

230201 - TV - Television Systems

Coordinating unit:	230 - ETSETB - Barcelona School of Telecommunications Engineering		
Teaching unit:	739 - TSC - Department of Signal Theory and Communications		
Academic year:	2019		
Degree:	BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Optional) BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Teaching unit Optional)		
ECTS credits:	6	Teaching languages:	Catalan, Spanish, English

Teaching staff

Coordinator:	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

Total learning time: 150h	Hours large group:	39h	26.00%
	Hours small group:	13h	8.67%
	Self study:	98h	65.33%

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Content

1. Introduction (3h)

Degree competences to which the content contributes:

Description:

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

Related activities:

Lab session 0

Specific objectives:

2. TV Signal (9h)

Degree competences to which the content contributes:

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

Related activities:

Lab session 1

Specific objectives:

3. Coding (6h)

Degree competences to which the content contributes:

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)

Related activities:

Lab session 2

Specific objectives:

4. Multiplex and Signaling (6h)

Degree competences to which the content contributes:

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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

Related activities:

Lab session 3

Specific objectives:

5. Modulation and Transmission (6h)

Degree competences to which the content contributes:

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

Related activities:

Lab session 4

Specific objectives:

6. Other environments: perspective (6h)

Degree competences to which the content contributes:

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

Related activities:

Lab session 5

Specific objectives:

7. Image Acquisition and Reproduction Systems (3h)

Degree competences to which the content contributes:

Description:

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

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Specific objectives:

LABORATORI SESSIONS

Degree competences to which the content contributes:

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

Qualification system

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

Regulations for carrying out activities

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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.

Others resources:

Lecture notes available from the Digital Campus