

Course guide

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

Last modified: 25/05/2023

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: 2023 **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

Type	Hours	Percentage
Hours small group	26,0	17.33
Hours large group	26,0	17.33
Self study	98,0	65.33

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:

- Ben-Ari, M.; Mondada, F.. Elements of Robotics [on line]. Switzerland: Springer, 2018 [Consultation: 03/06/2022]. Available on: <https://link.springer.com/book/10.1007/978-3-319-62533-1>. ISBN 9783319625324.
- Braünl, T. Embedded robotics: mobile robot design and applications with embedded systems [on line]. 3rd ed. Berlin ; Heidelberg: Springer, 2008 [Consultation: 03/06/2022]. Available on: <https://link.springer.com/book/10.1007/3-540-34319-9>. ISBN 9783540705338.
- McComb, G. Robot builder's bonanza [on line]. 5th ed. New York: McGraw-Hill, 2019 [Consultation: 03/06/2022]. Available on: <https://www.accessengineeringlibrary.com/content/book/9781260135015>. ISBN 9781260135015.

Complementary:

- Martin, F.G. Robotic explorations: a hands-on introduction to engineering. Upper Saddle River, N.J.: Prentice-Hall, 2001. ISBN 0130895687.
- Predko, M. Programming and customizing the PICmicro microcontrollers. 3rd ed. New York [etc.]; London: Tab; McGraw-Hill, 2007. ISBN 9780071472876.
- Arkin, R.C. Behavior-based robotics [on line]. London: MIT Press, 1998 [Consultation: 03/06/2022]. Available on: <https://mitpress.mit.edu/books/behavior-based-robotics>. ISBN 0262011654.

RESOURCES

Other resources:

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