[GJH004] ROBOTIC SYSTEMS AND ARTIFICIAL VISION

GENERAL INFORMATION

Studies	DEGREE IN MECHATRONICS ENGINEERING			**Subject**	AUTOMATION
Semester	1	**Course**	4	**Mention / Field of specialisation**	
Character	OPTIONAL				
Plan	2017	**Modality**	Face-to-face	**Language**	ENGLISH
Credits	4,5	**Hours/week**	3.75	**Total hours**	67.5 class hours + 45 non-class hours = **112.5 total hours**

PROFESSORS

ANDONEGI ARTEGUI, IMANOL
ALONSO NIETO, MARCOS

REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
PHYSICS I	Matlab programming
CALCULUS II	

SKILLS

VERIFICA SKILLS

SPECIFIC

GJCE19 - Knowledge of principles and applications of robotic systems

GENERAL

GJCG03 - Addressing and optimising activities of assembly, commissioning, assistance and maintenance of facilities, machinery, and industrial mechatronic systems

GJCG06 - Implement and materialize projects of automation and control of equipment, processes and flexible industrial systems, through the integration of hardware and software in order to optimize the operation of the different units that make up the system to meet the needs of the productive sector

BASIC

G_CB1 - To have proven to understand and have knowledge in a field of study based on general secondary education at a level found in advanced textbooks and including concepts at the forefront of their field of study.

LEARNING RESULTS

RGJ410 They design, apply and validate an artificial vision system for an industrial application.

LEARNING ACTIVITIES	*CH*	*NCH*	*TH*
Development, writing and presentation of memorandums, reports, audiovisual material, etc. Relating to projects/POPBLs carried out individually or in teams	5 h.	3 h.	8 h.
Individual study and work, tests and evaluations and check points	3 h.	2 h.	5 h.
Individual and team solving of exercises, problems, and practices	8 h.	6 h.	14 h.

EVALUATION SYSTEM	*W*
Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence	30%
Written, coding/programming and individual oral tests for the evaluation of technical skills in the field	70%

MAKE-UP MECHANISMS

(No mechanisms)

Comments: The final mark will be calculated with regards to the recap mark x 0.75 + 0.25 x exam mark

CH - Class hours: 16 h.
NCH - Non-class hours: 11 h.
TH - Total hours: 27 h.

RGJ411 They simulate, use and program robots in industrial applications.

LEARNING ACTIVITIES	*CH*	*NCH*	*TH*
Development, writing and presentation of memorandums, reports, audiovisual material, etc. Relating to projects/POPBLs carried out individually or in teams	10 h.	7 h.	17 h.
Individual study and work, tests and evaluations and check points	13 h.	7 h.	20 h.

Individual and team solving of exercises, problems, and practices	10,5 h.	8 h.	18,5 h.

EVALUATION SYSTEM	W
Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence	30%
Written, coding/programming and individual oral tests for the evaluation of technical skills in the field	70%

MAKE-UP MECHANISMS

(No mechanisms)

Comments: The final mark will be calculated with regards to the recap mark x 0.75 + 0.25 x exam mark

CH - Class hours: 33,5 h.
NCH - Non-class hours: 22 h.
TH - Total hours: 55,5 h.

RGJ412 They obtain the kinematic model of a robot with n degrees of freedom. Programming of an industrial robot based on information acquired through an artificial vision system.

LEARNING ACTIVITIES	CH	NCH	TH
Individual study and work, tests and evaluations and check points	5,5 h.	3,5 h.	9 h.
Individual and team solving of exercises, problems, and practices	5,5 h.	3,5 h.	9 h.

EVALUATION SYSTEM	W
Written, coding/programming and individual oral tests for the evaluation of technical skills in the field	100%

MAKE-UP MECHANISMS

(No mechanisms)

Comments: The final mark will be calculated with regards to the recap mark x 0.75 + 0.25 x exam mark

CH - Class hours: 11 h.
NCH - Non-class hours: 7 h.
TH - Total hours: 18 h.

RGJ414 They assume responsibilities in the team, organizing and planning the tasks to be developed, dealing with contingencies and encouraging the participation of its members.

LEARNING ACTIVITIES	CH	NCH	TH
Development, writing and presentation of memorandums, reports, audiovisual material, etc. Relating to projects/POPBLs carried out individually or in teams	2 h.	1 h.	3 h.

EVALUATION SYSTEM	W
Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence	100%

MAKE-UP MECHANISMS

Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence

Comments: Continuous assessment. Retake is not foreseen.

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

RGJ415 They analyze the variables involved in the problem and propose actions for a stable situation.

LEARNING ACTIVITIES	CH	NCH	TH
Development, writing and presentation of memorandums, reports, audiovisual material, etc. Relating to projects/POPBLs carried out individually or in teams	2 h.	1 h.	3 h.

EVALUATION SYSTEM	W
Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and	100%

MAKE-UP MECHANISMS

Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical

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

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

RGJ416 They define the problem, the development of the solution, as well as the conclusions in an effective way, arguing and justifying each of them, making a correct use of the language, in writing.

LEARNING ACTIVITIES	CH	NCH	TH
Development, writing and presentation of memorandums, reports, audiovisual material, etc. Relating to projects/POPBLs carried out individually or in teams	1 h.	2 h.	3 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence	100%	Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence **Comments:** Continuous assessment. Retake is not foreseen.

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

RGJ417 They define the problem, the development of the solution, as well as the conclusions in an effective way, arguing and justifying each one of them, and making a correct use of the language, orally.

LEARNING ACTIVITIES	CH	NCH	TH
Development, writing and presentation of memorandums, reports, audiovisual material, etc. Relating to projects/POPBLs carried out individually or in teams	2 h.	1 h.	3 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence	100%	Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence **Comments:** Continuous assessment. Retake is not foreseen.

CH - Class hours: 2 h.
NCH - Non-class hours: 1 h.
TH - Total hours: 3 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 onan industrial robot.

-Programming robots using scripting language.

-Socket communication.

Computer vision:

-Introduction to cameras and images.

-Image filtering, thresholding, convolutional filters.

-Morphological operations.

-2D metrology.

-Programming a camera assisted robotic system.

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources	Bibliography
Labs	Reza N. Jazar,Theory of Applied Robotics: Kinematics, Dynamics, and Control (2nd Edition), Springer US, 2010
Class presentations	Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo, Robotics: Modelling, Planning and Control, Advanced Textbooks in Control and Signal Processing, Springer-Verlag London, 2009.
Moodle Platform	Peter Corke, Robotics, Vision and Control: Fundamental Algorithms in MATLAB, Springer Tracts in Advanced Robotics 73, Springer-Verlag Berlin Heidelberg, 2011.
	ABB Robotics Technical reference manual RAPID Instructions, Functions and Data types (Online, fopen access)
	ABB Robotics Operating manual RobotStudio (Online, open access).