UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course:	PROGRAMMING MOBILE ROBOTS	**Code:**	56345
Type:	ELECTIVE	**ECTS credits:**	6
Degree:	420 - UNDERGRADUATE DEGREE PROGRAMME IN MECHANICAL ENGINEERING	**Academic year:**	2023-24
Center:	605 - SCHOOL OF INDUSTRIAL ENGINEERS. AB	**Group(s):**	11
Year:	4	**Duration:**	C2
Main language:	English	**Second language:**	
Use of additional languages:		**English Friendly:**	N
Web site:		**Bilingual:**	Y

Lecturer: **ANTONIO FERNANDEZ CABALLERO** - Group(s): **11**

Building/Office	Department	Phone number	Email	Office hours
Escuela Técnica Superior de Ingenieros Industriales / 1.C.3	SISTEMAS INFORMÁTICOS	2406	antonio.fdez@uclm.es	

2. Pre-Requisites

Pre-requisites

The student must have prior basic knowledge of computers and programming.

Therefore, and to properly follow this course, it is recommended that students have previously studied the subject 'Computer Fundamentals'.

3. Justification in the curriculum, relation to other subjects and to the profession

Justification in the study plan, and relation with other courses and the profession

The concepts and skills provided in this course are part of the reference MECHATRONICS and thus complement the fourth year electives called 'Pneumatic Systems', 'Sensors and Actuators', 'Virtual Instrumentation' and 'Mechanics of Robots and Manipulators' .

The course is initially based on the programming concepts learned in the subject of 'Computer Basics' as well as some of Robotics concepts seen on the subject 'Industrial Robotics'.

This course provides the concepts and basic skills that an Industrial Engineer specializing in Mechanics requires in relation to the programming of sensors, actuators and control of mobile robots.

4. Degree competences achieved in this course

Course competences

Code	Description
CEO20	Knowledge of the fundamentals of mobile robotics and its reasoning models, for the purpose of applying specific techniques according to the problem to be solved.
CG03	Knowledge of basic and technological subjects to facilitate learning of new methods and theories, and provide versatility to adapt to new situations.
CT02	Knowledge and application of information and communication technology.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Programming of a simulator for mobile robots and certain real mobile robots, mainly in aspects related to autonomous navigation.

Additional outcomes

Knowledge of the internal workings of mobile robots (sensors, actuators and control).
Ability in the handling of computer libraries.
Ability in oral and written communication.
Ability in teamwork.

6. Units / Contents

Unit 1: Mobile Robots
Unit 2: Mobile Robot Architectures
Unit 3: Robot Behaviours
Unit 4: Robot Locomotion
Unit 5: Robot Sensing
Unit 6: Robot Vision
Unit 7: Motion Planning

Unit 8: Localisation and Mapping
Unit 9: Robot Navigation
Unit 10: Learning in Mobile Robots
Unit 11: Multi-Robot Systems
Unit 12: Human-Robot Interaction

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures	CEO20 CG03	1.2	30	Y	N	The teacher will focus on the topic and explain its fundamental contents.
Computer room practice [ON-SITE]	Practical or hands-on activities	CEO20 CT02	0.48	12	Y	N	It consists in the realization, in small groups, of practical exercises and simulations with specific software.
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	CEO20 CG03 CT02	0.48	12	Y	N	It will consist of the exposition of the works carried out in the practices.
Progress test [ON-SITE]	Assessment tests	CEO20 CG03	0.16	4	Y	N	They will consist of tests related to both theoretical aspects and practical application.
Final test [ON-SITE]	Assessment tests	CEO20 CG03 CT02	0.08	2	Y	Y	It will deal with the whole subject evaluating its theoretical and practical aspects.
Study and Exam Preparation [OFF-SITE]	Self-study		3.6	90	N	-	
		Total:	**6**	**150**			
		Total credits of in-class work: 2.4					**Total class time hours: 60**
		Total credits of out of class work: 3.6					**Total hours of out of class work: 90**

As: Assessable training activity
Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Assessment of activities done in the computer labs	25.00%	25.00%	The work carried out by the student during the practices will be valued on the basis of a demonstration of the functioning of the programs and the documentation delivered in the written reports.
Practicum and practical activities reports assessment	15.00%	15.00%	Both the content of the work presented and the clarity of the written expression will be valued.
Progress Tests	60.00%	60.00%	There will be four optional progress tests. Each of these progress tests must be passed with a minimum of 5 out of 10. If in any of the four exams this requirement is not met, the student must achieve the grade corresponding to this activity by taking the final exam, which will include the contents of the subject not passed.
Total:	**100.00%**	**100.00%**	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject , an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

The final exam that includes all the subjects not passed during the course.

Non-continuous evaluation:

Evaluation criteria not defined

Specifications for the resit/retake exam:

The retake exam consists of a final exam that covers the whole subject.
No note is kept of the activities carried out during the course.

Specifications for the second resit / retake exam:

The second retake exam consists of a final exam that covers the whole subject.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	hours
Computer room practice [PRESENCIAL][Practical or hands-on activities]	12
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	12
Progress test [PRESENCIAL][Assessment tests]	4
Final test [PRESENCIAL][Assessment tests]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	90

Unit 1 (de 12): Mobile Robots	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2.5
Unit 2 (de 12): Mobile Robot Architectures	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2.5
Unit 3 (de 12): Robot Behaviours	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2.5
Unit 4 (de 12): Robot Locomotion	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2.5
Unit 5 (de 12): Robot Sensing	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2.5
Unit 6 (de 12): Robot Vision	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2.5
Unit 7 (de 12): Motion Planning	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2.5
Unit 8 (de 12): Localisation and Mapping	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2.5
Unit 9 (de 12): Robot Navigation	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2.5
Unit 10 (de 12): Learning in Mobile Robots	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2.5
Unit 11 (de 12): Multi-Robot Systems	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2.5
Unit 12 (de 12): Human-Robot Interaction	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2.5
Global activity	
Activities	**hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	30
Final test [PRESENCIAL][Assessment tests]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	12
Computer room practice [PRESENCIAL][Practical or hands-on activities]	12
Progress test [PRESENCIAL][Assessment tests]	4
Study and Exam Preparation [AUTÓNOMA][Self-study]	90
Total horas:	150

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
H. Choset, K.M. Lynch, S. Hutchinson, G. Kantor, W. Burgard, L.E. Kavraki, S. Thrun	Principles of Robot Motion: Theory, Algorithms, and Implementations	The MIT Press		978-0-272-03327-5	2005	
A. Ollero	Robótica: Manipuladores y Robots Móviles	Marcombo		978-8-426-71313-1	2005	Chapters 2 and 7-12
B. Siciliano, L. Scavicco, L. Villani, G. Oriolo	Robotics: Modelling, Planning and Control	Springer		978-1-84628-641-4	2009	Chapters 5 and 11-12
F. Fahimi	Autonomous Robots: Modeling, Path Planning, and Control	Springer		978-0-387-09537-0	2009	Chapter 6
F. Torres, J. Pomares, P. Gil, S.T. Puente, R. Aracil	Robots y Sistemas Sensoriales	Prentice Hall		84-205-3574-5	2002	Chapters 6-7, 11 and 14
	http://journalfieldrobotics.org/Home.html					
	http://www.elsevier.com/wps/find/journaldescription.cws_home/505622/description					
S. Thrun, W. Burghard, D. Fox	Probabilistic Robotics	The MIT Press		978-0-262-20162-9	2005	Chapters 2 and 7-12
R. Siegwart, I.R. Nourbakhsh, D. Scaramuzza	Introduction to Autonomous Mobile Robots, Second Edition	The MIT Press		978-0-262-01535-6	2011	