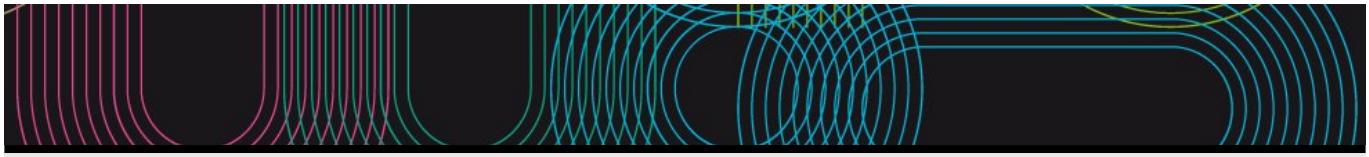
Universidade Vigo

Subject Guide 2020 / 2021



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 Galician			
Department				
Coordinator	Ulloa Sande, Carlos			
Lecturers	Ulloa Sande, Carlos			
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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.			

Competencies	
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

Learning outcomes	
Expected results from this subject	Training and Learning Results

- Knowledge, understanding, application and analysis of the basic configurations, subsystems and missions of the 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, commando 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	0	12
Seminars	0	2	2
Previous studies	0	79.5	79.5
Objective questions exam	2.5	0	2.5
Report of practices, practicum and external practices	0	6	6
Essay	10	10	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	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

Personalized assistance

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

Assessment

	Description	Qualification	Training and Learning Results			
Objective questions exam	Partial examination of short questions and problems (20%) (Percentage can be divided into shorter tests) Final examination of short questions and problems (50%)	70	A2 A3 A5	B1 B6	C24	D3 D4 D11 D13
Report of practices, practicum and external practices	Report of the laboratory practices	10	A2 A3 A5	B1 B6	C24	D3 D4 D6 D11 D13
Essay	Reports and presentations of essays and assignment proposed along the course during the practicum sessions	20	A2 A3 A5	B1 B6	C24	D3 D4 D6 D11 D13

Other comments on the Evaluation

The evaluation of the course at the first opportunity will be carried out by Ongoing Assessment. Students who have a justification may officially waive the ongoing assessment and ask for a first oportunity final exam, on the official date. The grade obtained in this exam will represent 100% of the final grade. This exam may have a part to do in a computer room and / or laboratory. The waiver of ongoing assessment must be made during the first month of class. During this period, the justification of the resignation will be presented to the coordinator of the subject for evaluation.

To pass the course at the first opportunity, a score greater than 5 points out of 10 will be required in the continuous evaluation during the development of classes and the exam on the official date, toghether. The final grade will be obtained according to the indicated percentages.

Ongoing assessment is not passed in the following cases:

- The non-execution or delivery, without justification, of any of the items of the ongoing assessment (works reports, practicum reports, exams ...). In this case, the final grade reflected in the official record will be "not presented"

- Obtaining a grade of less than 5 points out of 10 in the final exam of ongoing assessment. In this case, the final grade reflected in the official record will be the grade of the ongoing assessment final exam.

The evaluation of the course in the second opportunity will be carried out in a final exam on the date set by the center. The grade obtained in this exam will represent 100% of the final grade. This exam may have a part to do in a computer room and / or laboratory.

To pass the subject in the second opportunity, a score higher than 5 points out of 10 will be required in the exam on the official date.

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

The maximum length of the exams will be 3 hours if there is no interruption, and 5 hours if there is an intermediate break (maximum 3 hours for each part).

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

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies maintained
The proposed methodologies are maintained but carried out through the Remote Campus. The platform faitic will be used more intensively as reinforcement to ensure accessibility of the students to the contents of the subject.

* Teaching methodologies modified
Laboratory practices that require interaction with physical elements are replaced by other activities that can be carried out on the remote campus, such as work in groups.

* Contactless mechanism for student attention (tutorials)
The tutorials will place in the teacher's virtual office on the remote campus.

=== ADAPTATION OF THE EVALUATION ===
* Tests already carried out
The tests already carried out maintain their weight in the evaluation.

* Pending tests
Pending tests are planned and will be carried out using the Moodle platform and the remote campus, and they maintain their weight in the evaluation.