Course guides
230201 - TV - Television Systems

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

Degree:	BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Optional subject). BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).

Academic year: 2019   **ECTS Credits:** 6.0   **Languages:** Catalan, English, Spanish

LECTURER

Coordinating lecturer:	Josep R. Casas
Others:	Ferran Marqués Xavier Giró

PRIOR SKILLS

Basic knowledge of Analog and Digital Signals and Systems, Signal Processing and Communications.

REQUIREMENTS

Signals and Systems, Communications

TEACHING METHODOLOGY

This course is taught through lectures (3h/week) and laboratory sessions (2h every 2 weeks), with a continuous evaluation control by mid course consisting in a series of short questions.

The special assignment is a cooperative learning experience. In previous editions of this course, this has been either reviewing and adding new entries to the Wikipedia (in Catalan, Spanish or English) or preparing a debate of the kind "59 seconds" on topics related to the subject.

LEARNING OBJECTIVES OF THE SUBJECT

The course presents the basic principles and development of the TV systems. It offers a broad view of the analog and digital audiovisual communication systems as well as of the services and functionalities that these systems offer.

STUDY LOAD

Type	Hours	Percentage
Self study	98,0	65.33
Hours small group	13,0	8.67
Hours large group	39,0	26.00

Total learning time: 150 h

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CONTENTS

1. Introduction (3h)

Description:
1.1 Television engineering: elements of a visual communication system
1.2 Human Visual System: color sensitivity, gamma, spatial/temporal resolution

Specific objectives:
Introduction to systems for audiovisual communication, focusing on the importance of the information recipient

Related activities:
Lab session 0

2. TV Signal (9h)

Description:
2.1 Signal values: light and color, colorimetric representations (YCbCr), quantization
2.2 Signal domain: how to convert video to 1D? Scanning (sampling), progressive/interlaced
2.3 Standardization: SDTV/HDTV (ITU-R BT.601/BT.709), composite, component, SDI
2.4 Timing and synchronization: raster formats (4:2:2, 4:1:1, 4:2:0)
2 5 TV audio: analog stereo/dual, digital AES/EBU audio channels

Specific objectives:
Specific study of signals and values used to represent TV signals: signal components, dynamic range, synchronization, standards and audio

Related activities:
Lab session 1

3. Coding (6h)

Description:
3.1 Compression principles. Early strategies in TV: interlacing, color differences, chroma interleaving, NTSC, PAL, SECAM
3.2 Audiovisual coding: spatial-temporal compression, audio coding
3.3 MPEG2, SMPTE 421M (VC-1), H.264/AVC (HDTV)

Specific objectives:
Coding technologies for TV signals, highlighting early strategies for analog TV and its continuity in digital TV

Related activities:
Lab session 2

4. Multiplex and Signaling (6h)

Description:
4.1 Analog multiplex (FDM): TV signal and spectrum
4.2 Digital multiplex (TDM):
- Program Streams ES, PES, time stamps (PTS/DTS)
- Transport Streams: PCR, PID, PSI, conditional access

Specific objectives:
Study of the multiplexing strategies in analog and digital TV

Related activities:
Lab session 3

5. Modulation and Transmission (6h)

Description:
5.1 Analog modulation for color TV signals
5.2 Digital modulation for TV signals
5.3 Broadcasting standards: DVB, ATSC ¿ANSI/SMPTE
5.4 Datacasting

Specific objectives:
Modulation technologies and broadcasting standards for analog and digital TV.

Related activities:
Lab session 4

6. Other environments: perspective (6h)

Description:
6.1 Digital platforms and Interactive TV
6.2 Set Top Box: the system key element.
6.3 Middleware: API Multimedia Home Platform
6.4 Studio production environment

Specific objectives:
Review of other services related to TV broadcasting

Related activities:
Lab session 5

7. Image Acquisition and Reproduction Systems (3h)

Description:
7.1 Cameras and CCDs
7.2 Displays: CRTs, flat screens and projection systems

Specific objectives:
Introduction to display and camera systems

LABORATORI SESSIONS

Description:
0. Introduction to the TV lab (LABMU)
1. TV Signal (YCbCr+scanning)
2. Coding: program stream
3. Multiplex: transport stream
4. Modulation and transmission
5. Interactive TV (MHP)
LAB5. API MHP: development of an interactive application

GRADING SYSTEM

- Mid term control: 15%
- Special assignment: 15%
- Laboratory: 30%
- Final exam : 40%

EXAMINATION RULES.

BIBLIOGRAPHY

Basic:
- Sandbank, C.P. (ed.). Digital television. Chichester [etc.]: John Wiley & Sons, 1990. ISBN 0471923605.
- Benoit, H. Digital television: MPEG-1, MPEG-2 and principles of the DVB system. 2nd ed. Oxford [etc.]: Focal Press, 2002. ISBN 0240516958.
- Reimers, U. DVB: the family of international standards for digital video broadcasting. 2nd ed. Berlin [etc.]: Springer, 2005. ISBN 354043545X.
- Poynton, C.A. Digital video and HD: algorithms and interfaces [on line]. 2nd ed. Waltham: Morgan Kaufman, 2012 [Consultation: 26/06/2019]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=867675. ISBN 9780123919328.

Complementary:
- Collins, G.W. Fundamentals of digital television transmission. New York: Wiley, 2001. ISBN 0471391999.
- Massel, M. Digital television, DVB-T COFDM and ATSC 8-VSB. [s.l.]: Digital TV Books, 2008. ISBN 9780970493217.
- Whitaker, J.C. (ed.). Television receivers: digital video for DTV, cable, and satellite. New York: McGraw-Hill, 2001. ISBN 0071380426.
- Janesick, J.R. Scientific charge-coupled devices. Bellingham (Wash.): SPIE Press, 2001. ISBN 0819436984.

RESOURCES

Other resources:

Lecture notes available from the Digital Campus