

IDENTIFYING DATA				
Principles of Digital Communications				
Subject	Principles of Digital Communications			
Code	V05G300V01613			
Study programme	(*)Grao en Enxeñaría de Tecnoloxías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language				
Department				
Coordinator	González Prelcic, Nuria			
Lecturers	Comesaña Alfaro, Pedro González Prelcic, Nuria Márquez Flórez, Óscar Willian			
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General description	(*)Os obxectivos básicos da materia son os seguintes: - Aplicar criterios de optimización para a realización de esquemas de estimación e sincronización en receptores dixitáis de comunicacións. - Diferenciar os bloques e as funcionalidades dun sistema de transmisión de datos completo. - Utilizar o procesado dixital de sinais para transmitir e recibir formas de onda analóxicas - Aplicar os mecanismos básicos de redución do impacto de ruído nun sistema de comunicacións.			

Competencies	
Code	
A3	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
A4	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.
A35	CE26/ST6 The ability to analyze, codify, process and transmit multimedia information using analogical and digital signal processing techniques.
B2	To approach a new problem considering first the essential and then the secondary aspects

Learning aims		
Expected results from this subject		Training and Learning Results
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	A3	
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.	A4	
CE26/ST6 The ability to analyze, codify, process and transmit multimedia information using analogical and digital signal processing techniques.		B2
CG11: To approach a new problem considering first the essential and then the secondary aspects	A35	

Contents	
Topic	
1. Introduction to digital communications.	- The software radio concept. - Elements of a digital receiver. - Quality objectives in a digital receiver

2. Timing recovery	- Introduction to the problem. - Decision directed timing recovery. - Timing recovery via Ouput Power maximization.
3. Carrier recovery.	- Phase estimation with known frequency. - The Phase Locked Loop. - The Costas Loop. - Decision directed phase tracking. - Frequency tracking.
4. Equalization	- Equivalent discrete time channel. - Least Squares (LS) equalization. - Adaptation algorithms: trained, decision directed, blind.
(*)5. Codificación de canle.	(*)- Medida da información. Entropía. - Capacidade de canle. - Codificación de canle. Ganancia de codificación.
5. Coding	- Entropy. - Channel capacity. - Channel coding. Coding gain.

Planning

	Class hours	Hours outside the classroom	Total hours
Troubleshooting and / or exercises	4	12	16
Laboratory practises	12	36	48
Projects	7	35	42
Master Session	17	25	42
Long answer tests and development	2	0	2

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

Methodologies

	Description
Troubleshooting and / or exercises	Some of the proposed problems for each topic will be solved in class.
Laboratory practises	The concepts presented in class will be further illustrated and developed by means of Matlab-based simulation and signal processing tools
Projects	Development of a complete PAM and QAM modem in Matlab. Work in small groups.
Master Session	Presentation and discussion of the fundamental theory

Personalized attention

Methodologies	Description
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.
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.
Projects	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
Laboratory practises	Three short tests will be given during the semester	30
Projects	The project will be evaluated at the end of the semester.	30
Long answer tests and development	Final exam.	40

Other comments on the Evaluation

For those students that opt by continuous evaluation the final note will obtain eat:

*Npuntuables+*Nproyecto+*Nexamen

Being *Npuntuables the note accumulated in the scored short exercises, until a maximum of 3 points; *Nproyecto the note of the practical project until a maximum of 3 points, and *Nexamen the note of the final examination until a maximum of 4 points. To approve the *asignatura a student has to have a minimum of 4 points over 10 in the exam; but it reaches this minimum the final note of the student will be the obtained in the examination, although it have opted by continuous evaluation.

For the students that do not opt by continuous evaluation, the final note will be the obtained in the final examination.

The final examination will be the same for the two types of evaluation; only it will change his weight in the final note according to the student opt or no by continuous evaluation.

The student has to decide, after the realisation of the second race, if it opts by continuous evaluation or no, communicating it to the professor inside the term that *estableza. The students that opted by the continuous evaluation and did not approve the matter will receive the qualification of "suspense" *independentemente that they present to the final examination or no.

The note of the scored conserves for the announcement of Julio, but no for back courses. In the examination of the announcement of Julio the students that opt by continuous evaluation will be able to choose if they wish to keep the note obtained in the races and project, or be evaluated only by the final examination with a weight of 100%.

Sources of information

C. R. Johnson Jr y W. A. Sethares, **Telecommunication breakdown: Concepts of communication transmitted via software-defined radio**,

J.R. Barry, E. A. Lee y D. G. Messerschmitt, **Digital communication,**, 3rd edition,

A. Artés Rodríguez, F. Pérez González y otros,, **Comunicaciones Digitales**,

Recommendations

Subjects that it is recommended to have taken before

Signal Transmission and Reception Techniques/V05G300V01404
Multimedia Signal Processing/V05G300V01513