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>Total learning time: 112h 30m</th>
<th>Hours large group:</th>
<th>15h</th>
<th>13.33%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>15h</td>
<td>13.33%</td>
</tr>
<tr>
<td></td>
<td>Hours small group:</td>
<td>9h</td>
<td>8.00%</td>
</tr>
<tr>
<td></td>
<td>Guided activities:</td>
<td>6h</td>
<td>5.33%</td>
</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>67h 30m</td>
<td>60.00%</td>
</tr>
</tbody>
</table>
# Content

<table>
<thead>
<tr>
<th>Topic</th>
<th>Learning 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>3h 30m</td>
<td>1h 30m</td>
<td></td>
<td>2h</td>
</tr>
<tr>
<td><strong>System modeling</strong></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>22h 30m</td>
<td>6h</td>
<td>3h</td>
<td>13h 30m</td>
</tr>
<tr>
<td><strong>System stability</strong></td>
<td>9h 15m</td>
<td>2h</td>
<td>2h</td>
<td>5h 15m</td>
</tr>
</tbody>
</table>

**Description:**
- **Introduction to automatic**
  - Objective and scope of the subject. Feedback systems. Examples of dynamic systems in a ship.

- **System modeling**

- **Time response**
  - Impulse and step responses of first and second order systems. Stationary error of feedback systems.

- **System stability**
Design of PID controllers

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

**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.

Frequency response

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

**Description:**

Stability in the frequency domain

**Learning time:** 13h 45m
- Theory classes: 3h 30m
- Practical classes: 2h
- Self study: 8h 15m

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

Regulations for carrying out activities

- 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:

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