Course guide
280675 - 280675 - Regulation and Automatic Control

Unit in charge: Barcelona School of Nautical Studies
Teaching unit: 707 - ESAII - Department of Automatic Control.
Degree: BACHELOR'S DEGREE IN NAVAL SYSTEMS AND TECHNOLOGY ENGINEERING (Syllabus 2010). (Compulsory subject).
Academic year: 2023 ECTS Credits: 4.5 Languages: Catalan, Spanish

LECTURER
Coordinating lecturer: SERGIO ROMERO LAFUENTE
Others: Segon quadrimestre:
SERGIO ROMERO LAFUENTE - GESTN

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES
Specific:
1. Knowledge of the theory of automatic control methods and their application on board.

TEACHING METHODOLOGY
- Receive, understand and synthesize knowledge
- Consider and solve problems
- Analyze results
- Perform work in a team and individually

LEARNING OBJECTIVES OF THE SUBJECT
The main objective is to provide the concept of a dynamic system, applicable in practically all fields of engineering, and the signal as a variable of this system. Other objectives include:
- Introduction to the basic concepts and tools of system analysis.
- Design of controllers to improve the performance specifications of the systems.
- Presentation of control systems within the naval field.

At the end of the course the student must be able to perform the analysis and modification of the systems behavior in naval technology.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guided activities</td>
<td>6,0</td>
<td>5.33</td>
</tr>
<tr>
<td>Hours small group</td>
<td>9,0</td>
<td>8.00</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>15,0</td>
<td>13.33</td>
</tr>
<tr>
<td>Self study</td>
<td>67,5</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>15,0</td>
<td>13.33</td>
</tr>
</tbody>
</table>

Total learning time: 112.5 h
## CONTENTS

<table>
<thead>
<tr>
<th>Topic</th>
<th>Description</th>
<th>Full-or-part-time</th>
<th>Theory classes:</th>
<th>Practical classes:</th>
<th>Self study:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction to automatic</strong></td>
<td>Objective and scope of the subject. Feedback systems. Examples of dynamic systems in a ship.</td>
<td>3h 30m</td>
<td>1h 30m</td>
<td></td>
<td>2h</td>
</tr>
<tr>
<td><strong>System modeling</strong></td>
<td>Transfer function of linear systems. Canonical gain, poles and zeros. Block diagrams. Block algebra.</td>
<td>13h 45m</td>
<td>3h 30m</td>
<td>2h</td>
<td>8h 15m</td>
</tr>
<tr>
<td><strong>Time response</strong></td>
<td>Impulse and step responses of first and second order systems. Stationary error of feedback systems.</td>
<td>22h 30m</td>
<td>6h</td>
<td>3h</td>
<td>13h 30m</td>
</tr>
<tr>
<td><strong>System stability</strong></td>
<td>Definition of stability. Necessary and sufficient condition. Routh criterion.</td>
<td>9h 15m</td>
<td>2h</td>
<td>2h</td>
<td>5h 15m</td>
</tr>
</tbody>
</table>
## Design of PID controllers

**Description:**

**Related activities:**
Lab 1: Introduction and control system of the angular velocity of a DC motor. In this session the student has to: 1) Understand the system and the function of the different blocks of the plant; 2) Identify the model of the plant; 3) Evaluate the performance of different control systems in open and closed loop; and 4) Understand the effect of the different actions of proportional, integral and derivative controls.

Lab 2: Control system for the angular position of a DC motor. In this session the student has to: 1) Evaluate the performance of different systems in open and closed loop; and 2) Design a PID controller.

**Full-or-part-time:** 22h 15m  
Theory classes: 2h  
Practical classes: 3h 30m  
Laboratory classes: 4h  
Guided activities: 6h  
Self study: 6h 45m

## Frequency response

**Description:**

**Full-or-part-time:** 27h 30m  
Theory classes: 7h  
Practical classes: 4h  
Self study: 16h 30m

## Stability in the frequency domain

**Description:**
Nyquist criterion. Gain and phase margins.

**Full-or-part-time:** 13h 45m  
Theory classes: 3h 30m  
Practical classes: 2h  
Self study: 8h 15m
GRADING SYSTEM

The final mark is the partial sum of the following qualifications:
Nfinal: 0.45 Npf + 0.4 Nac + 0.15 Nel

Nfinal: Final result
Npf: Final exam qualification
Nac: Continuous evaluation
Nel: Laboratory qualification

The final exam consists of questions on concepts associated with the learning objectives of the course, and a set of practice exercises. Continuous evaluation is the result of a partial test (with a weight of 20% of the final mark) and activities conducted during the year.

Reexamination: According to the rules of the FNB, a reexamination test consisting of a comprehensive review of the subject will be performed. This test reassessment is aimed to students with a final mark ranging between 3.0 and 4.9.

EXAMINATION RULES.

· Students who do not submit the final test, or have not done any of the labs, or have not submitted any test of the continuous evaluation will be denoted as "NOT TAKEN".

BIBLIOGRAPHY

Basic:

Complementary:

RESOURCES

Other resources:
Notes of theory and problems of the subject (Digital Campus Atenea).