340035 - SIEK-N9O10 - Electronic Systems

Coordinating unit: 340 - EPSEVG - Vilanova i la Geltrú School of Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering
Academic year: 2015
Degree: BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan, Spanish, English

Teaching staff
Coordinator: José Antonio Soria Pérez

Others: José Antonio Soria Pérez
Francesc Xavier Villasevil
Luís García de Vicuña

Opening hours
Timetable: Office hours vary each semester according to professor availability.
Check on the EPSEVG web site for more information.

Prior skills
Autonomous learning and taking initiative in problem solvings are necessary skills in this course

Requirements
Students registering in this subject are expected to have the subjects "Equacions Diferencials", "Calcul Avançat" and "Sistemes Elèctrics" from previous semesters passed

Degree competences to which the subject contributes
Specific:
1. CE11. Knowledge of electronical fundamentals.
9. CE32. Ability to analize electrical circuits in all possible regimes.

Teaching methodology
Basic and theoretical concepts of electronics are provided by means of class lectures and by means of examples in the form of exercises. As for the lab, students will consolidate the main technical concepts by prototyping electronic circuits.

Learning objectives of the subject
The aim of this subject is to provide the fundamental knowledge and to show the basics of industrial electronics. It will
describe the most important technologies of electronic devices and systems available and it will explain the basic methodologies to analyze both digital and analog electronic systems.

At the end of the course students will be able to implement their own electronic prototypes.

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group:</th>
<th>45h</th>
<th>30.00%</th>
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<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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### Content

<table>
<thead>
<tr>
<th>Theme</th>
<th>Description</th>
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</table>
| **Module 1 - Basic Circuit Analysis (AC and DC)** | **Learning time:** 56h 20m  
Assessment sessions: 1h 20m  
Self study (distance learning): 35h  
Theory classes: 16h  
Laboratory classes: 4h |

#### Themes in Module 1:

1.1 Steady-state domain (DC): General and Basic Electrical Rules: Ohm's law, Kirchoff, Thevenin/Norton changes, the superposition theorem, voltage/current dividers, etc.


#### Related activities:

- Class sessions include examples in the form of exercises
- Lab activities (2 sessions)

- PRT1: Introduction to Lab Instrumentation
- PRT2: Time and Frequency domains

- Self study (35 hours)
- Evaluation sessions (80 min)

#### Specific objectives:

Knowing and learning how to apply the basic electrical rules so that the behaviour of electronic circuits can be analyzed and studied
- **Module 2: Introduction to DC Power Supplies**

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>51h 10m</th>
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<tbody>
<tr>
<td>Assessment sessions:</td>
<td>1h 10m</td>
</tr>
<tr>
<td>Self study (distance learning):</td>
<td>30h</td>
</tr>
<tr>
<td>Theory classes:</td>
<td>14h</td>
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<tr>
<td>Laboratory classes:</td>
<td>6h</td>
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**Description:**
Themes of Module 2

2.1 Introducció to Linear DC Power Supplies: Instrument main specifications and basic discrete semiconductors

2.2 Main block sections of DC Power Supply: Voltage Transformation, Rectifiers, Filters and Regulators

2.3. Advanced Features of DC Power Supplies: The use of Bipolar Junction Transistors (BJT) and Operational Amplifiers (OPAMP) in the improvement of output features.

**Related activities:**
- Class sessions include examples in the form of exercises
- Lab activities (3 sessions)

PRT3: Introduction to linear DC Power Supplies: Rectifier diode and Zener

PRT4: Switching Electronics: The Bipolar Transistor (BJT)

PRT5: Introduction to Analog Electronics: The Operational Amplifier

- Self study (30 hores)
- Evaluation Sessions (70 min)

**Specific objectives:**
To know how to use the basic discrete and integrated semiconductors (rectifier and zener diodes, bipolar transistors and operational amplifiers) and learn their basic operation within a DC power supply.
### Module 3: Introduction to Digital Electronics

**Learning time:** 39h
- Assessment sessions: 1h
- Self study (distance learning): 24h
- Theory classes: 12h
- Laboratory classes: 2h

<table>
<thead>
<tr>
<th>Themes of Module 3</th>
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<tbody>
<tr>
<td>3.1 Introduction to Boolean Algebra and Digital Codification: Boolean techniques and basic digital and numerical representations.</td>
</tr>
<tr>
<td>3.3 Sequential Systems: Basic sequential circuits: Latch, Flip-Flop and memory circuits (ROM, RAM, EEPROM, etc). Introduction to state machines and microcontroller systems.</td>
</tr>
</tbody>
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**Description:**
- Class sessions include examples in the form of exercises
- Lab activities (1 session)

**Related activities:**
- PRT6: Introducció to the Digital World
- PRT7: This session is reserved for the lab exam
- Self study (24 hores)
- Evaluation sessions (60 min)

**Specific objectives:**
- To know the basic digital formats for number representation and to get used to the basic simplification techniques used in combinational circuits.
- To know the basic elements the state machines and microcontrollers are made of.
Knowledge of students about electronics will be evaluated through written exams and lab activities. Theoretical concepts correspond to the 70%-weight of student evaluation. As for the lab, the weight is 30%.

The evaluation of theoretical concepts consists of two individual written exams: one midterm (NP1) and a second midterm exam (NP2), and the resolution of individual exercises (PRB) carried out through the web Atenea or in the class. In the event of an unfavorable evaluation of P1, students will have the chance of recovering P1, by means of another exam (P1rec) carried out in the same day as P2.

As for the lab, students will develop guided activities (in the form of tutorials) where correct measurements and circuit results are provided. Attendance to lab activities and follow-up correspond to the 5% of the final grade. The other 20% is an individual lab exam (EXLAB) carried out in the last lab session.

The overall grade of the course (NF) is obtained as follows,

\[
NF = 0.3\cdot\max(P1,P1\text{rec}) + 0.3\cdot NP2 + 0.1\cdot PRB + 0.05\cdot LAB + 0.25\cdot EXLAB
\]

Regulations for carrying out activities

As for the written exams (NP1 or NP1rec and NP2), students can take a scientific calculator, and can use a pencil or black/blue ballpen (the red colour is reserved for teacher corrections and annotations). Students can also use a one-sheet form containing formulae which will be available through the web page of Atenea.

Using any kind of electronic device with Internet connection (mobile phone, Tablet, or laptop) according to the current school regulations.

As for the lab exam, students can bring any kind of class notes and annotations but they must only be in notebooks or loose-leaf.

Bibliography