



## IDENTIFYING DATA

### Fundamentals of unmanned aerial systems

Subject	Fundamentals of unmanned aerial systems			
Code	O07M174V01101			
Study programme	Máster Universitario en Operaciones e Ingeniería de Sistemas Aéreos no Tripulados			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1st	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator				
Lecturers				
E-mail				
Web	<a href="http://aero.uvigo.es">http://aero.uvigo.es</a>			
General description	This subject aims to introduce the basic foundations that underlie the flight of any UAV: Aerodynamics, Flight Mechanics, and Propulsion. Its operating principles are described and the general concepts are reviewed.			
	International students may request teachers: a) materials and bibliographic references to follow the subject in English, b) attend tutorials in English, c) tests and evaluations in English.			

## Training and Learning Results

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			

## Expected results from this subject

Expected results from this subject	Training and Learning Results
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**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 principles	Compressibility. Viscosity. Limit layer and turbulence. Reynolds number. Mach number. Bernoulli's equation.. ISA.
Aerodynamics principles	Airfoils in incompressible flow. Flat plate. Cilinder. Kutta condition. Prandtl.
Introduction to the propulsion of aircraft.	Propellers: Theory of Froude; theory of the element of shovel. Propeller adaptation. Aero jets. Push power, specific impulse and control of push in electric propulsion.
Flight mechanics	Basic flight equations. Cruise flight, ascend, descent and gliding. Banking. Wind effect. Actuators. Stability and control.

**Planning**

	Class hours	Hours outside the classroom	Total hours
Lecturing	21	40	61
Problem solving	21	45	66
Problem and/or exercise solving	3	0	3
Report of practices, practicum and external practices	0	20	20

\*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.
Problem solving	Content presentation using audiovisual means. The contents will be upload to the e-learning platform.

**Personalized assistance**

Methodologies	Description
Lecturing	e-mail and one-to-one tutorials

<b>Assessment</b>						
	Description	Qualification	Training and Learning Results			
Problem solving	(*)Los alumnos para aprobar deben entregar todos los informes de prácticas y problemas requeridos durante el curso. Todos deben alcanzar de forma individual una nota mínima de un 5 sobre 10.  En la evaluación ordinaria, se requiere una evaluación de 5 sobre 10 para considerar el examen aprobado.  En la evaluación extraordinaria, los alumnos deben entregar todos aquellos informes de prácticas y problemas que no alcanzasen de forma individual una nota mínima de un 5. Igualmente, se requiere una evaluación de 5 sobre 10 para considerar el examen aprobado.	80	A1 A2 A3	B1 B3 B4 B5	C1	D2 D8 D9
Report of practices, practicum and external practices		20	A1 A2 A3	B1 B3 B4 B5	C1	D2 D8 D9

#### Other comments on the Evaluation

Students will deliver all the required reports during the course. All have to reach at least a 5/10 score to pass.

In June evaluation, a 5/10 is needed for students to pass the exam.

In July evaluation, a 5/10 score is also needed in the exam, as well as having scored a 5/10 on required reports.

#### 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

Radio communication and navigation systems/O07M174V01103

##### Subjects that are recommended to be taken simultaneously

Unmanned aerial systems operations/O07M174V01102