



IDENTIFYING DATA

Fundamentals of Acoustics Engineering

Subject	Fundamentals of Acoustics Engineering			
Code	V05G306V01327			
Study programme	Grado en Ingeniería de Tecnologías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	3rd	1st
Teaching language	Spanish			
Department				
Coordinator	González Valdés, Borja			
Lecturers	González Valdés, Borja			
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General description	<p>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.</p> <p>English Friendly subject: 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.</p>			

Training and Learning Results

Code	
B3	CG3: The knowledge of basic subjects and technologies that enables the student to learn new methods and technologies, as well as to give him great versatility to confront and adapt to new situations
B5	CG5: The knowledge to perform measurements, calculations, assessments, appraisals, technical evaluations, studies, reports, task scheduling and similar work to each specific telecommunication area.
B6	CG6: The aptitude to manage mandatory specifications, procedures and laws.
B9	CG9: The ability to work in multidisciplinary groups in a Multilanguage environment and to communicate, in writing and orally, knowledge, procedures, results and ideas related with Telecommunications and Electronics.
B11	CG11 To approach a new problem considering first the essential and then the secondary aspects
C34	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.
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.
D3	CT3 Awareness of the need for long-life training and continuous quality improvement, showing a flexible, open and ethical attitude toward different opinions and situations, particularly on non-discrimination based on sex, race or religion, as well as respect for fundamental rights, accessibility, etc.
D4	CT4 Encourage cooperative work, and skills like communication, organization, planning and acceptance of responsibility in a multilingual and multidisciplinary work environment, which promotes education for equality, peace and respect for fundamental rights.

Expected results from this subject

Expected results from this subject	Training and Learning Results
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* Understand the basic mechanisms of vibration of distinct elements and interpret his relation with the production of sound.	B3 B11	C34 C37
* Know the bases of the linear acoustics and understand the concepts of pressure, speed of particle, intensity, power and impedance.		
* Understand the phenomena of propagation of the sound and to analyse the influence of the medium.		
* Understand the phenomenon of the radiation of acoustic waves.		
* Understand the basic mechanisms of the *transducción mechanical-acoustic.		
* Analyse electro-mechanical-acoustic systems by the use of analogies which are based on circuit theory.	B3 B5 B11	C34 C37
* Design acoustic systems by using speakers, acoustic boxes and horns.		
* Analyse different types of microphones from the point of view of their technical specifications and their possible applications.		
* Comprender los principios básicos y aplicaciones concretas de los ultrasonidos.		
* Understanding of basic principles and specific applications of ultrasounds		
* Understanding of basic principles and specific applications of underwater acoustics		
* Interpret technical specifications within working teams.	B6	C34
* Apply norms of measuring.	B9	C37
* Elaborate trial procedures.	B11	
* Develop trial procedures.		
* Process data obtained from trials		
* Program processing algorithms.		
* Value technical results.		
* Write trial reports.		
* Cooperate and collaborate in working groups to carry out technical projects.		D3
* Adapt to new surroundings.		D4
* Accept the role allocation in a group.		
* Contribute to the resolution of conflicts.		

Contents

Topic	
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.	Techniques and design criteria of acoustic boxes
8. Microphones.	A microphone equivalent model. Tank circuits.
9. Submarine acoustics and ultrasounds	Submarine acoustics. Ultrasounds

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	17	38	55
Autonomous problem solving	0	44	44
Practices through ICT	13	0	13
Laboratory practical	6	6	12
Problem solving	0	20	20
Problem and/or exercise solving	2	0	2
Objective questions exam	1	0	1
Problem and/or exercise solving	1	0	1
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	Oral speech, promoting the critical discussion of the concepts. Theoretical bases of algorithms and procedures used to solve problems are presented. CG3, CG5, CG11, CE34, CE37.
Autonomous problem solving	Individual resolution of exercises as a practical application of the theoretical bases and procedures described in the master sessions. Given a specific situation, the student has to obtain the suitable solution, in a reasoned way, by properly choosing the appropriate formulas and coming to a valid solution. CG3, CG5, CG11, CE34, CE37.
Practices through ICT	Handle and adjustment of tools of analysis and algorithms, in group, identifying which is appropriate for a given situation. CG3, CG5, CG6, CG9, CG11, CE34, CE37, CT3, CT4.
Laboratory practical	Cooperative and collaborative work with measuring equipment in reduced groups, and registering of acoustic magnitudes, in laboratory environments. CG3, CG5, CG6, CG9, CG11, CE34, CE37, CT3, CT4.
Problem solving	Give solution to exercises, relative to practice sessions. CG3, CG5, CG6, CG11, CE34, CE37.

Personalized assistance

Methodologies	Description
Lecturing	Doubts may be solved in the tutorial classes. These will take place in the following way: - Individually or in small groups (typically with a maximum of 2-3 people). - Unless the contrary is specified, previous appointment with the professor will be required. The appointment will be requested and acknowledged by email or at moovi.uvigo.gal. Place and time will preferably be as officially scheduled.
Practices through ICT	Doubts may be solved in the tutorial classes. These will take place in the following way: - Individually or in small groups (typically with a maximum of 2-3 people). - Unless the contrary is specified, previous appointment with the professor will be required. The appointment will be requested and acknowledged by email or at moovi.uvigo.gal. Place and time will preferably be as officially scheduled.
Problem solving	Doubts may be solved in the tutorial classes. These will take place in the following way: - Individually or in small groups (typically with a maximum of 2-3 people). - Unless the contrary is specified, previous appointment with the professor will be required. The appointment will be requested and acknowledged by email or at moovi.uvigo.gal. Place and time will preferably be as officially scheduled.
Autonomous problem solving	Doubts may be solved in the tutorial classes. These will take place in the following way: - Individually or in small groups (typically with a maximum of 2-3 people). - Unless the contrary is specified, previous appointment with the professor will be required. The appointment will be requested and acknowledged by email or at moovi.uvigo.gal. Place and time will preferably be as officially scheduled.
Laboratory practical	Doubts may be solved in the tutorial classes. These will take place in the following way: - Individually or in small groups (typically with a maximum of 2-3 people). - Unless the contrary is specified, previous appointment with the professor will be required. The appointment will be requested and acknowledged by email or at moovi.uvigo.gal. Place and time will preferably be as officially scheduled.

Assessment

	Description	Qualification	Training and Learning Results		
Practices through ICT	Attendance to the practices at computer classroom.	1.5	B3 B5 B6 B9 B11	C34 C37	D3 D4
Laboratory practical	Attendance to the laboratory practices	2.5	B3 B5 B6 B9 B11	C34 C37	D3 D4
Problem and/or exercise solving	Written exam, with brief questions and problems	1	B3 B5 B11	C34 C37	
Objective questions exam	Exam on the work done in the computer classroom.	13.5	B3 B5 B6 B11	C34 C37	

Problem and/or exercise solving	Exam on the exercises of the laboratory practices.	22.5	B3 B5 B6 B11	C34 C37	
Problem and/or exercise solving	Written exam, with brief questions and problems 2	30	B3 B5 B11	C34 C37	D3 D4

Other comments on the Evaluation

Following the guidelines of the studies, two assessment systems will be offered to the students inscribed on this subject:

Continuous assessment (the preferred method, academic activities are linked to this system) and exam-only assessment (not recommended).

Weighting:

- * Magister sessions. Individual assesment. (weight: 60%)
- * Practises in computer rooms. Individual assesment. (weight: 15%)
- * Laboratory practises. Individual assesment. (weight: 25%)

*** Students who choose continuous assessment:**

Students will follow the continuous assessment system if they sit for any examination after the first course month.

Assessment activities:

- * Short answer tests of magister sessions.
- * Practices in computer rooms. The assessment will be done twofold: Attendance, and exam.
- * Laboratory practices. The assessment will be done twofold: Attendance, and exam.

To ensure that all competencies are acquired, it will be necessary to jointly 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)

In the event that only condition 2) is fulfilled, and not condition 1), the global mark in the subject will be 4.9.

Missed exams and/or lab classes will not be rescheduled.

The exams in continuous assessment are only valid for the ordinary continuous assessment call.

*** Students who choose for exam-only assessment:**

The possibility of a final examination will be provided to students who do not opt for the continuous assessment. This final exam will cover all the activities of the subject.

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

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

SECOND CALL

Two different situations:

=> Students that are evaluated using continuous assessment:

Two options to choose:

- * To keep the practice attendance grades and take all of the continuous assessment exams on the official date assigned by the Center.
- * To be evaluated with the same final exam as stated in the above section Students who choose for exam-only assessment.

=> Students who choose for exam-only assessment:

A final examination will be provided to students who do not opt for the continuous assessment. This final exam will be assessed as stated in the above section Students who choose for exam-only assessment.

END OF PROGRAM CALL

End of program calls will be assessed as stated in the above section Students who choose for exam-only assessment.

In the event of copycatting at any proof or work, the final assessment will be FAIL (0) and the event will be communicated to the Centre headmaster in order to conduct appropriate measures.

Additional comments

The use of generative artificial intelligence (GAI) is allowed in the realization of the academic activities of this subject. Its use must be carried out in an ethical, critical and responsible manner. In the case of using GAI, any result it provides must be critically evaluated, and any citation or reference generated must be carefully verified. It is also recommended to declare the use of the tools used.

Sources of information

Basic Bibliography

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,**

Complementary Bibliography

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

Vance Dickason, **Loudspeaker Design Cookbook,**

Recommendations