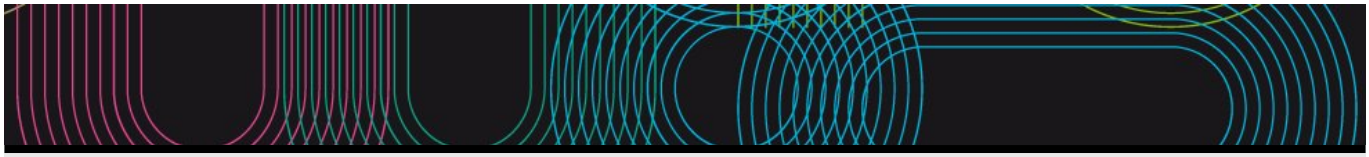

IDENTIFYING DATA				
Sound Processing				
Subject	Sound Processing			
Code	V05G300V01634			
Study programme	Degree in Telecommunications Technologies Engineering - In extinction			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	3rd	1st
Teaching language	Spanish			
Department				
Coordinator	Rodríguez Banga, Eduardo			
Lecturers	Rodríguez Banga, Eduardo			
E-mail	erbanga@uvigo.es			
Web	http://faitic.uvigo.es			
General description	This course describes the main techniques of the sound processing, with special emphasis on real applications. Students are shown 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 Speech Technologies and their applications.			

Competencies	
Code	
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.
C34	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.
C38	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.
D2	CT2 Understanding Engineering within a framework of sustainable development.

Learning outcomes			
Expected results from this subject	Training and Learning Results		
Understand some basic techniques for speech and audio processing.	B4	C34 C38	
Development of basic speech and audio coders.	B4	C34 C38	
Analyse speech and audio specifications and standards.	B4 B6	C34 C38	D2
Understand some basic techniques used in Speech Technologies.	B4	C34 C38	
Ability to adapt learned techniques to other applications.	B4		D2

Contents	
Topic	
Voice production and perception	Voice generation. Physiology. General characteristics of a speech signal. Perception. Auditive physiology.
Analysis of speech and audio signals	Short term analysis. Time and spectral parameters. Linear Prediction Techniques. Psychoacoustic models.

Speech coding	Waveform coding. Parametric coding. Hybrid coding. Standards. Applications.
Audio Coding	Main characteristics of an audio signal. Time-frequency analysis : filterbanks and transforms. Coding. Standards. Applications.
Speech Technologies	Recognition, Synthesis and related applications.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	21	42	63
Practices through ICT	12	9	21
Mentored work	7	57	64
Problem and/or exercise solving	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
Lecturing	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. The main objective of these sessions is to provide the students with the theoretical background so that they can develop all the subject competences. Therefore, every subject competence is developed in these sessions.
Practices through ICT	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. All the subject competences are developed in these sessions.
Mentored work	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. Tutored works are thought to develop CG4 and CG6 competences, as well as CE34, CE38 and CT2.

Personalized assistance

Methodologies	Description
Practices through ICT	The teacher will establish mechanisms to determine the degree of understanding of the main concepts by the students.
Mentored work	At the regular team meetings the teacher will track the work of each student. In addition , the teacher will establish additional mechanisms such as, for instance, cross-evaluation of the student work by his/her team mates.

Assessment

	Description	Qualification	Training and Learning Results		
Mentored work	The evaluation of a team work will be done through the collection of evidences and/or tests during its developement, at personal and 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 13th week of the teaching period. The precise date will be established at the beginning of this period. In order to pass this course a minimum score will be required in the tutored work as explained in the section Other comments on the evaluation.	50	B4 B6	C34 C38	D2
Problem and/or exercise solving	Final exam with several questions referred to the contents of the subject. In order to pass this course a minimum score will be required in the final exam as explained in the section Other comments on the evaluation.	50	B4 B6	C34 C38	D2

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 potential teammates, 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). Selecting C.E implies that the student will be graded in the first call. 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 to demonstrate that they have acquired the same skills that students following C.E.

In exceptional cases, such as long-term justified reasons that unable to follow the C.E. procedure or to take essential assessment tests within the foreseen period, the teacher will decide whether or not it is appropriate to allow the student to change from C.E. to final-exam assessment or to consider him/her 'no show'.

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 works, as described below, instead of answering the additional questions related to these works. In extraordinary calls the evaluation procedure will be equal to the case of opting out C.E.

Students will pass the course if they get a final mark equal to or greater than 5 (on a ten-points scale) and a score equal to or greater than 4 (on the same scale) in both the tutored work and the final exam. The individual mark of the tutored work will be obtained as the sum of the mark of two individual tests (30% of the grade of the tutored work) and the mark obtained jointly by the group (70%), although the latter will be weighted according to the results of the cross-evaluations and the teacher's opinion about the student's personal contribution to the group work. Normally the weighting factor will be 1, although factors less than 1 will be applied to students that hinder the normal progress of the group or show poor participation or understanding in the tasks of the supervised work. Likewise, the teacher will be able to reward those students who stand out significantly for their contribution to the teamwork with a weighting factor of up to 1.2, especially in case of unexpected difficulties. In case of justified absence to any of the individual tests corresponding to the tutored work, the student may recover it by answering some additional questions in the first final exam (or the second one in case of justified absence to the first final exam).

The score obtained jointly by the group (70% of the tutored work mark) will be obtained from the evaluation of the reports corresponding to the tasks assigned and from a joint final presentation. Non-attendance to this presentation, except for a justified reason, will result in a zero as weighting factor. In case of justified absence, the student must contact his/her teacher as soon as possible to ask for an interview in which he/she will have to demonstrate his/her knowledge of the work carried out by the group.

Just in case a student has no grade on the tutored work, or chooses to leave it out at the second call, the score obtained in the group of questions related to the tutored work will be considered the grade on the tutored work and the score on the remaining questions will be the final-exam grade. The final grade will be calculated as the weighted average of the grades of the tutored work (weight 0.5) and the final exam (weight 0.5). These weights could be modified as described in the contingency plan. If a mark of 4 is not reached in both parts (tutored work and final exam) separately, the final grade will be 4 at most.

Students attending the second-call exam, with independence of the assesment track followed, will be able to choose, before starting the exam, to maintain the grade obtained in the first call in any of the two aforementioned parts if equal or higher than 4. Nevertheless they must be aware of the weight of the two parts in the final grade.

The solution to any possible inconsistency, discrepancy or difference of interpretation that may arise from this guide, as well as any error or any other not considered case, will be discussed between the teacher and the directly concerned students and, in case of no agreement, the matter will be referred to the competent higher bodies.

Sources of information

Basic Bibliography

Andreas Spanias, Ted Painter and Venkatraman Attii, **Audio Signal Processing and Coding**, 978-0-471-79147-8, Wiley, 2007

Wai C. Chu, **Speech Coding Algorithms: Foundation and Evolution of Standardized Coders**, 978-0-471-66887-9, Wiley, 2004

Douglas O'Shaughnessy, **Speech Communications. Human and Machine**, 978-0780334496, Second edition, Wiley-IEEE Press, 1999

Boss, M. and Goldberg, R. E., **Introduction to digital audio coding and standards**, 978-1-4615-0327-9, Kluwer Academic Publishers, 2003

Ian Vince McLoughlin, **Speech and Audio Processing: A MATLAB Based Approach**, 978-1-107-08546-6, Cambridge University Press, 2016

Complementary Bibliography

Dutoit, T. and Marqués F., **Applied signal processing : a matlab-based proof of concept**, 978-0-387-74535-0, Springer, 2009

Paul Taylor, **Text-to-Speech Synthesis**, 978-0521899277, Cambridge University Press, 2009

Recommendations

Subjects that it is recommended to have taken before

Fundamentals of Sound and Image/V05G301V01209

Other comments

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

Contingency plan

Description

In case of online teaching (A, B and C groups), it will take place in a synchronous mode.

All the assessment tests provided for in the teaching guide are face-to-face, either oral or written. If not possible, they will be held online.

Based on the experience accumulated during the confinement period in the previous academic year, the following paragraphs complete the initial contingency plan. However, given the unpredictability of the events, further adjustments could be applied to this initial plan.

The teacher will decide, depending on the circumstances and the number of students in the course, whether these tests will be taken orally and whether the group presentation of the tutored work will be done individually, representing in this case the 25% of the grade of the tutored work. If this change takes place, the grade obtained jointly by the group will represent 45% of the supervised work grade, although this part of the grade will still be affected by the weighting factor described in this teaching guide.

Depending on the circumstances, it is also not ruled out to modify the weighting of the tutored work and the final exam (for instance 60% and 40% respectively, instead of the initial 50% each) and/or reorder the evaluated contents. Obviously, the type of online tests/exams, especially if they are oral, may also affect the type of questions and exercises involved, as well as the possible use of support material.

As for the duration of the final exam when it is an oral test, as a guideline, it is planned that for students following continuous assessment the duration will be about 30 minutes, while for those who take the whole final exam the duration will be about 60-90 minutes.

Regarding the exam date, if oral, it will be kept as close as possible to the official examination date for students taking the whole exam, as it is expected that the number of these students will be small. In any case, these students will be contacted to confirm the date and approximate time. For students following C.E., shifts will be established for the oral exam, with the possibility of even starting before the beginning of the official examination period.