Teaching Guide				
Identifying Data				2022/23
Subject (*)	Industrial System Integration		Code	730497237
Study programme	Mestrado Universitario en Enxeñaría Industrial (plan 2018)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	1st four-month period	Second	Optional	3
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	E-mail	jose.luis.casteleiro@udc.es	
Web				
General description	Practical approach for the integration of industrial systems based on IoT as a product of integration of industrial systems within the concept of Industry 4.0			

Study programme competences / results	
Code	Study programme competences / results
A7	ETI7 - Ability to design electronic systems and industrial instrumentation.
A8	ETI8 - Ability to design and project automated production systems and advanced process control.
B1	CB6 - 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.
B2	CB7 - That students know how to apply the knowledge acquired and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of ??study.
B3	CB8 - That students are able to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of their knowledge and judgments.
B4	CB9 - That the students know how to communicate their conclusions -and the knowledge and ultimate reasons that sustain them- to specialized and non-specialized audiences in a clear and unambiguous way.
B5	CB10 - That students have the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous.
B6	G1 - Have adequate knowledge of the scientific and technological aspects in Industrial Engineering.
B13	G8 - Apply the knowledge acquired and solve problems in new or unfamiliar environments within broader and multidisciplinary contexts.
B14	G9 - Be able to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of their knowledge and judgments.
B15	G10 - Knowing how to communicate the conclusions -and the knowledge and ultimate reasons that sustain them- to specialized and non-specialized publics in a clear and unambiguous way.
B16	G11 - Possess the learning skills that allow to continue studying in a self-directed or autonomous way.
C1	ABET (a) - An ability to apply knowledge of mathematics, science, and engineering.
C2	ABET (b) - An ability to design and conduct experiments, as well as to analyze and interpret data.
C3	ABET (c) - An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
C6	ABET (f) - An understanding of professional and ethical responsibility.
C7	ABET (g) - An ability to communicate effectively.
C8	ABET (h) - The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
C9	ABET (i) - A recognition of the need for, and an ability to engage in life-long learning.
C11	ABET (k) - An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Learning outcomes

Learning outcomes	Study programme competences / results		
Know the different technologies for the measurement of environment variables and integration of industrial systems in general	AJ7 AJ8	BJ1	CJ1 CJ3
Know the objective, operation, existing technology and know how to size industrial sensor and actuator systems	AJ7 AJ8	BJ1 BJ5 BJ16	CJ1 CJ6 CJ7
Know the interconnection and integration technologies between sensors, actuators and equipment	AJ7 AJ8	BJ1 BJ2 BJ3 BJ4 BJ6 BJ13 BJ14 BJ15	CJ1 CJ2 CJ3 CJ8 CJ9 CJ11

Contents	
Topic	Sub-topic
The contents described in the verification report are developed below according to the distribution shown	Introduction to systems integration. (Topic 1) Measurement and obtaining of variables in industrial environments. Choice and dimensioning of sensor systems. Select and size actuator system technologies. (Topic 2) Design and development of interconnection and integration systems. (Topic 3)
Topic 1: Measurement and obtaining of variables in industrial environments	IoT as a product of integration of industrial systems Introduction to the IoT ecosystem
Topic 2: Choice and dimensioning of sensor and actuator systems	IoT hardware: Architecture, sensors and actuators IoT platforms
Topic 3: Design and development of interconnection and integration systems	Developments with Arduino Ethernet based on Industrial networks Industrial Internet of Things (IIoT) and Industry 4.0

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A7 A8 B1 B5 B16 B6 C1 C6 C8 C9	9	13	22
Problem solving	A7 A8 B2 B13 C1 C2 C3	3	14	17
Laboratory practice	A7 A8 B1 B8 C1 C2 C3 C11	13	21	34
Mixed objective/subjective test	A7 A8 B1 B3 B4 B15 B14 C7	1	0	1
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, 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.
Mixed objective/subjective test	It consists in carrying out an objective test of approximately 2 hours, in which the acquired knowledge will be evaluated.

Personalized attention	
Methodologies	**Description**
Problem solving Laboratory practice	The student has the relevant meetings of personalized tutorials, to resolve the concerns arising from the matter.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Mixed objective/subjective test	A7 A8 B1 B3 B4 B15 B14 C7	Exam with part of multiple choice, development questions and exercises	50
Problem solving	A7 A8 B2 B13 C1 C2 C3	Resolution of a practical case	20
Laboratory practice	A7 A8 B1 B8 C1 C2 C3 C11	Some tasks established in the subject, within the framework of this methodology	30

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. The "Mixed Test" can be divided into a multiple choice part and a few questions. It will be necessary to exceed 35% of the score in the multiple choice of the "Mixed Test" to pass, as well as having passed the works collected within the "Problem solving" methodology. For the second opportunity there will be no second deadline for delivery of works, and the evaluation related to "Problem solving" will be included in the "Mixed test". The evaluation criteria for the early call in December will be the same as those for 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.

Sources of information	
Basic	- Tom Wanyama (2016). A Practical Approach To Industrial Systems Integration. McMaster University, Hamilton - (). Presentaciones del Profesor. - Perry Lea (2018). Internet of Things for Architects. Packet
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Other comments
To help achieve an immediate sustainable environment and meet the objective of action number 5: "Healthy and sustainable environmental and social teaching and research" of the "Green Campus Ferrol Action Plan":1. The delivery of the documentary works that are made in this matter: 1.1. They will be requested in virtual format and / or computer support   1.2. They will be made through Moodle, in digital format without the need to print them

(*)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.