820226 - IIEIA - Industrial Computer Science

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 707 - ESAII - Department of Automatic Control
Academic year: 2019
Degree: BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL 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

Teaching staff

Coordinator: ANTONIO CALOMARDE PALOMINO
Others: Primer quadrimestre:
ANTONIO CALOMARDE PALOMINO - T11, T12, T13
EDMUNDO GUERRA PARADAS - T11, T12, T13

Prior skills
1. Basic background on electronic systems.
2. Basic background on digital electronics.

Requirements
Prerequisite: Digital Electronics (EDEIA)
Co-requisite: Analog Electronics (EAEIA)

Degree competences to which the subject contributes

Specific:
3. Apply their knowledge to industrial informatics and communications.

Transversal:
1. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working
with others, assessing the effectiveness of a team and presenting the final results.

Teaching methodology
The course uses the methodology of exhibitions in 28% (theoretical and laboratory sessions), monitoring of activities
aimed at 12%, individual in 17.3%, the project-based learning by 40% evaluation sessions and 2.7%.

Learning objectives of the subject
1. Introduce students to basic concepts of microcontrollers, its architecture, its programming and the connection with the
   elements of their environment.
2. Acquire skills to design, deploy and implement electronic systems based on microcontrollers.
### Study load

<table>
<thead>
<tr>
<th>Description</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total learning time</td>
<td>150h</td>
<td></td>
</tr>
<tr>
<td>Hours large group</td>
<td>45h</td>
<td>30.00%</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td>Hours small group</td>
<td>15h</td>
<td>10.00%</td>
</tr>
<tr>
<td>Guided activities</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td>Self study</td>
<td>90h</td>
<td>60.00%</td>
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#### Content

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<tr>
<th>Tema 1: Introduction</th>
<th>Learning time: 2h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 1h</td>
</tr>
<tr>
<td></td>
<td>Self study: 1h</td>
</tr>
</tbody>
</table>

**Description:**
- Course overview.
- History and future of microcontrollers.
- Binary and hexadecimal codes.

<table>
<thead>
<tr>
<th>Tema 2: The C programming language</th>
<th>Learning time: 14h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Self study: 6h</td>
</tr>
</tbody>
</table>

**Description:**
- Basic blocks and syntax
- Flow control
- Strings and matrices
- Pointers
- Structs

**Related activities:**
- Individual study
- Solving exercises
- Laboratory session
### Tema 3: Estructura dels microcontroladors

**Description:**
- Block diagram
- Processor registers
- Memory and addressing
- Instruction set

**Related activities:**
- Individual study
- Solving exercises
- Laboratory session

**Specific objectives:**
At the end of this module, the student should be able to describe all the internal subsytems of a microcontroller.

**Learning time:** 14h
- Theory classes: 6h
- Laboratory classes: 2h
- Self study: 6h

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### Tema 4: Digital inputs and outputs

**Description:**
- Hardware
- Programming

**Related activities:**
- Individual study
- Solving exercises
- Laboratory session

**Learning time:** 14h
- Theory classes: 6h
- Laboratory classes: 2h
- Self study: 6h
<table>
<thead>
<tr>
<th>Tema 5: Interrupts and low power characteristics.</th>
<th>Learning time: 14h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td>Related activities:</td>
<td>Self study : 6h</td>
</tr>
<tr>
<td>- Individual study.</td>
<td></td>
</tr>
<tr>
<td>- Solving exercises.</td>
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</tr>
<tr>
<td>- Searching for information.</td>
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<tr>
<td>- Laboratory sessions.</td>
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</table>

<table>
<thead>
<tr>
<th>Tema 6: Analog inputs and outputs.</th>
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</thead>
<tbody>
<tr>
<td>Description:</td>
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<tr>
<td></td>
<td>Laboratory classes: 2h</td>
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<tr>
<td>Related activities:</td>
<td>Self study : 6h</td>
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<tr>
<td>- Estudi individual</td>
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<tr>
<td>- Resolució d’ exercicis</td>
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<tr>
<td>- Pràctiques de laboratori</td>
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</tbody>
</table>
## Tema 7: Timers and PWM

**Learning time:** 14h  
Theory classes: 6h  
Laboratory classes: 2h  
Self study: 6h

### Description:
- Compare mode.
- Capture mode.
- Pulse width modulation.

### Related activities:
- Individual study
- Solving exercises
- Laboratory session

## Tema 8: Serial communications

**Learning time:** 14h  
Theory classes: 6h  
Laboratory classes: 2h  
Self study: 6h

### Description:
- UART
- SPI bus
- I2C bus

### Specific objectives:
- Individual study
- Solving exercises
- Laboratory session

## Tema 9: Conceptes avançats

**Learning time:** 3h  
Theory classes: 1h  
Self study: 2h

### Description:
- Direct Memory Access.
- High performance and low power.

### Specific objectives:
- Individual study
- Solving exercises.
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<table>
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<tr>
<th>Final team project.</th>
<th>Learning time: 47h</th>
</tr>
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<tbody>
<tr>
<td>Description:</td>
<td>Theory classes: 1h</td>
</tr>
<tr>
<td></td>
<td>Self study: 46h</td>
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</tbody>
</table>

Design and prototyping of a microcontroller based system.

Qualification system

Exercises: 10%
Midterm exam: 25%
Final exam: 25%
Laboratory: 20%
Final project: 20%

Regulations for carrying out activities

The evaluation method of this course meets the current academic regulations to be qualified as: NO REVALUABLE

Bibliography

Basic:


Complementary:


Others resources:

Final team project.

Description:

Design and prototyping of a microcontroller based system.

Learning time: 47h

Theory classes: 1h
Self study: 46h