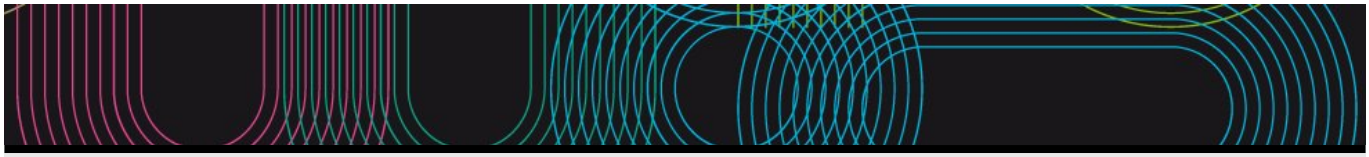

IDENTIFYING DATA				
Space vehicles				
Subject	Space vehicles			
Code	O07G410V01933			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Ulloa Sande, Carlos			
Lecturers	Ulloa Sande, Carlos			
E-mail	carlos.ulloa@uvigo.es			
Web	http://aero.uvigo.es			
General description	The space vehicles operate in a very different environment than the earth. This environment is critical when defining the design requirements of the space vehicles. In addition to the space environment, it is under the scope of this subject the study of the necessary concepts of orbital mechanics for the understanding of the main application orbits, maneuvers and perturbations of the space vehicles. Main subsystems of a space vehicle are studied, as well, with special attention to the subsystem of thermal control and the subsystem of attitude control. Labs are included using specific material and simulation software of mission analysis. English Friendly subject: 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.			

Training and Learning Results	
Code	
A2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study
A3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues
A5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
B1	Capabiliity for design, development and management in the field of aeronautical engineering (in according with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials , airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
B6	Capability to participate in flight testing programs for take-off and landing distances, ascent speeds, loss speeds, maneuverability and landing capacities.
C24	Appropriate knowledge applied to engineering: systems of aircrafts and automatic systems of flight control of the aerospace vehicles.
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D6	Capabiliity for interpersonal communication
D11	Show motivation for quality with sensitivity towards subjects within the scope of the studies
D13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources

Expected results from this subject	
Expected results from this subject	Training and Learning Results

Knowledge, understanding, application and analysis of the basic configurations, subsystems and missions of space vehicles.	A2 A3 A5	B1 B6	C24	D3 D4 D6 D11 D13
- Capacity for the analysis of the mission, of the type of law of guided and space path	A2 A3 A5	B1 B6	C24	D3 D4 D6 D11 D13
- Knowledge, understanding, application and analysis of the thermal control of the space vehicle	A2 A3 A5	B1 B6	C24	D3 D4 D6 D11 D13
- Knowledge, understanding, application and analysis of control of attitude and orbit of the space vehicle	A2 A3 A5	B1 B6	C24	D3 D4 D6 D11 D13
- Knowledge and understanding of the system of essays and of the support of earth of the space vehicle	A2 A3 A5	B1 B6	C24	D3 D4 D6 D11 D13

Contents

Topic	
BLOCK 1: Introduction	Lesson 1.1: Brief historical review. Lesson 1.2: Classification of space vehicles Lesson 1.3: Types of subsystems of space vehicles Lesson 1.4: The solar system. Lesson 1.5: The space and planetary surroundings.
BLOCK 2: Orbital Mechanics	Lesson 2.1: Systems of reference and time. Lesson 2.2: The two-body problem. Time laws and orbital elements. Lesson 2.3: Tracks, coverage and visibility Lesson 2.4: Perturbations Lesson 2.5: Types of orbits Lesson 2.6: The three-body problem
BLOCK 3: Analysis of mission	Lesson 3.1: Space maneuvers Lesson 3.2: Rendezvous Lesson 3.3: Lunar and interplanetary missions
BLOCK 4: Subsystems	Lesson 4.1: Propulsion systems and launch vehicles Lesson 4.2: Space vehicles structures Lesson 4.3: System of attitude control Lesson 4.4: System of thermal control Lesson 4.5: Electrical , communications, command and telemetry systems Lesson 4.6: Ground segment Lesson 4.7: Laboratory tests

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	0	28
Laboratory practical	12	6	18
Seminars	0	2	2
Previous studies	0	79.5	79.5
Mentored work	10	10	20
Objective questions exam	2.5	0	2.5

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

Methodologies

	Description
Lecturing	Classroom lecture

Laboratory practical	Practicum with different subsystems of space vehicles Practicum of simulation of analysis of mission Essays and reports about space vehicles
Seminars	Tutorials in small groups
Previous studies	Autonomous work
Mentored work	Mentored work

Personalized assistance

Methodologies	Description
Seminars	Small group tutoring with the teachers of the subject. The tutorials will be held, by appointment, in the theacher's office or in the teacher's virtual office, on the Remote Campus.

Assessment

	Description	Qualification	Training and Learning Results			
Laboratory practical	Laboratory report	10	A2 A3 A5	B1 B6	C24	D3 D4 D11 D13
Mentored work	Reports and presentations of the work proposed during the course of the course within the practical sessions	20	A2 A3 A5	B1 B6	C24	D3 D4 D6 D11 D13
Objective questions exam	Partial examination of short questions and problems (30%) (Percentage can be divided into shorter tests) Final examination of short questions and problems (40%)	70	A2 A3 A5	B1 B6	C24	D3 D4 D11 D13

Other comments on the Evaluation

First Call:

(1) Students who follow the course by Continuous Assessment:

In order to pass the subject at the first opportunity, through Continuous Assessment, it will be necessary:

-A grade in the Continuous Assessment final exam of at least 5.0.

-Attend at least 80% of the practical sessions.

-Submit all the practical reports and assignments for the subject, obtaining at least a grade of 3 in each of them.

In the case of not meeting these conditions, the final mark will be the result of the minimum of the average mark of EC and 4.9.

Continuous assessment tests will be carried out during school hours, whenever possible. The final Continuous Assessment exam will be held on the date approved by the center for the first call.

(2) Students who wish to be evaluated by exam-only assessment:

The evaluation of the course at the first call will be carried out, by default, through Continuous Assessment. The student body has the right to opt for the exam-only assessment according to the procedure and the period established by the center for each call, which may not exceed one month.

The grade obtained in this exam will represent 100% of the final grade. The student must obtain a minimum grade of 5.0 in this exam. This exam may have a part to be taken in a computer room and/or laboratory, and will include all of the material taught, as well as the content covered in all the practical sessions and assignments.

The exam-only assessment exam will be carried out on the date approved by the center for the first call.

Second call and end-of-program call:

Students who have not passed the subject at the first call may take an exam that will account for 100% of the final grade. The student must obtain a minimum grade of 5.0 in this exam. This exam may have a part to be taken in a computer room and/or laboratory, and will include all of the material taught, as well as the content covered in all the practical sessions and assignments.

The second call and end of degree exams will be held on the dates approved by the center for each call.

Other considerations:

In case of detection of plagiarism in any qualification element, the qualification in said item will be 0 and the fact will be communicated to the direction of the Center for the appropriate effects.

The evaluation test schedule officially approved by the Board of the EEAE Center is published on the website http://aero.uvigo.es/es/docencia/examenes

Sources of information

Basic Bibliography

H.D. Curtis, **Orbital Mechanics for Engineering Students**, ELSEVIER, 2014

P. Fortescue, **Spacecraft Systems Engineering**, 4, Wiley, 2011

M.D. Griffin y J.R. French, **Space Vehicle Design**, AIAA Education Series, 2004

Charles Brown, **Elements of Spacecraft design**, AIAA Education Series, 2002

Complementary Bibliography

Bong Wie, **Space vehicle Dynamics and Control.**, AIAA Education Series, 1998

R. Karam, **Satellite Thermal Control for Systems Engineers**, AIAA Education Series, 1998

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics I/O07G410V01103
Physics: Physics II/O07G410V01202
Aerospace technology/O07G410V01205
Classical mechanics/O07G410V01305