Teaching Guide				
Identifying Data				2022/23
Subject (*)	Autonomous Robotics Applications		Code	770538015
Study programme	Máster Universitario en Informática Industrial e Robótica			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Optional	3
Language	SpanishGalician			
Teaching method	Face-to-face			
Prerequisites				
Department	Ciencias da Computación e Tecnoloxías da InformaciónEnxeñaría Naval e IndustrialMatemáticas			
Coordinador	Bellas Bouza, Francisco Javier	E-mail	francisco.bellas@udc.es	
Lecturers	Bellas Bouza, Francisco Javier Deibe Díaz, Álvaro Orjales Saavedra, Félix	E-mail	francisco.bellas@udc.es alvaro.deibe@udc.es felix.orjales@udc.es	
Web				
General description	The aim of this subject is to provide students with an updated vision of the main fields of application of autonomous robots at a technical level, but also at a legislative and ethical level. With this theoretical basis, students will acquire an updated vision of the different areas to be considered when facing the implementation of robots in different areas of industry and society. On a practical level, two fields in particular will be studied in detail: marine robotics and aerial robotics.			

Study programme competences / results	
Code	Study programme competences / results
A6	CE06 - Capacidad para diseñar, simular y/o implementar soluciones tecnológicas que impliquen el uso de robots y/o sistemas de informática industrial en un entorno, contemplando aspectos éticos y legales
B3	CB8 - Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios
B4	CB9 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades
B14	CG9 - Aplicar conocimientos de ciencias y tecnologías avanzadas a la práctica profesional o investigadora
B16	CG11 - Valorar la aplicación de tecnologías emergentes en el ámbito de la industria y la robótica
B17	CG12 - Desarrollar la capacidad para asesorar y orientar sobre la mejor forma o cauce para optimizar los recursos
C1	CT01 - Adquirir la terminología y nomenclatura científico-técnica para exponer argumentos y fundamentar conclusiones
C5	CT05 - Adquirir la capacidad para elaborar un trabajo multidisciplinar
C6	CT06 - Dominar la expresión y la comprensión de un idioma extranjero

Learning outcomes			
Learning outcomes	Study programme competences / results		
To understand the particularities of the different application domains of autonomous robotics and thus be able to provide an adequate solution to the problems that may arise in the industrial and social sphere.	AC6	BC3 BC4 BC14 BC16 BC17	CC1 CC5 CC6
To understand the ethical aspects behind the implementation of autonomous robots.		BC3 BC17	CC1 CC5 CC6

Obtain an overview of the legal aspects that affect each specific field.		BC3 BC16 BC17	CC1 CC5 CC6
Develop appropriate solutions to the most common problems in the fields of underwater and aerial robotics, as a practical example of specific fields of application.	AC6	BC14 BC16 BC17	CC5 CC6

Contents	
Topic	**Sub-topic**
Application fields of autonomous robotics	- Robotics and Artificial Intelligence - Design of an autonomous robotic system - Main fields of application -- Industry 4.0 -- Service robotics -- Agriculture -- Intelligent environments
Legal and ethical aspects of autonomous robotics	- Legal aspects at European level - Ethical aspects - Situation in Spain
Application field 1: unmanned aerial vehicles (UAV)	- Evolution and types of UAVs - Sensorisation - Processing - Control - Use cases
Application field 2: autonomous underwater vehicles (AUV)	- Underwater vehicle types and characteristics - Sensorisation - Motion control - Actuation - Applications

Planning				
Methodologies / tests	**Competencies / Results**	**Teaching hours (in-person & virtual)**	**Student?s personal work hours**	**Total hours**
Supervised projects	A6 B3 B4 B14 B16 B17 C1 C5 C6	0	30	30
Oral presentation	A6 B3 B4 B16 B17 C1 C5 C6	0.5	5	5.5
Workshop	B3 B14 B16 C1 C5 C6	6	6	12
Field trip	B3 B14 B16 B17 C1 C5 C6	4	8	12
Guest lecture / keynote speech	A6 B3 B4 B16 B17 C1 C5 C6	10.5	3	13.5
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**

Supervised projects	Carrying out a work/project outside the classroom in which programming practices will be carried out using a simulator or a real robot. This work will be carried out autonomously by the students and their progress will be tutored by the teachers.
Oral presentation	Theoretical report or similar on a topic proposed by the subject teachers, which must be presented in front of classmates and also handed in in writing.
Workshop	Seminars in which students are trained on the tools to be used in the practical part of the subject, such as robotic simulators or equivalent.
Field trip	One or several field trips to real autonomous vehicles test areas will be carried out, where students will have to interact with the real systems following the teachers' instructions.
Guest lecture / keynote speech	Oral presentation of the theoretical syllabus by the teachers of the course.

Personalized attention	
Methodologies	**Description**
Oral presentation Workshop Supervised projects Field trip	Workshops: the students will be able to ask the teacher any questions they may have about the topics covered. Tutored work: it is advisable to use personalised attention in these activities to resolve conceptual or procedural questions that may arise during the resolution of practical problems. In addition, personalised attention will also focus on the student's explanation of the proposed solution. Oral presentation: students will have to go to the teachers to solve any doubts they may have about the preparation of the work to be presented, both in terms of the content and the presentation itself. Field trips: the teacher will monitor the process at all times, guiding the students in the areas visited, and checking their understanding of the process. Students enrolled part-time will have an online personalised communication channel in all the methodologies.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Oral presentation	A6 B3 B4 B16 B17 C1 C5 C6	The oral presentation of the theoretical work/works, the written version of the same and the active participation in the presentations of the classmates have an important weight in the final grade of the course.	30
Supervised projects	A6 B3 B4 B14 B16 B17 C1 C5 C6	One or two practical projects will be proposed throughout the course focusing on the resolution of underwater and/or aerial robotics problems. These tasks will be developed autonomously by the student outside of class and must be defended in front of the lecturers.	60
Field trip	B3 B14 B16 B17 C1 C5 C6	The correct preparation, execution and understanding of the field trips will be assessed by the teachers of the subject. Students must prepare a report which will be evaluated.	10

Assessment comments

In order to obtain a pass in this subject, a minimum score of 50 must be passed by adding up all the previous methodologies, there being no minimum in any of them. In the event that the student does not pass the subject in the ordinary exam, he/she will have to repeat the activities that are necessary from the methodology/s that were not passed in the extraordinary exam. As an example, if a student passed the part of the oral presentation but failed the supervised work, he/she will have to repeat the practical work necessary to achieve a pass, normally those that were not passed individually.
Assessment of the advanced session (December): students who opt for this session must carry out the tutored work and oral presentation methodologies, but not the field trip. The value of this methodology is added to that of tutored work, becoming worth 70%. Students must contact their teachers at the beginning of the four-month period (September) in order to have enough time to submit their work.
Students enrolled part-time will be able to accumulate 10% of the mark corresponding to the fiel trip in the Supervised projects, both in ordinary and extraordinary calls. This modification must be requested to the teachers of the subject at the beginning of the course. Likewise, in the event of not being able to make the oral presentation with the rest of the students, an alternative date must be agreed with the teachers.
The fraudulent realisation of tests or activities, once verified, will directly imply the qualification of failing "0" in the subject in the corresponding call, thus invalidating any qualification obtained in all the assessment activities for the extraordinary call.

Sources of information	
Basic	- Bruno Siciliano (2008). Springer handbook of robotics. Springer-Verlag - Niku, Saeed B. (2011). Introduction to robotics: analysis, control, applications. John Wiley & Sons - Thor I. Fossen (2011). Handbook of Marine Craft Hydrodynamics and Motion Control. John Wiley & Sons, Ltd - Nonami, K., Kendoul, F., Suzuki, S., Wang, W., Nakazawa (2010). Autonomous Flying Robots, Unmanned Aerial Vehicles and Micro Aerial Vehicles. Springer-Verlag - Dronekit (2015). https://dronekit-python.readthedocs.io/en/latest/.
Complementary	- Geoff Roberts and Robert Sutton (2006). Advances in unmanned marine vehicles. Institution of Engineering and Technology - Floreano, Dario y otros (2010). Flying Insects and Robots. Springer-Verlag

Recommendations
Subjects that it is recommended to have taken before
Smart Robotics and Autonomous Systems/770538005
Subjects that are recommended to be taken simultaneously
Machine Vision I/770538018 Introduction to Python for Engineers/770538011 Robotics Application Development: Introduction to ROS/770538013 Machine Learning I/770538016
Subjects that continue the syllabus
Other comments
The documents to be deliver in this subject:- Virtual format or digital support will be requested.- They'll be done on the Virtual Campus without printing them.In case they?re done in paper:- Don't use plastics.- Use double-sided printing.- Use recycled paper.- Avoid printing drafts.