Course guide  
804040 - SV-M - Video Systems

Unit in charge: Image Processing and Multimedia Technology Centre  
Teaching unit: 804 - CITM - Image Processing and Multimedia Technology Centre.

Degree: BACHELOR’S DEGREE IN MULTIMEDIA STUDIES (Syllabus 2009). (Compulsory subject).

Academic year: 2022  
ECTS Credits: 6.0  
Languages: Catalan

LECTURER

Coordinating lecturer: Melenchón Maldonado, Javier

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
5. Assess the state of current audiovisual technologies.
6. Identify the fundamental concepts of digital TV.
7. Use tools for processing audiovisual signals.
8. Know the principles of video encoding and the main standards for multimedia applications.
10. Identify the technologies used for the management of and access to audiovisual content.

Transversal:
1. SELF-DIRECTED LEARNING. Detecting gaps in one’s knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.
2. EFFICIENT ORAL AND WRITTEN COMMUNICATION. Communicating verbally and in writing about learning outcomes, thought-building and decision-making. Taking part in debates about issues related to the own field of specialization.
3. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.
4. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.

TEACHING METHODOLOGY

Classes are divided, in general, into 3 types.
1. Realization, explanation and discussion of the exercises during the previous session and resolution of doubts about them.
2. Exhibition activity directed by the teacher to introduce new knowledge (topics).
3. Explanation of next year and the supplementary materials.
These activities are modulated according to the complexity of the exercises and the corresponding content.
LEARNING OBJECTIVES OF THE SUBJECT

1. Know the state of the art of current audiovisual technologies.
2. To interpret the temporal and frequency representation of the signals.
3. To understand the fundamentals of visual perception, sound and voice production.
4. To convert analog signals to digital.
5. To know the concepts of filtering, the basic filters and to design and apply correctly the most appropriate filters in the proposed situation.
6. To know the need, the conditioning factors and the basic fundamentals of audio and image codification.
7. To apply the knowledge obtained in the realization of a task according to the belonging and importance. Deciding the way to carry it out and the time that is necessary to dedicate to it, selecting the most appropriate sources of information.
8. Plan and use the necessary information for an academic work from a critical reflection on the information resources used.
9. Communicate clearly and efficiently in oral and written presentations adapted to the type of audience and the objectives of communication using appropriate strategies and media.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>60,0</td>
<td>40.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

(ENG) Tema 1 - Introducció als sistemes de comunicació visual

Description:
Historical Introduction to Visual Communication Systems
Elements of a visual communication system
- Capture
- Storage
- Transmission
- Reception
- Representation

Full-or-part-time: 10h
Practical classes: 4h
Self study: 6h
## (ENG) Tema 2 - Introducció al Processament Digital de Imatge (I)

**Description:**
- Concept of image and image elements
- Basic operations with images
  - Cropping
  - Scale
  - Operations with color
- Processing of images using point transformations
  - Contrast enhancement
  - Binarization
  - Range correction
  - Negative histogram
  - Interpretation of the histogram
  - Equalization of the histogram

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

## (ENG) Tema 3 - Introducció al Processament Digital de Imatge (II)

**Description:**
- Concept of filtering on an image
- Types of filters
- Basic applications of filters
  - Reduce image resolution
  - Improved focus

**Full-or-part-time:** 10h
- Practical classes: 4h
- Self study: 6h

## (ENG) Tema 4 - Introducció al Processament Digital de Imatge (III)

**Description:**
- Concept of geometric transformation
- Types of geometric transformations
  - Translation
  - Rotation
  - Scale
  - Bias
  - Interpolation and delimitation

**Full-or-part-time:** 15h
- Practical classes: 6h
- Self study: 9h
### (ENG) Tema 5 - Introducció als sistemes de vídeo i televisió (I)

**Description:**
- Compatibility in video broadcasting
- Color image decomposition
  - Spaces of color
  - RGB Components
  - YUV components
- Aspect Ratio
- Viewing distance and number of lines
  - Conventional definition
  - High Definition
  - Super High Definition
- Perception of movement and temporal sampling
- Analogic TV signals
- Traditional signals and connections

**Full-or-part-time:** 20h  
Practical classes: 8h  
Self study : 12h

### (ENG) Tema 6 - Digitalització de la senyal de vídeo

**Description:**
- Uncompressed digital formats
- Conventional ITU-601R Standards and Applications
- Sub-standards
- High definition formats
- The need for video compression

**Full-or-part-time:** 5h  
Practical classes: 2h  
Self study : 3h

### (ENG) Tema 7 - Principis de compressió de vídeo

**Description:**
- Redundancy in audiovisual signals
- Generic Diagram of a Data Compressor
- Differential coding
- Entropic coding
- Quantification, compression and quality

**Full-or-part-time:** 12h 30m  
Practical classes: 5h  
Self study : 7h 30m
(ENG) Tema 8 - Codificació de imatges fixes

Description:
Block diagram of a JPEG encoder
Properties of block transformations
The cosine transform: features and visual effects
Other still image encoders.
· JPEG-2000
· TIFF

Full-or-part-time: 12h 30m
Practical classes: 5h
Self study : 7h 30m

(ENG) Tema 9 - Estàdars MPEG-1 i MPEG-2

Description:
MPEG and ISO standards. Objectives of video standardization
Basics of Video Compression
Motion Compensation
Types of images and GOPs
Fundamental differences between MPEG-1 and MPEG-2. Applications

Full-or-part-time: 20h
Practical classes: 8h
Self study : 12h

(ENG) Tema 10 - Estàndard H.264

Description:
Description of H.264 Standard Features
Basic technologies used. basic examples
H.264 vs MPEG-4. Distinction and clarification of the two standards
H.264 Profiles and Applications

Full-or-part-time: 10h
Practical classes: 4h
Self study : 6h

(ENG) Tema 11 - Multiplexació de senyals audiovisuals

Description:
Concept of multiplexing of audiovisual signals
Introduction to Transport Stream and Stream Program
Contextualization of Transport Stream with respect to video transport over IP

Full-or-part-time: 10h
Practical classes: 4h
Self study : 6h
ACTIVITIES

(ENG) ACTIVITAT 01 - DISCUSSIÓ SOBRE ASPECTES TECNOLÒGICS DELS SISTEMES DE COMUNICACIÓ VISUAL

Related competencies:
CEM 11.12. Identify the fundamental concepts of digital TV.
CEM 11.1. Assess the state of current audiovisual technologies.
CEM 11.13. Use tools for processing audiovisual signals.
06 URI. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.
04 COE. EFFICIENT ORAL AND WRITTEN COMMUNICATION. Communicating verbally and in writing about learning outcomes, thought-building and decision-making. Taking part in debates about issues related to the own field of specialization.
07 AAT. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.

(ENG) ACTIVITAT 02 - PRÀCTICA DE TRACTAMENT DE IMATGE (I)

Related competencies:
CEM 11.12. Identify the fundamental concepts of digital TV.
CEM 11.13. Use tools for processing audiovisual signals.
06 URI. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.
07 AAT. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.
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(ENG) ACTIVITAT 03 - PRÀCTICA DE TRACTAMENT DE IMATGE (II)

Related competencies:
CEM 11.13. Use tools for processing audiovisual signals.
05 TEQ. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.
07 AAT. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.

(ENG) ACTIVITAT 04 - CAPTURA, CODIFICACIÓ I COMPRESSIÓ DE VÍDEO

Related competencies:
CEM 11.1. Assess the state of current audiovisual technologies.
CEM 11.15. Understand digital video capture and presentation technologies.
CEM 11.14. Know the principles of video encoding and the main standards for multimedia applications.
05 TEQ. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.
06 URI. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.
07 AAT. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.
04 COE. EFFICIENT ORAL AND WRITTEN COMMUNICATION. Communicating verbally and in writing about learning outcomes, thought-building and decision-making. Taking part in debates about issues related to the own field of specialization.

Full-or-part-time: 4h
Theory classes: 4h
(ENG) ACTIVITAT 05 - TRANSMISIÓN DE VÍDEO

Related competencies:
CEM 11.12. Identify the fundamental concepts of digital TV.
CEM 11.1. Assess the state of current audiovisual technologies.
CEM 11.13. Use tools for processing audiovisual signals.
05 TEQ. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.
06 URI. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.
04 COE. EFFICIENT ORAL AND WRITTEN COMMUNICATION. Communicating verbally and in writing about learning outcomes, thought-building and decision-making. Taking part in debates about issues related to the own field of specialization.
07 AAT. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.

Full-or-part-time: 4h
Theory classes: 4h

(ENG) ACTIVITAT 06 - GESTIÓN DE CONTENIDOS AUDIOVISUALES

Related competencies:
CEM 11.14. Know the principles of video encoding and the main standards for multimedia applications.
CEM 11.12. Identify the fundamental concepts of digital TV.
CEM 11.1. Assess the state of current audiovisual technologies.
06 URI. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.
05 TEQ. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.
04 COE. EFFICIENT ORAL AND WRITTEN COMMUNICATION. Communicating verbally and in writing about learning outcomes, thought-building and decision-making. Taking part in debates about issues related to the own field of specialization.
07 AAT. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.

Full-or-part-time: 4h
Theory classes: 4h
GRADING SYSTEM

The final grade for the course consists of five elements:

- Midterm Exam 1 (20%)
- Midterm Exam 2 (20%)
- Final exam (25%)
- Practical Exercises (25%)
- Participation and attitude (10%)

The midterm exams and the final exam assess the competencies acquired by the student throughout the different periods of the course. The practical exercises consist of solving situations in which the student must apply the competencies developed during the course. The student's participation includes the attitude, follow-up, quality of the interventions, as well as the capacity of autonomous resolution of the questions formulated throughout the course in a context of synchrony in the classroom.

Re-evaluation. Students who have not passed the course through continuous evaluation will have the option of taking the re-evaluation exam. It will consist of a two-hour exam and the grade obtained will replace the grades of the partial exams and the final exam (65% of the final grade of the course). In order to take the exam, it is necessary to have taken the continuous evaluation process.

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EXAMINATION RULES.

(ENG) Ejercicios de prácticas

Los ejercicios de prácticas se realizan siguiendo las instrucciones que se dan en el documento Hoja de Práctica correspondiente y las indicaciones que a tal efecto se hayan dado en la parte de la clase correspondiente.

Exámenes y pruebas finales

Los exámenes y la prueba final se realizan en el laboratorio. Se proporcionará un enunciado con cuestiones y problemas relativos a los contenidos estudiados en la asignatura. Las cuestiones de carácter teórico se entregarán en papel y se resolverán en papel. Las cuestiones prácticas que requieran aspectos de programación o procesado de imágenes, en su caso, se entregarán en formato electrónico.

Las puntuaciones de cada cuestión estarán indicadas en el enunciado.

Las revisiones y / o reclamaciones respecto a los exámenes se realizarán exclusivamente en las fechas y horarios establecidos en el Calendario Académico.

BIBLIOGRAPHY

Basic: