Digital audio processing

Academic Year: (2019 / 2020) **Review date: 23-04-2019**

Department assigned to the subject: Signal and Communications Theory Department

Coordinating teacher: GONZALEZ DIAZ, IVAN

Type: Compulsory ECTS Credits : 6.0

Year : 4 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Electromagnetic Fields
Electroacoustic and Sound Systems
Linear Systems

OBJECTIVES

The students will acquire the following competences:

- Know the audio signal in its analog and digital forms, and the processing pipeline for an effective and high performance conversion between both (A / D and D / A chain).

- Analyze and design usual devices and equipments in the professional audio chain, covering both the processing and distribution of the audio signal: processors in time, frequency processors, dynamics processors and mixing consoles.

- Know systems and interfaces for digital interconnection, and audio coding techniques that allow efficient and robust storage and transmission.

- Design and deploy some fundamental applications that involve processing and distribution of the audio signal in professional environments: recording process and mixing of a sound program, stereo and multichannel sounding of audio programs, room equalization for sound reinforcement , etc..

DESCRIPTION OF CONTENTS: PROGRAMME

- Introduction to audio signal
- Digital audio fundamentals. A/D and D/A conversion. Techniques for digitalization improvement.
- Digital audio processing: Time, frequency and dynamic processors.
- Introduction to digital mixing consoles.
- Audio coding systems and standards: lossy and losses coding; predictive and entropic coding; perceptual coding.

LEARNING ACTIVITIES AND METHODOLOGY

Three teaching activities are proposed: theoretical classes, exercises, and lab exercises.

THEORETICAL CLASSES
The theoretical class will be given in the blackboard, with slides or by any other means to illustrate the concepts of the lectures. In these classes the explanation will be completed with examples.

In these sessions the student will acquire the basic concepts of the course. It is important to highlight that these classes will require the initiative and the personal and group involvement of the students (there will be concepts and particular cases that the students themselves should develop).

EXERCISES
Through these sessions, the student will apply the studied theoretical concepts to concrete problems and scenarios of audio systems. Sometimes, the teacher will directly solve the problems, whereas in others, the students will first solve the problem and to later discuss their answers.

LABORATORY EXERCISES
Basic concepts learnt during the course will be applied in the laboratory.

The lab exercises will be carried out using the lab equipment (acoustic instrumentation and audio equipment) and simulation and design software. There will be guided exercises and an audio coding design exercise.

ASSESSMENT SYSTEM

The final grade is computed considering:

Continuous Assessment Grades (4 points)::
- Simulation Exercises: 1.6 points
- Hardware Lab Reports and exam question: 2.4 points

End-of-term Exam: 6 points

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

BASIC BIBLIOGRAPHY

- John Watkinson Principios de Audio Digital, Focal-Press , 2001.
- Ken C. Pohlmann Principles of Digital Audio, McGraw-Hill/TAB Electronics, 5ª ed, 2005.
- Udo Zölzer Digital Audio Effects, John Wiley&Sons, 2002.

ADDITIONAL BIBLIOGRAPHY

- A.C. Luther Principles of Digital Audio and Video, Artech House, 1997.
- Bob Metzler Audio Mesaurement Handbook, Audio Precision, 1993.
- Francis Rumsey The Audio Workstation Handbook, Focal Press (Music Technology Series), 1996.
- M. Hans y R. W. Schafer Lossless Compression of Digital Audio, Signal Processing Magazine, Vol. 18, Issue 4, July 2001.
- Stanley R. Alten Audio in Media, Wadsworth, 2001.
- T. Painter y A. Spanias Perceptual Coding of Digital Audio, Proceedings of the IEEE, vol 88, nº 4, April 2000.
- Udo Zölzer Digital Audio Signal Processing, John Wiley, 1997.