

**1. General information****Course:** INDUSTRIAL ROBOTS**Code:** 56506**Type:** CORE COURSE**ECTS credits:** 6**Degree:** 359 - UNDERGRAD. IN INDUSTRIAL ELECTRONICS AND AUTOMAT. ENGINEERING (CR)**Academic year:** 2021-22**Center:** 602 - E.T.S. INDUSTRIAL ENGINEERING OF C. REAL**Group(s):** 20**Year:** 3**Duration:** C2**Main language:** Spanish**Second language:** English**Use of additional languages:****English Friendly:** Y**Web site:****Bilingual:** N**Lecturer:** ANDRES SALOMON VAZQUEZ FERNANDEZ PACHECO - Group(s): 20

Building/Office	Department	Phone number	Email	Office hours
Edificio Politécnico 2-B02	INGENIERÍA ELÉCTRICA, ELECTRÓNICA, AUTOMÁTICA Y COMUNICACIONES	Via Teams	andress.vazquez@uclm.es	

2. Pre-Requisites

Not established

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

Not established

4. Degree competences achieved in this course**Course competences**

Code	Description
A05	To have developed the learning skills necessary to undertake subsequent studies with a greater degree of autonomy.
A12	Knowledge of basic materials and technologies that assist the learning of new methods and theories and enable versatility to adapt to new situations.
A13	Ability to take the initiative to solve problems, take decisions, creativity, critical reasoning and ability to communicate and transmit knowledge, skills and abilities in Industrial Electronic Engineering and Automation.
D09	Knowledge of principles and applications of robotic systems.

5. Objectives or Learning Outcomes**Course learning outcomes**

Description

Know the work space of a robot and its limitations

Ability to generate trajectories within the work environment

Ability to identify different classes of robots

Use the principle programming languages of industrial robots

Know the applications of industrial robots

Ability to dynamically model the structure of a rigid robot

Application of the main robot information tools

6. Units / Contents**Unit 1: Presentation**

Unit 1.1

Unit 1.2

Unit 2: Introduction

Unit 2.1

Unit 2.2

Unit 2.3

Unit 2.4

Unit 3: Robot Morphology

Unit 3.1

Unit 3.2

Unit 3.3

Unit 3.4

Unit 3.5

Unit 3.6

Unit 4: Mathematical Tools

Unit 4.1

Unit 4.2

Unit 4.3
 Unit 4.4
 Unit 4.5
 Unit 4.6
Unit 5: Robot Kinematics
 Unit 5.1
 Unit 5.2
 Unit 5.3
Unit 6: Differential Kinematics
 Unit 6.1
 Unit 6.2
 Unit 6.3
 Unit 6.4
 Unit 6.5
 Unit 6.6
Unit 7: Static Forces in Manipulators
 Unit 7.1
 Unit 7.2
 Unit 7.3
 Unit 7.4
Unit 8: Trajectory Planning
 Unit 8.1
 Unit 8.2
 Unit 8.3
 Unit 8.4
 Unit 8.5
 Unit 8.6
 Unit 8.7
Unit 9: Robot Programming
 Unit 9.1
 Unit 9.2
 Unit 9.3
 Unit 9.4
 Unit 9.5
 Unit 9.6
 Unit 9.7
 Unit 9.8
Unit 10: Industrial applications of manipulators
 Unit 10.1
 Unit 10.2
Unit 11: New Trends in robotics
 Unit 11.1
 Unit 11.2
 Unit 11.3
 Unit 11.4
 Unit 11.5
 Unit 11.6
 Unit 11.7

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	A05 A12 A13 D09	0.8	20	N	-	
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	A05 A12 A13 D09	0.72	18	N	-	
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	A05 A12 A13 D09	0.6	15	Y	Y	
Writing of reports or projects [OFF-SITE]	Group Work	A05 A12 A13 D09	1.68	42	Y	Y	
Practicum and practical activities report writing or preparation [OFF-SITE]	Guided or supervised work	A05 A12 A13 D09	0.6	15	Y	Y	
Study and Exam Preparation [OFF-SITE]	Self-study	A05 A12 A13 D09	1.24	31	N	-	
Final test [ON-SITE]	Assessment tests	A05 A12 A13 D09	0.08	2	Y	Y	
Project or Topic Presentations [ON-SITE]	Group Work	A05 A12 A13 D09	0.08	2	Y	Y	
Individual tutoring sessions [ON-SITE]	Other Methodologies	A05 A12 A13 D09	0.12	3	N	-	
On-line debates and forums [OFF-SITE]	Other Methodologies	A05 A12 A13 D09	0.08	2	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%	
Projects	35.00%	35.00%	
Final test	40.00%	40.00%	
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).

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	hours
Unit 1 (de 11): Presentation	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	.5
Unit 2 (de 11): Introduction	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	3
Individual tutoring sessions [PRESENCIAL][Other Methodologies]	.25
Unit 3 (de 11): Robot Morphology	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Writing of reports or projects [AUTÓNOMA][Group Work]	5
Study and Exam Preparation [AUTÓNOMA][Self-study]	4
Final test [PRESENCIAL][Assessment tests]	.25
Project or Topic Presentations [PRESENCIAL][Group Work]	.25
Individual tutoring sessions [PRESENCIAL][Other Methodologies]	.5
On-line debates and forums [AUTÓNOMA][Other Methodologies]	.25
Unit 4 (de 11): Mathematical Tools	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2
Writing of reports or projects [AUTÓNOMA][Group Work]	5
Study and Exam Preparation [AUTÓNOMA][Self-study]	4
Final test [PRESENCIAL][Assessment tests]	.25
Project or Topic Presentations [PRESENCIAL][Group Work]	.25
Individual tutoring sessions [PRESENCIAL][Other Methodologies]	.25
On-line debates and forums [AUTÓNOMA][Other Methodologies]	.25
Unit 5 (de 11): Robot Kinematics	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	5
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	6
Writing of reports or projects [AUTÓNOMA][Group Work]	5
Practicum and practical activities report writing or preparation [AUTÓNOMA][Guided or supervised work]	6
Study and Exam Preparation [AUTÓNOMA][Self-study]	5
Final test [PRESENCIAL][Assessment tests]	.25
Project or Topic Presentations [PRESENCIAL][Group Work]	.25
Individual tutoring sessions [PRESENCIAL][Other Methodologies]	.25
On-line debates and forums [AUTÓNOMA][Other Methodologies]	.25
Unit 6 (de 11): Differential Kinematics	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	4
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	3
Writing of reports or projects [AUTÓNOMA][Group Work]	5
Practicum and practical activities report writing or preparation [AUTÓNOMA][Guided or supervised work]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	4

Final test [PRESENCIAL][Assessment tests]	.25
Project or Topic Presentations [PRESENCIAL][Group Work]	.25
Individual tutoring sessions [PRESENCIAL][Other Methodologies]	.5
On-line debates and forums [AUTÓNOMA][Other Methodologies]	.25
Unit 7 (de 11): Static Forces in Manipulators	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	3
Writing of reports or projects [AUTÓNOMA][Group Work]	5
Study and Exam Preparation [AUTÓNOMA][Self-study]	3
Final test [PRESENCIAL][Assessment tests]	.25
Project or Topic Presentations [PRESENCIAL][Group Work]	.25
Individual tutoring sessions [PRESENCIAL][Other Methodologies]	.25
On-line debates and forums [AUTÓNOMA][Other Methodologies]	.25
Unit 8 (de 11): Trajectory Planning	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	3
Writing of reports or projects [AUTÓNOMA][Group Work]	5
Practicum and practical activities report writing or preparation [AUTÓNOMA][Guided or supervised work]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	4
Final test [PRESENCIAL][Assessment tests]	.25
Project or Topic Presentations [PRESENCIAL][Group Work]	.25
Individual tutoring sessions [PRESENCIAL][Other Methodologies]	.25
On-line debates and forums [AUTÓNOMA][Other Methodologies]	.25
Unit 9 (de 11): Robot Programming	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	1.5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	3
Writing of reports or projects [AUTÓNOMA][Group Work]	5
Practicum and practical activities report writing or preparation [AUTÓNOMA][Guided or supervised work]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	2
Final test [PRESENCIAL][Assessment tests]	.25
Project or Topic Presentations [PRESENCIAL][Group Work]	.25
Individual tutoring sessions [PRESENCIAL][Other Methodologies]	.25
On-line debates and forums [AUTÓNOMA][Other Methodologies]	.25
Unit 10 (de 11): Industrial applications of manipulators	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Writing of reports or projects [AUTÓNOMA][Group Work]	5
Study and Exam Preparation [AUTÓNOMA][Self-study]	1
Final test [PRESENCIAL][Assessment tests]	.25
Project or Topic Presentations [PRESENCIAL][Group Work]	.25
Individual tutoring sessions [PRESENCIAL][Other Methodologies]	.25
On-line debates and forums [AUTÓNOMA][Other Methodologies]	.25
Unit 11 (de 11): New Trends in robotics	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Writing of reports or projects [AUTÓNOMA][Group Work]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	1
Individual tutoring sessions [PRESENCIAL][Other Methodologies]	.25
Global activity	
Activities	hours
Class Attendance (theory) [PRESENCIAL][Lectures]	20
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	18
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	15
Writing of reports or projects [AUTÓNOMA][Group Work]	42
Practicum and practical activities report writing or preparation [AUTÓNOMA][Guided or supervised work]	15
Study and Exam Preparation [AUTÓNOMA][Self-study]	31
Final test [PRESENCIAL][Assessment tests]	2
Project or Topic Presentations [PRESENCIAL][Group Work]	2
Individual tutoring sessions [PRESENCIAL][Other Methodologies]	3
On-line debates and forums [AUTÓNOMA][Other Methodologies]	2
Total horas: 150	

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description

ABB	Manual de RobotStudio http://www.abb.es/product/seitp327/df90f6fe2c1ffc64c125725100252d4d.aspx?productLanguage=es&country=ES		2013
Bruno Siciliano	HandBook of Robotics	Springer	2008
J.J. Craig.	Introduction to Robotics	Addison-Wesley	1998
Peter Corke	ROBOTIC TOOLBOX http://petercorke.com/Robotics_Toolbox.html		2008
Richard M. Murray	A Mathematical Introduction to Robotic Manipulation http://www.cds.caltech.edu/~murray/mlswiki	CRC	
The MathWorks	MATLAB Reference Guide		1993
A. Barrientos, L.F. Peñín, C. Balaguer y R. Aracil.	Fundamentos de Robótica	Mc Graw-Hill	2007