LEARNING GUIDE

MULTIMEDIA COMMUNICATIONS

MÁSTER EN INGENIERÍA DE TELECOMUNICACIÓN

ACADEMIC YEAR	CODE	COURSE	CREDITS	TYPE	SEMESTER
2026-27	93001370	1	5 ECTS	COMPULSORY	SECOND SEMESTER

LANGUAGE	ASSIGNED CENTER
ENGLISH, SPANISH	E.T.S. DE INGENIEROS DE TELECOMUNICACION

ASSIGNED DEPARTMENT

SEÑALES, SISTEMAS Y RADIOCOMUNICACIONES

COORDINATOR

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REQUIRED PREREQUISITES

REQUIRED COURSES

—

RECOMMENDED PRIOR KNOWLEDGE

RECOMMENDED COURSES

—

OTHER RECOMMENDATIONS

—

RESULTS

RD-822/2021

Knowledge

KG1 Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación

Skills

HG2 Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio

HE1 Capacidad para aplicar métodos de la teoría de la información, la modulación adaptativa y codificación de canal, así como técnicas avanzadas de procesado digital de señal a los sistemas de comunicaciones y audiovisuales

Competences

CG3 Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios

CE9 Capacidad para resolver la convergencia, interoperabilidad y diseño de redes heterogéneas con redes locales, de acceso y troncales, así como la integración de servicios de telefonía, datos, televisión e interactivos

CG4 Que los estudiantes sepan comunicar sus conclusiones ¿y los conocimientos y razones últimas que las sustentan¿ a públicos especializados y no especializados de un modo claro y sin ambigüedades

CG5 Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo

CT6 Capacidad para emitir juicios sobre implicaciones económicas, administrativas, sociales, éticas y medioambientales ligadas a la aplicación de sus conocimientos

CT4 Capacidad para trabajar de forma efectiva como individuo, organizando y planificando su propio trabajo, de forma independiente o como miembro de un equipo

CE6	Capacidad para modelar, diseñar, implantar, gestionar, operar, administrar y mantener redes, servicios y contenidos
CT3	Capacidad para adoptar soluciones creativas que satisfagan adecuadamente las diferentes necesidades planteadas
CE4	Capacidad para diseñar y dimensionar redes de transporte, difusión y distribución de señales multimedia
CT2	Capacidad para dinamizar y liderar equipos de trabajo multidisciplinares
CT7	Capacidad para trabajar en contextos internacionales

DESCRIPTION

The objective of the course is to provide **applied and systemic training** in the techniques and technologies that shape the entire audiovisual communication chain, from content capture and production to its presentation and interaction with the end user. The course aims to provide students with an **integrated and critical overview of the multimedia workflow**, enabling them to interconnect concepts of perception, coding, transport, and quality of service.

Thus, the course offers an essential reference framework for understanding the current audiovisual ecosystem, combining technological rigor with solutions commonly employed in the industry. This **applied approach** is reflected in the constant reference to real-world systems, pedagogically simplified, and is structured around three core pillars:

- **Understanding the End-to-End flow:** Connecting the fundamentals of human visual and auditory systems with digitization, processing, and hybrid audio and video compression techniques.
- **Efficiency in transport and distribution:** Analyzing and sizing contribution and broadcasting infrastructures, contrasting traditional distribution models (Push) with current adaptive streaming technologies (Pull / DASH).
- **Interactivity and user-centricity:** Exploring new consumption paradigms (2D/3D environments, video games, and immersivity), establishing **Quality of Experience (QoE)** as the definitive criterion for the design and evaluation of communication systems.

Through the analysis of case studies, the course not only consolidates and unifies knowledge previously acquired by students, but also **develops the engineering judgment and common sense** required to design, manage, and innovate in future multimedia services.

TOPICS

1. Unit 1 - Generation and production

1.1. Multimedia production

1.2. Digitalization basics

1.3. The Human Visual System

1.4. Images-digital representation

1.5. Video-digital representation

1.6. The Human Auditory System

1.7. Audio-digital representation

1.8. The need of compressing

1.9. Video editing

1.10. Audiovisual equipment and tools

2. Unit 2 - Compression of audiovisual signals

2.1. Chroma subsampling

2.2. Data coding

2.3. Transform coding

2.4. Predictive coding

2.5. Hybrid video encoder

2.6. Video coding standards

2.7. Audio coding

3. Unit 3 - Delivery of television and multimedia

3.1. Regulation and standardization

3.2. Delivery structure: contribution, broadcasting and distribution

3.3. Design and sizing of contribution and broadcasting

3.4. "Push" distribution and "Pull" distribution (DASH)

4. Unit 4 - Display and human-computer interaction

4.1. 2D/3D displays

4.2. Interactivity and immersivity

4.3. Videogames

4.4. Quality of Experience (QoE)

ACTIVITIES

Assessment activity Learning activity

Classroom assessment

WEEKS: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 E

FORMAT	TOTAL DURATION	LOCATION	ASSESSMENT	WEIGHT	MINIMUM GRADE
In person	04h 20m	Classroom (scheduled)	Progressive	15%	0 Non-rec.

RECOVERABLE: No

JUSTIFICATION: These are activities that take place in the classroom interspersed with the lessons.

TOPICS: T1 T2 T3 T4

METHODOLOGY: Other assessment

ASSESSED OUTCOMES: CE4 CE6 CE9 CG3 CG4 CG5 CT2 CT3 CT4 CT6 CT7

Unit 1

WEEKS: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 E

FORMAT	TOTAL DURATION	LOCATION	GROUP
In person	07h 00m	Classroom (scheduled)	Normal

TOPICS: T1

METHODOLOGY: Lecture

Lab 1

WEEKS: 1 2 **3** 4 5 6 7 8 9 10 11 12 13 14 15 E

FORMAT	TOTAL DURATION	LOCATION	GROUP
In-person	03h 20m	Laboratory	Reduced

TOPICS: T1

METHODOLOGY: Laboratory assignments

Evaluation of Lab 1

WEEKS: 1 2 **3** 4 5 6 7 8 9 10 11 12 13 14 15 E

FORMAT	TOTAL DURATION	ASSESSMENT	WEIGHT	MINIMUM GRADE
In-person	00h 10m	Progressive, Global, Retake (Extraordinary)	10%	0 Non-rec.

RECOVERABLE	JUSTIFICATION
No	It requires supervised teamwork in the laboratory.

TOPICS: T1

METHODOLOGY: Work in group, Problem-solving exam

ASSESSED OUTCOMES: CE4 CE6 CE9 CG3 CG4 CG5 CT2 CT3 CT4 CT6

Unit 2

WEEKS: 1 2 3 **4** **5** **6** **7** 8 9 10 11 12 13 14 15 E

FORMAT	TOTAL DURATION	LOCATION	GROUP
In person	07h 00m	Classroom (scheduled)	Normal

TOPICS: T2

METHODOLOGY: Lecture

Lab 2

WEEKS: 1 2 3 4 5 **6** 7 8 9 10 11 12 13 14 15 E

FORMAT	TOTAL DURATION	LOCATION	GROUP
In-person	02h 10m	Laboratory	Reduced

TOPICS: T2

METHODOLOGY: Laboratory assignments

Evaluation of Lab 2

WEEKS: 1 2 3 4 5 **6** 7 8 9 10 11 12 13 14 15 E

FORMAT	TOTAL DURATION	LOCATION	ASSESSMENT	WEIGHT	MINIMUM GRADE
In person	00h 10m	Laboratory	Progressive, Global, Retake (Extraordinary)	5%	0 Non-rec.

RECOVERABLE	JUSTIFICATION
No	It requires supervised teamwork in the laboratory.

TOPICS: T2

METHODOLOGY: Problem-solving exam, Work in group

ASSESSED OUTCOMES: CE4 CE6 CE9 CG3 CG4 CG5 CT2 CT3 CT4 CT6

Unit 3

WEEKS: 1 2 3 4 5 6 **7** **8** **9** 10 11 12 13 14 15 E

FORMAT	TOTAL DURATION	LOCATION	GROUP
In person	06h 00m	Classroom (scheduled)	Normal

TOPICS: T3

METHODOLOGY: Lecture

Lab 3.1

WEEKS: 1 2 3 4 5 6 7 **8** 9 10 11 12 13 14 15 E

FORMAT	TOTAL DURATION	LOCATION	GROUP
In-person	02h 10m	Laboratory	Reduced

TOPICS
T3

METHODOLOGY
Laboratory assignments

Evaluation of Lab 3.1

WEEKS: 1 2 3 4 5 6 7 **8** 9 10 11 12 13 14 15 E

FORMAT	TOTAL DURATION	LOCATION	ASSESSMENT	WEIGHT	MINIMUM GRADE
In person	00h 10m	Laboratory	Progressive, Global, Retake (Extraordinary)	5%	0 Non-rec.

RECOVERABLE	JUSTIFICATION
No	It requires supervised teamwork in the laboratory.

TOPICS
T3

METHODOLOGY
Problem-solving exam, Work in group

ASSESSED OUTCOMES
CE4, CE6, CE9, CG3, CG4, CG5, CT2, CT3, CT4, CT6

Lab 3.2

WEEKS: 1 2 3 4 5 6 7 8 9 **10** 11 12 13 14 15 E

FORMAT	TOTAL DURATION	LOCATION	GROUP
In-person	02h 10m	Laboratory	Reduced

TOPICS
T3

METHODOLOGY
Laboratory assignments

Evaluation of Lab 3.2

WEEKS: 10

FORMAT	TOTAL DURATION	LOCATION	ASSESSMENT	WEIGHT	MINIMUM GRADE
In person	00h 10m	Laboratory	Progressive, Global, Retake (Extraordinary)	5%	0 Non-rec.

RECOVERABLE	JUSTIFICATION
No	It requires supervised teamwork in the laboratory.

TOPICS: T3

METHODOLOGY: Problem-solving exam, Work in group

ASSESSED OUTCOMES: CE4, CE6, CE9, CG3, CG4, CG5, CT2, CT3, CT4, CT6

Unit 4

WEEKS: 10, 11, 12, 13

FORMAT	TOTAL DURATION	LOCATION	GROUP
In person	06h 00m	Classroom (scheduled)	Normal

TOPICS: T4

METHODOLOGY: Lecture

Conference

WEEKS: 11

FORMAT	TOTAL DURATION	LOCATION	GROUP
In person	02h 20m	Classroom (scheduled)	Normal

METHODOLOGY: Lecture

Lab 4

WEEKS: 13

FORMAT	TOTAL DURATION	LOCATION	GROUP
In-person	02h 10m	Laboratory	Reduced

TOPICS: T4

METHODOLOGY: Laboratory assignments

Evaluation of Lab 4

WEEKS: 1 2 3 4 5 6 7 8 9 10 11 12 **13** 14 15 E

FORMAT	TOTAL DURATION	LOCATION	ASSESSMENT	WEIGHT	MINIMUM GRADE
In person	00h 10m	Laboratory	Progressive, Global, Retake (Extraordinary)	5%	0 Non-rec.

RECOVERABLE	JUSTIFICATION
No	It requires supervised teamwork in the laboratory.

TOPICS
T4

METHODOLOGY
Problem-solving exam | Work in group

ASSESSED OUTCOMES
CE4 | CE6 | CE9 | CG3 | CG4 | CG5 | CT2 | CT3 | CT4 | CT6

Final exam (part 1)

WEEKS: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 **E**

FORMAT	TOTAL DURATION	LOCATION	ASSESSMENT	WEIGHT	MINIMUM GRADE
In person	02h 00m	Exam Classroom	Progressive	30%	4

TOPICS
T1 | T2

METHODOLOGY
Written exam

ASSESSED OUTCOMES
CE4 | CE6 | CE9 | CG3 | CG4 | CG5 | CT2 | CT3 | CT4 | CT6 | CT7 | KG1 | HE1 | HG2

Final exam (part 2)

WEEKS: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 **E**

FORMAT	TOTAL DURATION	LOCATION	ASSESSMENT	WEIGHT	MINIMUM GRADE
In person	02h 00m	Other	Progressive	30%	4

TOPICS
T3 | T4

METHODOLOGY
Written exam

ASSESSED OUTCOMES
CE4 | CE6 | CE9 | CG3 | CG4 | CG5 | CT2 | CT3 | CT4 | CT6 | CT7 | KG1 | HE1 | HG2

Final exam (part 1)

WEEKS: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 **E**

FORMAT	TOTAL DURATION	LOCATION	ASSESSMENT	WEIGHT	MINIMUM GRADE
In-person	02h 00m	Exam Classroom	Global, Retake (Extraordinary)	35%	4

TOPICS: T1 T2

METHODOLOGY: Written exam

ASSESSED OUTCOMES: KG1 HE1 CE4 CE6 HG2 CE9 CG3 CG4 CG5 CT2 CT3 CT4 CT6 CT7

Final exam (part 2)

WEEKS: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 **E**

FORMAT	TOTAL DURATION	LOCATION	ASSESSMENT	WEIGHT	MINIMUM GRADE
In-person	02h 00m	Exam Classroom	Global, Retake (Extraordinary)	35%	4

TOPICS: T3 T4

METHODOLOGY: Written exam

ASSESSED OUTCOMES: KG1 HE1 CE4 CE6 HG2 CE9 CG3 CG4 CG5 CT2 CT3 CT4 CT6 CT7

WEEKLY SCHEDULE

Assessment activity · Learning activity · • Week with activity · E Exam period

Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	E
Classroom assessment	•	•	•	•	•	•	•	•	•	•	•	•	•			
Unit 1	•	•	•													
Lab 1			•													
Evaluation of Lab 1			•													
Unit 2				•	•	•	•									

Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	E
Lab 2						•										
Evaluation of Lab 2						•										
Unit 3							•	•	•							
Lab 3.1								•								
Evaluation of Lab 3.1								•								
Lab 3.2										•						
Evaluation of Lab 3.2										•						
Unit 4										•	•	•	•			
Conference											•					
Lab 4													•			
Evaluation of Lab 4													•			
Final exam (part 1)																•
Final exam (part 2)																•
Final exam (part 1)																•
Final exam (part 2)																•

ASSESSMENT CRITERIA

General criteria

Students will be evaluated through progressive evaluation. The evaluation will assess if students have acquired all the competences of the subject. Thus, evaluation through global assessment will be carried out considering all the evaluation techniques used in progressive evaluation (EX, ET, TG, etc.), and will be carried out in the exam period

approved by Consejo de Escuela for the current course and semester, except for those activities to evaluate learning results that are difficult to grade in a comprehensive test. In this case, these evaluation activities may be carried out throughout the course.

Extraordinary examination will be carried out exclusively by the global assessment method.

Carrying out laboratory sessions is an unrecoverable compulsory activity, since the practical laboratory activity is essential to ensure the skills and learning results corresponding to the subject and the availability of the laboratory is limited. The session calendar included in this guide is indicative and may be modified depending on the semester calendar and the availability of the laboratory. The final dates and times will be published at the beginning of the teaching period.

The laboratory activity constitutes a liberatory block within the academic year and it will be necessary to obtain at least a 4/10 in its overall mark to pass the subject. Any evaluation or delivery carried out may require a complementary oral evaluation by the teacher to validate that it has been carried out by the student without the help of AI systems.

Each of the two final exams is also a liberatory block within the academic year, requiring a minimum of 4 points out of 10 in each one to pass the subject.

The schedule for the invited lecture included in this guide is for guidance only and may be subject to change depending on the semester calendar and the speaker's availability. The final date and time will be published at the beginning of the academic term. Attendance at this lecture is mandatory; therefore, unexcused absences will result in a penalty to the final grade.

The subject will be passed when a grade greater than or equal to 50% of the total score is obtained. Any type of copy or fraudulent action implies a mark of zero in the ordinary examination.

Assessment criteria for the regular exam period. Progressive assessment

Assessment criteria

The evaluation will consist of:

- Classroom assessment (C): Short quizzes during lectures, or short exercises and assignments related to those lectures. They will result in a grade, C, between 0 and 10 points.
- Laboratory (30%): Submissions/exams related to laboratory sessions. They will result in a grade, L, between 0 and 10 points.
- Final exam (part 1) (30%): Exam covering the content of the first two units of the course. It will result in a grade, E1, between 0 and 10 points.
- Final exam (part 2) (30%): Exam covering the content of the last two units of the course. It will result in a grade, E1, between 0 and 10 points.

The final average grade, N, will be calculated as follows:

N = min(10, 0.15*C + 0.3*L + 0.3*E1 + 0.3*E2)

Activities

- Classroom assessment (15%)
- Evaluation of Lab 1 (10%)
- Evaluation of Lab 2 (5%)
- Evaluation of Lab 3.1 (5%)
- Evaluation of Lab 3.2 (5%)
- Evaluation of Lab 4 (5%)
- Final exam (part 1) (30%)
- Final exam (part 2) (30%)

Assessment criteria for the regular exam period. Global assessment

Assessment criteria

Students who do not wish to participate in the progressive assessment must indicate this within the timeframe and in the manner that will be communicated to them at the beginning of the academic period.

The evaluation will consist of:

- Laboratory (L): Assignments/exams related to laboratory work. They will result in a grade, L, between 0 and 10 points.
- Final Exam (Part 1) (E1): Exam covering the content of the first two units of the course. It will result in a grade, E1, between 0 and 10 points.
- Final Exam (Part 2) (E2): Exam covering the content of the last two units of the course. It will result in a grade, E2, between 0 and 10 points.

The final average grade, N, will be calculated as follows:

N = 0.3*L + 0.35*E1 + 0.35*E2

Activities

- Evaluation of Lab 1 (10%)
- Evaluation of Lab 2 (5%)
- Evaluation of Lab 3.1 (5%)
- Evaluation of Lab 3.2 (5%)
- Evaluation of Lab 4 (5%)
- Final exam (part 1) (35%)
- Final exam (part 2) (35%)

Assessment criteria for the retake (extraordinary) exam period

Assessment criteria

The evaluation will consist of:

- Laboratory (L): Assignments/exams related to laboratory work. They will result in a grade, L, between 0 and 10 points.
- Final Exam (Part 1) (E1): Exam covering the content of the first two units of the course. It will result in a grade, E1, between 0 and 10 points.
- Final Exam (Part 2) (E2): Exam covering the content of the last two units of the course. It will result in a grade, E2, between 0 and 10 points.

The final average grade, N, will be calculated as follows:

N = 0.3*L + 0.35*E1 + 0.35*E2

Activities

- Evaluation of Lab 1 (10%)
- Evaluation of Lab 2 (5%)
- Evaluation of Lab 3.1 (5%)
- Evaluation of Lab 3.2 (5%)
- Evaluation of Lab 4 (5%)
- Final exam (part 1) (35%)
- Final exam (part 2) (35%)

RESOURCES

Bibliography

Apuntes

Apuntes de la asignatura

Web

Página web de la asignatura

http://moodle.upm.es/titulaciones/oficiales

Equipment

Aula

Aula asignada por Jefatura de Estudios

Laboratorio

Laboratorio de Señales y Comunicaciones A.202-L

Bibliography

Libro - Bovik

A. Bovik, The Essential Guide to Video Processing, Academic Press, 2009.

Libro - Owens (Video)

J. Owens, Video Production Handbook (6th Edition). Focal Press, 2017.

Libro - Owens (Television)

J. Owens, Television Production (17th Edition). Focal Press, 2020.

Libro - Poynton

C. Poynton, Digital Video and HDTV Algorithms and Interfaces (2nd Edition), Morgan Kaufmann Publishers, 2012.

Libro - Schaar

M. van der Schaar, P. A. Chou, Multimedia over IP and Wireless Networks, Academic Press, 2007.

Libro - Watkinson

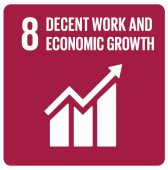
J. Watkinson, The MPEG Handbook. MPEG-1, MPEG-2, MPEG-4 (2nd Edition), Elsevier, 2004.

SUSTAINABLE DEVELOPMENT GOALS

Good Health and Well-being

Quality Education

Affordable and Clean Energy



Decent Work and Economic Growth

Industry, Innovation and Infrastructure

Sustainable Cities and Communities