semiconductor devices circuits.
ACTIVITY 4.2: Second exam.

**Full-or-part-time:** 16h
- Theory classes: 3h 30m
- Practical classes: 1h 30m
- Laboratory classes: 1h
- Self study: 10h

### ACTIVITIES

**ACTIVITY 1: Theory lectures**

**Full-or-part-time:** 24h 30m
- Theory classes: 24h 30m

**ACTIVITY 2: Problem solving lectures.**

**Full-or-part-time:** 15h
- Practical classes: 15h
ACTIVITY 3.1: Introduction to the lab.

Full-or-part-time: 4h
Laboratory classes: 2h
Self study: 2h

ACTIVITY 3.2: Microcontroller based applications.

Full-or-part-time: 15h
Laboratory classes: 7h
Self study: 8h

ACTIVITY 3.3: Experimentation based on op-amps and semiconductor devices circuits.

Full-or-part-time: 13h
Laboratory classes: 6h
Self study: 7h

ACTIVITY 4.1: First exam

Full-or-part-time: 37h 30m
Theory classes: 2h 30m
Self study: 35h

ACTIVITY 4.2: Second exam.

Full-or-part-time: 41h
Theory classes: 3h
Self study: 38h

GRADING SYSTEM

(i) 1st exam (37.5%) + 2nd exam (37.5%) + Lab (25%).
Lab: Mark obtained due to the work carried out during the lab sessions and the corresponding lab reports.
(ii) In case of make-up exam (reconducció):
1r exam_R (37.5%) + 2nd exam (37.5%) + Lab (25%),
where 1r exam_R = min[5, max(1st exam, make-up exam)]

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 (questionnaire and 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.

EXAMINATION RULES.
BIBLIOGRAPHY

Basic:

Complementary: