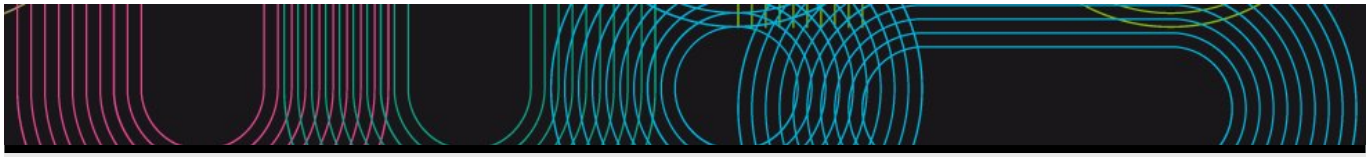

IDENTIFYING DATA				
(*)Fundamentos de sistemas aéreos non tripulados				
Subject	(*)Fundamentos de sistemas aéreos non tripulados			
Code	O07M174V01101			
Study programme	(*)Máster Universitario en Operacións e Enxeñería de Sistemas Aéreos non Tripulados			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1st	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Orgeira Crespo, Pedro			
Lecturers	Orgeira Crespo, Pedro			
E-mail	porgeira@uvigo.es			
Web	http://aero.uvigo.es			
General description	This subject intends to show the basic elements of an unmanned aerial vehicle as well as the description of the its principles of operation. International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Competencies	
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	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
A3	That the students be able to integrate knowledge and face the complexity of formulating judgments from information, which being incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of their knowledge and judgments
B1	That students acquire general knowledge in unmanned aircraft systems engineering
B3	That students acquire the capabilities to analyze the needs of a company in the field of unmanned aerial systems and determine the best technological solution for the same
B4	That the students acquire the knowledge to develop unmanned aerial systems or to plan specific operations, depending on the existing needs and to apply the existing technological tools
B5	That students know and be able to apply the principles and methodologies of research, such as bibliographical searches, data collection and analysis and interpretation thereof, as well as the presentation of conclusions, in a clear, concise and rigorous way
C1	Knowledge of the main systems, the on board instruments and the control station of a non-manned aircraft, as well as its influence on security
D2	Ability to communicate orally and in writing in Galician
D8	Ability of analysis and synthesis
D9	Capacity for critical reasoning and creativity

Learning outcomes	
Expected results from this subject	Training and Learning Results

Understand the operation of a profile of flight, the basic performance of the aircraft and surfaces of control.	A1 A2 A3 B1 B3 B4 B5 C1 D2 D8 D9
Learn which are the main propulsion and structures employed in unmanned air vehicles	A1 A2 A3 B1 B3 B4 B5 C1 D2 D8 D9
Know the main useful payloads	A1 A2 A3 B1 B3 B4 B5 C1 D2 D8 D9

Contents

Topic	
Introduction	Historical approximation to unmanned aerial vehicles. Ranking of the aircraft and his systems of propulsion. Terrestrial infrastructures. Management of aerial traffic. Legal environment.
Unmanned air vehicles	Principles of flight. Aircraft performance. General description of fixed wing aircraft . Controls of flight. Structure. Main instruments and systems. General description of helicopters. Controls of flight. Main instruments and systems. Multicopters.
Fluid mechanics priinciples	Compresivility. Viscosity. Limit layer and turbulence. Reynolds number. Mach number. Bernoulli's equation.. ISA.
Aerodynamics principles	Airfoils in incompresible flow. Flat plate. Cilinder. Kutta condition. Prandtl.
Introduction to the propulsion of aircraft.	Propellers: Theory of Froude; theory of the element of shovel. Propellerr adaptation. Aero jets. Push power, specific impulse and control of push in electric propulsion.
Flight mechanics	Basic flight equations. Cruisse flight, ascend, descent and gliding. Banking. Wind effect. Actuators. Stability and control.

Navigation systems	Avionics introduction Navigation sensors and systems. Inertial navigation. Integrated navigation. Kalman filter. GPS positioning.
Brushless control	Information gathering. Calculation and treatment of PID signals Control signal command.
Main payloads	Digital cameras. LIDAR. RADAR.
Other payloads	Liquid disperson systems. Environmental sensors. Transport of light payloads.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	10	0	10
Autonomous practices through ICT	22	22	44
Mentored work	7	63	70
Practices report	0	10	10
Problem and/or exercise solving	3	13	16

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

Methodologies

	Description
Lecturing	Content presentation using audiovisual means. The contents will be upload to the e-learning platform.
Autonomous practices through ICT	Practical activities in laboratory and computer room, to put in practice the outcome of the subject.
Mentored work	A group activity to have an overview of the subject through a real project.

Personalized assistance

Methodologies	Description
Lecturing	e-mail and one-to-one tutorials
Autonomous practices through ICT	e-mail and one-to-one tutorials
Mentored work	e-mail and one-to-one tutorials

Assessment

	Description	Qualification	Training and Learning Results			
Autonomous practices through ICT		50	A1 A2 A3	B1 B3 B4 B5	C1	D2 D8 D9
Mentored work		50	A1 A2 A3	B1 B3 B4 B5	C1	D2 D8 D9

Other comments on the Evaluation

Students to pass must submit all practice reports and problems. Everyone must individually achieve a minimum grade of 5.

In the July evaluation students must submit all reports of practices and problems that do not individually reach a minimum grade of 5.

Sources of information

Basic Bibliography

Complementary Bibliography

Jeffrey D. Barton, **Fundamentals of small unmanned aircraft flight**,

Aviation Civil Aviation Organization, **Unmanned aircraft systems**,

Mouhamed Abdulla, Jaroslav V. Svoboda, Luis Rodrigues, **Avionics made simple**,
Bon Dewitt, **Unmanned aerial systems for mapping**,
Sergio Esteban Ronceso, **Fundamentos de Ingeniería Aeroespacial**,
John Anderson, **Fundamentos de aerodinámica**, 6, McGraw Hill, 2017
Miguel Ángel Gómez Tierno, **Mecánica de vuelo**, 2, Garceta, 2012
Antonio Esteban Oñate, **Conocimientos del avión**, 1, Paraninfo, 2007

Recommendations

Subjects that continue the syllabus

(*)Sistemas de comunicacións e navegación por radio/O07M174V01103

Subjects that are recommended to be taken simultaneously

(*)Operacións de sistemas aéreos non tripulados/O07M174V01102