Syllabus

Academic year:	*2011-12*
Subject:	**Acoustic engineering**
Subject's code:	**21605**
Degree:	**Bachelor's degree in Audiovisual Systems Engineering**
ECTS credits:	**4**
Time commitment:	**100 h**
Teaching staff:	**Toni Mateos, Martin Haro**
Group:	**1**

Syllabus

1. Descriptive information on the subject

- **Academic year:** 2010-2011
- **Subject:** Acoustic engineering **Code:** 2010.21605
- **Subject's type:** Compulsory
- **Degree:** Bachelor's in Audiovisual Systems Engineering
- **Credits:** 4 **ECTS credits:** 4
- **Time commitment:** 100 h
- **Timing:**
  - Year:
    Audiovisual Systems Engineering: 2nd year
  - Type: *Quarterly*
  - Term: 1st term
- **Coordinator:** *Toni Mateos*
- **Department:** *Department of Information and Communication technologies*
- **Teaching staff:** *Toni Mateos, Martin Haro*
- **Group:** *1*
- **Language:** *Catalan*
- **Building where the subject is taught:** *Roc Boronat building*
- **Timetable:**
  Group 1

2. Presentation of the subject

This is an introductory course in acoustic engineering addressed to Audiovisual Engineering students. The aim of the course is to understand the basic physical phenomena which describe and govern the acoustic field, from its generation, propagation and interaction with the spaces where it is generated, to its interaction with human auditory systems. It will also be taught the suitable mathematical language to describe acoustic field physics and its power will always be illustrated with daily life examples very specially related to music. It will also be studied the fundamental concepts of psychoacoustics, with the aim of understanding the effect of the auditory and nervous systems on the final sound perception.

3. Previous requirements to follow the formative itinerary

It is highly recommended that the students have some basic knowledge of physics about harmonic and wave motion, and also of some areas of mathematics: analysis, differential equations, and complex numbers. However, the concepts of these disciplines directly important will be reminded and reinforced during the course.

Previous needed subjects: Numeric Calculation and Methods, Linear Algebra and Discrete Mathematics, Waves and Electromagnetism, and Differential Equations.

4. Competences to be obtained in the subject

Transferable skills	Specific competences
Instrumental 1. Capacity to analyze and summarize. 2. Problem resolution. 3. Oral and written communication. ***Interpersonal*** 4. Teamwork. 5. Capacity to be critic and self-critical. ***Systemic*** 6. Capacity to put knowledge and methodologies into practice. 7. Concern about quality.	1. Know and understand the mathematical and physical suitable concepts to describe the behaviour of the acoustic field. 2. Understand and know how to use suitable concepts to describe some different aspects about sound generation. 3. Understand approximations that describe sound propagation by means of lineal differential equations, and also its physical and mathematical/operational relevance. 4. Understand basic notions of human psychoacoustics. 5. Understand inherent problems in systematic and scientific study of psychoacoustics, and also the related methodology. 6. Understand how to put into practice some theoretical concepts of acoustics into technological process.

5. Learning aims

The students should manage to understand basic physical phenomena which describe and govern the acoustic field, from its generation, propagation and interaction with the spaces where it is generated, to its interaction with human auditory systems. During this process, students should learn how to use physical and mathematical language to describe and predict this type of phenomena, and they also should understand that the methodology developed in the sound perception field is necessary.

6. Evaluation

6.1. General criteria of evaluation

The subject will have a final exam including evaluation of all the list of topics discussed during the three parts of the subject (lectures, seminars and laboratories). Furthermore, the students will have to hand in each essay, and they have to pass the final exam and these essays separately. If these requirements are achieved, the final mark will be:
Mark = 0.65 * Final exam + 0.35 * Essays.

During laboratory sessions, the students will work on some activities which test their skills to solve practical problems and implement algorithms by computer programs. Some activities must be done individually and other in group.

Before each seminar, the students will be given a collection of problems to solve individually before the session, as a previous preparation for the seminar. These problems belong to concepts or knowledge explained during lectures and practiced during laboratory sessions. During the seminar, all the students must participate in the resolution of problems which have been handed in previously and in the resolution of other additional problems. The evaluation of this activity is focused on student's participation during seminar sessions.

6.2. Details about competences

Competencies to be obtained in the subject	Achievement indicator	Evaluation procedure	Timing
1. Capacity to analyse and summarize 2. Problem resolution	Capacity to suggest problem solutions.	Evaluation of essays, seminars and final exam.	During the entire term.
3. Teamwork 4. Capacity to be critic and self-critical	Participation in seminars.	Evaluation of seminars.	During the entire term.
5. Oral and written communication 6. Skill to put knowledge and methodologies into practice. 7. Concern about quality.	Correct oral and written expositions.	Evaluation of essays, seminars and final exam.	During the entire term.
1. Know and understand the mathematical and physical suitable concepts to describe the behaviour of the acoustic field. 2. Understand and know how to use suitable concepts to describe some aspects about sound generation. 3. Understand approximations that describe sound propagation by means of lineal differential equations, and also its physical and mathematical/operational relevance. 4. Understand basic notions of human psychoacoustics. 5. Understand inherent problems in systematic and scientific study of psychoacoustics, and also the related methodology. 6. Understand how to put into practice some theoretical concepts of acoustics into technological process.	Carry out correctly all the subject's tests.	Evaluation of essays, seminars and final exam.	During the entire term.

7. Contents

7.1. Content units

1. Acoustic waves: generation, propagation and measurement.
2. Psychoacoustics and perception.

8. Methodology

8.1. Methodological approach of the subject

The usual learning process of each unit is composed of: one lecture, one seminar and one laboratory session. Each unit starts with a lecture which includes the presentation of some theoreticopractical fundamentals. This lecture is carried out in a big group. The student must complement this activity with a detailed reading of his notes and additional material that the teacher provides. For example, one lecture which lasts 2 hours, conveniently used, will require a student additional work out of the classroom which must last 1 hour.

Later, there will be a seminar focused on problems and activities resolution in order to put into practice all the concepts and techniques learned during the lecture. The students will be given just the solutions of the first activities of the session, but not the rest. The aim is that students consolidate the fundamentals in order to subsequently solve more complex problems. This activity is carried out in small seminar groups and all the students must participate actively in the problem resolutions.

The next step of the learning process is the laboratory or practical session. Some practical problems are launched. They require a previous solution planning and they must include several concepts and techniques. Some of these essays must be done individually and other in group. It is assumed that the students also work on this activity out of the classroom.

The last step of the learning process of each unit is to take a final theoretical exam in order to check if the students have acquired all the competences required.

8.2. Time organization: sessions, learning activities and estimated time commitment

Week	Lecture	Seminar (lecturer)	Laboratory (lecturer)	Study (student)	Activities (student)	Total hours
1	1. Waves I			3	2	**7**
2	2. Waves II	1. Waves I	1. Essay 1	2	3	**10**
3	3. Waves III	2. Waves II		3	2	**8**
4	4. Waves IV	3. Waves III		2	2	**7**
5	5. Waves V	4. Waves IV	2. Essay 2	2	3	**10**
6	6. Psychoacoustics I	5. Waves V		3	2	**8**
7		6. Waves VI		3	2	**6**
8	7. Psychoacoustics II	7. Psychoacoustics I	3. Essay 3	3	3	**11**
9	8. Psychoacoustics III	8. Psychoacoustics II		3	2	**8**
10	9. Psychoacoustics I Psychoacoustics IV	9. Psychoacoustics III	4. Essay 4	3	3	**11**
11		10. Psychoacoustics IV		3	2	**6**
Exam preparation and execution						**8**
	18	**10**	**8**	**30**	**26**	**100**

9. Bibliography and didactic resources

9.1. Learning information resources. Basic bibliography (on paper or electronic media)

- *Introduction to the Physics and Psychoacoustics of music*, Juan Roederer, Springer Verlag, 1995
- Signals, sound, and sensation, William M. Hartmann, Springer Verlag, 1998
- *Theoretical Acoustics*, Morse & Ingard, Princeton University Press, 1992
- *The physics of sound*, E.Berg, D.G.Stork, 3rd edition

9.2. Learning information resources. Additional bibliography (on paper or electronic media)

- *The Sense of Hearing,* Plack, C.J. (2005). Mahwah, New Jersey: Laurence Erlbaum Associate

- *An Introduction to the Psychology of Hearing,* Moore, B. (2003)., 5th edition. London:Academic Press Ltd.

- *Music, Physics and Engineering*, Harry F. Olson, Dover Publications, 1967

- Handbook for acoustic ecology:
  http://www2.sfu.ca/sonic-studio/handbook/index.html

- Engineering Acoustics:
  http://en.wikibooks.org/wiki/Engineering_Acoustics

- *Elements of Green's Functions and Propagation: Potentials, Diffusion, and Waves*, G. Barton, Oxford Science Publications.

9.4. Didactic resources. Subject learning material.

- There are some notes of each lecture available on the webpage of the subject.

- There is a collection of problems of each seminar available on the webpage of the subject.

- There are some instructions about each practical session essay available on the webpage of the subject.