COURSE DATA

Data Subject	
Code	34809
Name	Multimedia electronic systems
Cycle	Grade
ECTS Credits	6.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1402 - Degree in Telecommunications Electronic Engineering	School of Engineering	3	Second term

Subject-matter

Degree	Subject-matter	Character
1402 - Degree in Telecommunications Electronic Engineering	14 - Applications of electronic systems	Obligatory

Coordination

Name	Department
FRANCES VILLORA, JOSE VICENTE	242 - Electronic Engineering

SUMMARY

'Multimedia Electronic Systems' is part of the subject 'Applications of Electronic Systems'. It is a quarterly and obligatory matter, taught in the 2nd quarter of the third year of the Degree in Electronic Engineering in Telecommunications. It comprises a total of 6 ECTS.

This course is intended for students to delve into the domain of devices that enables multimedia. To do this, and taking as a starting point to study the characteristics of visual and auditory perceptual systems humans, establish the characteristics, components, techniques and peculiarities of the systems acquisition and reproduction of audio data, image and digital video, emphasizing noise considerations and signal quality. Also describe techniques and digital processing algorithms commonly used in the scope of audio and image.

The subject has a mixed theoretical and practical, so that over the theoretical contents are added a practical level. As problems resolution as the realization of practical laboratory work, exercise the concepts and techniques studied familiarizing the student with the scope.

This course complements the course Digital Signal Processing, studied in the first quarter of the third year of the degree of grade, providing a real vision systems that perform digital processing within the scope of multimedia.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

No previous knowledge is required, but is recommended that students have taken the course of Digital Signal Processing, which is taught in the first semester of the third year of the degree.

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

1402 - Degree in Telecommunications Electronic Engineering

- G4 - Ability to solve problems with initiative, decision-making and creativity, and to communicate and transmit knowledge, abilities and skills, understanding the ethical and professional responsibility of the activity of a telecommunications technical engineer.
- G5 - Knowledge to carry out measurements, calculations, assessments, evaluations, loss adjustments, studies, reports, task planning, and other analogous work in the specific field of telecommunications.
- G7 - Ability to analyze and assess the social and environmental impact of technical solutions.
- TE1 - Ability to construct, operate and manage systems for the acquisition, transport, representation, processing, storage, management and presentation of multimedia information, from the perspective of electronic systems.
- TE2 - Ability to select specialized electronic circuits and devices for transmitting, routing and the terminals, both in fixed and mobile environments.
- TE4 - Ability to apply electronics as support technology in other fields and activities, not only in the field of Information Technology and Communications.
- TE7 - Ability to design interface, data acquisition and storage devices, and terminals for telecommunication services and systems.

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

Students will possess the ability to analyze, dessign, specify and select interface, acquisition, playback and recording systems of quality audio and image, using as conventional as oversampling converters (TE1, TE7). Also, students will know and will be able to apply basic techniques of compression and digital processing in the scope of audio and image (TE1).

Students will be able to construct, operate and manage systems of acquisition, transportation, representation, processing, storage, management and presentation of multimedia information from the point of view of electronic systems (TE1). Be able to apply electronically and supporting technology in other fields and activities, not only in the field of Information Technology and Communications (TE4).

DESCRIPTION OF CONTENTS

1. Basical multimedia foundations.

Historical evolution. Media classification. Digital media integration. Multimedia system definition.

Global estructure. Devices domain.

2. Devices domain

Processing conversion estructure. Sampling and aliasing. Sampling Theorem. Quantization. Frequency sampling selection.

3. Hearing perception.

Physics of sound. Psychoacustics. The human hearing. Intensity perception. Rang of frequencies. Atributes of sound. Sensibility to the phase. Location. Psicoacustical keys of spatial location of sounds.

4. Recording process.

Coding systems. Dither generation. Antialiasing filtering. Sample and hold circuits. Jitter. A/D conversion. Channel coding.

5. Reprodution process.

Signal reproduction. D/A conversion. Distorsion by lineaty errors.

6. Oversampling.

Oversampling. Delta modulation. Sigma-Delta modulation.

7. Digital Audio Effects.

Digital delay. Echo and digital reverberation. Enhancements. Chorus. Ping-pong. Equalization. Aurealization.

8. Image perception.

Human eye. Response to the ilumination and discrimination. Color perception. Coordinate color systems.

9. Image acquisition foundations.

Bidimensional sampling. Spatial and temporal aliasing. Estructure and characteristics of an image digitizer. Light sensor. Modulator transference function: MTF

10. Acquisition devices.

Video signal digitizing. Solid state cameras: fotodiodes array, charge coupling devices (CCD) and charge injection devices (CID). Bayer masks. Other sensors.

11. Digital image processing.

Basical concepts. Enhancements techniques. Digital filters. Edge detection. The bidimensional transfer function. Pseudocolor.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Laboratory practices	20,00	100
Classroom practices	10,00	100
Study and independent work	20,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	50,00	0
Preparation of practical classes and problem	10,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

This course is structured around theory and problems classes, labs and office hours.

The **lectures** (outcomes TE1, TE7, G3, G4 y G9) will use in general a model of flipped learning, although at some sessions the subjects do not lend themselves to be taught in this form and will be used the usual theoretical class model:.

- Flipped learning: The students will have, prior to the class, a video recording with the explanation of the contents of the session and a bulletin of questions to answer after viewing the video. Thus, the session will focus on clarifying the doubts that have arisen while viewing the video or during the resolution of the questions's bulletin. Later, the teacher will propose activities related with the contents of the session.

- Theoretical classes. At the topics that do not lend to use flipped learning, the usual model of theoretical classes will be used. In this, the teacher will teach the class by presenting and explaining the contents of each issue, focusing on key aspects for understanding it. It may be used different kinds of media (presentations,transparencies, blackboard, ...).

In the **class of problems** (outcomes TE1, TE4, TE7, G4 and G9), the flipped classroom method will be used too, with an emphasis on problem solving.

For **laboratory practice** sessions (outcomes T1, TE4, TE7 and G4), students will have scripts to conducte the session, under the supervision of the teacher. At the beginning of each practice will be done an introduction and explanation of the most complex issues. Its estimated time is 3 hours, and practice groups will consist of no more than two persons.

In addition, students will have a schedule of **office hours** aimed at solving the problems and doubts about the matter. The schedule of these office hours will be indicated at the beginning of the academic year and will be as broad as possible so that students can attend it. However, they also have the opportunity to clarify some doubts via email.

EVALUATION

The learning evaluation will take place from the evaluation of a single theoretical exam (EXT), that will be carried out on the official date, plus the results obtained in the laboratory sessions (LAB).

Laboratory grade (LAB) will contribute to the final grade with a weight of 25%. The theory part (EXT) will contribute to the final grade with a weight of 75%.

Total mark = 0.25 * Practice mark (LAB) + 0.75 * Theory mark (EXT)

Laboratory practice mark (LAB) is non-recoverable, thus this mark will be kept for the two official exams. Their contribution to the final grade is 25%, and the average will only be calculated when both pass, individually, the grade of 5.

Eventually, partial exams may be held during the course. Any partial exam will be considered approved when it exceeds the grade of 5. Passing a partial exam implies eliminating the corresponding matter in the first official examination. However, even with reduced matter, the official exam must be passed with a grade of 5 or higher.

EXT evaluates the outcomes TE1, TE4, TE7, G3, G4 and G9. LAB evaluates the outcomes TE1, TE4, and G4.

In any case, the evaluation system will be subordinate for the Evaluatino an Qualification Regulation of the University of València for Degrees and Masters (https://webges.uv.es/uvTaeWeb/MuestraInformacionEdictoPublicoFrontAction.do?accion=inicio&idEdictoSeleccionado= 5639).

REFERENCES

Basic

- Referencia b1: Watkinson, John. Audio Digital. Paraninfo. 1996
  Referencia b2: Pohlmann, Ken C. Principles of Digital Audio, Cuarta Edición. McGraw-Hill. 2000
  Referencia b3: Smith S.W. Scientist & Engineers Guide to Digital Signal Processing. California Technical Publishing, 1997. http://www.dspguide.com/

  Referencia b4: Castlemann, Kenneth R. Digital Image Processing. Prentice-Hall. 1996
  Referencia b5: Watkinson, John. Vídeo Digital. Paraninfo. 1996
  Referencia b6: Luther, A. "Principles of digital audio and video". Springer. 1998.
  Referencia b7: Cuello, F.F.; Rueda, J.C. Compresión de vídeo digital.

Additional

- Referencia c1: González, Javier. Visión por computador. Paraninfo. 2000
Referencia c2: Jain, Anil J. Fundamentals of digital image processing. Prentice-Hall. 1989
Referencia c3: Burrus, C.S.; et al. Ejercicios de tratamiento de la señal utilizando Matlab Prentice-Hall. 1998
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Referencia c8: Orfanidis, S.J. Introduction to Signal Processing. Prentice-Hall. 1996
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Referencia c14: Coulter, D. "Digital Audio Processing". CMP Books. 2000.
Referencia c15: Zoelzer, Udo. "Digital audio signal processing". Wiley. 2008.
Referencia c16: Faller, C. "Spatial audio processing:MPEG surroun