240AR057 - Human Robot Interaction & Teleoperation

Degree competences to which the subject contributes

By the end of the course, the student will have achieved the following skills and knowledge:

- Understand the components of a teleoperation system
- Application of qualitative and quantitative methods.
- Developing of technological solutions
- Modeling the interaction between humans and automation
- Interface design of human-automation systems
- Performance criteria and metrics.
- Ergonomic interaction in human automation systems
- Understand the best control strategies

Others:

Alicia Casals, Andreu Català, Enrique Ajenjo, Pere Ponsa

Teaching staff

Coordinator: Alicia Casals, Pere Ponsa

Others: Alicia Casals, Andreu Català, Enrique Ajenjo, Pere Ponsa

Prior skills

Skills and knowledge in control theory, robotics.

Degree competences to which the subject contributes

Specific:

1. The student will be able to analyze and determine the kinematic and dynamic models of robots and control systems design motion and strength.

General:

3. Ability to conduct research, development and innovation in the field of systems engineering, control and robotics, and as to direct the development of engineering solutions in new or unfamiliar environments, linking creativity, innovation and transfer of technology

4. Have adequate mathematical skills, analytical, scientific, instrumental, technological, and management information.

Teaching methodology

Teaching lessons in class
Problem based Learning

Learning objectives of the subject

By the end of the course, the student will have achieved the following skills and knowledge:

Understand the components of a teleoperation system
Application of qualitative and quantitative methods.
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Interface design of human-automation systems
Performance criteria and metrics.
Ergonomic interaction in human automation systems
Understand the best control strategies
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<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group:</th>
<th>20h 15m</th>
<th>18.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total learning time:</strong></td>
<td>Hours small group:</td>
<td>20h 15m</td>
<td>18.00%</td>
</tr>
<tr>
<td>112h 30m</td>
<td>Self study:</td>
<td>72h</td>
<td>64.00%</td>
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</table>
## Content

### 1 Human-Robot Interaction and Teleoperation

<table>
<thead>
<tr>
<th>Learning time: 15h</th>
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<tbody>
<tr>
<td>Theory classes: 5h</td>
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<tr>
<td>Self study: 10h</td>
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</tbody>
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**Description:**

**Related activities:**
Relate the components of a teleoperation system. The concepts and schemes are evaluated within the written test.

**Specific objectives:**
Understand what is a teleoperation system and recognize the most important elements and the relationship between them.

### 2 Design and Evaluation of Interfaces

<table>
<thead>
<tr>
<th>Learning time: 9h</th>
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</thead>
<tbody>
<tr>
<td>Theory classes: 3h</td>
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<tr>
<td>Self study: 6h</td>
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**Description:**

**Related activities:**
Leap Motion practices.

**Specific objectives:**
Know the element that allow the conversation between the human and the system.

### 3 Human factors

<table>
<thead>
<tr>
<th>Learning time: 9h</th>
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</thead>
<tbody>
<tr>
<td>Theory classes: 3h</td>
</tr>
<tr>
<td>Self study: 6h</td>
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</table>

**Description:**

**Related activities:**
Knowledge evaluated in the written test.

**Specific objectives:**
Understand the relevance of human factors inside human-automation interaction.
### 4 Haptic interaction

**Description:**

**Related activities:**
Knowledge evaluated inside the written test.
Practicum activities with Phantom interface.
Introduction to CHAI3D environment. Use of the OPENHAPTICS toolbox.
Creation of a socket for the communication between two devices.
Practicum activities with the Leap Motion interface.
Teleoperation strategies for UR3 Robot.

**Specific objectives:**
Learn the value of haptic/tactil channel in telerobotics.

**Learning time:** 61h 15m
- Theory classes: 3h
- Laboratory classes: 20h 15m
- Self study: 38h

### 5 Human Automation structures

**Description:**

**Related activities:**
Knowledge evaluated inside the written test.

**Specific objectives:**
Recognize the control architectures.

**Learning time:** 9h
- Theory classes: 3h
- Self study: 6h

### 6 Fields of application

**Description:**

**Related activities:**
Link between introduction and fields, evaluated in the written test.

**Specific objectives:**
Understand the fields of application in teleoperation systems.

**Learning time:** 9h 15m
- Theory classes: 3h 15m
- Self study: 6h
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Qualification system

Written test_1: 35%
Written test_2: 35%
Laboratory practices: 30%

Bibliography

Basic:


Complementary:


Others resources:

ESAII-ETSEIB Laboratory, second floor.
Leap Motion Interface. Phantom Interface.
UR3 robots.