240EI013 - Extended Electronics

Coordinating unit: 240 - ETSEIB - Barcelona School of Industrial Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering

Academic year: 2019
Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Teaching unit Compulsory)
ECTS credits: 4.5
Teaching languages: Catalan, Spanish, English

Teaching staff

Coordinator: Manich Bou, Salvador
Others: Torrents Dolz, Josep Maria
Gómez Pau, Álvaro
Parisi Baradad, Vicenç
Rodríguez Montañes, Rosa

Opening hours

Timetable: Request an appointment by email.

Prior skills

- Knowledge on circuit analysis
- Knowledge on electrical signals
- Basic concepts about electronic devices
- Basic concepts about amplification
- Knowledge of Boolean and Switching algebra
- Basic concepts of information coding
- Knowledge of combinational and sequential systems
- Basic concepts of structured programming
- Basic concepts of C programming language
- Basic concepts of automatic control

Requirements

- 10,5 ECTS in informatics subjects
- 6 ECTS in electrotechnics subjects
- 7,5 ECTS in electronics subjects
- 6 ECTS in automatic control subjects

Degree competences to which the subject contributes

Basic:
CB6. (ENG) Tenir i comprendre coneixements que aportin una base o oportunitat de ser originals en el desenvolupament i/o aplicació d’idees, sovint en un context d’investigació

Specific:
CEMEI07. Ability to design electronic systems and industrial instrumentation.

CEEELECT1. Design electronic systems (mixed analogical and digital systems and micro-mechanical systems on silicon, digital systems based on discrete components, logical programable devices and/or microprocessors, electronic instrumentation systems and power electronic systems) and manage development projects and/or commercialization.
Learning objectives of the subject

- To understand the basic architecture of microprocessors.
- To understand the internal structure of microcontrollers.
- Learn how to program a microcontroller in C language.
- To know the use of debugging and simulation tools specific for microcontrollers.
- Learn how to send and receive analog and digital signals by means of a microcontroller.
- Learn how to design a small instrumentation system control unit able to capture sensor signals and to actuate electromechanical devices.
- To understand the minimization methodologies for combinational systems.
- To know how to design combinational systems.
- To understand the minimization methodologies for sequential systems.
- Learn how to design sequential systems.
- To understand the source of interferences in electronic systems.
- To know the different steps followed during the fabrication of integrated circuits.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 112h 30m</th>
<th>Hours large group: 25h 30m</th>
<th>22.67%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours small group: 15h</td>
<td></td>
<td>13.33%</td>
</tr>
<tr>
<td>Guided activities: 0h</td>
<td></td>
<td>0.00%</td>
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<tr>
<td>Self study: 72h</td>
<td></td>
<td>64.00%</td>
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</tbody>
</table>
## Content

<table>
<thead>
<tr>
<th>Topic</th>
<th>Learning time:</th>
<th>Theory classes:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>T0 - Subject overview</strong></td>
<td>0h 45m</td>
<td>0h 45m</td>
</tr>
<tr>
<td><strong>T1 - Introduction to C language</strong></td>
<td>1h 45m</td>
<td>1h 45m</td>
</tr>
<tr>
<td><strong>T2 - Introduction to microprocessors</strong></td>
<td>3h</td>
<td>3h</td>
</tr>
<tr>
<td><strong>T3 - Microprocessor architectures</strong></td>
<td>4h 30m</td>
<td>4h 30m</td>
</tr>
<tr>
<td><strong>T4 - Interruptions</strong></td>
<td>3h</td>
<td>3h</td>
</tr>
</tbody>
</table>

**Description:**

- **T0 - Subject overview:** General overview of the subject, summary of different topics and methodology.


- **T3 - Microprocessor architectures:** Princeton architecture. Harvard architecture. Memory map and addressing map. Program memory and data memory organization. Instruction set.

- **T4 - Interruptions:** Status register. Stack (hardware and software). Concept of real time. Interruptions: interrupt sources, types, priorities, enabling and activation of interruptions. Definition of interrupt services in C.
### T5 - Peripherals

**Description:**

**Learning time:** 3h  
Theory classes: 3h

### T6 - Combinational systems

**Description:**

**Learning time:** 3h  
Theory classes: 3h

### T7 - Sequential systems

**Description:**

**Learning time:** 3h  
Theory classes: 3h

### T8 - Manufacturing process of integrated circuits

**Description:**

**Learning time:** 0h 30m  
Theory classes: 0h 30m
Qualification system

The grading of the subject includes four types of scores, from the less to the most important:
- Participation in class: Npc
- Laboratory work: Npl
- Midterm examination: Nep
- Final examination: Nef

The final score (legal marks) is the sum up \( N_f = 0.10 \times Npc + 0.25 \times Npl + 0.25 \times Nep + 0.40 \times Nef \).

The final score \( N_f \) will be NP (absent) if at least one of the following NPs happen: \( Npl = NP \) or \( Nep = Nef = NP \). Otherwise NPs will be substituted by 0s in the \( N_f \) formula.

Students not passing the regular evaluation will have the opportunity to recover it in an extra examination held in July, please find out dates in the Academic Calendar. In this case, the legal marks will be calculated according to the following formula: \( N_f = 0.10 \times Npc + 0.25 \times Npl + 0.65 \times Nee \) where \( Nee \) is the score of the extra examination. The other two scores, \( Npc \) and \( Npl \) will be kept from the regular evaluation of the subject.

Regulations for carrying out activities

Midterm, final and extra examinations are written tests whose duration is indicated in the Academic Calendar and that follow the general rules of the school. They will be closed book tests unless it is explicitly indicated differently by the professor.

The midterm exam consists of 12 questions single choice test, in some questions a justification can be required. The final exam consists of 15 questions single choice test and 1 problem, as in the midterm exam a justification can be requested in some questions. The extraordinary exam consists of 30 questions single choice test.

Laboratory exercises are held in groups of maximum two students. During the first session groups are organized and must continue until the last session. In the final report all members of the group must sign.

Regarding the class participation score, the professor will assess attendance, live participation and correct answer to questions.
Bibliography

Bibliography

Basic:


Complementary:


