320116 - APA - Algorithms and Audiovisual Programming

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications
Academic year: 2018
Degree: BACHELOR’S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 6

Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: Morros Rubio, Josep Ramon
Others: Ruiz Hidalgo, Javier
Nogueiras Rodriguez, Albino

Prior skills
Students will be expected to have passed all of the subjects related to mathematics and IT/programming, as well as Signals and Systems, Digital Image Processing and Digital Audio Processing.

Degree competences to which the subject contributes

Specific:
1. AUD: Ability to build, exploit and manage telecommunication services and applications, understood as capture systems, analogue and digital manipulation, coding, transport, representation, processing, storage, reproduction, management and presentation of audiovisual services and multimedia information.
2. AUD: Ability to create, encode, manage, promote and distribute multimedia content, on the basis of the criteria of usability and accessibility of audiovisual services and interactive broadcasts.

Teaching methodology

- Face-to-face lecture sessions.
- Face-to-face practical work sessions.
- Independent learning and exercises.
- Preparation and completion of group activities subject to assessment.

In the face-to-face lecture sessions, the lecturer will introduce the basic theory, concepts, methods and results for the subject and use examples to facilitate students' understanding.

Students will be expected to study in their own time to become familiar with the concepts, using their own notes taken in theory classes and the compulsory and recommended reading lists. It is particularly important that students read in their own time the assigned articles from the scientific literature.

Students are expected to complement in-class programming activities with independent learning activities outside of class in order to gain sufficient algorithm-coding practice in the appropriate programming language (MATLAB or C++).

Learning objectives of the subject

This subject will cover audio- and video-signal processing applications that use PC technology. Students will learn to develop and program systems that operate in real time, and receive a hands-on overview of the various theoretical concepts by means of specific practicals.
## Study load

<table>
<thead>
<tr>
<th></th>
<th>Total learning time: 158h</th>
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<tbody>
<tr>
<td>Hours large group:</td>
<td>15h</td>
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<tr>
<td>Hours medium group:</td>
<td>0h</td>
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<tr>
<td>Hours small group:</td>
<td>45h</td>
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<tr>
<td>Guided activities:</td>
<td>8h</td>
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<tr>
<td>Self study:</td>
<td>90h</td>
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- **Total learning time:** 158h
- **Hours large group:** 15h (9.49%)
- **Hours medium group:** 0h (0.00%)
- **Hours small group:** 45h (28.48%)
- **Guided activities:** 8h (5.06%)
- **Self study:** 90h (56.96%)
## 320116 - APA - Algorithms and Audiovisual Programming

### Content

<table>
<thead>
<tr>
<th>TOPIC 1: Digital Signal Processing</th>
<th>Learning time: 37h 30m</th>
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<tbody>
<tr>
<td>Description:</td>
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<tr>
<td>- A/D D/A conversion; sampling theorem.</td>
<td>Theory classes: 3h 45m</td>
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<tr>
<td>- The Fourier transform</td>
<td>Laboratory classes: 11h 15m</td>
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<tr>
<td>Related activities:</td>
<td>Self study: 22h 30m</td>
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<tr>
<td>- Video signal processing with MATLAB.</td>
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<td>- Time and frequency representation.</td>
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<tr>
<th>TOPIC 2: AUDIOVISUAL ALGORITHMS</th>
<th>Learning time: 37h 30m</th>
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<tr>
<td>Description:</td>
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<tr>
<td>- Noise reduction.</td>
<td></td>
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<tr>
<td>- Digital filtering of video signals.</td>
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<td>- Contrast correction.</td>
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<td>- Motion detection and estimation.</td>
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<td>Related activities:</td>
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<tr>
<td>- Design of filters.</td>
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<td>- Reduction of interference in audio signals.</td>
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<tr>
<td>- Improvement of images.</td>
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<td>- Motion estimation.</td>
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### TOPIC 3: PROGRAMMING VIDEO ALGORITHMS IN C/ C++

**Learning time:** 45h  
- Theory classes: 4h 30m  
- Laboratory classes: 13h 30m  
- Self study: 27h

**Description:**
- Data types, flow control, vectors, matrices.  
- Representation of video signals in C/C++.

**Related activities:**
- Processing of video signals with C/C++.  
- Programming of filters. Temporal convolution.  
- Reading/writing video files.

### TOPIC 4: REAL-TIME PROGRAMMING

**Learning time:** 4h  
- Theory classes: 1h  
- Laboratory classes: 1h  
- Self study: 2h

**Description:**
- Multimedia processing libraries: DirectX, GStreamer.  
- Real-time signal processing.

**Related activities:**
- Recording and playback of multimedia signals.  
- Audio capture and processing.  
- Video capture and processing using webcams and miniDV cameras.

### TOPIC 5: STORAGE OF VIDEO SIGNALS

**Learning time:** 7h  
- Theory classes: 1h  
- Laboratory classes: 2h  
- Self study: 4h

**Description:**
- Storage standards for video signals.  
- Multimedia signal containers.

**Related activities:**
- Reading/writing video files.
Qualification system

- Exams: 40% (20% first term, 20% second term)
- Laboratory: 40%
- Final project: 20%

For those students who meet the requirements and submit to the reevaluation examination, the grade of the reevaluation exam will replace the grades of all the on-site written evaluation acts (tests, midterm and final exams) and the grades obtained during the course for lab practices, works, projects and presentations will be kept. If the final grade after reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after reevaluation is greater or equal to 5.0, the final grade of the subject will be pass 5.0.

Bibliography

Basic:

Complementary: