Course guide
230105 - SAM - Sensors, Actuators and Microcontrollers in Mobile Robots

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: BACHELOR’S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).
BACHELOR’S DEGREE IN DATA SCIENCE AND ENGINEERING (Syllabus 2017). (Optional subject).
BACHELOR’S DEGREE IN ELECTRONIC ENGINEERING AND TELECOMMUNICATION (Syllabus 2018). (Optional subject).

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

LECTURER

Coordinating lecturer: Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/responsables-assignatura
Others: Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/professorat-assignat-idioma

PRIOR SKILLS

Analogue and digital electronics concepts. Microprocessors.

TEACHING METHODOLOGY

LEARNING OBJECTIVES OF THE SUBJECT

The course is an introduction to autonomous robotics where microcontrollers are part of the control strategies of the electronic system. The basic concepts of the different types of sensors and actuators commonly used in robotic applications and the basic control strategies as well as their implementation are analyzed, with special emphasis on adaptive and behavior-based alternatives in the design of micro-robots and intelligent robots.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Self study</td>
<td>98,0</td>
<td>65.33</td>
</tr>
<tr>
<td>Hours large group</td>
<td>26,0</td>
<td>17.33</td>
</tr>
<tr>
<td>Hours small group</td>
<td>26,0</td>
<td>17.33</td>
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</tbody>
</table>

Total learning time: 150 h
## CONTENTS

### 1. Basics

**Description:**
- What are robots?
- Robot taxonomies
- Robot architectures
- Open source robotics
- Line following: motivation, architecture & algorithms

**Full-or-part-time:** 2h  
**Theory classes:** 2h

### 2. Robot learning architectures

**Description:**
- Case studies
- The sensory block
- The driving block

**Specific objectives:**

**Full-or-part-time:** 2h  
**Theory classes:** 2h

### 3. Hardware fundamentals

**Description:**
- Building blocks: The sensory block, The driving block and The control block
- Case studies

**Full-or-part-time:** 6h  
**Theory classes:** 6h

### 4. Control

**Description:**
- Heuristics and PID control

**Full-or-part-time:** 4h  
**Theory classes:** 4h

### 5. Behavior-based robots

**Description:**
- Principles and methodology for behavioral design

**Full-or-part-time:** 2h  
**Theory classes:** 2h
6. Robot swarms

Description:
Design principles for a colony based on large number of homogeneous robots

Full-or-part-time: 2h
Theory classes: 2h

7. Modular robots

Description:
Building blocs and operators for designing modular micro-robots

Full-or-part-time: 4h
Theory classes: 4h

8. Intelligent robots

Description:
Robot learning: What Robots Should Learn; Learning sensory information; Reinforcement learning in robotics; Self-driving cars
Intelligent processing
Object detection

Full-or-part-time: 6h
Theory classes: 6h

GRADING SYSTEM

100% of the evaluation mark of the course is obtained from the elaboration throughout the course of guided robotic mini-projects.

BIBLIOGRAPHY

Basic:

Complementary:
RESOURCES

Other resources:
Class notes and other multimedia material available on the course intranet.