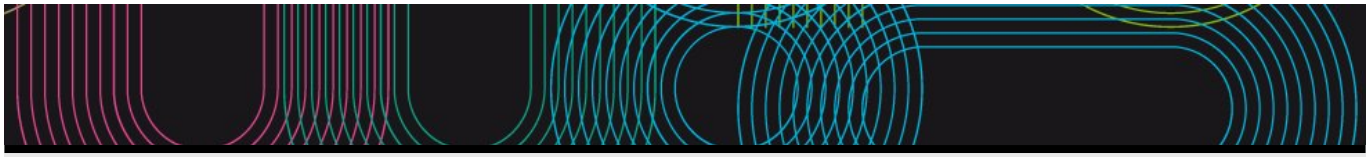

IDENTIFYING DATA				
Signal Transmission and Reception Techniques				
Subject	Signal Transmission and Reception Techniques			
Code	V05G300V01404			
Study programme	Degree in Telecommunications Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	Spanish			
Department	Signal Theory and Communications			
Coordinator	López Valcarce, Roberto			
Lecturers	Comesaña Alfaro, Pedro Isasi de Vicente, Fernando Guillermo López Valcarce, Roberto Márquez Flórez, Óscar Willian Rodríguez Banga, Eduardo Rodríguez Vaqueiro, Yolanda			
E-mail	valcarce@gts.uvigo.es			
Web	http://faitic.uvigo.es			
General description	The course "Techniques for Signal Transmission and Reception" is an introduction to the different existent methods for the exchange of information in digital format at the physical layer level. Its main focus is on pulse amplitude modulation (PAM) as illustrative example. The main components of a digital transmitter and receiver are described, as well as the different effects caused by the communication channel and the different performance parameters of a digital system.			

Competencies	
Code	
B3	CG3: The knowledge of basic subjects and technologies that enables the student to learn new methods and technologies, as well as to give him great versatility to confront and adapt to new situations
B4	CG4: The ability to solve problems with initiative, to make creative decisions and to communicate and transmit knowledge and skills, understanding the ethical and professional responsibility of the Technical Telecommunication Engineer activity.
B6	CG6: The aptitude to manage mandatory specifications, procedures and laws.
C7	CE7/T2: The ability to use communication and software applications (ofimatics, databases, advanced calculus, project management, visualization, etc.) to support the development and operation of Electronics and Telecommunication networks, services and applications.
C9	CE9/T4: The ability to analyze and specify the main parameters of a communications system.
C10	CE10/T5: The ability to evaluate the advantages and disadvantages of different technological alternatives in the implementation and deployment of communication systems from the point of view of signals, perturbations, noise and digital and analogical modulation systems.
C20	CE20/T15: The knowledge of national, European and international telecommunication regulations and laws.
D2	CT2 Understanding Engineering within a framework of sustainable development.
D3	CT3 Awareness of the need for long-life training and continuous quality improvement, showing a flexible, open and ethical attitude toward different opinions and situations, particularly on non-discrimination based on sex, race or religion, as well as respect for fundamental rights, accessibility, etc.

Learning outcomes	
Expected results from this subject	Training and Learning Results

Differentiate the blocks and the functionalities of a complete transmission data system.	B3	C7 C9 C10	
Identify the minimum requirements for a reliable data communication.	B3 B4	C9 C10	
Distinguish the fundamental parameters of a complete communications system oriented to data transmission.	B3 B4	C9 C10	
Describe, develop and analyse the different blocks of a data transmission system.	B3 B6	C9 C10 C20	D3
Develop and implement basic circuits for modulation and demodulation of signals.	B4 B6	C9 C10 C20	D2
Use applications of communication and computer (text processing, databases, advanced calculus, management of projects, visualisation, etc.) to support the design of data transmission systems.	B4		D2 D3
Recognise the different quality assessment measures of a digital signal.		C9 C10	
Statistically analyse the noise and understand its effects.	B3	C9 C10	

Contents

Topic	
1. Introduction to digital communication systems	-Basic elements and general description of a communication system. -Analog and digital communications -Description of a digital transmitter -Description of a digital receiver
2. Signals, systems and stochastic processes in communications	-Review of basic concepts: signals, systems, transforms. -Autocorrelation function of a stochastic process. -Power spectral density. Transmitted power, transmission bandwidth. -Noise characterization
3. Frequency conversion and analog processing	-Amplitude modulation (AM) with suppressed carrier -I/Q Modulation and demodulation. - Transceiver requirements and specifications -Receiver architectures: direct conversion, intermediate frequency. Analog and digital stages.
4. Pulse amplitude modulation (PAM)	- Baseband PAM - Bandlimited channels and intersymbol interferences (ISI) - Nyquist criterion, raised cosine pulses, eye diagram - Bandpass PAM
5. Modulation and detection in Gaussian channels	-Introduction to the Signal Space -Derivation of the Matched Filter -Maximum A Posteriori (MAP) and Maximum Likelihood (ML) detectors -Probability of error
6. The communication channel	-Transmission media -Signal to noise ratio -Multipath and frequency selectivity -Fading -Doppler effect

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	24	24	48
Computer practices	21	31.5	52.5
Problem solving	2	8	10
Laboratory practices	6	9	15
Essay questions exam	2	16	18
Short answer tests	1	5.5	6.5

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

Methodologies

	Description
Lecturing	Presentation and discussion of the fundamental theory. Through this methodology, skills CE9, CE10, CE20, CG3, CG4, CG6, CT2, CT3 are developed

Computer practices	The concepts presented in class will be further illustrated and developed by means of Matlab-based simulation and signal processing tools. Through this methodology, skills CE7, CE9, CE10, CG3, CG4, CT2 are developed
Problem solving	A simple problem will be solved after each batch of slides. This problem will help to understand the concepts introduced in that batch of slides. Through this methodology, skills CE9, CE10, CG4 are developed
Laboratory practices	Experimental study with real communication signals by means of Software-Defined Radio tools. This year a new practice, dealing with the modulation and demodulation of digital communications signals, will be introduced. Through this methodology, skills CE9, CE10, CG3, CG6, CT2 are developed

Personalized attention

Methodologies	Description
Laboratory practices	Beyond the initial explanation to the group, the teachers will resolve the individual doubts of the students.
Lecturing	The personalized attention will be done at the office hours.
Computer practices	Beyond the initial explanation to the group, the teachers will resolve the individual doubts of the students.
Problem solving	The personalized attention will be done at the office hours. Special group sessions will be organized for solving the proposed problems; in those sessions the students will try to resolve the problems, so questions on the subject will be arised, and will be solved by the teachers.

Assessment

	Description	Qualification	Training and Learning Results		
Essay questions exam	Final examination. It will cover all of the material covered during the course and will take place during the exam period as established by the Center.	60	B3 B4 B6	C9 C10 C20	D2
Short answer tests	Three short tests will be given during the semester.	40	B3 B4 B6	C7 C9 C10 C20	

Other comments on the Evaluation

For those students that choose the continuous assesment track. Four tests: 10% the first, 15% the second, 15% the third, and 60% the fourth.

The first three tests will take place following the schedule to be approved by the Academic Committee, which will be published by the beginning of the semester. These tests are not recoverable, that is to say, if a student does not show up when they take place, the instructors do not have the obligation to repeat them. In each test, the material covered from the start of the course until the previous week (inclusive) will be evaluated. The fourth test will be a shorter version of the exam that students who do not choose the continuous assesment track will have to take.

For those students that do not choose the continuous assessment track. Final examination: 100%

Students will be graded as long as they take any test (either the short-answer tests, or the final exam). Students will be assumed to choose the continuous assesment track as soon as they take any two of the short-answer tests. Students taking at most one of the short answer tests and the final exam will be assumed to choose the final assesment track.

Students choosing the continuous assesment track and not passing the subject will receive the "fail" mark, whether they took the final exam or not.

The mark achieved in the first three short-answer tests will be kept for the second call, but not for subsequent years.

Regarding the second call, students in the continuous assessment track will be allowed to choose if they wish to keep the mark achieved in the short-answer tests, or if they want to be assessed only by the final exam.

Plagiarism is regarded as serious misconduct. If any form of plagiarism is detected in any of the tests or exams, the final grade will be FAIL (0), and the corresponding academic authorities will be informed about the fact, in order to take the

adequate measures.

Sources of information

Basic Bibliography

A. Artés, F. Pérez González et al., **Comunicaciones Digitales**, 1,

J. G. Proakis, M. Salehi, **Fundamentals of Communication Systems**, 1,

Complementary Bibliography

C.R. Johnson Jr., W.A. Sethares, **Telecommunication Breakdown**, 1,

Bernard Sklar, **Digital Communications: Fundamentals and Applications**, 2,

B. Razavi, **RF Microelectronics**, 1,

Recommendations

Subjects that continue the syllabus

Principles of Digital Communications/V05G300V01613

Subjects that it is recommended to have taken before

Physics: Analysis of Linear Circuits/V05G300V01201
Mathematics: Probability and Statistics/V05G300V01204
Digital Signal Processing/V05G300V01304

Other comments

It is assumed that the student has basic knowledge of analog and digital signal processing, as well as of probability and statistics.