



IDENTIFYING DATA

Flight dynamic

Subject	Flight dynamic			
Code	O07M197V01201			
Study programme	(*)Máster Universitario en Enxeñaría Aeronáutica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1st	2nd
Teaching language	Spanish			
Department				
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Lecturers	Navarro Medina, Fermín			
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General description	The study of the equations of the dynamic motion of aircraft and space vehicles is addressed. As a previous step, the static stability and control of the airplane is studied, in straight flight and maneuver. Subsequently, the dynamic equations of motion are analyzed: linearizing them, obtaining the derivatives of longitudinal and lateral-directional stability, the modes of the airplane, and the stability and control in open and closed loop. Finally, an introduction is made to the attitude dynamics of space vehicles, their equations and applied to orientation control maneuvers.			

Training and Learning Results

Code	
D3	Understanding and mastery of atmospheric flight mechanics (performance, stability, static and dynamic control), orbital mechanics and attitude dynamics.

Expected results from this subject

Expected results from this subject	Training and Learning Results
Understanding and command of atmospheric flight mechanics (actions, stability, static and dynamic control), orbital mechanics and attitude dynamics.	D3

Contents

Topic	
1. Static stability and control of the aircraft	<ul style="list-style-type: none"> - Brief review of static stability and static control of the aircraft. - Response of the aircraft to inputs on the aerodynamic controls. - Longitudinal static stability and control in manoeuvre
2. Stability and dynamic control of the aircraft	<ul style="list-style-type: none"> - Linearization of the general equations of the plane's motion. - Derivatives of longitudinal and lateral-directional stability. - Longitudinal and lateral-directional dynamic modes. - Dynamic stability and controllability in closed loop. - Flight qualities (FQ) and flight control systems (FCS).
3. Orbital mechanics and attitude dynamics of space vehicles	<ul style="list-style-type: none"> - Kinematics of rotational attitude - Attitude dynamics of rigid solid - Rotational maneuvers and attitude control

Planning

	Class hours	Hours outside the classroom	Total hours
Case studies	12	62	74
Lecturing	29	0	29
Previous studies	0	30	30

Problem solving	4.5	0	4.5
Autonomous problem solving	0	10	10
Objective questions exam	1.5	0	1.5
Presentation	1	0	1

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

Methodologies

	Description
Case studies	Realization of practical case studies on the contents of the subject, which will be explained and started in the classroom to be finished and delivered by the students outside the classroom. The case studies will require the use of software.
Lecturing	Presentation of a topic or resolution of problems by the teaching staff according to a previously established script.
Previous studies	Students study autonomously, with the support of the teaching staff if required according to the procedures established by the university for tutorials
Problem solving	Resolution of problems and/or exercises that deal with specific aspects of the contents of the subject, developed by the teaching staff and/or the students in the classroom
Autonomous problem solving	Resolution of problems and/or exercises that deal with specific aspects of the contents of the subject, developed by the students outside the classroom

Personalized assistance

Methodologies	Description
Case studies	Realization of practical case studies on the contents of the subject, which will be explained and started in the classroom to be finished and delivered by the students outside the classroom. The students will have the necessary tutorials with the teaching staff to monitor the development of the case studies.
Previous studies	Support tutorials for students to study independently, according to the procedures established by the university.

Assessment

	Description	Qualification	Training and Learning Results
Case studies	Four case studies to be carried out during the semester distributed over time, and software will be used for their resolution. The qualification of each of them will be 15%.	60	D3
Objective questions exam	Exam based on solving problems and/or conceptual questions about the contents of the subject. It will be on the official exam date. Minimum grade of 5.0.	35	D3
Presentation	Presentations of the results of the case studies to be carried out by the students throughout the course.	5	D3

Other comments on the Evaluation

First call

To pass the subject on the 1st opportunity, it will be necessary to obtain a score of more than 5 points out of 10 in the joint evaluation of the continuous evaluation during the development of the classes and the exam on the official date. In addition, the exam grade on the official date must be greater than or equal to 5 points out of 10. The final grade of the continuous assessment will be obtained according to the indicated percentages.

For the global evaluation, an exam will be carried out on the day of the official date, which includes all the contents of the subject, including the contents and methods used in the case studies. The qualification of said exam to pass the subject will be 5 points out of 10.

The evaluation test schedule officially approved by the Junta de Centro da EEAE is published on the web

<http://aero.uvigo.es/gl/docencia/exames>

Continuous assessment tests will be carried out during school hours"

The student has the right to opt for the global assessment according to the procedure and the deadline established by the centre for each call.

Second call

The student must take the second call exam of all the contents of the subject, which will mean 100% of the grade, if the final continuous assessment grade is less than 5 points out of 10. They will also have to attend the second call exam when the first call final exam grade is less than 5 points out of 10.

In case of obtaining a grade greater than or equal to 5 in the second call exam, the final grade for the subject will be the highest grade between:

* the 2nd call call

* the average with the activities carried out during the course (averaging with the percentages of the evaluation table substituting the mark of the first call exam for the second call)

End-of-program call

For the end of degree evaluation, an exam will be held on the day of the official date, which includes all the contents of the subject. The qualification of said exam to pass the subject will be 5 points out of 10.

Sources of information

Basic Bibliography

Gómez Tierno M.A., Pérez Cortés M., Puentes Márquez C, **Mecánica del vuelo**, 2, Ibergarceta Publicaciones, 2012

Complementary Bibliography

Bong Wie, **Space Vehicle Dynamics and Control**, 2, American Institute of Aeronautics and Astronautics, 2008

Bernard Etkin, Lloyd Duff Reid, **Dynamics of flight. Stability and control**, 3, John Wiley & Sons, 1996

Recommendations

Subjects that are recommended to be taken simultaneously

Avionics/O07M197V01205

Subjects that it is recommended to have taken before

Advanced aerodynamics and aeroelasticity/O07M197V01101