



IDENTIFYING DATA

Space telecommunication systems

Subject	Space telecommunication systems			
Code	O07M197V01305			
Study programme	(*)Máster Universitario en Enxeñería Aeronáutica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	2nd	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Aguado Agelet, Fernando Antonio			
Lecturers	Aguado Agelet, Fernando Antonio Arias Acuña, Alberto Marcos Rubiños López, José Óscar			
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General description The subject "Space Telecommunication Systems" provides a comprehensive understanding of the technologies and systems used in space communication. First, it covers the study of radiofrequency and optical communication technologies, essential for data transmission in space. It delves into link budget, analyzing the necessary calculations to ensure effective communication between transmitters and receivers. Additionally, it examines the communication subsystems between ground stations and satellites, as well as the subsystems that enable inter-satellite communication. Satellite navigation systems are also covered.

Another important aspect of the subject is the study of antennas, where the principles and specific designs for space communications are explored. The performance and applications of different types of antennas in satellites and ground stations are analyzed. Furthermore, the subject reviews radiofrequency systems and space electronics, fundamental for the design and operation of equipment in the space environment. Finally, the ground segment is considered, addressing the terrestrial infrastructure necessary to support space operations and the concept of operations, which includes the planning and management of space missions to ensure efficient and continuous communication.

English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.

Training and Learning Results

Code	
B13	Adequate knowledge of aeronautical information technologies and communications.
C8	To conceive spatial products that correspond to the needs of the agents involved, defining functions, concepts and their architecture.
D11	Understand and apply the knowledge, methods and tools necessary to develop space engineering projects.

Expected results from this subject

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Adequate knowledge of aeronautical information technologies and communications.	B13
Understand and apply the knowledge, methods and tools necessary to develop space engineering projects.	D11
To conceive spatial products that correspond to the needs of the agents involved, defining functions, concepts and their architecture.	C8

Contents

Topic	
1.- Technologies and Link Analysis of Communications	1.- Radiofrequency, Optical Communications 2.- Link Budget 3.- Antennas
2.- Communication Subsystems - Space Segment	1.- Space-to-Earth Communication Subsystems 2.- Inter-Satellite Communication Subsystems
3.- Satellite Navigation Systems	1.- Basics of Satellite Navigation. 2.- Main Satellite Navigation Systems. 3.- Generation and Reception of Navigation Signals.
4.- Radio Systems and Space Electronics	1.- Architecture of Radio Systems. 2.- Space Environment Requirements in the Electronics of Radio Systems.
5.- Ground Segment	1.- Architecture 2.- Concept of Operations 3.- Operations Standards and Software

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	15	10	25
Problem solving	14	10	24
Autonomous problem solving	0	20	20
Laboratory practical	10	10	20
Practices through ICT	6.5	12	18.5
Essay questions exam	1.5	0	1.5
Problem and/or exercise solving	1	0	1
Essay	0	40	40

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

Methodologies

	Description
Lecturing	Presentation by the faculty of the contents on the subject under study, theoretical foundations, and guidelines for a project or exercise that the student has to develop.
Problem solving	Activity in which problems and/or exercises related to the subject are formulated. Students must develop appropriate solutions through the practice of routines, the application of formulas or algorithms, the application of procedures to transform the available information, and the interpretation of the results. This is usually used as a complement to the lecture.
Autonomous problem solving	Activity in which problems and/or exercises related to the subject are formulated. Students must develop the analysis and resolution of the problems and/or exercises independently.
Laboratory practical	Laboratory practices. Activities for applying knowledge to specific situations and acquiring basic and procedural skills related to the subject under study. These are conducted in specialized spaces with specialized equipment (laboratories, computer rooms, etc.).
Practices through ICT	Practices in computer labs. Activities for applying knowledge in a specific context and acquiring basic and procedural skills related to the subject, through ICT.
	Software used: Matlab, Python, Excel, STK (or similar).

Personalized assistance

Methodologies	Description
Lecturing	Students will have the opportunity to attend personalized tutoring sessions in the professor's office during the hours established by the professors for this purpose at the beginning of the course, which will be published on the course webpage (https://moovi.uvigo.gal). They may also ask their questions via telematic means.
Problem solving	Students will have the opportunity to attend personalized tutoring sessions in the professor's office during the hours established by the professors for this purpose at the beginning of the course, which will be published on the course webpage (https://moovi.uvigo.gal). They may also ask their questions via telematic means.
Autonomous problem solving	Students will have the opportunity to attend personalized tutoring sessions in the professor's office during the hours established by the professors for this purpose at the beginning of the course, which will be published on the course webpage (https://moovi.uvigo.gal). They may also ask their questions via telematic means.
Laboratory practical	Students will have the opportunity to attend personalized tutoring sessions in the professor's office during the hours established by the professors for this purpose at the beginning of the course, which will be published on the course webpage (https://moovi.uvigo.gal). They may also ask their questions via telematic means.

Practices through ICT Students will have the opportunity to attend personalized tutoring sessions in the professor's office during the hours established by the professors for this purpose at the beginning of the course, which will be published on the course webpage (<https://moovi.uvigo.gal>). They may also ask their questions via telematic means.

Assessment				
	Description	Qualification	Training and Learning Results	
Laboratory practical	Preparation of a report by the students reflecting the characteristics of the work carried out. Students must describe the tasks and procedures developed, show the results obtained or the observations made, as well as the analysis and processing of the data.	10	B13	C8 D11
Practices through ICT	Preparation of a report by the students reflecting the characteristics of the work carried out. Students must describe the tasks and procedures developed, show the results obtained or the observations made, as well as the analysis and processing of the data.	10	B13	C8 D11
Essay questions exam	Activity in which problems and/or exercises related to the subject are formulated. Students must develop the analysis and resolution of the problems and/or exercises independently.	20	B13	C8 D11
Problem and/or exercise solving	A test in which students must solve a series of problems or exercises within a time and under conditions established by the professor. In this way, students must apply the knowledge they have acquired.	20	B13	C8 D11
Essay	Work(s) on the entire content of the subject.	40	B13	C8

Other comments on the Evaluation

First Opportunity Evaluation:

To pass the subject on the first opportunity, students must obtain a grade higher than 5 out of 10 in the combined assessment of continuous evaluation tests, the submission of assignments during class sessions, and the exam held on the official date. The final grade for continuous evaluation will be determined according to the indicated percentages.

Students have the right to opt for a global evaluation according to the procedure and deadline established by the center for each call.

Global Evaluation:

An exam will be held on the official date, which includes all the content of the subject, including the content and methods used in case studies. The grade for this exam to pass the subject will be 5 out of 10.

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

Second Opportunity Evaluation:

Students must take the second call exam covering all the content of the subject, which will account for 100% of the grade if the final grade for continuous evaluation is less than 5 out of 10.

If they have a score equal to or greater than 5 out of 10 in the combined work/continuous evaluation tests, the grade will be preserved for the second opportunity, requiring them to take only the official exam, which will weigh 30% of the final grade for the subject.

Final Year Evaluation:

For the final year evaluation, an exam will be held on the official date, covering all the content of the subject. The grade for this exam to pass the subject will be 5 out of 10.

Sources of information

Basic Bibliography

Documentación del curso y transparencias,

Maral y Busquet, **Satellite Communications Systems: Systems, Techniques and Technology.**,

<http://www.ecss.nl>,

Teresa M. Braun, **Satellite Communications, Payload and System,**

Marcos Arias Acuña, Oscar Rubiños López, **Radiocomunicación**, Primera, Andavira Editora, 2011

Complementary Bibliography

Recommendations

Other comments

Dedicate the indicated amount of personal study time, and make use of personal tutoring sessions with the professor to resolve any doubts that arise during personal study.

A complete follow-up of the subject and an active attitude in classes are recommended.
