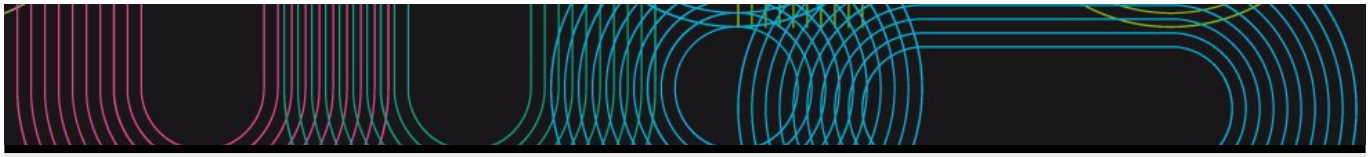

IDENTIFYING DATA				
Signal Transmission and Reception Techniques				
Subject	Signal Transmission and Reception Techniques			
Code	V05G300V01404			
Study programme	(*)Grao en Enxeñaría de Tecnoloxías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	Spanish			
Department				
Coordinator	Comesaña Alfaro, Pedro			
Lecturers	Comesaña Alfaro, Pedro Isasi de Vicente, Fernando Guillermo López Valcarce, Roberto Márquez Flórez, Óscar Willian Rodríguez Banga, Eduardo Rodríguez Rodríguez, José Luis			
E-mail	pcomesan@gts.tsc.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 capacitates the student to learn new methods and technologies, as well as to give him great versatility to confront and update 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 large carrier, 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
Master Session	24	24	48
Practice in computer rooms	21	31.5	52.5
Troubleshooting and / or exercises	2	8	10
Laboratory practises	6	9	15
Long answer tests and development	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
Master Session	Presentation and discussion of the fundamental theory. Through this methodology the competencies CE9, CE10, CE20, CG3, CG4, CG6, CT2, CT3 are developed

Practice in computer rooms	The concepts presented in class will be further illustrated and developed by means of Matlab-based simulation and signal processing tools. Through this methodology the competencies CE7, CE9, CE10, CG3, CG4, CT2 are developed
Troubleshooting and / or exercises	Students will be given different take-home sets of problems. The answers to selected problems will be provided later on. Through this methodology the competencies CE9, CE10, CG4 are developed
Laboratory practises	Experimental study of different components and effects in analog transmitter/receiver frontends. Through this methodology the competencies CE9, CE10, CG3, CG6, CT2 are developed

Personalized attention

Methodologies	Description
Laboratory practises	Student aid will be provided during office hours as well as on-line (email, chat). On-line discussion forums will be set up for each chapter, through the usual e-learning platform.
Master Session	Student aid will be provided during office hours as well as on-line (email, chat). On-line discussion forums will be set up for each chapter, through the usual e-learning platform.
Practice in computer rooms	Student aid will be provided during office hours as well as on-line (email, chat). On-line discussion forums will be set up for each chapter, through the usual e-learning platform.
Troubleshooting and / or exercises	Student aid will be provided during office hours as well as on-line (email, chat). On-line discussion forums will be set up for each chapter, through the usual e-learning platform.

Assessment

	Description	Qualification	Training and Learning Results		
Long answer tests and development	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 continuous assesment. Four tests: 10% the first, 15% the second, 15% the third, and 60% the fourth.

The three first will realise roughly in the weeks 5, 9, and 14. The results will give to know in a reasonable time from his realisation. These tests are not recoverable, that is to say, if a student can not realise them in the moment in that they take place, the instructors do not have the obligation of repeating them. Each test will evaluate the exposed concepts in the subject from its start until the previous week to its realisation, included. The fourth test will be a version reduced of the examination that will realise those who do not choose continuous assesment.

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

Students will be graded as long as they make any test (either the short tests, or the final examination). Students will be considered to choose continuous assesment as long as they make any short answer test. Students choosing final assesment will only make the final exam.

Students who chose continuous assesment and did not pass the subject, will receive the "fail" mark, independently of doing the final exam or not.that

The achieved mark will be kept for the retest, but not for subsequent years.

During the retest those students who chose continuous assessment will be allowed to choose if they wish to keep the mark achieved in the short tests, or if they want to be 100% assessed by the final exam.

Sources of information

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

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

Leon W. Couch, **Digital & Analog Communication Systems**, 7,

Bernard Sklar, **Digital Communications: Fundamentals and Applications**, 2,
J. G. Proakis, M. Salehi, **Fundamentals of Communication Systems**, 1,
B. Razavi, **RF Microelectronics**, 1,
R. Sobot, **Wireless communication electronics : introduction to RF circuits and design techniques**, 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.