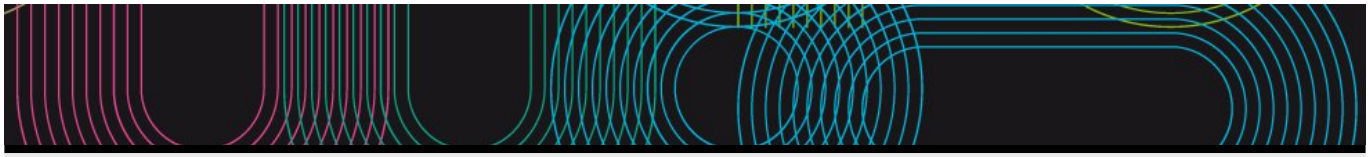

IDENTIFYING DATA				
(*)Tratamento de Sinal en Comunicacións				
Subject	(*)Tratamento de Sinal en Comunicacións			
Code	V05M145V01102			
Study programme	(*)Máster Universitario en Enxeñaría de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Mandatory	1st	1st
Teaching language	Spanish			
Department				
Coordinator	López Valcarce, Roberto			
Lecturers	González Prelcic, Nuria López Valcarce, Roberto			
E-mail	valcarce@gts.uvigo.es			
Web				
General description	This course presents several of the signal processing techniques most commonly found in the design and implementation of communication systems, with focus on digital processing schemes. Covered aspects include sampling and quantization, block and adaptive estimation, block transform coding, efficient resampling and filtering methods.			

Competencies	
Code	
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
Ability to apply multirate processing, adaptive filtering, block-based transform and spectral estimation techniques to communication and multimedia systems	Know How	A9 A19
Ability to implement advanced signal processing techniques in diverse fields of application: bioengineering, bioinformatics, etc.	Know How	A13
Ability to apply signal processing techniques to the modeling and simulation of communication systems	Know How	A9 A19 A20
Ability to simulate the physical layer of cable, wireline, satellite systems in fixed/mobile communication environments.	Know How	A9 A20 A21

Contents
Topic

Chapter 1: Block-based Transforms in Communications and Multimedia	- DFT: formulation and properties. - Frequency Analysis based on DFT. Windowing. - DFT-based digital modulation schemes: DMT, OFDM. - DCT: formulation and properties. - Transform domain coding.
Lab Assignment 1: Sampling and quantization	- Aliasing - Baseband and bandpass sampling - Quantization noise - Converter overload - Spurious-free dynamic range - Sampling jitter
Lab Assignment 2: Simulation of a multicarrier-based digital communication system	-Experimental study of the diverse effects and tradeoffs involved in the design of the transmitter and receiver of a multicarrier communication system.
Chapter 2: Statistical Signal Processing	- Parameter estimation: framework and estimators - Least Squares and Minimum Mean Squared Error problems - Power spectral density estimation: Welch's periodogram
Lab Assignment 3: Adaptive Filtering	- LMS and NLMS Algorithms - Simulation in a channel equalization context - Simulation in an echo/interference cancellation context
Chapter 3: Multirate Processing and Filter Banks	- Sampling rate conversion: decimation, interpolation, multirate filters - Filter Banks: framework, classes. The DFT as a filter bank. Wavelet transform and application to image coding. - Efficient implementation: polyphase decomposition. Filter banks as transmultiplexers.
Lab Assignment 4: Design and implementation of a polyphase channelizer.	- Application of the polyphase filter architecture to the design of a wideband receiver, efficiently separating the signals present in the different channels.
Final Project	- The student will develop the design of a signal processing system involving several aspects covered during the course, and meeting a series of specifications/requirements.

Planning

	Class hours	Hours outside the classroom	Total hours
Master Session	28	28	56
Autonomous practices through ICT	0	40	40
Tutored works	10	10	20
Long answer tests and development	2	0	2
Reports / memories of practice	0	5	5
Jobs and projects	0	2	2

*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 of main topics, possibly with audiovisual aids. Applied/theoretical problem sessions.
Autonomous practices through ICT	Computer-based simulation of signal processing applications to communications and multimedia.
Tutored works	Under the guidance of the instructor, the student will develop the design and/or simulation of a signal processing system involving several of the techniques studied during the course.

Personalized attention

Methodologies	Description
Tutored works	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

Assessment

	Description	Qualification
Long answer tests and development	Final test in which the student must solve a series of exercises. With this methodology, skills A19, A20 and A21 are assessed.	40

Reports / memories of practice	Written reports corresponding to the different lab assignments. With this methodology, skills A9, A19, A20 and A21 are assessed.	40
Jobs and projects	Written report describing the developed design and obtained results for the final project. With this methodology, skills A9 and A13 are assessed.	20

Other comments on the Evaluation

Final grade will consist of:

- comprehensive test (up to 4 points)

- lab reports (up to 4 points)

- final project (up to 2 points)

Lab report grades from the first call will be kept for the second call, in which the student will be allowed to resubmit the final project and/or take a new comprehensive test.

Sources of information

Behrouz Farhang-Boroujeny, **Signal Processing Techniques for Software Radios**, 2nd,

P.P. Vaidyanathan, **Multirate systems and Filter Banks**,

F. Harris, **Multirate Signal Processing for Communication Systems**,

J.G. Proakis and D.G. Manolakis, **Digital Signal Processing**, 4th,

S. Haykin, **Adaptive Filter Theory**, 4th,

S.M. Kay, **Fundamentals of Statistical Signal Processing, Volume I: Estimation Theory**, 1st,

S. Mitra, **Digital Signal Processing: A Computer Based Approach.**, 4th,

The instructors will make available to the students via Faitic all relevant materials related to the course (slides, class notes, etc.)

Recommendations