### 340033 - FOAU-F4007 - Fundamentals of Automatic Control

<table>
<thead>
<tr>
<th>Coordinating unit:</th>
<th>340 - EPSEVG - Vilanova i la Geltrú School of Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching unit:</td>
<td>707 - ESAII - Department of Automatic Control</td>
</tr>
<tr>
<td>Academic year:</td>
<td>2019</td>
</tr>
<tr>
<td>Degree:</td>
<td>BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)</td>
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<tr>
<td></td>
<td>BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)</td>
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<td>BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)</td>
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<td>BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2009). (Teaching unit Optional)</td>
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<tr>
<td>ECTS credits:</td>
<td>6</td>
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<tr>
<td>Teaching languages:</td>
<td>Catalan, Spanish, English</td>
</tr>
</tbody>
</table>

#### Teaching staff

- **Coordinator:** 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

#### Opening hours

**Timetable:**
See schedule consultation in ATENEA.

#### 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>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>22h 30m</th>
<th>15.00%</th>
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<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Hours small group:</td>
<td>37h 30m</td>
<td>25.00%</td>
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<tr>
<td></td>
<td>Guided activities:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>90h</td>
<td>60.00%</td>
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</table>
# Content

<table>
<thead>
<tr>
<th>Unit</th>
<th>Learning time</th>
<th>Theory classes</th>
<th>Practical classes</th>
<th>Laboratory classes</th>
<th>Guided activities</th>
<th>Self study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 0: Automation and Robotics fundamentals</td>
<td>22h</td>
<td>2h</td>
<td>2h</td>
<td>12h</td>
<td>3h</td>
<td>3h</td>
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<tr>
<td>Unit 1: Transfer Functions</td>
<td>17h</td>
<td>2h</td>
<td>2h</td>
<td>1h</td>
<td>12h</td>
<td></td>
</tr>
<tr>
<td>Unit 2: Physical systems modeling</td>
<td>17h</td>
<td>2h</td>
<td>2h</td>
<td>1h</td>
<td>12h</td>
<td></td>
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<tr>
<td>Unit 3: Time response analysis</td>
<td>17h</td>
<td>2h</td>
<td>2h</td>
<td>1h</td>
<td>12h</td>
<td></td>
</tr>
<tr>
<td>Unit 4: Properties of feedback systems</td>
<td>17h</td>
<td>2h</td>
<td>2h</td>
<td>1h</td>
<td>12h</td>
<td></td>
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</tbody>
</table>
### Unit 5: Frequency response analysis

**Learning time:** 20h  
Theory classes: 2h  
Practical classes: 2h  
Laboratory classes: 4h  
Self study: 12h

### Unit 6: Stability analysis using frequency response

**Learning time:** 20h  
Theory classes: 2h  
Practical classes: 2h  
Laboratory classes: 4h  
Self study: 12h

### Unit 7: Control systems design

**Learning time:** 20h  
Theory classes: 2h  
Practical classes: 2h  
Laboratory classes: 4h  
Self study: 12h

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### Qualification system

- Partial exams: E1 and E2  
- Laboratory controls: P1 and P2  
- Oral presentation: O

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

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

In this case,

**Final grade:**  
\[
\text{min}(5, \text{max}(0.65 \cdot TR + 0.25 \cdot P + 0.1 \cdot O, \ 0.7 \cdot TR + 0.3 \cdot P)), \text{ where: }
\]
\[
TR = \text{max}(R, \frac{(E1+R)}{2})
\]
**Bibliography**

**Basic:**

