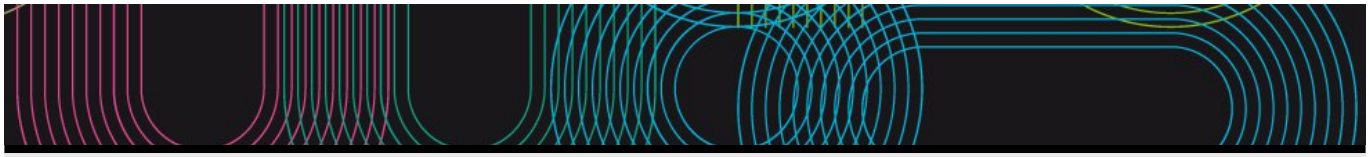

IDENTIFYING DATA				
Cyberphysical systems				
Subject	Cyberphysical systems			
Code	V04M183V01105			
Study programme	Máster Universitario en Industria 4.0			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	1st
Teaching language	#EnglishFriendly Spanish Galician English			
Department				
Coordinator	Soto Campos, Enrique			
Lecturers	Fernández Ulloa, Antonio Soto Campos, Enrique			
E-mail	esotoc@uvigo.es			
Web	http://masterindustria40.webs7.uvigo.es/wordpress/			
General description	Know the elements and principles of operation of the cyberphysic systems resulting from the integration of physical processes, computational resources and communications.			

Training and Learning Results	
Code	
A1	Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context
A2	Students should be able to apply their acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.
A5	Students have got the learning skills that will enable them to continue studying in a largely self-directed or autonomous manner
B2	Problem solving.
B5	Oral and written communication in your own language.
B7	Computer skills related to the field of study.
C11	Know and use the elements and principles of operation of cyberphysical systems resulting from the integration of physical, computational and communication processes.
C12	Develop cyberphysical systems for application to product and process solutions in factories, using Systems Engineering procedures.
D1	Ability to understand the meaning and application of the gender perspective in different areas of knowledge and in professional practice with the aim of achieving a more just and equal society
D2	Incorporate criteria of sustainability and environmental commitment into professional practice. To acquire skills in the equitable, responsible and efficient use of resources
D3	Multidisciplinary teamwork

Expected results from this subject	
Expected results from this subject	Training and Learning Results
1. Know the elements and principles of operation of the cyberphysic systems resulting from the integration of physical processes, computational and communications.	A5 B5 C11 C12 D1

2. Know the applications of the cyberphysics systems in the context of the Industry 4.0.	A1 B5 C11 C12 D2
3. Developcyberphysic systems for its application to solutions of product and of process in the factories 4.0, employing procedures of Engineering of Systems.	A2 A5 B2 B7 C11 C12 D3
4. Apply the criteria of efficiency and quality to the development of cyberphysic systems.	C11 C12

Contents

Topic	
1. Cyberphysics in the Industry 4.0.	Introduction
2. Integration of physical processes, computational resources and communications.	Basic concepts
3. Components of cyberphysics systems: subsystems, functions and internal and external relations.	3.1. Embedded Systems 3.1.1. Microprocessors and microcontrollers 3.1.2. Programming 3.1.3. Peripherals of microcontrollers 3.2. Communications 3.2.1. Principles of the digital communications 3.2.2. Industrial communications 3.3. Sensors and actuators 3.3.1. Sensors 3.3.2. Actuators
4. Applications of the cyberphysics systems in the industry.	4.1. Industrial communications systems 4.2. Arduino
5. Development of cyberphysics systems for solutions of product and of processes.	Practical examples.
6. Application of Systems Engineering to the study of the cyberphysics systems.	Introduction
7. Analysis of the execution of cyberphysics systems.	Practical examples

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	9	12	21
Problem solving	5	20	25
Laboratory practical	10	15	25
Objective questions exam	1	3	4

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

Methodologies

	Description
Lecturing	They will expose the most important aspects of the subject, looking for the active participation of the student posing questions that has to resolve in class.
Problem solving	The students will resolve in class with the help of the professor applications of the theory.
Laboratory practical	Laboratory with embedded systems, sensors and communications systems.

Personalized assistance

Methodologies	Description
Problem solving	The students will be able to access anytime to academic support through the professor office or virtual room and the email
Laboratory practical	The students will be able to access anytime to academic support through the professor office or virtual room and the email

Tests	Description

Objective questions exam	The students will be able to access anytime to academic support through the tutorial sessions in the professor's office or virtual room and by email. The students will be supervised at all times during the tests.

Assessment

	Description	Qualification	Training and Learning Results			
Problem solving	Systematic observation. Complementary activities of continuous evaluation	40	A2	B2 B5	C11 C12	D1 D2 D3
Laboratory practical	Presentations/Work/Project/Laboratory report	40	A5	B5 B7	C11 C12	D1 D2 D3
Objective questions exam	Exam of objective questions. Partial objective test and/or finals	20	A1 A5	B5	C11 C12	

Other comments on the Evaluation

Students who do not pass the subject in continuous training at the first opportunity of each academic year, in which the distribution of evaluation weights is as stablished above, will have the possibility of having an exam of objective questions, worth 100% of the final mark, in successive calls that are not the first opportunity of each academic year.

Ethical commitment: Students are expected to behave ethically. If unethical behaviour is detected (copying, plagiarism, use of unauthorised electronic devices,...), the student will be considered to be ineligible to pass the subject. Depending on the type of unethical behaviour detected, it could be concluded that the student has not reached the necessary skills to overcome the subject. Students are expected to behave in a respectful and dignified manner and to collaborate with the teaching system, teaching staff, coordination and administrative and services personnel of the Master's degree. Any question due to the lack of ethical and dignified behaviour of the student body may have repercussions on the evaluation of the subject.

Sources of information

Basic Bibliography

Enrique Mandado Pérez et al, **SISTEMAS DE AUTOMATIZACIÓN Y AUTÓMATAS PROGRAMABLES**, 3, Marcombo, 2018

Daniel Lozano Equisoain, **Arduino Práctico. Edición 2017**, Anaya, 2017

Complementary Bibliography

Edited by Bogdan M. Wilamowski J. david Irwin, **The Industrial Electronics Handbook: Industrial communication systems**, 2, CRC Press Taylor & Francis Group, 2011

Simon Monk, **Programming Arduino: Getting Started with Sketches**, 2, McGraw-Hill Education TAB, 2016

Recommendations