Course guide
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 DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2009). (Optional 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).

Academic year: 2022 ECTS Credits: 6.0 Languages: Catalan, Spanish, English

LECTURER
Coordinating lecturer: FRANCISCO JAVIER RUIZ VEGAS
Others: FRANCISCO JAVIER RUIZ VEGAS
XAVIER LLANAS PARRA
RAMON GUZMAN SOLA
LUIS MIGUEL MUÑOZ MORGADO
Lumbiarres López, Rubén
Alfaro Aragon, Carlos Arturo

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 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>
<tr>
<td>Hours small group</td>
<td>37.5</td>
<td>25.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

Unit 0: Automation and Robotics fundamentals

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

Unit 1: Transfer Functions

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

Unit 2: Physical systems modeling

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

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

Unit 4: Properties of feedback systems

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

Unit 5: Frequency response analysis

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

Unit 6: Stability analysis using frequency response

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

Unit 7: Control systems design

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

GRADING SYSTEM

Midterm: P Control lab practice 1 2 and 3: L1 MATLAB control: L2 Control lab practice 5 and 6: L3 Oral exposition: O Final Exam: F
Laboratori grade: \( L=0.33L1+0.33L2+0.33L3 \)
Theory and problems grade: \( T=\max(F, 0.5\cdot P+0.5\cdot F) \)
Final grade: \( \max(0.7\cdot T+0.3\cdot L, 0.65\cdot T+0.25\cdot L+0.1\cdot O) \)
If Final grade is between 3.0 and 4.9, students can take a Retake exam that substitute Theory and problems grade. However the maximum grade for students who takes the retake exam will be 5.
BIBLIOGRAPHY

Basic: