[MHAA01] INDUSTRIAL AUTOMATION

GENERAL INFORMATION

Studies	UNIVERSITY MASTER IN INDUSTRIAL ENGINEERING	**Subject**	INDUSTRIAL AUTOMATION AND PROCESS CONTROL
Semester	2 **Course** 1	**Mention / Field of specialisation**	
Character	COMPULSORY		
Plan	2010	**Language**	CASTELLANO/ENGLISH
Credits	5,5 **Hours/week** 4.78	**Total hours**	86 class hours + 51.5 non-class hours = **137.5 total hours**

PROFESSORS

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REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
(No specific previous subjects required)	*(No previous knowledge required)*

SKILLS

VERIFICA SKILLS

SPECIFIC

MHC02 - To be able to plan, calculate and design integrated manufacturing systems

MHC08 - To be able to plan and design automated manufacturing systems and advanced process control systems

CROSS

MHC47 - To select one measure or idea out of several and implement them in response to the needs or circumstances emerging in the work process

BASIC

M_CB10 - To have learning skills and the capacity for self-guided or independent subsequent learning.

M_CB6 - To have and understand knowledge which provides a base or opportunity to be original in the development and/or application of ideas, often in an investigation context

M_CB7 - To know how to apply the acquired knowledge and competencies and the ability to solve problems in new or unfamiliar contexts within wider (or multidisciplinary) environments related to their field of study

M_CB8 - To be able to integrate different types of knowledge and make complex judgements based on information that, in spite of being partial or limited, includes ideas on the social and ethical responsibilities associated with the application of knowledge

M_CB9 - To share knowledge, conclusions and their rationale with specialised and lay audiences in a clear, unambiguous manner

ENAEE LEARNING RESULTS	***ECTS***
ENA124 - Knowledge and comprehension: Deep knowledge and comprehension of the engineering disciplines of their speciality, at the level necessary to acquire the rest of the competencies of the degree.	0,61
ENA125 - Knowledge and comprehension: Critical Possession of avant-garde knowledge of their speciality.	0,61
ENA127 - Analysis in engineering: Ability to analyse new and complex engineering products, processes and systems within a broader multidisciplinary context; select and apply the most appropriate analysis, calculation and experimental methods already established, as well as innovative methods; and critically interpret the results of such analyses.	0,61
ENA129 - Analysis in engineering: Ability to identify, formulate and solve engineering problems defined incompletely, and/or with conflicts, which accept different valid solutions and require considering knowledge beyond those of their discipline and take into account the social, health and security, environmental, economic and industrial implications; to select and apply the most appropriate methods of analysis, calculation and experimental, as well as the most innovative methods for solving problems.	0,61
ENA132 - Engineering projects: Ability to project while applying the knowledge and cutting-edge understanding of their engineering speciality.	0,61
ENA137 - Research and innovation: Ability to investigate the application of the most advanced technologies in their speciality.	0,61
ENA140 - Practical application of engineering: Complete knowledge of application of materials, equipment and tools, engineering technology and processes, and their limitations.	0,61
ENA146 - Communication and Teamwork: Ability to employ different methods to communicate their conclusions, clearly and unambiguously, and the knowledge and logical foundations that support them, to audiences specialised and not specialised in the issue, in domestic and international contexts.	0,61
ENA147 - Communication and Teamwork: Ability to operate effectively in domestic contexts as a member or leader of a team, which may be composed of people of different disciplines and levels, and who can use virtual communication tools.	0,61
Total:	**5,5**

LEARNING RESULTS

RMH134 Designs the structure of a control system to meet the requirements of a production process, defining resources to automate industrial processes.

LEARNING ACTIVITIES	CH	NCH	TH
Classroom presentations of relevant concepts and procedures in participatory environments.	6 h.		6 h.
Individual and/or group project development, report writing and presentations.		4 h.	4 h.

EVALUATION SYSTEM	W
Group work	100%

Comments: The failed tasks, training… must be retaken and they will be valued with a maximum of a 5.

MAKE-UP MECHANISMS
Retake of the group work

Comments:

CH - Class hours: 6 h.
NCH - Non-class hours: 4 h.
TH - Total hours: 10 h.

RMH135 Lists and describes the resources used to automate manufacturing processes.

LEARNING ACTIVITIES	CH	NCH	TH
Classroom presentations of relevant concepts and procedures in participatory environments.	11 h.		11 h.
Individual and group exercises.	3 h.		3 h.
Individual study and work, tests and evaluations.	1 h.	11 h.	12 h.
Visits to companies and/or technology centres.	3 h.		3 h.
Individual and/or group project development, report writing and presentations.	2 h.		2 h.

EVALUATION SYSTEM	W
Individual or group exercises	50%
Test	50%

Comments: All training activities (check points, individual and team works,…) must have a minimun of a 5 and a retake opportunity. In case of taking a retake (RE) of the check point (PC) the final mark (N) will be calculated as follows: N=0,25*PC+075*RE The failed tasks, training… must be retaken and they will be valued with a maximum of a 5.

MAKE-UP MECHANISMS
Retake of the exercises
Retake of the test

Comments:

CH - Class hours: 20 h.
NCH - Non-class hours: 11 h.
TH - Total hours: 31 h.

RMH136 Models and analyzes the dynamic behavior of mechatronic and /or multiphysics systems based on both principles and physical laws and experimentation.

LEARNING ACTIVITIES	CH	NCH	TH
Classroom presentations of relevant concepts and procedures in participatory environments.	7 h.	4 h.	11 h.
Individual and group exercises.	5 h.	3 h.	8 h.
Individual and/or team computer simulation practice.	4 h.	2 h.	6 h.
Workshop and/or lab practice.	2 h.	1 h.	3 h.
Individual study and work, tests and evaluations.	2 h.	4 h.	6 h.
Individual and/or group project development, report writing and presentations.	6 h.	1,5 h.	7,5 h.

EVALUATION SYSTEM	W
Test	100%

Comments: All training activities (check points, individual and team works,…) must have a minimun of a 5 and a retake opportunity. In case of taking a retake (RE) of the check point (PC) the final mark (N) will be calculated as follows: N=0,25*PC+075*RE

MAKE-UP MECHANISMS
Retake of the test

Comments:

CH - Class hours: 26 h.
NCH - Non-class hours: 15,5 h.
TH - Total hours: 41,5 h.

RMH137 Design controllers for SISO systems and validate them by simulation. Also set and implements an industrial controller.

LEARNING ACTIVITIES	CH	NCH	TH

Classroom presentations of relevant concepts and procedures in participatory environments.	9 h.	6 h.	15 h.
Individual and group exercises.	7 h.	4 h.	11 h.
Individual and/or team computer simulation practice.	6 h.	1 h.	7 h.
Workshop and/or lab practice.	4 h.	2 h.	6 h.
Individual study and work, tests and evaluations.	2 h.	6 h.	8 h.
Individual and/or group project development, report writing and presentations.	6 h.	2 h.	8 h.

EVALUATION SYSTEM	W
Lab practices	50%
Simulation practices	50%

Comments: The failed tasks, training… must be retaken and they will be valued with a maximum of a 5.

MAKE-UP MECHANISMS

Individual written and oral tests

Comments:

CH - Class hours: 34 h.
NCH - Non-class hours: 21 h.
TH - Total hours: 55 h.

CONTENTS

MODULO I. INDUSTRIAL AUTOMATION

1. Introduction
2. Measurement of Physical quantities: Sensors
3. Actuators
4. Process controllers
5. Process control and supervision: Scadas
6. Industrial communications
7. Machine Safety

MODULO II. CONTROL THEORY

1. Basic concepts systems control
1.1 Automation. Control of Systems
1.2 System concept
1.3 Control of a system
1.4. Control Theory
1.5 Basic control actions

2. Continuous dynamic systems modeling.
2.1 Mathematical behavior of a system. Mathematical modeling.
2.2 Impulsion response
2.3 Transfer function
2.4 Graphical definition of systems
2.5 Mathematical model of physic systems. Examples

3. Analysis of linear continuous systems
3.1 Time domain analysis of systems
3.2 Frequency domain analysis of systems
3.3 Precision of a controlled system
3.4 Stability of linear systems

4. Controllers design
4.1 Introduction
4.2 Theoretical analysis of basic control actions
4.3 Compensation techniques

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources

Simulation software
Process control laboratory
MUDLE: Documentation of the subject

Bibliography

Tapia Otaegi, Arantxa; Florez Esnal,Julian. Erregulazio automatikoa. Elhuyar. Usurbil. 1995

Ogata, Katsuhiko. Ingenieria de control moderna. Prentice Hall. 4. edición. Madrid. 2003

Bolton,W. Mecatrónica. Sistemas de control electrónico en la ingeniería mecánica y eléctrica. 4ª edición. Marcombo. Barcelona. 2010

Rodriguez, Aquilino. Sistemas SCADA. 3ª ed. Marcombo. Barcelona. 2012. ISBN: 978-84-267-1785-8

Piedrafita Moreno, Ramon. Ingeniería de la automatización industrial. 2ª ed. Editorial RA-MA. Madrid. 2004. ISBN: 84-78978-604-3

Shinskey, F.G. Process Control Systems. Application, Design and Tuning. Mc Graw-Hill Book Company. 1988.