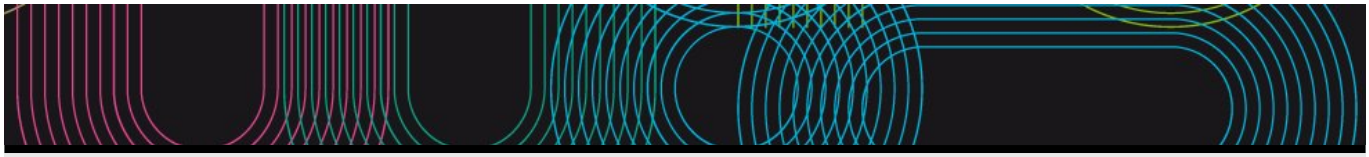

IDENTIFYING DATA

Room Acoustics

Subject	Room Acoustics			
Code	V05G301V01330			
Study programme	Grado en Ingeniería de Tecnologías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Sobreira Seoane, Manuel Ángel			
Lecturers	Sobreira Seoane, Manuel Ángel			
E-mail	msobre@gts.uvigo.es			
Web	http://moovi.uvigo.gal			
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. International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results

Code	
B2	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.
B5	CG5: The knowledge to perform measurements, calculations, assessments, appraisals, technical evaluations, studies, reports, task scheduling and similar work to each specific telecommunication area.
C36	CE36/SI3 The capacity to implement projects at places and installations for the production and recording of audio and video signals.
C37	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.

Expected results from this subject

Expected results from this subject	Training and Learning Results	
Knowledge on the theoretical fundamentals of room acoustics.	B2	C36
Ability to analyse the acoustic behaviour of rooms and identify acoustic problems.	B5	C37
Capacity to design solutions to acoustic problems in rooms.		
Capacity to write expert technical reports on room acoustics measurement test and analysis.		
Ability to check and assess the acoustic quality of rooms.		
Capacity to design different kind of rooms matched to the specific acoustic requirements (recording studios, control rooms, conference rooms and classrooms).		

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. Measurement of reverberation time and absorption coefficient.
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. Measurement of acoustic quality of rooms and practical work on acoustic design of small spaces.
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
Mentored work	7	28	35
Practices through ICT	12	9	21
Previous studies	0	15	15
Lecturing	19	38	57
Problem and/or exercise solving	2	10	12
Problem and/or exercise solving	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
Mentored work	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 Through this methodology the general competencies CG2, CG5 and the specific competency CE36 and CE37 are developed.
Practices through ICT	During practical sessions, the student will learn the use use of software to measure and analyse the impulse response of rooms. Through this methodology the general competencies CG5 and the specific competency CE36 and CE37 are developed.
Previous studies	The students must study and prepare with the sources of information given before the lectures and the practical sessions. Through this methodology the general competencies CG2, CG5 and the specific competency CE36 and CE37 are developed.
Lecturing	Lectures will be given, developing the main theoretical concepts of the subject. Through this methodology the general competencies CG2, CG5 and the specific competency CE36 and CE37 are developed.

Personalized assistance

Methodologies	Description
Lecturing	Lectures are develop within a continuous interaction framework, where students can answer questions delivered by the teacher. They could also solve their particular doubts during the sessions. In any case the students will be able to contact the teacher to request tutoring through the platform of the subject (www.moovi.gal).
Mentored work	Tutored works are developed in small working groups. The works are followed during meetings between the groups and the teacher. In those meetings the students can interact and ask their questions to the teacher.
Practices through ICT	In practical sessions, each student must solve his/her own tasks. The teacher will be available during the session to solve any problem/question or doubt the student may have.

Assessment

	Description	Qualification	Training and Learning Results
Mentored work	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. Each student will give a final presentation on its contribution to the group.	35	C36 C37
Practices through ICT	Practical tasks, solved in a computer lab with specific acoustic software.	15	B2 B5
Problem and/or exercise solving	Written examination, solving calculation problems. Evaluation of the learning aims, mainly in those aspects related to "know how to carry calculations out" in the field of room acoustics. To be done at the end of the semester in the dates agreed and published by the Degree Academic Comitee (Comisión Académica de Grado-CAG).	25	B5
Problem and/or exercise solving	Short answers related to the theoretical content of the subject. Evaluation of the knowledge of regulations in the matter of room acoustics. To be done at the mid of the semester in the dates agreed and published by the Degree Academic Comitee (Comisión Académica de Grado-CAG).	25	B2

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. By default it's assumed all students follow the continuous assessment process unless a written notice of resignation is presented after the first month. The final degree will be obtained by a weighted average of the grades obteined in the methodologies/tests described.

Some considerations on the continous assessment process:

- Tutored works are developed in groups. The final grade will be weighted taking into account the results of a cross assesment survey and the individual final presentation of each student's contribution to the work. To consider as "satisfactory" the contribution of each student to the group a minimum grade of 2 over 5 points is stablished.
    - During the presentation of the work the competences related to analysis, synthesis, mastering of the specific vocabulary of the specialty and his/her presentation and oral exchange skills will be evaluated. 25% of the final grade will be assigned on the basis of the individual presentation of each student.
- The studenst have to show good skills in all the learning outcomes, therefore, four points over a ten points scale must be obtained in all the learning outcomes evaluated during the continuous evaluation process.
- The final grade will be obtained through a weighted average, with the weights included in the qualification column of the methodologies/tests section, once the minimum grade is obtained in each activity.
- In case the final overage is greater than 5 over 10 points, but any of the requirements are not met, the final grade will be 4.9-FAILED.

Final examination: The final examination, (both, ordinary and extraordinary exams) will include two parts:

- A written examination covering a short anwer tests and a troubleshouting part.
- Practical activities: practical questions and delivering the reports of a practical work the teacher may ask.
- The final examination will be develpoped on the official dates published by the accademic staff.

Those students who have passed the subject following the continuous assessment proccess, will have the chance to attend the final examination in order to get a higher grade (either in the written part or the practical activities or both).
Those students who did not succeed in some of the parts of the evaluation proccess, will have the chance to do only the part of the final examination required to fullfill the requirement.
If the subject is passed in first chance, there is no chance to attend the second opportunity to improve the final grade.

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.

NON CONTINUOUS ASSESSMENT:

If a student does not sign the agreement to follow the continous assesment proccess, he/she will be evaluated through the final examination, with the same structure as commented before. The student have to show he/she has got the same skills as the students who have followed the continuous assessment proccess. The final grade will be obtained by averaging the grades of each part (written examination+ practical questions and reports) provided at least of 4 over 10 points have been obtained en each part. The final grade should be greater than 5 over 10 points.

EXTRAORDINARY CALL:

The same criteria as the established in case of non continuous assessment will be followed for the extraordinary call.

Sources of information

Basic Bibliography

Higini Arau, **ABC de la acústica arquitectónica**,
Heinrich Kuttruff, **Room Acoustics**, 5,
Manuel A. Sobreira, **Acústica Arquitectónica (Apuntes de la Asignatura)**,

Complementary Bibliography

Phillip R. Newell, **Recording Studio Design**, 3,
Lothar Cremer, **Principles and applications of room acoustics**,

Recommendations

Subjects that it is recommended to have taken before

Fundamentals of Sound and Image/V05G301V01209
Fundamentals of Acoustics Engineering/V05G301V01327