Course guide
295120 - 295II235 - Robotic Systems

Last modified: 04/06/2026

Unit in charge: Barcelona East School of Engineering
Teaching unit: 707 - ESAII - Department of Automatic Control.

Degree: MASTER'S DEGREE IN INTERDISCIPLINARY AND INNOVATIVE ENGINEERING (Syllabus 2019). (Optional subject).
ERASMUS MUNDUS MASTER IN SUSTAINABLE SYSTEMS ENGINEERING (EMSSE) (Syllabus 2024). (Optional subject).

Academic year: 2026 **ECTS Credits:** 6.0 **Languages:** English

LECTURER

Coordinating lecturer: EDMUNDO GUERRA PARADAS

Others: Primer quadrimestre:
ANTONI GRAU SALDES - Grup: T11, Grup: T12
EDMUNDO GUERRA PARADAS - Grup: T11, Grup: T12

PRIOR SKILLS

Basic knowledge about programming, automatic control systems and computer vision.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEMUEII-14. Design and manage production processes that include quality control systems using advanced characterization techniques. (Specific competence of the Advanced Manufacturing Systems specialty).

Generical:
CGMUEII-01. Participate in technological innovation projects in multidisciplinary problems, applying mathematical, analytical, scientific, instrumental, technological and management knowledge.
CGMUEII-05. To communicate hypotheses, procedures and results to specialized and non-specialized audiences in a clear and unambiguous way, both orally and through reports and diagrams, in the context of the development of technical solutions for problems of an interdisciplinary nature.

Transversal:
05 TEQ. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.
06 URI. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.
03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

LEARNING RESULTS

Knowledges:
K03. Design, implement and manage automated systems for the control and supervision of industrial processes.
K04. Design and manage advanced manufacturing processes that include quality control systems using advanced characterisation techniques.
K08. Design, plan and implement robotic and computer vision systems in automated industrial production plants.

Skills:
S01. Communicate effectively in oral, written and graphic form with others regarding learning, the development of ideas and decision making, and participate in discussions using interpersonal skills such as active listening and empathy, which foster teamwork.

Competences:
C03. Manage the acquisition, organisation, analysis and presentation of data and information in the field of complex systems engineering and critically assess the results obtained.
C05. Propose advanced scientific and technological solutions to complex industrial challenges in areas such as intelligent production, robotic systems, logistics, fault detection and predictive maintenance.
C02. Work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

TEACHING METHODOLOGY

The course combines lectures (50%) with practical activities at laboratory (50%).

LEARNING OBJECTIVES OF THE SUBJECT

Have an overall knowledge of the current development of robotics.
Know the operation, programming and applications of industrial manipulator robots. Be able to program an industrial robot manipulator.
Know the operation of mobile robots and their applications in industrial environments.
Be able to simulate and optimize a productive process that integrates robots.

STUDY LOAD

Type	Hours	Percentage
Hours small group	21,0	14.00
Hours large group	21,0	14.00
Self study	108,0	72.00

Total learning time: 150 h

CONTENTS

Introduction.

Description:
Introduction to robotics. Robot types. Applications. Economic and social issues.

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

Robot manipulators.

Description:
Fundamental problems in robot manipulation. Types of robot manipulators. Sensors and actuators. Kinematics. Trajectory generation. Dynamics. Control. Programming.

Full-or-part-time: 18h
Theory classes: 8h
Laboratory classes: 10h

Mobile robots.

Description:
Fundamental probles in mobile robotics. Locomotion: wheeled, legged and aerial robots. Kynematics and dynamics for wheeled robots. Trajectory generation and tracking. Sensors. Localization. Navigation and planning.

Full-or-part-time: 16h
Theory classes: 8h
Laboratory classes: 8h

Simulation of robotized production systems.

Description:
Petri nets. Discrete systems simulation.

Full-or-part-time: 8h
Theory classes: 4h
Laboratory classes: 4h

Seminars on advanced robotics.

Description:
Advanced manipulation. Robot programming by demonstration. Human-computer interaction. Bio-inpired robots. Social robotics.

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

GRADING SYSTEM

Any academic fraud, plagiarism or use or possession of unauthorised means in an assessment activity leads to a mark of zero (0) for the affected test or assignment. Furthermore, in accordance with the University's regulations, if disciplinary proceedings are initiated the subject is recorded as "Pending Assessment" until a decision is reached. These incidents are managed in accordance with the **Action Framework for Academic Integrity in Assessment at the UPC**.

The final course marks will be calculated from the evaluation of: practical activities carried out at the laboratory, homework and reports.

BIBLIOGRAPHY

Basic:
- Siciliano, Bruno [et al.]. Robotics : modelling, planning and control [on line]. London: Springer, cop. 2009 [Consultation: 14/04/2020]. Available on: http://dx.doi.org/10.1007/978-1-84628-642-1. ISBN 9781846286414.
- Siegwart, Roland [et al.]. Introduction to autonomous mobile robots [on line]. 2nd ed. Cambridge: MIT Press, cop. 2011 [Consultation: 14/04/2020]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=3339191. ISBN 9780262015356.
- Banks, Jerry [et al.]. Discrete-event system simulation. 5th ed. Upper Saddle River, NJ: Prentice Hall, 2010. ISBN 9780138150372.

Complementary:
- Corke, Peter I. Robotics, vision and control : fundamental algorithms in MATLAB® [on line]. 2nd ed. Cham: Springer International Publishing : Imprint: Springer, 2017 [Consultation: 14/04/2020]. Available on: http://dx.doi.org/10.1007/978-3-319-54413-7. ISBN 978-3319544120.
- Siciliano, Bruno; Khatib, Oussama. Springer Handbook of Robotics [on line]. 2nd ed. Cham: Springer International Publishing, 2016 [Consultation: 14/04/2020]. Available on: http://dx.doi.org/10.1007/978-3-319-32552-1. ISBN 9783319325507.