Course guide
300034 - CA - Audiovisual Communication

Last modified: 01/06/2023

Unit in charge: Castelldefels School of Telecommunications and Aerospace Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications.

Degree: BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: Definit a la infoweb de l'assignatura.

Others: Definit a la infoweb de l'assignatura.

PRIOR SKILLS

· Operation with matrix algebra
· Ability to quickly interpret Fourier transforms in one dimension
· Knowledge of the Discrete Fourier Transform
· Knowledge of signal filtering and familiarity with the structures and characteristics of FIR and IIR filters
· Easy to perform calculations on probabilities and random variables
Knowledge of digital modulation systems
Knowledge of digital signal multiplexing
Knowledge of basic error control techniques
Knowledge of IP protocols and structure of data networks

REQUIREMENTS

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DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. CE 26 SIS. Capacidad para analizar, codificar, procesar y transmitir información multimedia, empleando técnicas de procesado analógico y digital de señal. (CIN/352/2009, BOE 20.2.2009.)

Generical:
6. EFFICIENT USE OF EQUIPMENT AND INSTRUMENTS - Level 1: Using instruments, equipment and software from the laboratories of general or basic use. Realising experiments and proposed practices and analyzing obtained results.

Transversal:
2. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.
3. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.
4. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
5. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.
7. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

TEACHING METHODOLOGY

Theory classes will be mainly expository although the participation of the student will be encouraged by means of the discussion of subjects and technologies related to the systems of audiovisual communications. The practices will be carried out in small groups, where it will be possible to discuss the possible solutions in each of the sections and the interaction with the teacher to clarify the possible doubts or interpretations of the results. Study activities and team exercises will be done essentially by the students themselves. The teacher will validate their work.

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the subject of Audiovisual Communications, the student must be able to:

· Know the basics of traditional audiovisual signal broadcasting systems: Analog television and PAL system
· Know the different digital formats for uncompressed audio and video signals
· Mastery of the basics on source coding and ability to perform various calculations on entropy of a source, Huffman codes, variants on variable length codes, arithmetic codes.
· Knowledge of the basic tools for compressing audiovisual signals: linear prediction, cosine transform, filter banks, wavelet transform, motion compensation.
· Knowledge of the main standards for encoding audiovisual signals such as MPEG-1, MPEG-2, MPEG-4 and H.264 knowing how to identify the scope of each and its main differential characteristics.
· Knowledge of the multiplexing systems of various audiovisual programs in a Transport Stream
· To know the fundamentals and the problematic of systems of television by IP and television by Internet
· Know the problem of indexing audiovisual content and some methodologies for the analysis of audio and video signals to extract descriptors from their content
· Know various applications and technologies to access multimedia content from audio or video information
· Have a perspective on the evolution of audiovisual systems and their future trends: high definition, 3D systems, super-high definition, etc.
· Know the different tools available to adapt AV content to the conditions of the user, the terminal or the network, and to manage the digital rights of the contents.

STUDY LOAD

Type	Hours	Percentage
Hours small group	12,0	8.00
Self study	84,0	56.00
Hours large group	39,0	26.00
Guided activities	15,0	10.00

Total learning time: 150 h

CONTENTS

(ENG) Títol contingut 1: introducció als sistemes de comunicació visual

Description:
(ENG) Aquest primer bloc presenta una perspectiva global dels sistemes de comunicació visual des d'una perspectiva històrica. La perspectiva històrica es fonamental per introduir paràmetres bàsics com la relació d'aspecte, el número d'imatges per segon, l'entrellaçament dels camps, etc. que serien complexos de comprendre actualment si no és mitjançant la noció de compatibilitat, que és un concepte fonamental per comprendre no només l'evolució històrica sinó també les tendències de futur. S'introdueixen també, a nivell molt divulgatiu, conceptes de percepció del color, coordenades de color i una versió molt simplificada del sistema PAL analògic. També es presenta el concepte de televisió digital presentant les normes ITU-601 per a definició convencional i ITU-709 per a alta definició amb les seves diferents variants. Pel que fa a la component d'àudio es presenten els diferents formats digitals no comprimits emprats en els sistemes comercials. Finalment, es discuteix sobre els sistemes de televisió en 3D i els futurs sistemes de super-alta definició.

Related activities:
(ENG) Activitat 1. Seguiment a l'aula.
Activitat 2: Experimentació i simulació de sistemes.

Full-or-part-time: 15h
Theory classes: 6h
Self study : 9h

(ENG) Títol contingut 2:. Principis de compressió de senyals

Description:
(ENG) En aquest mòdul s'introdueix el diagrama de blocs bàsic d'un codificador de font i es presenten les eines matemàtiques per a la compressió de senyals audiovisuals. En concret, es consideren les tècniques de redundància estadística on es presenten els conceptes d'entropia de la font, codis de longitud variable, codis de Huffman, codis de Golomb-Rice i codis aritmètics. Pel que fa a les tècniques transformades, es presenta la codificació diferencial, la predicció lineal, la transformada cosinus, la transformada cosinus modificada, la transformada de wavelet i la compensació de moviment. Com a exemples d'aplicació pràctica es discuteixen els detalls sobre sistemes de compressió sense pèrdues comercials com el FLAC (àudio) o el JPEG-Lossless (imatge) .

Related activities:
(ENG) Activitat 1. Seguiment a l'aula.
Activitat 2: Experimentació i simulació de sistemes.

Full-or-part-time: 50h
Theory classes: 12h
Laboratory classes: 8h
Self study : 30h

(ENG) Títol contingut 3:. Estàndards de codificació d'àudio i de vídeo

Description:
The main audio encoding standards are presented: MPEG-1 Layer I, Layer II and Layer II. MPEG-2 BC, MPEG-2 AAC and MPEG-4 AAC. As for the video, the main features of the MPEG-1, MPEG-2 and MPEG-4 standards and the scope in which they are applied are introduced. The most characteristic tools of the H.264 standard are also presented and their profiles and the scope of each are discussed. Video and image compression techniques based on Artificial Intelligence are also presented.

Related activities:
Activity 1. Follow-up in the classroom
Activity 2: Experimentation and simulation of systems
Activity 3. Study activities and application synthesis

Full-or-part-time: 25h
Theory classes: 6h
Laboratory classes: 4h
Self study : 15h

(ENG) Títol contingut 4:. Multiplexació i difusió de senyals audiovisuals en diferents medis

Description:
(ENG) S'introdueixen les tecnologies Transport Stream per multiplexar diversos programes amb continguts de vídeo, àudio multicanal, múltiples idiomes, subtítols, dades, sincronismes, etc. També es proporciona una visió general de com el Transport Stream és emprat en serveis de difusió terrena, cable i satel·lit. Finalment, una part molt important d'aquest mòdul, considera les tecnologies associades a aplicacions de televisió per IP i televisió per internet.

Related activities:
(ENG) Activitat 1. Seguiment a l'aula.
Activitat 2: Experimentació i simulació de sistemes.

Full-or-part-time: 8h
Theory classes: 3h
Self study : 5h

Digital Image Processing Introduction

Description:
Techniques for mathematical representation of the digital image are presented and several algorithms for image analysis are described

Related activities:
Software and algorithm developement in the laboratory

Full-or-part-time: 52h
Theory classes: 9h
Laboratory classes: 12h
Self study : 31h

ACTIVITIES

(ENG) TÍTOL ACTIVITAT 1: SEGUIMENT A L'AULA

Full-or-part-time: 5h
Theory classes: 5h

(ENG) TÍTOL ACTIVITAT 2: EXPERIMENTACIÓ I SIMULACIÓ DE SISTEMES

Full-or-part-time: 45h
Laboratory classes: 18h
Self study: 27h

GRADING SYSTEM

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EXAMINATION RULES.

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BIBLIOGRAPHY

Basic:
- Benoit, Hervé. Digital television : satellite, cable, terrestrial, IPTV, mobile TV in the DVB framework. 3rd. Burlington: Focal Press/Elsevier, 2008. ISBN 9780240520810.
- Sandbank, C.P. Digital television. Chichester: John Wiley & Sons, 1990. ISBN 0471923605.

Complementary:
- Burnett, Ian S. The MPEG-21 book. Chichester: John Wiley & Sons, 2006. ISBN 0470010118.
- Manjunath, B. S.; Salembier, Philippe; Sikora, Thomas. Introduction to MPEG-7 : multimedia content description interface. Chichester: John Wiley & Sons, 2002. ISBN 0471486787.
- Simpson, Wes. Video over IP : a practical guide to technology and applications. Burlington, MA: Elsevier/Focal Press, 2006. ISBN 9780240805573.
- Schreer, Oliver; Kauff, Peter; Sikora, Thomas. 3D videocommunication : algorithms, concepts and real-time systems in human centred communication. Chichester: John Wiley, 2005. ISBN 047002271X.
- Kim, Hyoung-Gook. MPEG-7 audio and beyond : audio content indexing and retrieval. Chichester: John Wiley, 2005. ISBN 047009334X.