



Teaching Guide

Identifying Data					2023/24
Subject (*)	Industrial Robotics	Code	770G01041		
Study programme	Grao en Enxeñaría Electrónica Industrial e Automática				
Descriptors					
Cycle	Period	Year	Type	Credits	
Graduate	2nd four-month period	Third	Optional	6	
Language	Spanish				
Teaching method	Face-to-face				
Prerequisites					
Department	Enxeñaría Industrial				
Coordinador	Casteleiro Roca, José Luis	E-mail	jose.luis.casteleiro@udc.es		
Lecturers	Casteleiro Roca, José Luis Meizoso López, Maria del Carmen	E-mail	jose.luis.casteleiro@udc.es carmen.meizoso@udc.es		
Web	https://moodle.udc.es/				
General description	This subject is dedicated to the study of robots as elements of production automation. Robots are machines that integrate mechanical, electrical, electronic components and sensory and communication devices, under the supervision of a real-time control computer system.				

Study programme competences / results

Code	Study programme competences / results
A9	Capacidade de visión espacial e coñecemento das técnicas de representación gráfica, tanto por métodos tradicionais de xeometría métrica e xeometría descritiva como mediante as aplicacións de deseño asistido por ordenador.
A26	Coñecer os fundamentos e aplicacións da electrónica dixital e microprocesadores.
A28	Coñecemento aplicado de instrumentación electrónica.
A31	Coñecementos de regulación automática e técnicas de control e a súa aplicación á automatización industrial.
A32	Coñecer os principios e aplicacións dos sistemas robotizados.
A33	Coñecemento aplicado de informática industrial e comunicacións.
A34	Capacidade para deseñar sistemas de control e automatización industrial.
B1	Capacidade de resolver problemas con iniciativa, toma de decisións, creatividade e razoamento crítico.
B4	Capacidade de traballar e aprender de forma autónoma e con iniciativa.
B5	Capacidade para empregar as técnicas, habilidades e ferramentas da enxeñaría necesarias para a práctica desta.
B6	Capacidade de usar adecuadamente os recursos de información e aplicar as tecnoloxías da información e as comunicacións na enxeñaría.
C3	Desenvolverse para o exercicio dunha cidadanía aberta, culta, crítica, comprometida, democrática e solidaria, capaz de analizar a realidade, diagnosticar problemas, formular e implantar solucións baseadas no coñecemento e orientadas ao ben común.

Learning outcomes

Learning outcomes	Study programme competences / results		
Know what an industrial robot is and identify its main applications	A26 A28 A32	B5 B6	
Know the problem of modeling and kinematic control in robots	A9 A31 A33 A34	B5	



Know the problem of modeling and dynamic control in robots	A26 A28 A32 A34	B1 B4 B6	
Know the robot programming methods	A26 A32 A34	B1 B5 B6	
Know the criteria for implementing an industrial robot	A33 A34	B6	C3

Contents	
Topic	Sub-topic
Morphology: mechanical structures, sensory and actuation subsystems, tools and fixtures.	Morphology: Mechanical structure, transmissions and reducers, actuators, sensors, control system and final effector.
Direct and inverse geometric and kinematic model.	Direct kinematic problem. Denavit - Hartember method. Inverse kinematic problem. Methods. Jacobian concept.
Kinematic control and trajectory generation.	Kinematic control functions. Types of trajectories. Generation of trajectories. Interpolation.
Modeling and dynamic control. Servo control strategies.	Monoarticular control. Multi-joint control. adaptive check.
Control of force and accommodation. Integration with external sensors.	Types of external sensors in industrial robotics.
Robot programming.	Robot programming methods. ABB's RAPID language. Simulation and programming with RobotStudio.
Selection and implementation of industrial robots. Safety of robotic installations.	Design and control of a robotic cell. Criteria for selecting a robot and economic justification. Safety in robotic installations.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A26 A32 A33 A34 B1 B4 B5 B6 C3	9	15	24
Problem solving	A9 A28 A31 A32 A33 A34 B1 B4	6	15	21
Laboratory practice	A26 A28 A31 A32 A33 B1 B4 B5 B6	24	35	59
Supervised projects	A31 A32 B1 B4	8	0	8
Personalized attention		1	0	1

(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
Methodologies	Description



Guest lecture / keynote speech	Keynote speech complemented with the use of audiovisual media and the introduction of some questions to students, in order to transmit knowledge and facilitate learning. The order of the topics covered will not have to be the one described in the teaching guide. In addition, there will be topics that can be seen together on the development of others, and the division between them may not be strict.
Problem solving	Solving exercises and specific problems in the classroom, from the knowledge explained.
Laboratory practice	Performing laboratory practice as far as possible; or, failing that, solving exercises and specific problems in the classroom, from the knowledge explained.
Supervised projects	An individual work was carried out, along with the correction of the work of other colleagues. In addition, this work will have to be presented in class.

Personalized attention

Methodologies	Description
Supervised projects	The student has the relevant meetings of personalized tutorials, to resolve the concerns arising from the matter.

Assessment

Methodologies	Competencies / Results	Description	Qualification
Laboratory practice	A26 A28 A31 A32 A33 B1 B4 B5 B6	Some tasks established in the subject, within the framework of this methodology	30
Problem solving	A9 A28 A31 A32 A33 A34 B1 B4	Realization of works, exercises and problems	20
Supervised projects	A31 A32 B1 B4	Realization of a practical application developed by the robot, which can be combined with the vision system and other laboratory equipment.	50

Assessment comments

As part of the "Laboratory practice" may include aspects such as attendance, attitude, etc., to help obtain the approved. In addition, it may also include in this methodology the assessment of the presentation in class of personal work.

For the second opportunity, there will be second deadline for assignments.

The evaluation criteria of the early December call will be the same as those of the second opportunity of the previous year.

Students with recognition of part-time dedication and academic waiver of attendance exemption, second establishes the "NORMA QUE REGULA O RÉXIME DE DEDICACIÓN AO ESTUDO DOS ESTUDANTES DE GRAO NA UDC (Arts. 2.3; 3.b e 4.5) (29/5/212)", will be evaluated in the same way, allowing one more week of margin in the assignments.

The fraudulent completion of tests or assessment activities, once verified, will directly imply that the student will be qualified with "suspension" (numerical grade 0) in the corresponding call for the academic year, whether the offense is committed at the first opportunity as in the second. For this, your qualification will be modified in the first opportunity report, if necessary.

In case the student commits an infraction in the subject (according to the Student Disciplinary Regulations): the student will be graded with a "fail" (numerical grade 0) in the corresponding exam session, whether the infraction is committed at the first or second opportunity. For this, the student's grade will be modified in the first opportunity report, if necessary.

Sources of information

Basic	<ul style="list-style-type: none"> - Ollero Baturone, A (2001). Manipuladores y Robots móviles. Marcombo - Barrientos Cruz, Antonio; Peñín Honrubia, Luis Felipe (2007). Fundamentos de Robótica. Mc Graw-Hill - John J, Craig (2006). Robótica.. Pearson Prentice Hall - Torres, F y otros (2002). Robots y Sistemas Sensoriales. Prentice Hall - Peter Corke (2011). Robotics, Vision and Control. Robotics, Vision and Control
Complementary	

Recommendations

Subjects that it is recommended to have taken before



Computer Science/770G01002

Physics I/770G01003

Linear Algebra/770G01006

Physics II/770G01007

Automatic Control Systems/770G01017

Fundamentals of Electronic Circuits/770G01018

Digital Systems I/770G01026

Subjects that are recommended to be taken simultaneously

Automation II/770G01037

Advanced Control/770G01042

Subjects that continue the syllabus

Graduation Project /Bachelor Thesis/770G01045

Other comments

Recommendations on sustainability and the environment Students will be taught the importance of ethical principles related to the values of sustainability so that they can apply them not only in the classroom, but also in their personal and professional behaviour. To help achieve an immediate sustainable environment and meet the objective of action number 5: "Healthy, environmentally and socially sustainable teaching and research" of the "Green Campus Ferrol Action Plan": The delivery of the documentary work carried out in this subject:- It will be requested in digital format and/or in computer support.- It will be done through Moodle, in digital format without the need to print it.- If it is necessary to do them on paper: o No plastics will be used. o Double-sided printing will be used. o Recycled paper should be used. o Drafts should not be printed. Sustainable use of resources and prevention of negative impacts on the natural environment should be made. Recommendations on Gender Equality and respect for diversity- According to the different regulations applicable to university teaching, the gender perspective must be incorporated in this subject (non-sexist language will be used, bibliography of authors of both sexes will be used, the intervention of male and female students in class will be encouraged...).- We will work to identify and modify sexist prejudices and attitudes, and we will influence the environment to modify them and promote values of respect and equality.- Situations of gender discrimination will be detected and actions and measures to correct them will be proposed.- The full integration of students who, for physical, sensory, mental or socio-cultural reasons, experience difficulties in gaining suitable, equal and beneficial access to university life will be facilitated.

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.