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 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**

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>39h</th>
<th>26.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours small group:</td>
<td>13h</td>
<td>8.67%</td>
</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>98h</td>
<td>65.33%</td>
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</tbody>
</table>
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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:**

**Description:**

**Related activities:**

**Specific objectives:**
4. Modulation and Transmission (6h)

Degree competences to which the content contributes:

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. 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

Related activities:
Lab session 4

Specific objectives:
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
Bibliography

Basic:


Complementary:


Others resources:

Lecture notes available from the Digital Campus