340104 - REAU-E5007 - Automatic Regulation

Coordinating unit: 340 - EPSEVG - Vilanova i la Geltrú School of Engineering
Teaching unit: 707 - ESAII - Department of Automatic Control
Academic year: 2017
Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
ECTS credits: 6
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: FRANCISCO JAVIER RUIZ VEGAS
Others: FRANCISCO JAVIER RUIZ VEGAS
RUBEN LUMBIARRES LÓPEZ
RAMON GUZMAN SOLA

Prior skills
It is very convenient to have taken and passed the Fundamentals of Automatic course.

Degree competences to which the subject contributes
Specific:

Teaching methodology
Classroom training activities
· Participatory Lectures
· Conducting individual and team exercises
· Perform computer labs in
· Project Implementation Team
· Report writing and oral defense of problems, practices and projects
Educational activities outside the class:
· Perform exercises and theoretical or practical projects outside the classroom, individual and / or group.
· Review of theoretical concepts, study, work and individual and group analysis
· Tutoring and formative evaluation of the learning process

Learning objectives of the subject
The aim of this course is to provide basic knowledge of linear control systems description in discrete time in order to be able to design some discrete controllers.
### Study load

<table>
<thead>
<tr>
<th><strong>Total learning time:</strong> 150h</th>
<th>Hours large group:</th>
<th>30h</th>
<th>20.00%</th>
</tr>
</thead>
<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>30h</td>
<td>20.00%</td>
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<tr>
<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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</table>
## Content

<table>
<thead>
<tr>
<th>Module 1: Introduction to control systems in discrete time</th>
<th>Learning time: 18h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 6h</td>
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<tr>
<td></td>
<td>Self study : 12h</td>
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</tbody>
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**Description:**
Objective
The aim of this first module is to introduce the basic architecture of digital control systems, applicability and benefits of their use.

Subsections:
- Types of signals
- Digital control systems
- DAC and ADC converters
- Supervisor control vs direct digital control
- Advantages of digital control vs analogic control

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<tr>
<th>Module 2: Mathematical models in discrete time</th>
<th>Learning time: 18h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td></td>
<td>Self study : 12h</td>
</tr>
</tbody>
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**Description:**
Objective
The aim of this second module is to present the mathematical tools that are used to analyze control systems in discrete time. Will relate these techniques with the techniques used to analyze continuous systems.

Content:
- Z transform definition and properties
- Methods of calculating the Z transform and its inverse

<table>
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<tr>
<th>Module 3: Signal sampling and reconstruction</th>
<th>Learning time: 18h</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td></td>
<td>Self study : 12h</td>
</tr>
</tbody>
</table>

**Description:**
Content:
- Ideal sampling or impulse sampling
- Sampled signal spectrum. Shannon Theorem. Ideal filter
- 0 and 1 order holder
- Star transform
- Empiric rule
There will be a first test (P) in the middle of the semester and a second test (F) at the end of the semester. The theory grade of the subject is calculated by the formula \( T = \max(0.5 \cdot (P + F), F) \).

In the laboratory part, two exams are proposed: a mid term exam (LP) and a final exam (FP). In addition, the attendance and participation will be taken into account (A). The lab grade will be: \( L = 0.45 \cdot LP + 0.45 \cdot FP + 0.1 \cdot A \)

The final grade is calculated as follows: \( 0.6 \cdot T + 0.4 \cdot L \)
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Bibliography

Basic:
