

## [GJH204] ROBOTIC SYSTEMS AND ARTIFICIAL VISION

### GENERAL INFORMATION

<b>Studies</b>	DEGREE IN MECHATRONICS ENGINEERING		<b>Subject</b>	?
<b>Semester</b>	1	<b>Course</b>	4	<b>Mention / Field of specialisation</b>
<b>Character</b>	COMPULSORY		<b>Language</b>	CASTELLANO/EUSKARA
<b>Plan</b>	2022	<b>Modality</b>	Face-to-face	<b>Total hours</b>
<b>Credits</b>	4,5	<b>Hours/week</b>	3.75	67.5 class hours + 45 non-class hours = <b>112.5 total hours</b>

### PROFESSORS

ALONSO NIETO, MARCOS
SEIJO BARQUIN, IRAIDE

### REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
FUNDAMENTALS OF COMPUTING SCIENCE	(No previous knowledge required)
MATHEMATICS I	
MATHEMATICS II	

### LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
<b>GJR404</b> - To know and apply the principles of robotic systems and artificial vision			x	4,02
<b>G-RTR1</b> - To develop interdisciplinary projects specific to their specialty and of gradual complexity, - becoming aware of respect for human rights and fundamental rights, and analyzing and assessing the impact of the proposed solutions on the SDGs - to acquire and/or apply basic, advanced and /or avant-garde, demonstrating the ability to work in multidisciplinary teams and/or undertake further studies with a high degree of autonomy		x		0,24
<b>G-RTR2</b> - To express information, ideas and the arguments that support them in an orderly, clear and coherent manner, orally and in writing, based on quality information, self-made or obtained from different sources, using inclusive and non-discriminatory language		x		0,24
<b>Total:</b>				<b>4,5</b>

KC: Knowledge or Content / SK: Skills / AB: Abilities

### SECONDARY LEARNING RESULTS

**RGJ490** [!] *Definir y gestionar los objetivos y la planificación de un proyecto que le permita adquirir y/o reforzar los conocimientos de tecnologías específicas de su especialidad,- que en ocasiones llegan a la vanguardia del conocimiento- y definir una estrate*

LEARNING ACTIVITIES	CH	NCH	TH
Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams	1 h.	2 h.	3 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	100%	(No mechanisms)

**Comments:** Continuous assessment. Retake is not foreseen.

**CH - Class hours:** 1 h.  
**NCH - Non-class hours:** 2 h.  
**TH - Total hours:** 3 h.

**RGJ491** [!] *Coordinar el equipo de trabajo, estimulando la cohesión y buen clima para lograr la integración de todas las personas y su contribución para alcanzar un rendimiento apropiado, tanto a nivel individual como grupal, para el desarrollo del proyecto en*

LEARNING ACTIVITIES	CH	NCH	TH
Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams	1 h.	2 h.	3 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	100%	(No mechanisms)
<b>Comments:</b> Continuous assessment. Retake is not foreseen.		
<b>CH - Class hours:</b> 1 h. <b>NCH - Non-class hours:</b> 2 h. <b>TH - Total hours:</b> 3 h.		

**RGJ493** [!] *Elabora la memoria del proyecto, aportando argumentos elaborados y haciendo un uso correcto, inclusivo y no discriminatorio del lenguaje.*

LEARNING ACTIVITIES	CH	NCH	TH
Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams	2 h.	1 h.	3 h.
EVALUATION SYSTEM	W	MAKE-UP MECHANISMS	
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	100%	(No mechanisms)	
<b>Comments:</b> Continuous assessment. Retake is not foreseen.			
<b>CH - Class hours:</b> 2 h. <b>NCH - Non-class hours:</b> 1 h. <b>TH - Total hours:</b> 3 h.			

**RGJ494** [!] *Realiza una presentación oral del proyecto, justificando las soluciones propuestas con argumentos elaborados y precisos, y haciendo un uso correcto, inclusivo y no discriminatorio del lenguaje.*

LEARNING ACTIVITIES	CH	NCH	TH
Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams	2 h.	1 h.	3 h.
EVALUATION SYSTEM	W	MAKE-UP MECHANISMS	
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	100%	(No mechanisms)	
<b>Comments:</b> Continuous assessment. Retake is not foreseen.			
<b>CH - Class hours:</b> 2 h. <b>NCH - Non-class hours:</b> 1 h. <b>TH - Total hours:</b> 3 h.			

**RGJ410** [!] *Diseña, implementa y valida un sistema de visión artificial para una aplicación industrial*

LEARNING ACTIVITIES	CH	NCH	TH
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	2 h.		2 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	10 h.	5 h.	15 h.
Carrying out exercises and solving problems individually and/or in teams	7 h.	3 h.	10 h.
EVALUATION SYSTEM	W	MAKE-UP MECHANISMS	
Individual written and/or oral tests or individual coding/programming tests	100%	Individual written and/or oral tests or individual coding/programming tests	

**CH - Class hours:** 19 h.
   
**NCH - Non-class hours:** 8 h.
   
**TH - Total hours:** 27 h.

**RGJ411** [!] *Simula, utiliza y programa robots en aplicaciones industriales*

LEARNING ACTIVITIES	CH	NCH	TH
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	2,5 h.		2,5 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	20 h.	5 h.	25 h.
Carrying out exercises and solving problems individually and/or in teams	14 h.	14 h.	28 h.
<b>EVALUATION SYSTEM</b>	<b>W</b>	<b>MAKE-UP MECHANISMS</b>	
Individual written and/or oral tests or individual coding/programming tests	100%	Individual written and/or oral tests or individual coding/programming tests	

**CH - Class hours:** 36,5 h.
   
**NCH - Non-class hours:** 19 h.
   
**TH - Total hours:** 55,5 h.

**RGJ412** [!] *Obtiene el modelo cinemático de un robot de n grados de libertad. Programación de un robot industrial basada en información adquirida mediante un sistema de visión artificial*

LEARNING ACTIVITIES	CH	NCH	TH
Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams	6 h.	12 h.	18 h.
<b>EVALUATION SYSTEM</b>	<b>W</b>	<b>MAKE-UP MECHANISMS</b>	
Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems	100%	Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems	

**CH - Class hours:** 6 h.
   
**NCH - Non-class hours:** 12 h.
   
**TH - Total hours:** 18 h.

## CONTENTS

### Industrial robot programming and simulation

- Basics about the simulation environment.
- Cartesian reference systems: pose and frame transformations.
- Targets and paths. -Creating and calibrating a new tool on an industrial robot.
- Programming robots using scripting language.
- Socket communication.

### Computer vision:

- Introduction to cameras and images.

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- Image filtering, thresholding, convolutional filters.
  - Morphological operations.
  - 2D metrology.
  - Programming a camera assisted robotic system.

## LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources	Bibliography
Labs	ABB Robotics Technical reference manual RAPID Instructions, Functions and Data types (Online, fopen access)
Moodle Platform	ABB Robotics Operating manual RobotStudio (Online, open access).
Class presentations	Richard Szeliski - Computer Vision Algorithms and Applications Rafael C. Gonzalez and Richard E. Woods - Digital Image Processing 4th Ed. MVTEC Halcon Documentation - (Online, open access) John J. Craig. introduction to Robotics: Mechanics and Control. Pearso, 3rd editon. 2005