



IDENTIFYING DATA

Fundamentals of Acoustics Engineering

Subject	Fundamentals of Acoustics Engineering			
Code	V05G300V01531			
Study programme	(*)Grao en Enxeñaría de Tecnoloxías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	3rd	1st
Teaching language	Spanish			
Department				
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Lecturers	Pena Giménez, Antonio Torres Guijarro, María Soledad			
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General description	Concepts covered by the subject: vibratory systems related to the acoustic wave equation, radiation and propagation, mechanisms of acoustic-mechanical-electrical transduction, behaviour and design of speakers and microphones.			

Competencies

Code				
A3	CG3: The knowledge of basic subjects and technologies that capacitates the student to learn new methods and technologies, as well as to give him great versatility to confront and update to new situations			
A43	CE34/SI1 The 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.			
B2	To approach a new problem considering first the essential and then the secondary aspects			

Learning aims

Expected results from this subject	Training and Learning Results	
Results of learning:	A3	B2
<input type="checkbox"/> Evaluate the different types of microphones from the point of view of their technical specifications and their possible applications.	A43	
<input type="checkbox"/> Describe the acoustic wave radiation phenomenon.		
<input type="checkbox"/> Understand the basic mechanisms of mechanical-acoustic transduction.		
<input type="checkbox"/> Analyze electro-mechanical systems using acoustic analogies based on circuit theory.		
<input type="checkbox"/> Design acoustic systems using speakers, cabinets and horns.		
Results of learning:	A3	B2
<input type="checkbox"/> Understand the basic mechanisms of vibration of different elements and understand their relationship with sound production.	A46	
<input type="checkbox"/> Learn the basics of linear acoustics and relate the concepts of pressure, particle velocity, current, power and impedance.		
<input type="checkbox"/> Explain the sound propagation phenomena and analyze the influence of the medium		

Contents

Topic	
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1. Sound power measurement tests.	Acoustic variables. Sound field. Propagation. Uses of intensity and power. Sound intensity probes. Power measurement standards using acoustic pressure or intensity.
2. Models of radiation sources.	Directivity. Acoustic impedance. Monopole. Dipole. Monopole on infinite baffle. Baffled circular piston. Directivity measurement standards.
3. Vibrating systems.	Damped and forced oscillatory motion. Vibration of strings, bars, membranes and plates. The sound in tubes. Sound sources. Acoustic filters.
4. Specifications and measurement of electroacoustic systems.	Introduction to loudspeakers: baffles and crossovers. Acoustic measurement tests: measurement of speakers. Measurement of noise and nonlinear distortion.
5. Analogies and transduction.	Electro-mechano-acoustic systems. Equivalent circuits. Transduction
6. Speakers, horns and cabinets.	Equivalent model of an infinite baffle loudspeaker. Equivalent model of a cabinet with speaker. Horns.
7. Cabinet design.	
8. Microphones.	A microphone equivalent model. Tank circuits.

Planning

	Class hours	Hours outside the classroom	Total hours
Troubleshooting and / or exercises	3	6	9
Practice in computer rooms	11	19	30
Projects	7	45	52
Master Session	19	38	57
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
Troubleshooting and / or exercises	Given a certain situation, students should obtain the reasoned suitable solution, properly choosing the applicable formulas and arriving to a valid solution. This methodology is targeted to competency B2.
Practice in computer rooms	Handle and adjustment of tools of analysis and algorithms, identifying which is appropriate for a given situation. This methodology is targeted to competencies A43 and A46.
Projects	Collaborative work in reduced groups related to lab tests. Role assignments, working in common, planning and report writing. This methodology is targeted to competency A46.
Master Session	Oral speech, promoting the critical discussion of the concepts. Theoretical bases of algorithms and procedures used to solve problems are presented. This methodology is targeted to competencies A3, A43 and A46.

Personalized attention

Methodologies	Description
Master Session	Tutoring to solve issues related to master sessions or lab practice is implemented: -> Individually or -> in reduced groups (no more than 2-3 students). E-mail confirmation to match the date of the appointment is needed. ----- During group projects an individualized tracking of the student is developed. Cross-assessment within the group and self-assessment may be used.
Troubleshooting and / or exercises	Tutoring to solve issues related to master sessions or lab practice is implemented: -> Individually or -> in reduced groups (no more than 2-3 students). E-mail confirmation to match the date of the appointment is needed. ----- During group projects an individualized tracking of the student is developed. Cross-assessment within the group and self-assessment may be used.
Practice in computer rooms	Tutoring to solve issues related to master sessions or lab practice is implemented: -> Individually or -> in reduced groups (no more than 2-3 students). E-mail confirmation to match the date of the appointment is needed. ----- During group projects an individualized tracking of the student is developed. Cross-assessment within the group and self-assessment may be used.
Projects	Tutoring to solve issues related to master sessions or lab practice is implemented: -> Individually or -> in reduced groups (no more than 2-3 students). E-mail confirmation to match the date of the appointment is needed. ----- During group projects an individualized tracking of the student is developed. Cross-assessment within the group and self-assessment may be used.

Assessment

Description	Qualification
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Practice in computer rooms	Assessment of the reports describing the results obtained in the computer classroom. Targeted to assess competencies A43 and A46.	15
Projects	Assessment of the work realised in group along the semester, including the preparation of reports. Targeted to assess competency A46.	35
Short answer tests	Written exam, with brief questions and problems. Targeted to assess competencies A3, B2, A43 and A46.	50

Other comments on the Evaluation

Following the guidelines of the studies, two evaluation systems will be offered to the students inscribed on this subject: continuous evaluation (the preferred method, academic activities are linked to this system) and evaluation at the end of the semester (not recommended).

* Students who choose continuous evaluation:

Students follow the continuous evaluation system if they assign a document that will be delivered and collected during weeks 1-3, so the collaborative work can begin. Three tasks are evaluated. The approximate task calendar and the weight of each task in the final grade are listed below.

- * Reports / memories of practice (Weight: 15%) collected approximately once a week.
- * Written exam (weight: 50%): At the end of the semester, the same day when the final exam is planned.
- * Collaborative work in a group C (weight: 35%): during the semester each group develop several reports related to the laboratory tests. These reports must be delivered approximately once per week.

To ensure that all competencies are acquired, it will be necessary to fulfill these two conditions to pass:

- 1) to obtain a grade equal to or greater than 4 (on a scale of 0 to 10), in the set of activities of each type.
- 2) to obtain an overall mark, calculated as the sum of the scores of activities weighted correspondingly, equal to or greater than 5 (on a scale of 0 to 10)

* Students who choose for evaluation at the end of the semester:

The possibility of a final examination will be provided to students who do not opt for the continuous evaluation. This final exam will cover all the activities of the subject. To ensure that all competencies are acquired, it will be necessary to fulfill these two conditions: to pass the exam

- 1) to obtain a grade equal to or greater than 4 (on a scale of 0 to 10), in each of the sections in which the test is divided. The sections correspond respectively to the contents covered by:

- * Master classes
- * Simulation practices
- * Measurement tests performed in the laboratory.

- 2) to obtain an overall grade in the examination equal to or greater than 5 (on a scale of 0 to 10).

RETAKE

Two different situations:

=> Students that are evaluated using continuous evaluation:

Two options to choose (just before the exam begins):

- * Perform the short answer test again on the official date assigned by the Center and be evaluated as stated in the above section "Students who choose continuous evaluation".
- * be evaluated with the same final exam as stated in the above section □Students who choose for evaluation at the end of the semester□.

=> Students who choose for evaluation at the end of the semester:

A final examination will be provided to students who do not opt for the continuous evaluation. This final exam will be assessed as stated in the above section □Students who choose for evaluation at the end of the semester□.

Sources of information

Lawrence E. Kinsler, **Fundamentals of acoustics**,

Basilio Pueo Ortega, Miguel Romá Romero, **Electroacústica : altavoces y micrófonos**,

W. Marshall Leach, Jr., **Introduction to electroacoustics and audio amplifier design**,

Finn Jacobsen et al., **FUNDAMENTALS OF ACOUSTICS AND NOISE CONTROL**,

Besides the literature mentioned the student will have as support material:

- Scripts of theory: this material contains the theoretical basis of what is discussed in more detail in the master sessions.
- Scripts of practices: formulations and problems of each practice session.
- Copy of the artwork used in the master sessions.
- Tasks and proposed problems.

Recommendations

Subjects that continue the syllabus

Room Acoustics/V05G300V01635

Audiovisual Technology/V05G300V01631

Subjects that are recommended to be taken simultaneously

Audio Systems/V05G300V01532

Subjects that it is recommended to have taken before

Physics: Analysis of Linear Circuits/V05G300V01201

Physics: Fields and Waves/V05G300V01202

Physics: Fundamentals of Mechanics and Thermodynamics/V05G300V01102

Fundamentals of Sound and Image/V05G300V01405
