Course guide
820130 - TCEE - Control Techniques

Unit in charge: Barcelona East School of Engineering
Teaching unit: 709 - DEE - Department of Electrical Engineering.
Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
Academic year: 2022 ECTS Credits: 6.0 Languages: Catalan, Spanish

LECTURER

Coordinating lecturer: JOSE MATAS ALCALA
Primer quadrimestre:
JOSE MATAS ALCALA - Grup: T11, Grup: T12, Grup: T13

Others:
Primer quadrimestre:
JUAN CRUZ VAQUER - Grup: T11, Grup: T12, Grup: T13
JOSE MATAS ALCALA - Grup: T11, Grup: T12, Grup: T13

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Understand automatic regulation and control techniques and their application to industrial automation.

Transversal:
4. EFFECTIVE USE OF INFORMATION RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.

TEACHING METHODOLOGY

The course uses master classes by 70%, problem analysis in a 20% and work with Matlab by 10%.

LEARNING OBJECTIVES OF THE SUBJECT

To study the control of feedback systems, while introducing input-output relationships in the electric and electromechanical systems, along with the time-domain response.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Hours small group</td>
<td>15,0</td>
<td>10.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>45,0</td>
<td>30.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
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</tbody>
</table>

Total learning time: 150 h
CONTENTS

**Theme 1. Type of systems and modelling of systems**

**Description:**
The most common types of physical systems are described and the principles for developing its mathematical modelling are exposed. Also, the equivalence between the different systems is explained.

**Specific objectives:**
The identification of physical systems
The modelling of systems
The understanding of the equivalence between systems.

**Full-or-part-time:** 4h 30m
Theory classes: 2h
Laboratory classes: 0h 30m
Self study: 2h

**Theme 2. Feedback systems.**

**Description:**
The concept of feedback systems is introduced, its representation, dynamical properties, stability and response to perturbations are described.

**Specific objectives:**
Understanding of the achievements of feedback systems
Understanding the main properties of feedback systems

**Full-or-part-time:** 5h 40m
Theory classes: 2h
Laboratory classes: 1h
Self study: 2h 40m

**Themes 3 to 5. Transient response of 1st and 2nd order systems. Analysis of steady state errors.**

**Description:**
The transient response of first and second order systems for different kind of inputs. The steady state response is also analyzed.

**Specific objectives:**
Understand to which parameters depend the transient response of first and second order systems.
Understand the sources of error at steady state and the ways to improve it.

**Full-or-part-time:** 36h
Theory classes: 12h
Practical classes: 4h
Self study: 20h
**Themes 6 and 7. Root locus. Design of controllers in the LGR domain**

**Description:**
The analysis of the evolution of the roots of a system due to feedback is carried out using the root locus method. Controllers as P, PD, PI, PID, lag and lead are designed using the root locus.

**Specific objectives:**
Calculate the root locus. 
Design feedback controllers using the root locus.

**Full-or-part-time:** 28h 32m
Theory classes: 3h 12m
Practical classes: 2h
Self study: 23h 20m

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**Themes 8 and 9. Bode and Nyquist diagrams**

**Description:**
Calculate de Bode diagram and understand the stability criteria using the Nyquist diagram.

**Specific objectives:**
Calculate de Bode diagram.
Understand the stability criteria in the frequency domain.

**Full-or-part-time:** 17h
Theory classes: 6h
Laboratory classes: 1h
Self study: 10h

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**Theme 10. Design in the frequency domain of compensators**

**Description:**
The controllers P, PI, lead and lag are designed in the frequency domain

**Specific objectives:**
The design of feedback controllers in the frequency domain

**Full-or-part-time:** 34h
Theory classes: 12h
Laboratory classes: 2h
Self study: 20h

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**GRADING SYSTEM**

The evaluation will be conducted through the assessment by the teacher, with the following weights assigned to evaluated activities:
First partial exam: 28%, Second partial exam: 33%, Third partial exam: 22%, Laboratory practice: 17%.
This subject will not have a re-evaluation exam.
It is compulsory to carry out the practices to pass the course.

**EXAMINATION RULES.**

The attendance to the laboratory sessions is mandatory.
BIBLIOGRAPHY

Basic:

Complementary: