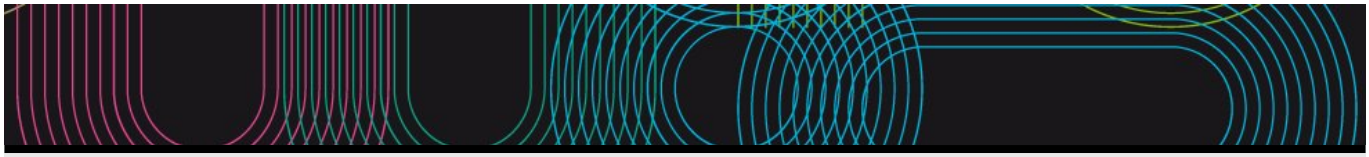

IDENTIFYING DATA

Room Acoustics

Subject	Room Acoustics			
Code	V05G300V01635			
Study programme	(*)Grao en Enxeñaría de Tecnoloxías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Sobreira Seoane, Manuel Ángel			
Lecturers	Cardenal López, Antonio José Sobreira Seoane, Manuel Ángel			
E-mail	msobre@gts.uvigo.es			
Web	http://faitic.uvigo.es			
General description	Architectural acoustics, develops the fundamental theoretical principles of the architectural acoustics, in the fields of room acoustics and acoustic isolation. The aims of the subject are: provide a sufficient theoretical background that allow the understanding of the behaviour of the sound filed in rooms; define the parameters that allow to evaluate the acoustic quality of rooms; develop the techniques of design that allow to optimise the acoustic behaviour of rooms; detail the parameters that allow to evaluate the acoustic isolation in buildings and introduce the problematic of the calculation of the acoustic insulation in the buildings and building elements.			

Competencies

Code	
A2	CG2: The knowledge, comprehension and ability to apply the needed legislation during the development of the Technical Telecommunication Engineer profession and aptitude to manage compulsory specifications, procedures and laws.
A5	CG5: The knowledge to perform measurements, calculations, assessments, appraisals, technical evaluations, studies, reports, task scheduling and similar work to each specific telecommunication area.
A45	CE36/SI3 The capacity to implement projects at places and installations for the production and recording of audio and video signals.
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.

Learning aims

Expected results from this subject	Training and Learning Results
CG2: The knowledge, comprehension and ability to apply the needed legislation related to the subject of Room Acoustics CG5: The knowledge to perform measurements, calculations, assessments, appraisals, technical evaluations, studies, reports, task scheduling and similar work related to the field of Room Acoustics.	A2 A5
CE36/SI 3 The capacity to implement projects at places and installations for the production and recording of audio and video signals. CE37/SI 4.1 The ability to carry out acoustic engineering projects related to: acoustical isolation and conditioning of rooms. CE 37/SI 4.2 The ability to carry out acoustic loudspeaker installations, specification, analysis and selection of electro acoustical transducers and measurements.	A45 A46

Contents

Topic

Introduction	Basic concepts in acoustics. Acoustic power, sound pressure, sound intensity. Levels and decibels.
Statistital theory in acoustics.	Average sound pressure in rooms. Reverberation time: Sabine and Eyring equations.
Absorbents and Acoustic Diffusers.	Porous absorbing materials. Membrane and Helmhotz resonators. Acoustic diffusers.
Wave theory in rooms.	Three dimensional wave equation.Resonant frequencies and resonant modes in rooms. Modal density. Frequency response of rooms. The influence of dimension relations and frequency response.
Geometrical theory.	Method of the virtual image. Reflections in flat surfaces. The acoustic behaviour of curved surfaces
Acoustic design of rooms.	Descriptors of room acoustics. Echoes in rooms. Focalization effects in rooms. Acoustic behaviour of audience: seat dip. Geometrical design of rooms. Design of conference rooms and classrooms. Recording studios: LEDE and Non-Environment design techniques.
Acoustic insulation.	Introduction to the acoustic insulation. Acoustic isolation of single panels. Insulation of double walls. Introduction to the flanking transmission evaluation in buildings. Noise control in buildings.

Planning

	Class hours	Hours outside the classroom	Total hours
Tutored works	7	28	35
Practice in computer rooms	12	9	21
Previous studies / activities	0	15	15
Master Session	19	38	57
Troubleshooting and / or exercises	2	10	12
Short answer tests	2	8	10

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

Methodologies

	Description
Tutored works	Learning aim A45 and A46 are covered through the development of practical tutored works and measurements. The students will have to develop and write a report on three small projects: 1. Design and building Helmholtz and membrane resonators. 2. Design and acoustic measurements on scale models. 3. Software to calculate acoustic reflectors and diffusers
Practice in computer rooms	During practical sessions, the student will learn the use use of software to measure and analyse the impulse response of rooms. (Learning aim A5)
Previous studies / activities	The students must study and prepare with the sources of information given before the lectures and the practical sessions. (Learning aim related to the knowledge of regulations related to room acoustics-Learning aim A2).
Master Session	Lectures will be given, developing the main theoretical concepts of the subject.

Personalized attention

Methodologies	**Description**
Master Session	The doubts, questions and discussions on topics related to the subject can be carried out in tutoring sessions which can be attended either individually or in small groups (maximum 3 students) Previous appointment with the professor is needed. The appointment will be requested and agreed by email, preferably in the hours and places previously scheduled and officially published.
Tutored works	The doubts, questions and discussions on topics related to the subject can be carried out in tutoring sessions which can be attended either individually or in small groups (maximum 3 students) Previous appointment with the professor is needed. The appointment will be requested and agreed by email, preferably in the hours and places previously scheduled and officially published.
Practice in computer rooms	The doubts, questions and discussions on topics related to the subject can be carried out in tutoring sessions which can be attended either individually or in small groups (maximum 3 students) Previous appointment with the professor is needed. The appointment will be requested and agreed by email, preferably in the hours and places previously scheduled and officially published.
Tests	**Description**

Troubleshooting and / or exercises	The doubts, questions and discussions on topics related to the subject can be carried out in tutoring sessions which can be attended either individually or in small groups (maximum 3 students) Previous appointment with the professor is needed. The appointment will be requested and agreed by email, preferably in the hours and places previously scheduled and officially published.
Short answer tests	The doubts, questions and discussions on topics related to the subject can be carried out in tutoring sessions which can be attended either individually or in small groups (maximum 3 students) Previous appointment with the professor is needed. The appointment will be requested and agreed by email, preferably in the hours and places previously scheduled and officially published.

Assessment

	Description	Qualification
Tutored works	Tutored practical project, with the delivery of a final report. The learning aims containing the develompent of the ability to develop projects are assesed through this practical tutored works (SI 3.1, SI 4.1 and SI 4.2.)	35
Practice in computer rooms	Practical tasks, solved in a computer lab with specific acoustic software. Assesment of the practical aspects related to the learning aims CG2 y CG5.	15
Troubleshooting and / or exercises	Written examination, solving calculation problems. Evaluation of the learning aim CG5, mainly in those aspects related to "know how to carry calculations out" in the field of room acoustics.	25
Short answer tests	Short answers related to the theoretical content of the subject. Evaluation of the competence CG2 in the aspects related to knowledge of regulations in the matter of room acoustics.	25

Other comments on the Evaluation

Following the guidelines of the degree, two systems of evaluation are offered: continuous assessment (recommended) and a final examination. Evaluation with only a final examination will be only allowed in situations in which it is imposible to follow the system recommended.

CONTINUOUS ASSESSMENT:

The continuous assessment will be based in the evaluation of practical task, projects and two tests. Once a student has signed a document of agreement with the process of continuous assessment, the final degree will be obtained by the application of the criteria described bellow, even though a student could miss some of the tasks or tests envolved in the process.

The final grade with be obtained from the weighted sum of the grade obtained in the following tasks with the given weights:

1. Tutored works: The students will deliver three reports on tutored works during the weeks 5th, 9th and 14th. The total weight of tutored works on the final grade is 35 %.

2. Reports of practical tasks (Weight: 15 %).

3. Short answer tests : A short answer tests is scheduled around the 6th week. (25 % of the final grade)

4. A second examination, containing problems and exercises is scheduled on the official scheduled date at the end of the semester.(25 % of the final grade)

FINAL EXAMINATION:

A final examination is available for those students that for some reason could not follow the continuous evaluation assessment process. In this case there is date scheduled and officially published for final examination. The final examination will consist in two short answer tests, and some additional questions related with the practical tasks and projects.

The subject is assessed in a 0 to 10 points scale and it is considered "passed" if the final grade obtained is equal or greater than 5.

SECOND CALL:

There is scheduled date in july for a final examination retake, for those students that either dropped out during the semester or failed. Prior the examination, a student can choose to follow the continuous assessment or the final examination. In the former selection, the grades obtained in the projects and practical tasks will be taken into account and the student will only answer to the short answer tests. If the later, (final examination), the student will have also to answer a full examination as described before.

Sources of information
Higini Arau, **ABC de la acústica arquitectónica**,
Phillip R. Newell, **Recording Studio Design**, 3,
Lothar Cremer, **Principles and applications of room acoustics**,

Recommendations
Subjects that continue the syllabus
Advanced Acoustics/V05G300V01933
Noise Measurement Techniques and Regulations/V05G300V01934

Subjects that it is recommended to have taken before
Fundamentals of Sound and Image/V05G300V01405
Fundamentals of Acoustics Engineering/V05G300V01531