

# ANX-PR/CL/001-01

## LEARNING GUIDE

### SUBJECT

**105000444 - Multimedia**

### DEGREE PROGRAMME

10II - Grado En Ingenieria Informatica

### ACADEMIC YEAR & SEMESTER

2022/23 - Semester 2

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## 1. Description

### 1.1. Subject details

<b>Name of the subject</b>	105000444 - Multimedia
<b>No of credits</b>	3 ECTS
<b>Type</b>	Optional
<b>Academic year of the programme</b>	Fourth year
<b>Semester of tuition</b>	Semester 8
<b>Tuition period</b>	February-June
<b>Tuition languages</b>	English
<b>Degree programme</b>	10II - Grado en Ingeniería Informática
<b>Centre</b>	10 - Escuela Técnica Superior De Ingenieros Informáticos
<b>Academic year</b>	2022-23

## 2. Faculty

### 2.1. Faculty members with subject teaching role

<b>Name and surname</b>	<b>Office/Room</b>	<b>Email</b>	<b>Tutoring hours *</b>
Antonio Jesus Diaz Honrubia (Subject coordinator)	4302	antoniojesus.diaz@upm.es	Tu - 12:00 - 14:00 W - 10:00 - 12:00 Th - 12:00 - 14:00 Please, send an e-mail before.

\* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

## 2.3. External faculty

Name and surname	Email	Institution
Angel Mario García Pedrero	agpedrero@fi.upm.es	E.T.S.I. Informáticos

## 3. Skills and learning outcomes \*

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### 3.1. Skills to be learned

CG-1/21 - Capacidad de resolución de problemas aplicando conocimientos de matemáticas, ciencias e ingeniería.

CG-19 - Capacidad de usar las tecnologías de la información y la comunicación.

CG-2/CE45 - Capacidad para el aprendizaje autónomo y la actualización de conocimientos, y reconocimiento de su necesidad en el área de la informática.

CG-6 - Capacidad de abstracción, análisis y síntesis

Ce 44 - Conocimiento de tecnologías punteras relevantes y su aplicación.

### 3.2. Learning outcomes

RA276 - Dado un campo de aplicación de la informática, evaluar y diseñar el sistema informático más apropiado para resolver alguno de sus problemas, exponiendo las dificultades técnicas y los límites de la aplicación.

RA544 - Conocer cuáles son los estándares para contenidos digitales.

RA545 - Conocer las técnicas y estándares de compresión multimedia.

RA546 - Analizar sistemas y aplicaciones multimedia.

\* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

## 4. Brief description of the subject and syllabus

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### 4.1. Brief description of the subject

This Multimedia course aims to provide the knowledge needed to identify different types of multimedia content, to understand the techniques used to compress and encode audiovisual contents, and to learn about the main standards for image, video and audio coding, as well as for multimedia systems.

### 4.2. Syllabus

1. Introduction to multimedia
2. Capture, formats and metrics of audiovisual signals
  - 2.1. Digital signals
  - 2.2. Multimedia data types
  - 2.3. Formats
  - 2.4. Metrics
3. Techniques for image, video and audio compression
4. Standards for image compression
  - 4.1. Early standards
  - 4.2. JPEG
  - 4.3. JPEG-2000 and JPEG-XR
5. Standards for video compression
  - 5.1. H.261
  - 5.2. MPEG-1
  - 5.3. MPEG-2
  - 5.4. H.263
  - 5.5. MPEG-4 Part 2
6. Advanced standards for video compression
  - 6.1. H.264/AVC (MPEG-4 Part 10)

## 6.2. H.265/HEVC

## 6.3. Next-generation video coding and other alternatives

## 7. Standards for audio compression

### 7.1. Standards for voice compression: G.72x

### 7.2. Standards for music compression: MP3, AAC, etc.

## 8. Multimedia systems

### 8.1. Digital containers for multimedia storage

### 8.2. Video-conferencing

### 8.3. TV Broadcasting

### 8.4. Digital containers for video streaming

## 5. Schedule

### 5.1. Subject schedule\*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	<b>Introduction to multimedia</b> Duration: 02:00 Lecture			
2	<b>Capture, formats and metrics of audiovisual signals</b> Duration: 01:00 Lecture  <b>Capture, formats and metrics of audiovisual signals</b> Duration: 01:00 Problem-solving class			
3	<b>Techniques for image, video and audio compression</b> Duration: 01:00 Lecture  <b>Capture, formats and metrics of audiovisual signals</b> Duration: 01:00 Problem-solving class			
4	<b>Techniques for image, video and audio compression</b> Duration: 01:00 Lecture  <b>Techniques for image, video and audio compression</b> Duration: 01:00 Problem-solving class			
5	<b>Techniques for image, video and audio compression</b> Duration: 01:00 Problem-solving class  <b>Techniques for image, video and audio compression</b> Duration: 01:00 Problem-solving class			
6	<b>Techniques for image, video and audio compression</b> Duration: 00:30 Problem-solving class	<b>Lab session: "Discrete Cosine Transform"</b> Duration: 01:20 Laboratory assignments		

7	<b>Standards for image compression</b> Duration: 01:00 Problem-solving class  <b>Standards for image compression</b> Duration: 01:00 Problem-solving class			
8	<b>Standards for image compression</b> Duration: 00:30 Problem-solving class	<b>Lab session: "JPEG"</b> Duration: 01:20 Laboratory assignments		
9	<b>Standards for video compression</b> Duration: 01:00 Lecture  <b>Standards for video compression</b> Duration: 01:00 Problem-solving class			
10	<b>Standards for video compression</b> Duration: 00:30 Problem-solving class	<b>Lab session: "Basics on video coding"</b> Duration: 01:20 Laboratory assignments		
11	<b>Advanced standards for video compression</b> Duration: 01:00 Lecture  <b>Advanced standards for video compression</b> Duration: 01:00 Problem-solving class			
12	<b>Advanced standards for video compression</b> Duration: 01:30 Problem-solving class	<b>Lab session: "Advanced video coding"</b> Duration: 01:20 Laboratory assignments		
13	<b>Standards for audio compression</b> Duration: 01:00 Lecture  <b>Standards for audio compression</b> Duration: 01:00 Problem-solving class			
14	<b>Multimedia systems</b> Duration: 00:20 Problem-solving class  <b>Multimedia systems</b> Duration: 00:30 Problem-solving class	<b>Lab session: "Multimedia systems"</b> Duration: 01:00 Laboratory assignments		
15				<b>Lab questionnaires</b> Problem-solving test Continuous assessment and final examination Presential Duration: 00:45  <b>Class problems, questions and participation</b> Other assessment Continuous assessment Presential Duration: 00:00



16				
17				<b>Theory exam</b> Written test Continuous assessment and final examination Presential Duration: 01:30

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

\* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.

## 6. Activities and assessment criteria

### 6.1. Assessment activities

#### 6.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
15	Lab questionnaires	Problem-solving test	Face-to-face	00:45	40%	4 / 10	CG-2/CE45 CG-6 CG-19
15	Class problems, questions and participation	Other assessment	Face-to-face	00:00	20%	0 / 10	CG-1/21 CG-2/CE45 CG-6 CG-19 Ce 44
17	Theory exam	Written test	Face-to-face	01:30	40%	4 / 10	CG-1/21 CG-6 Ce 44

#### 6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
15	Lab questionnaires	Problem-solving test	Face-to-face	00:45	40%	4 / 10	CG-2/CE45 CG-6 CG-19
17	Theory exam	Written test	Face-to-face	01:30	40%	4 / 10	CG-1/21 CG-6 Ce 44

#### 6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Theory exam	Written test	Face-to-face	01:30	40%	4 / 10	CG-1/21 CG-6 Ce 44

Lab questionnaires	Problem-solving test	Face-to-face	01:30	40%	4 / 10	CG-2/CE45 CG-6 CG-19
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## 6.2. Assessment criteria

### Progressive assessment and non-recoverable assessment items

According to the new assessment regulation of the Universidad Politécnica de Madrid, the only way to follow a course is the progressive assessment method. According to article 12.1, this method allows students to pass an assessment item during the course and in the global evaluation of the ordinary and extraordinary calls, unless the assessment item has been defined as "non-recoverable". In Multimedia course there is only one non-recoverable assessment item which corresponds with the score given to "Class problems, questions and participation" (20%).

This item cannot be considered to be passed with an exam in the ordinary and/or extraordinary calls since it consists on the continuous work of the student, inspired on flipped classroom. Therefore, the student will need to study class material and to solve problems at home, which will be solved and assessed in each day of class. These activities may include class problems, questions and proactive participation: students will be asked to solve problems and short questions at home and at class and they will need to solve them in the blackboard. Moreover, proactive participation in class will be considered.

There is not a minimum mark in this activity, but student who does not obtain points in the activity will not opt to more than then 80% of the total score of the course, either in the ordinary or the extraordinary call.

### Recoverable assessment items

Besides that, the course will be composed of two assessment items more:

- Theory exam: one final exam at the end of the semester, during the ordinary and the extraordinary calls (40%).
- Lab questionnaires: very short lab exams at the end of each lab session (40%). These short lab exams can be also passed during the global exam if they were not passed during the semester.

Students are required to obtain a minimum mark of 4 points (out of 10) in the theory exam and in the average of all lab exams. If any of these activities is graded lower than 4 points (out of 10), then the final mark of the subject will

be no greater than 4.5 (out of 10). The minimum mark required to pass this course is 5 points (out of 10), as long as the above criteria are met.

If the mark in the theory exam of the ordinary call is 5 or greater, it will be kept for the theory exam in the extraordinary call. Moreover, if the mark in the lab questionnaires of the ordinary call is 5 or greater, it will be kept for the lab questionnaires in the extraordinary call.

### Action procedures against fraudulent behavior

- All exams and lab deliverables must be done individually, unless specified otherwise by the teaching staff. If any non-conformity with this criteria is detected (copy, plagiarism, etc.), according to article 13 of the assessment regulations, it will be considered as academic fraud.
- According to this same article, all students involved in the fraud will be graded with 0 points (out of 10) in the corresponding call and professors may prepare a special exam only for them in the next official call to assess the learning results of the course.
- To this end, all students involved in the fraud are considered accountable, and the above actions will be taken against both active and passive agents.
- If a student is involved in a fraudulent behaviour, their marks will not be kept for the extraordinary call. Additionally, no marks will be kept between calls of future academic years.
- The above actions do not exclude other actions covered by the normative and laws.

## 7. Teaching resources

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### 7.1. Teaching resources for the subject

Name	Type	Notes
The H.264 Advanced Video Compression Standard. Second Edition	Bibliography	Iain E. Richardson. Wiley. 2010. 978-0-470-51692-8
Multimedia Signal Coding and Transmission	Bibliography	Jens-Rainer Ohm. Springer. 2014. 978-3-662-46690-2
High Efficiency Video Coding (HEVC): Algorithms and Architectures	Bibliography	Vivienne Sze, Madhukar Budagavi, Gary J. Sullivan. Springer. 2014. 978-3-319-06894-7
High Efficiency Video Coding (HEVC): Coding Tools and Specification	Bibliography	Mathias Wien. Springer. 2015. 978-3-662-44275-3
Image and Video Compression for Multimedia Engineering Fundamentals, Algorithms, and Standards, Second Edition	Bibliography	Yun Q. Shi, Huifang Sun. CRC Press. 2008. 978-0-8493-7364-0

## 8. Other information

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### 8.1. Other information about the subject

For attending this course, it is recommended that students bring a laptop.

The information contained in this learning guide might be subjected to small deviations according to the actual planning of the semester. Any deviation will be reported on Moodle with enough time.