Course guides
340033 - FOAU-F4007 - Fundamentals of Automatic Control

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 707 - ESAII - Department of Automatic Control.

Degree: BACHELOR’S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR’S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR’S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR’S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2009). (Optional subject).

Academic year: 2020  ECTS Credits: 6.0  Languages: Catalan, English, Spanish

LECTURER

Coordinating lecturer: FRANCISCO JAVIER RUIZ VEGAS
Others: FRANCISCO JAVIER RUIZ VEGAS
CRISTÓBAL RAYA GINER
XAVIER LLANAS PARRA
ALBERT SAMÀ MONSONÍS
RAMON GUZMAN SOLA
ANDREU CATALA MALLOFRE
LUIS MIGUEL MUÑOZ MORGADO

PRIOR SKILLS

Prerequisites: basic Calculus and Algebra course, with complex numbers and a basic course on Physics.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

Transversal:
1. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.
2. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

TEACHING METHODOLOGY

theoretical classes, practical classes and laboratory
LEARNING OBJECTIVES OF THE SUBJECT

1. To understand the concept of linear dynamic system invariant in time and its representation through its transfer function.
2. To be able to model some mechanical and electrical systems using the formalism of the transfer functions.
3. To determine the characteristics that may hold the responses to first and second order systems where standard inputs (impulse, step or ramp) are applied.
4. To understand the advantages of closed loop system.
5. To be able to represent by Bode and Nyquist diagrams frequency responses of first and second order systems, as well as higher order systems.
6. To know how to interpret frequency diagrams.
7. To learn to select in some cases the best controller to reach the given specifications relating to stability, steady-state error and characteristics of the stationary response.
8. To be able to simulate the behavior of linear systems using MATLAB and Simulink.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours small group</td>
<td>37,5</td>
<td>25.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>22,5</td>
<td>15.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

Unit 0: Automation and Robotics fundamentals

Full-or-part-time: 22 h
Theory classes: 2h
Practical classes: 2h
Laboratory classes: 12h
Guided activities: 3h
Self study: 3h

Unit 1: Transfer Functions

Full-or-part-time: 17 h
Theory classes: 2h
Practical classes: 2h
Laboratory classes: 1h
Self study: 12h

Unit 2: Physical systems modeling

Full-or-part-time: 17 h
Theory classes: 2h
Practical classes: 2h
Laboratory classes: 1h
Self study: 12h
Unit 3: Time response analysis

**Full-or-part-time:** 17 h
Theory classes: 2h
Practical classes: 2h
Laboratory classes: 1h
Self study: 12h

Unit 4: Properties of feedback systems

**Full-or-part-time:** 17 h
Theory classes: 2h
Practical classes: 2h
Laboratory classes: 1h
Self study: 12h

Unit 5: Frequency response analysis

**Full-or-part-time:** 20 h
Theory classes: 2h
Practical classes: 2h
Laboratory classes: 4h
Self study: 12h

Unit 6: Stability analysis using frequency response

**Full-or-part-time:** 20 h
Theory classes: 2h
Practical classes: 2h
Laboratory classes: 4h
Self study: 12h

Unit 7: Control systems design

**Full-or-part-time:** 20 h
Theory classes: 2h
Practical classes: 2h
Laboratory classes: 4h
Self study: 12h
**GRADING SYSTEM**

- partial exams: E1 and E2
- Laboratory controls: P1 and P2
- oral presentation: O

final grade:
\[
\max(0.65 \cdot T + 0.25 \cdot P + 0.1 \cdot O , 0.7 \cdot T + 0.3 \cdot P), \text{ where:}
\]
\[
T = \max(E2, (E1 + E2)/2) \text{ and } P = (0.5 \cdot P1 + 0.5 \cdot P2)
\]

Re-assessment is possible if final grade \( \geq 3 \)

In this case,
\[
\text{final grade} = \min(5, \max(0.65 \cdot TR + 0.25 \cdot P + 0.1 \cdot O, 0.7 \cdot TR + 0.3 \cdot P)), \text{ where:}
\]
\[
TR = \max(R, (E1 + R)/2)
\]

**BIBLIOGRAPHY**

**Basic:**