Teaching Guide				
Identifying Data				2021/22
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 Quintián Pardo, Héctor	E-mail	jose.antonio.becerra.permuy@udc.es hector.quintian@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.			
Contingency plan	1. Modifications to the contents No changes will be made. 2. Methodologies * Teaching methodologies that are maintained All methodologies are maintained. * Teaching methodologies that are modified All methodologies will have to be adapted. Thus, lectures, laboratory practices, supervised project, and exam will be carried out using Teams and / or Moodle. The presentation of the supervised project will also be done through Teams. The physical devices used in all the methodologies will be replaced by simulators or they will be given to the students (depending on the final number of students enrolled and the availability of material). 3. Mechanisms for personalized attention to students Except for in-office tutorials, the same personalized attention mechanisms are maintained, namely: videoconferencing and messaging by Teams, Moodle and email, in this order of preference. Additionally, if the teaching staff observes that there are doubts common to a group of students, small group tutorials can be scheduled through videoconference by Teams. 4. Changes in the evaluation * Evaluation observations: There are no changes to the evaluation, apart from the fact that it will be carried out online using Moodle or Teams. 5. Modifications to the bibliography or webgraphy All the recommended bibliography was acquired by the center's library in PDF as well as on paper, so it could be provided to the students. In the event that this is not possible due to a copyright issue, the faculty would provide a free-access substitute.			

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
Guest lecture / keynote speech	B2 B6 B8 C2 C3 C4	21	31.5	52.5
Laboratory practice	B3 B6 B8 C2 C3 C4	21	31.5	52.5
Supervised projects	B3 B4 B5 B6 B7 B8 B11 B13 C2 C3 C4 C6 C7	0	39.5	39.5
Mixed objective/subjective test	B4 B11 B13 C2	1	1.5	2.5
Personalized attention		3	0	3
(*)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	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	Single assignment proposed incrementally, carried out autonomously, and tutored by the teachers, which will involve putting into practice a large part of the concepts seen in the lectures. The work will be done in groups and the students will deliver a report and will also have to make a presentation to the teacher and their classmates.
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.

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	Autonomous work in small groups. It will be necessary to deliver the materials (document and presentation) in a timely manner following the instructions. In addition, it will require oral presentation by all the members of the working group. Not to perform the presentation will result in a score of zero in this activity. General evaluation criteria: * Clarity, length and quality of the working memory. * Clarity and quality of the oral presentation. * Adequacy of the student's answers to the teacher's questions during the presentation. * Attendance to tutoring sessions. 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.