Teaching Guide				
Identifying Data				2022/23
Subject (*)	Industrial Internet of Things (IIoT)		Code	730542015
Study programme	Master Universitario Erasmus Mundus en Sostibilidade e Industria 4.0 aplicada ao Sector Marítimo			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Optional	6
Language	English			
Teaching method	Face-to-face			
Prerequisites				
Department	Ciencias da Computación e Tecnoloxías da InformaciónEnxeñaría Industrial			
Coordinador	Becerra Permuy, Jose Antonio	E-mail	jose.antonio.becerra.permuy@udc.es	
Lecturers	Becerra Permuy, Jose Antonio Guerreiro Santalla, Sara Quintián Pardo, Héctor Timiraos Díaz, Miriam	E-mail	jose.antonio.becerra.permuy@udc.es sara.guerreiro@udc.es hector.quintian@udc.es miriam.timiraos.diaz@udc.es	
Web				
General description	This course is focused on providing the students with practical knowledge in the Internet of Things (IoT) and, specifically, regarding its application to industrial environments (Industrial Internet of Things, IIoT). The theoretical lessons will cover a broad view of all relevant aspects of IoT, while practical lessons will prepare the students for carrying out the implementation of those theoretical concepts.			

Study programme competences	
Code	Study programme competences
B2	CB6 - Acquire and understand knowledge that provides a basis or opportunity to be original in the development and / or application of ideas, usually in a research context.
B3	CB7 - That students know how to apply the acquired knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.
B4	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.
B5	CB9 ? That students are able to communicate their conclusions -and the knowledge and ultimate reasons that sustain them- to specialized and non-specialized publics in a clear and unambiguous way.
B6	CB10 - That students have the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous.
B7	CG1 ? To display the adequate intercultural competence to successfully navigating within multicultural learning environments and to implement basic management principles suitable for a multicultural working environment.
B8	CG2 ? To express an attitude of intellectual inquisitiveness and open-mindedness.
B11	CG5 ? To have the capability to identify, formulate and solve engineering problems within realistic constraints.
B13	CG7 ? To have the capability to critically analyse, synthesise, interpret and summarise complex scientific processes.
C2	CT2 - Mastering oral and written expression in a foreign language.
C3	CT3 - Using ICT in working contexts and lifelong learning.
C4	CT4 - Acting as a respectful citizen according to democratic cultures and human rights and with a gender perspective.
C6	CT6 - Acquiring skills for healthy lifestyles, and healthy habits and routines.
C7	CT7 -Developing the ability to work in interdisciplinary or transdisciplinary teams in order to offer proposals that can contribute to a sustainable environmental, economic, political and social development.

Learning outcomes	
Learning outcomes	Study programme competences

The students will be able to understand and implement the basic theoretical concept of Internet of Things in industrial environments.		BC1 BC2 BC3 BC4 BC5 BC6 BC7 BC10 BC12	CC2 CC3 CC4 CC6 CC7

Contents	
Topic	**Sub-topic**
Introduction.	- Background and definitions. - Involved technologies. - IoT vs. IIoT. - Relationship with Industry 4.0.
Devices.	- Sensors and endpoints. - Actuators. - Hardware platforms. - Low level communication.
Communication networks.	- Types of networks. - Gateways. - Protocols.
Data processing.	- Edge, fog, and cloud computing. - Data analytics and machine learning application. - Software platforms.
User interfaces.	- Standalone. - Cloud-based.
Security.	- Firewalls. - Encryption. - Authentication.

Planning				
Methodologies / tests	**Competencies**	**Ordinary class hours**	**Student?s personal work hours**	**Total hours**
Mixed objective/subjective test	B4 B11 B13 C2	2.5	0	2.5
Guest lecture / keynote speech	B2 B6 B8 C2 C3 C4	21	21	42
Laboratory practice	B3 B6 B8 C2 C3 C4	21	21	42
Supervised projects	B3 B4 B5 B6 B7 B8 B11 B13 C2 C3 C4 C6 C7	0	61.5	61.5
Personalized attention		2	0	2
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	**Description**
Mixed objective/subjective test	It will consist of a written test with short and / or multiple choice questions, in order to check the consolidation of the most important theoretical concepts seen in the subject.

Guest lecture / keynote speech	Activity in the classroom that serves to establish the fundamental concepts of the subject. It consists of oral presentation making profuse use of audiovisual media and seeking the participation of students by posing practical cases and asking questions, in order to facilitate learning and foster a critical spirit.
Laboratory practice	Through this activity, students will implement small systems in the laboratory that will exemplify the concepts seen in the lectures, so that they can test some of the methods and techniques in the real world, and assess the problems (and their implications) that arise in the implementation of IoT systems.
Supervised projects	Completion of one or more assignments throughout the term, carried out autonomously and supervised by the teachers, which will involve putting into practice the concepts seen in the lectures. At least the final work will be done in groups and students will submit a report and they will also have to make a presentation to the teacher and their classmates.

Personalized attention	
Methodologies	**Description**
Supervised projects Laboratory practice	Laboratory practice: personalized attention in laboratory practices will consist of solving conceptual or procedural doubts that may arise during students' work. Supervised projects: it will be necessary to show the progress that is being made to offer the appropriate guidance, resolve doubts and ensure the quality of the work. These tutorials will be carried out in groups and in person in the teacher's office or using Teams.

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Supervised projects	B3 B4 B5 B6 B7 B8 B11 B13 C2 C3 C4 C6 C7	Development of one or more individual projects or in small groups. It will be necessary to deliver the materials (document and presentation) in a timely manner following the instructions. At least the final work will require oral presentation by all members of the working group. Not to perform the presentation will result in a score of zero in this activity. Nomenclature used in the observations section for this activity: P: mark obtained in the supervised project (70% of the final mark).	70
Mixed objective/subjective test	B4 B11 B13 C2	It will consist of a written exam with short and / or multiple choice questions, in order to check the consolidation of the most important theoretical concepts seen in the subject. General evaluation criteria: * Correct answers. Nomenclature used in the observations section for this activity: E: mark obtained in this test (30% of the final mark).	30

Assessment comments
In order to pass the subject, the student must meet the following requirements (score between 0 and 10 in all activities):1) P> = 5.2) E> = 5.If all the above requirements are not met, the maximum qualification mark that can be obtained, in the corresponding opportunity, will be 4.5 points. If the required requirements are met, the final mark will be calculated as follows:FINAL MARK = 0.7 × P + 0.3 * EGeneral EMJMD Sustainable Ship and Shipping SEAS 4.0 evaluation rules: - Students will have only two oportunities to pass a course. If failing to do so, they may be forced to leave the degree. - No part time or lecture attendance exemption are allowed in this degree.

Sources of information	
Basic	- Veneri, G., & Capasso, A. (2018). Hands-On Industrial Internet of Things. Packt Publishing Ltd. - Dow, C. (2018). Internet of Things Programming Projects. Packt Publishing Ltd.

Complementary	- Lea, P. (2018). Internet of Things for Architects. Packt Publishing Ltd. - Ravulavaru, A. (2018). Enterprise Internet of Things Handbook. Packt Publishing Ltd.

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Industry 4.0 Enabling Technologies/730542010
Subjects that continue the syllabus
Digital Twin in Marine System/730542022
Other comments
To help in achieving a sustainable environment and to get the objective of number 5 action of the "Ferrol Green Campus Action Plan" (Healthy and environmentaly and socially sustainable research and teaching):The assignments to be done in this course:- Will be required in digital format.- Will be delivered using Moodle, with no need to print them.In case it is necessary to print them:- Plastics won´t be used.- Two side printing will be used.- Recycled paper will be used.- Printing drafts will be avoided.A sustainable use of the resources should be done, together with the prevention of negative impacts on the environment.