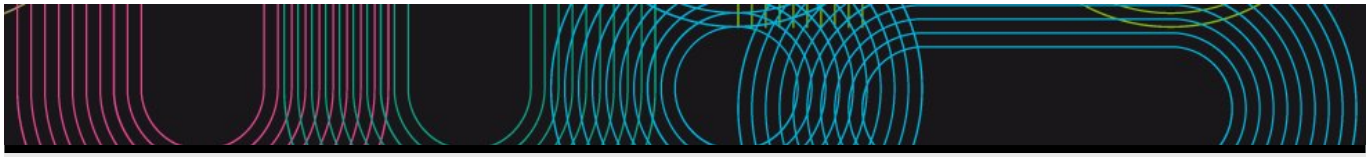

IDENTIFYING DATA				
(*)Comunicacións Dixitais Avanzadas				
Subject	(*)Comunicacións Dixitais Avanzadas			
Code	V05M145V01211			
Study programme	(*)Máster Universitario en Enxeñaría de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Mandatory	1st	2nd
Teaching language	English			
Department				
Coordinator	Pérez González, Fernando			
Lecturers	Mosquera Nartallo, Carlos Pérez González, Fernando			
E-mail	fperez@gts.uvigo.es			
Web				
General description	This course presents advanced topics in digital communications with emphasis on modulations, coding and detection. Teaching and exams are in English.			

Competencies	
Code	
A6	CG1 The ability to project, calculate and design products, processes and facilities in telecommunication engineering areas.
A9	CG4 The capacity for mathematical modeling, calculation and simulation in technological centers and engineering companies, particularly in research, development and innovation tasks in all areas related to Telecommunication Engineering and associated multidisciplinary fields.
A13	CG8 The ability to apply acquired knowledge and to solve problems in new or unfamiliar environments within broader and multidiscipline contexts, being able to integrate knowledge.
A19	CE1 The ability to apply methods of information theory, adaptive modulation and channel coding, as well as advanced techniques of digital signal processing systems and audiovisual communications.
A20	CE2 The ability to develop radio communication systems: antenna, equipment and subsystems design; channel modeling; link budgeting; and planning.
A21	CE3 The ability to implement systems by cable, line, satellite, in fixed and mobile communication environments.

Learning aims		
Expected results from this subject	Typology	Training and Learning Results
Design transmitters, receivers and measurement equipment for modern digital communication systems.	know Know How	A6 A9 A13 A19 A20 A21
Handle the mathematical tools needed to model, simulate and evaluate moderns communication systems.	know Know How	A6 A9 A13 A19 A20 A21

Solve problems whose solution does not derive from the application of a standardized procedure.	Know How	A6 A9 A19 A20 A21
Understand the principles underlying modern communication standards.	know	A6 A19

Contents

Topic	
Lectures 1-3: MIMO communications	- Introduction. Array, spatial diveristy and spatial multiplexing gains. MIMO channel and signal models. - MIMO transmitter design. Principles of precoding for MIMO. Space-time coding. Multiuser MIMO transmitter design. - MIMO receiver design. Multiuser MIMO receiver design.
Lecture 4: Synchronization and spectrum sensing in cognitive radio.	- Motivation and requirements. Spectrum management. Synchronization in cognitive radio. Spectrum sensing.
Lecture 5: Dirty paper coding.	- Code design. Costa's theorem. Opportunistic low SNR codes. Applications in downlink channels.
Lecture 6: OFDM and beyond.	- Principles of orthogonal frequency division multiplexing. Filterbanks and multicarrier. Cooperative diversity.
Lecture 7: Information theory for communications: a field guide.	- Basics of information theory. Shannon's capacity. MIMO channel capacity. Capacity of multiple access channels. Broadcast channel capacity.

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practises	15	30	45
Master Session	15	55	70
Long answer tests and development	0	2	2
Reports / memories of practice	0	8	8

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

Methodologies

	Description
Laboratory practises	Lab practices will cover different aspects of multiple-input multiple-output (MIMO) communications. This will allow students to practically implement and considerably expand some of the concepts seen in the lectures. Competences: CG1, CG4, CE1, CE2, CE3
Master Session	The course is structured in several advanced topics in digital communications with emphasis on multiple-input multiple-output (MIMO) communications. Competences: CG1, CG4, CG8, CE1, CE2, CE3

Personalized attention

Methodologies	**Description**
Master Session	Students will have the opportunity to meet in person with the instructor at some office hours that will be announced at the beginning of the course. The schedule will published in the course webpage.
Tests	**Description**
Reports / memories of practice	Students will have the opportunity to meet in person with the instructor at some office hours that will be announced at the beginning of the course. The schedule will published in the course webpage.

Assessment

	Description	Qualification
Long answer tests and development	Final exam with short questions on the contents of the subject. Competences: CG1, CG4, CG8, CE1, CE2, CE3	50

Reports / memories of practice	Reports of the practices that employ the techniques seen in the classroom.	50

Competences: CG1, CG4, CG8, CE1, CE2, CE3

Other comments on the Evaluation

A minimum score of 35% with respect to the maximum possible score in the final exam is required to pass the course.

In those cases in which the student decides not to carry out the continuous evaluation tasks, the final score will be solely based on the exam with questions of the subject. This applies as well to the second call.

Once the student turns in any of the deliverables, he/she will be considered to be following the continuous evaluation track. Any student that chooses the continuous evaluation track will get a final score, regardless of he/she takes the final exam.

Continuous evaluation tasks cannot be redone after their corresponding deadlines, and are only valid for the current year.

Sources of information

Ezio Biglieri et al., **MIMO Wireless Communications**, First,

David Tse and Pramod Viswanath, **Fundamentals of Wireless Communication**, First,

Ezio Bliglieri et al., **Principles of Cognitive Radio**, First,

Behrouz Farhang-Boroujeny, **Signal Processing Techniques for Sotware Radios**, Second,

Thomas Cover and Joy Thomas, **Elements of Information Theory**, Second,

Recommendations

Subjects that continue the syllabus

(*)Sistemas Avanzados de Comunicacións/V05M145V04312