



POLITÉCNICA

INTERNATIONAL
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COORDINATION PROCESS OF
LEARNING ACTIVITIES
PR/CL/001



E.T.S. de Ingenieros
Informaticos

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

105000444 - Multimedia

DEGREE PROGRAMME

10II - Grado En Ingenieria Informatica

ACADEMIC YEAR & SEMESTER

2021/22 - Semester 2

Index

Learning guide

1. Description.....	1
2. Faculty.....	1
3. Skills and learning outcomes	2
4. Brief description of the subject and syllabus.....	3
5. Schedule.....	5
6. Activities and assessment criteria.....	8
7. Teaching resources.....	11
8. Other information.....	12

1. Description

1.1. Subject details

Name of the subject	105000444 - Multimedia
No of credits	3 ECTS
Type	Optional
Academic year of the programme	Fourth year
Semester of tuition	Semester 8
Tuition period	February-June
Tuition languages	English
Degree programme	10II - Grado en Ingenieria Informatica
Centre	10 - Escuela Tecnica Superior De Ingenieros Informaticos
Academic year	2021-22

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
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
Gabriel Cebrián Márquez	gabriel.cebrian@upm.es	E.T.S.I. Informáticos
Angel Mario García Pedrero	agpedrero@fi.upm.es	E.T.S.I. Informáticos

3. Skills and learning outcomes *

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

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	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	Introduction to multimedia Duration: 02:00 Lecture			
2	Capture, formats and metrics of audiovisual signals Duration: 01:00 Lecture Capture, formats and metrics of audiovisual signals Duration: 01:00 Problem-solving class			
3	Techniques for image, video and audio compression Duration: 01:00 Lecture Capture, formats and metrics of audiovisual signals Duration: 01:00 Problem-solving class			
4	Techniques for image, video and audio compression Duration: 01:00 Lecture Techniques for image, video and audio compression Duration: 01:00 Problem-solving class			
5	Techniques for image, video and audio compression Duration: 01:00 Problem-solving class Techniques for image, video and audio compression Duration: 01:00 Problem-solving class			
6	Techniques for image, video and audio compression Duration: 00:30 Problem-solving class	Lab session: "Discrete Cosine Transform" Duration: 01:20 Laboratory assignments		Lab questionnaire: "Discrete Cosine Transform" Problem-solving test Continuous assessment Presential Duration: 00:10

7	<p>Standards for image compression Duration: 01:00 Problem-solving class</p> <p>Standards for image compression Duration: 01:00 Problem-solving class</p>			
8	<p>Standards for image compression Duration: 00:30 Problem-solving class</p>	<p>Lab session: "JPEG" Duration: 01:20 Laboratory assignments</p>		<p>Lab questionnaire: "JPEG" Problem-solving test Continuous assessment Presential Duration: 00:10</p>
9	<p>Standards for video compression Duration: 01:00 Lecture</p> <p>Standards for video compression Duration: 01:00 Problem-solving class</p>			
10	<p>Standards for video compression Duration: 00:30 Problem-solving class</p>	<p>Lab session: "Basics on video coding" Duration: 01:20 Laboratory assignments</p>		<p>Lab questionnaire: "Basics on video coding" Problem-solving test Continuous assessment Presential Duration: 00:10</p>
11	<p>Advanced standards for video compression Duration: 01:00 Lecture</p> <p>Advanced standards for video compression Duration: 01:00 Problem-solving class</p>			
12	<p>Advanced standards for video compression Duration: 01:30 Problem-solving class</p>	<p>Lab session: "Advanced video coding" Duration: 01:20 Laboratory assignments</p>		<p>Lab questionnaire: "Advanced video coding" Problem-solving test Continuous assessment Presential Duration: 00:10</p>
13	<p>Standards for audio compression Duration: 01:00 Lecture</p> <p>Standards for audio compression Duration: 01:00 Problem-solving class</p>			
14	<p>Multimedia systems Duration: 00:20 Problem-solving class</p> <p>Multimedia systems Duration: 00:30 Problem-solving class</p>	<p>Lab session: "Multimedia systems" Duration: 01:00 Laboratory assignments</p>		<p>Lab questionnaire: "Multimedia systems" Problem-solving test Continuous assessment Presential Duration: 00:10</p>

15				Class problems, questions and participation Other assessment Continuous assessment Presential Duration: 00:00
16				
17				Theory exam (continous assesment) Written test Continuous assessment Presential Duration: 01:30 Final Lab exam (Final-exam-only assessment) Problem-solving test Final examination Presential Duration: 01:30 Final theory exam (Final-exam-only assessment) Written test 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. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
6	Lab questionnaire: "Discrete Cosine Transform"	Problem-solving test	Face-to-face	00:10	8%	3 / 10	CG-19 CG-6 CG-2/CE45
8	Lab questionnaire: "JPEG"	Problem-solving test	Face-to-face	00:10	8%	3 / 10	CG-19 CG-6 CG-2/CE45
10	Lab questionnaire: "Basics on video coding"	Problem-solving test	Face-to-face	00:10	8%	3 / 10	CG-19 CG-6 CG-2/CE45
12	Lab questionnaire: "Advanced video coding"	Problem-solving test	Face-to-face	00:10	8%	3 / 10	CG-19 CG-6 CG-2/CE45
14	Lab questionnaire: "Multimedia systems"	Problem-solving test	Face-to-face	00:10	8%	3 / 10	CG-19 CG-6 CG-2/CE45
15	Class problems, questions and participation	Other assessment	Face-to-face	00:00	20%	0 / 10	CG-6 CG-19 Ce 44 CG-1/21 CG-2/CE45
17	Theory exam (continuous assesment)	Written test	Face-to-face	01:30	40%	3 / 10	CG-1/21 CG-6 Ce 44

6.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Final Lab exam (Final-exam-only assessment)	Problem-solving test	Face-to-face	01:30	40%	5 / 10	CG-2/CE45 CG-19 CG-6
17	Final theory exam (Final-exam-only assessment)	Written test	Face-to-face	01:30	60%	5 / 10	CG-1/21 CG-6 Ce 44

6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Final theory exam	Written test	Face-to-face	01:30	60%	5 / 10	CG-1/21 CG-6 Ce 44
Final lab exam	Problem-solving test	Face-to-face	01:30	40%	5 / 10	CG-19 CG-6 CG-2/CE45

6.2. Assessment criteria

Continuous assessment method

To follow the continuous assessment method students will need to study class material and to solve problems at home, since the teaching methodology is inspired on flipped classroom.

The continuous assessment of the course is divided into three main categories:

- Theory exam: one final exam at the end of the semester (40%).
- Lab questionnaires: five lab questionnaires at the end of each lab session (8% each, 40% total).
- 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 (20%).

Students are required to obtain a minimum mark of 3 points (out of 10) in the theory exam and each of the lab questionnaires. If any of these activities is graded lower than 3 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.

Final-exam-only assessment method and extraordinary call assessment

The final-exam-only assessment method will only be offered as agreed upon by the Examination and Assessment Regulations of the University in force in the academic course. The procedure to apply for this method is subject to the regulation established by the Associate Dean for Academic Affairs. For further information, please refer to

<http://www.fi.upm.es/?pagina=1147>

The final-exam-only assessment method and extraordinary call assessment are both divided into two main categories:

- Theory exam: one final exam (60%).
- Lab exam: one comprehensive exam, comprising the contents of all lab sessions developed during the course (40%).

Students are required to obtain a minimum mark of 5 points (out of 10) in each of the exams. If this condition is not met, then the final mark 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.

In the case of the final-exam-only assessment method, the exams might not be necessarily the same as the one of the continuous assessment.

For students following the continuous assessment method, if both the theory exam and the class problems, questions and participation marks are 5 or greater, this mark will be kept for the extraordinary call as the "Theory exam" mark (respecting the same proportion as in the continuous assessment). Similarly, if all the lab questionnaires are graded 3 or greater and the mean of all of them is 5 or greater, such a mean will be kept for the extraordinary call as the "Lab exam".

For students following the final-exam-only method, 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 exam of the ordinary call is 5 or greater, it will be kept for the lab exam 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.), all students involved will be graded with 0 points (out of 10) in the corresponding activity, and therefore they will not reach the minimum mark to pass 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

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

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.

The health situation caused by the COVID-19 pandemic is expected to have improved enough to allow the full capacity of the classrooms to be used. For this reason, the teaching of this semester has been planned in face-to-face mode.

If the sanitary conditions do not allow to use the full capacity of the classrooms, it will be transferred to a modality of mixed presence in shifts, as the one proposed in first semester guides, without the need to modify this guide.