IDENTIFYING DATA
(*)Procesado de son

Subject	(*)Procesado de son
Code	V05G300V01634
Study programme	(*)Grao en Enxeñaría de Tecnoloxías de Telecomunicación

Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd

Teaching language	Spanish
Department	
Coordinator	Rodríguez Banga, Eduardo
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General description	This course describes the main techniques of the sound processing, with special emphasis on real applications. Students are shown s the basic principles of these techniques and how the same principles may give rise to different algorithms or systems depending on the type of signal to process (speech or audio, for instance). This course also makes an introduction to the principles of underwater acoustic and ultrasounds as well as their applications.

Competencies

Code	
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.
A6	CG6: The aptitude to manage mandatory specifications, procedures and laws.
A43	CE34/SI1The ability to construct, exploit and manage telecommunication services and applications, such as receiving, digital and analogical treatment, codification, transporting and representation, processing, storage, reproduction, management and presentation of audiovisual and multimedia information services.
A46	CE37/SI4 The ability to carry out acoustic engineering projects related to: acoustical isolation and conditioning of rooms, loudspeaker installations, specification, analysis and selection of electro acoustical transducers, measurement, analysis and control of radio vibration systems, environmental acoustics, submarine and acoustical systems.
A47	CE38/SI5 The ability to create, modify, manage, broadcast and distribute multimedia contents taking into account the use and accessibility criteria to audiovisual, broadcasting and interactive services.

Learning aims

Expected results from this subject	Training and Learning Results
CG4.1 The ability to solve problems with initiative and make creative decisions	A4
CG4.2 Ability to communicate and transmit knowledge and skills	A4
CG6 Ease for handling specifications, regulations and norms of forced fulfillment.	A6
IF1.2 Ability to build, exploit and manage telecommunications services and applications, under the perspective of audiovisual services and multimedia information: analog and digital processing, coding, transport, parameterization and storage of the sound.	A43
IF4.4 Ability to develop projects in acoustic engineering: underwater acoustic systems.	A46
IF5.1 Ability to generate and encode multimedia contents, attending to the usability and accessibility criteria of the audiovisual services, and related aspects of broadcasting and interaction: sound.	A47

Contents

Topic

Voice production and perception	Voice generation. Physiology. General characteristics of a speech signal. Perception. Auditive physiology. Hearing aids.
Analysis of speech and audio signals	Short term analysis. Time and spectral parameters. Linear Prediction Techniques. Psychoacoustic models.
Speech coding	Waveform coding. Parametric coding. Standards. Other related applications: speech recognition and synthesis.
Audio Coding	Main characteristics of an audio signal. Time-frequency analysis : filterbanks and transforms. Transform coding. Standards. Related applications: music synthesis and effects.
Underwater acoustics and ultrasounds	Propagation of acoustic waves in water. Applications. Ultrasounds. Applications

Planning

	Class hours	Hours outside the classroom	Total hours
Master Session	21	42	63
Practice in computer rooms	12	9	21
Tutored works	7	57	64
Short answer tests	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
Master Session	The teacher makes a presentation of some relevant contents of the subject. Some concepts may be illustrated by means of computer simulation. Students are encouraged to make questions and discuss some proposed problems and exercises.
Practice in computer rooms	Students will carry out computer simulations using Matlab, which will help them to better understand the concepts introduced in the theory sessions and to discover new ones.
Tutored works	The students will be grouped into teams which will develop one or several tasks proposed by the teacher. The number of students in a team will be established taking into account the number of students enrolled and the complexity of the proposed tasks. Each team work will be supervised by the teacher who, in addition to evaluate the team work, may establish procedures for self and cross evaluation.

Personalized attention

Methodologies	Description
Practice in computer rooms	The teacher will establish mechanisms to determine the degree of understanding of the main concepts by the students. At the regular team meetings the teacher will track the work of each student. If deemed appropriate, the teacher may establish additional mechanisms such as, for instance, self-evaluation and assessment of the student work from their team mates.
Tutored works	The teacher will establish mechanisms to determine the degree of understanding of the main concepts by the students. At the regular team meetings the teacher will track the work of each student. If deemed appropriate, the teacher may establish additional mechanisms such as, for instance, self-evaluation and assessment of the student work from their team mates.

Assessment

	Description	Qualification
Tutored works	The evaluation of a team work will be done through the collection of evidences and/or tests during its developement, at personal ang group levels, a final report and a presentation and/or test about the work. A final report will be delivered to the teacher around the 14th week of the teaching period. The precise date will be established at the beginning of this period.	50
Short answer tests	Final exam with several questions referred to the contents of the subject.	50

Other comments on the Evaluation

The previously proposed evaluation method will apply to students who follow the recommended continuous evaluation (C.E.) procedure.In order to not handicap his potentia lteam mates,the student will have a brief period to decide whether or not follows the C.E. procedure (as an orientation,the first two weeks of the semester). Students attending only the final exam may obtain the maximum grade in the subject. However, these students will have to answer some additional questions related to the proposed team works in order to demonstrate that they have acquired the same skills that students following C.E.

The second call will consist of a final exam, but students who followed C.E. may choose to keep the grade obtained in the team work instead of answering the additional questions related to these works.

Sources of information
Andreas Spanias, Ted Painter and Venkatraman Attii, **Audio Signal Processing and Coding**, Wiley-Interscience,
Wai C. Chu, **Speech Coding Algorithms: Foundation and Evolution of Standardized Coders**, John Wiley & Sons,
X. Lurton, **An Introduction to Underwater Acoustics. Principles and Applications**, Springer,
Douglas O'Shaughnessy, **Speech Communications. Human and Machine**, Wiley-IEEE Press,
Dutoit, T. and Marqués F., **Applied signal processing : a matlab-based proof of concept**, Springer,
Kuttruff, H., **Acoustics. An introduction**, Taylor & Francis,
D. Ensminger and F. B. Stulen, Eds., **Ultrasonics. Data, Equations, and Their Practical Uses**, CRC Press,

Recommendations

Subjects that it is recommended to have taken before
(*)Fundamentos de son e imaxe/V05G300V01405
(*)Procesado dixital de sinais/V05G300V01304

Other comments
It is assumed that the student has some basic skills in Matlab.