



POLITÉCNICA

INTERNATIONAL
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COORDINATION PROCESS OF
LEARNING ACTIVITIES
PR/CL/001



E.T.S. de Ingenieros de
Telecomunicacion

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

93000806 - Media Data System Design

DEGREE PROGRAMME

09AQ - Master Universitario En Ingenieria De Telecomunicacion

ACADEMIC YEAR & SEMESTER

2023/24 - Semester 2

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1. Description

1.1. Subject details

Name of the subject	93000806 - Media Data System Design
No of credits	6 ECTS
Type	Optional
Academic year of the programme	Second year
Semester of tuition	Semester 4
Tuition period	February-June
Tuition languages	English
Degree programme	09AQ - Master Universitario en Ingenieria de Telecomunicacion
Centre	09 - Escuela Tecnica Superior De Ingenieros De Telecomunicacion
Academic year	2023-24

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Fco. Javier Casajus De Quiros	C-328	javier.casajus@upm.es	Sin horario. Appointment arranged by email.
Jose Manuel Menendez Garcia (Subject coordinator)	C-300	jm.menendez@upm.es	Sin horario. Appointment arranged by email.

Jose Luis Blanco Murillo	C-303	jl.blanco@upm.es	Sin horario. Appointment arranged by email.
Alberto Belmonte Hernandez	D.103	alberto.belmonte@upm.es	Sin horario. Appointment arranged by email

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

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

- Tratamiento De Señal Para Datos Masivos

3.2. Other recommended learning outcomes

- Digital processing of images and video
- Digital processing of audio and voice

4. Skills and learning outcomes *

4.1. Skills to be learned

CE1 - 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.

CE4 - Capacidad para diseñar y dimensionar redes de transporte, difusión y distribución de señales multimedia.

CG1 - 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.

CG2 - 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.

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.

CT1 - Capacidad para comprender los contenidos de clases magistrales, conferencias y seminarios en lengua inglesa.

CT2 - Capacidad para dinamizar y liderar equipos de trabajo multidisciplinares.

CT3 - Capacidad para adoptar soluciones creativas que satisfagan adecuadamente las diferentes necesidades planteadas.

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

CT5 - Capacidad para gestionar la información, identificando las fuentes necesarias, los principales tipos de documentos técnicos y científicos, de una manera adecuada y eficiente.

4.2. Learning outcomes

RA194 - Conocer y aplicar técnicas de análisis de datos

RA229 - Conocimiento de las aplicaciones basadas en el análisis y tratamiento espacio-temporal de la señal de vídeo

RA23 - Capacidad de abordar la gestión de un proyecto de ingeniería sencillo, en todas sus fases: planificación, asignación de recursos, estudio de la viabilidad económica y seguimiento y control. (CG1, CG2, CT3)

RA228 - Manejar algunas de las herramientas informáticas fundamentales para la implementación de algoritmos de Tratamiento Digital de Vídeo

RA9 - Saber redactar informes técnicos sobre trabajos realizados, con una estructura, contenidos y lenguaje del nivel adecuado a un trabajo de ingeniería

RA10 - Saber realizar una presentación de carácter técnico, ante una audiencia de pares, que describa el trabajo realizado y sus resultados, de forma clara y bien estructurada, en el tiempo establecido, y usando un lenguaje preciso

RA44 - Conocimiento y caracterización de los elementos de los sistemas multimedia

RA25 - P ráctica de habilidades transversales necesarias para la gestión y participación en proyectos de

ingeniería. (CG4, CT2, CT4)

RA43 - Conocimiento de los problemas prácticos que pueden resolverse mediante sistemas multimedia

RA46 - Conocimiento las técnicas y herramientas necesarias para analizar, especificar, implantar y mantener sistemas y servicios multimedia

RA49 - Manejo de las herramientas informáticas requeridas para la implantación y gestión de sistemas y servicios multimedia

RA227 - Manejar las herramientas matemáticas y conceptuales que sirven de base a las técnicas de Tratamiento Digital de Vídeo

RA134 - Manejar con soltura las bases de álgebra lineal y cálculo infinitesimal necesarias para formular problemas de optimización.

RA135 - Conocer y dominar herramientas para la resolución de problemas fundamentales de optimización.

RA230 - Conocer la teoría y las aplicaciones de los algoritmos de estimación y análisis de movimiento

RA231 - Conocer la teoría y las aplicaciones de los algoritmos de filtrado de vídeo

RA232 - Conocer la teoría y las aplicaciones de los algoritmos de segmentación, detección y seguimiento

RA1 - Conocer estándares y protocolos utilizados en el desarrollo de aplicaciones orientadas a servicios. Comprender el funcionamiento de aplicaciones software constituidas por un conjunto de servicios interactuando, coordinados por procesos de negocio

RA110 - Describir el diseño de sistemas avanzados basados en procesador con diagrama de bloques

RA111 - Implementar y usar el software, modos de dirección y conjuntos de instrucciones de procesadores avanzados

RA127 - Capacidad de entender y seleccionar las diferentes alternativas para realizar el procesado analógico y digital

RA274 - Knowledge of the practical problems that can be solved with video processing techniques

RA136 - Manejar con soltura las bases del modelado matemático de señales aleatorias.

RA137 - Conocer y dominar herramientas para la resolución de problemas de estimación y detección.

RA247 - Capacidad de evaluar, diseñar y analizar estrategias de procesamiento de señal asociadas a sistemas de comunicaciones y/o audiovisuales

RA273 - Knowledge, characterization, acquisition and manipulation of video signals

RA276 - Knowledge of the applications based on the spatio-temporal analysis of video signals

RA280 - To know the theory and applications of segmentation, detection and tracking algorithms

RA281 - Handle some of the fundamental computer tools for the implementation of Digital Video Processing algorithms

RA305 - Capability to design, develop and evaluate machine-learning techniques for a wide range of application areas

RA193 - Conocer los principios de los sistemas inteligentes

RA248 - Conocimiento y caracterización de los elementos de sistemas de procesamiento de señal audiovisual.

RA275 - Manage the mathematical and conceptual tools that serve as a basis for the Digital Video Processing techniques

RA277 - To know the theory and applications related to the algorithms of motion estimation and analysis

RA279 - To know the theory and applications of video filtering algorithms

* 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.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

The subject includes the study of main functional components of media asset management systems (MAMs), enabling students to design systems that add value to the exploitation of media data by applying signal processing, data analytics and machine learning techniques to different media elements: audio, video, text, etc.

The subject has a strong practical component aim, and so it is complemented with several laboratory exercises, according to the Project Based Learning philosophy. The students will be organised in small groups that must properly organise and coordinate themselves to be able to cover all the functional aspects that the exercises require, in a given time slot. Resources from the Laboratory of Signals and Communications will be used, including workstations.

5.2. Syllabus

1. Media asset management (MAM)
2. Audio data analysis
 - 2.1. Audio characterization
 - 2.2. Audio summarization
 - 2.3. Audio annotation
3. Database search
4. User profiling and content recommendation
5. Video data analysis
 - 5.1. Video characterisation
 - 5.2. Video summarization
 - 5.3. Video annotation
6. Sentiment analysis and fake news detection
7. QoE monitoring

6. Schedule

6.1. Subject schedule*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	<p>Chapter 0 Duration: 00:30 Lecture</p> <p>Chapter 1 Duration: 00:30 Lecture</p> <p>Chapter 2 Duration: 03:00 Lecture</p>			
2	<p>Chapter 2 Duration: 04:00 Lecture</p>			
3	<p>Chapter 2 Duration: 03:00 Lecture</p> <p>Chapter 3 Duration: 01:00 Lecture</p>			
4		<p>Laboratory Exercise 1: Audio characterization Duration: 04:00 Laboratory assignments</p>		<p>Collaborative work. Presentation of the laboratory exercise memory in time, following the specified procedure, to allow a continuous evaluation. Group work Continuous assessment and final examination Not Presential Duration: 04:00</p> <p>Evaluation during the performance of the laboratory exercise Problem-solving test Continuous assessment and final examination Presential Duration: 00:00</p>
5	<p>Chapter 3 Duration: 04:00 Lecture</p>			
6	<p>Chapter 3 Duration: 01:00 Lecture</p> <p>Chapter 4 Duration: 03:00 Lecture</p>			

7		<p>Laboratory Exercise 2: User profiling and content recommendation Duration: 04:00 Laboratory assignments</p>		<p>Collaborative work. Presentation of the laboratory exercise memory in time, following the specified procedure, to allow a continuous evaluation. Group work Continuous assessment and final examination Not Presential Duration: 04:00</p> <p>Evaluation during the performance of the laboratory exercise Problem-solving test Continuous assessment and final examination Presential Duration: 00:00</p>
8	<p>Chapter 4 Duration: 01:00 Lecture</p> <p>Chapter 5 Duration: 03:00 Lecture</p>			
9	<p>Chapter 5 Duration: 04:00 Lecture</p>			
10	<p>Chapter 5 Duration: 04:00 Lecture</p>			
11		<p>Laboratory Exercise 3: Video characterization Duration: 04:00 Laboratory assignments</p>		<p>Collaborative work. Presentation of the laboratory exercise memory in time, following the specified procedure, to allow a continuous evaluation. Group work Continuous assessment and final examination Not Presential Duration: 04:00</p> <p>Evaluation during the performance of the laboratory exercise Problem-solving test Continuous assessment and final examination Presential Duration: 00:00</p>
12	<p>Chapter 6 Duration: 04:00 Lecture</p>			
13	<p>Chapter 6 Duration: 01:00 Lecture</p> <p>Chapter 7 Duration: 01:00 Lecture</p>			

14		Laboratory Exercise 4: Text analysis for video data Duration: 04:00 Laboratory assignments		Collaborative work. Presentation of the laboratory exercise memory in time, following the specified procedure, to allow a continuous evaluation. Group work Continuous assessment and final examination Not Presential Duration: 04:00 Evaluation during the performance of the laboratory exercise Problem-solving test Continuous assessment and final examination Presential Duration: 00:00
15				
16				
17				Final exam (Chapters 1 to 7) Written test Continuous assessment and final examination Presential Duration: 02:00

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.

7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
4	Collaborative work. Presentation of the laboratory exercise memory in time, following the specified procedure, to allow a continuous evaluation.	Group work	No Presential	04:00	4.75%	5 / 10	CG4 CT2 CT3 CT4 CT1 CT5 CG2 CG5 CE1 CE4
4	Evaluation during the performance of the laboratory exercise	Problem-solving test	Face-to-face	00:00	4%	5 / 10	CG4 CT2 CT3 CT4 CT1 CT5 CG2 CG5 CE1 CE4
7	Collaborative work. Presentation of the laboratory exercise memory in time, following the specified procedure, to allow a continuous evaluation.	Group work	No Presential	04:00	4.75%	5 / 10	CG4 CT2 CT3 CT4 CT1 CT5 CG2 CG5
7	Evaluation during the performance of the laboratory exercise	Problem-solving test	Face-to-face	00:00	4%	5 / 10	
11	Collaborative work. Presentation of the laboratory exercise memory in time, following the specified procedure, to allow a continuous evaluation.	Group work	No Presential	04:00	4.75%	5 / 10	CG4 CT2 CT3 CT4 CT1 CT5 CG2 CG5 CE1

11	Evaluation during the performance of the laboratory exercise	Problem-solving test	Face-to-face	00:00	4%	5 / 10	CG4 CT2 CT3 CT4 CT1 CT5 CG2 CG5 CE1
14	Collaborative work. Presentation of the laboratory exercise memory in time, following the specified procedure, to allow a continuous evaluation.	Group work	No Presential	04:00	4.75%	5 / 10	CT2 CT3 CT4 CT1 CT5 CG2 CG5 CG1 CG4
14	Evaluation during the performance of the laboratory exercise	Problem-solving test	Face-to-face	00:00	4%	5 / 10	CG4 CT2 CT3 CT4 CT1 CT5 CG2 CG5 CG1
17	Final exam (Chapters 1 to 7)	Written test	Face-to-face	02:00	65%	5 / 10	CG4 CT2 CT3 CT4 CT1 CT5 CG2 CG5

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
4	Collaborative work. Presentation of the laboratory exercise memory in time, following the specified procedure, to allow a continuous evaluation.	Group work	No Presential	04:00	4.75%	5 / 10	CG4 CT2 CT3 CT4 CT1 CT5 CG2 CG5 CE1 CE4

4	Evaluation during the performance of the laboratory exercise	Problem-solving test	Face-to-face	00:00	4%	5 / 10	CG4 CT2 CT3 CT4 CT1 CT5 CG2 CG5 CE1 CE4
7	Collaborative work. Presentation of the laboratory exercise memory in time, following the specified procedure, to allow a continuous evaluation.	Group work	No Presential	04:00	4.75%	5 / 10	CG4 CT2 CT3 CT4 CT1 CT5 CG2 CG5
7	Evaluation during the performance of the laboratory exercise	Problem-solving test	Face-to-face	00:00	4%	5 / 10	
11	Collaborative work. Presentation of the laboratory exercise memory in time, following the specified procedure, to allow a continuous evaluation.	Group work	No Presential	04:00	4.75%	5 / 10	CG4 CT2 CT3 CT4 CT1 CT5 CG2 CG5 CE1
11	Evaluation during the performance of the laboratory exercise	Problem-solving test	Face-to-face	00:00	4%	5 / 10	CG4 CT2 CT3 CT4 CT1 CT5 CG2 CG5 CE1
14	Collaborative work. Presentation of the laboratory exercise memory in time, following the specified procedure, to allow a continuous evaluation.	Group work	No Presential	04:00	4.75%	5 / 10	CT2 CT3 CT4 CT1 CT5 CG2 CG5 CG1 CG4

14	Evaluation during the performance of the laboratory exercise	Problem-solving test	Face-to-face	00:00	4%	5 / 10	CG4 CT2 CT3 CT4 CT1 CT5 CG2 CG5 CG1
17	Final exam (Chapters 1 to 7)	Written test	Face-to-face	02:00	65%	5 / 10	CG4 CT2 CT3 CT4 CT1 CT5 CG2 CG5

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Final exam (Chapters 1 to 7)	Written test	Face-to-face	02:00	65%	5 / 10	CT2 CT3 CT4 CG4 CT1 CT5 CG2 CG5

7.2. Assessment criteria

This subject belongs to the Master of Science in Telecommunication Engineering. The master's degree requires compulsory attendance by the student for those activities whose competences cannot be acquired remotely.

The assessment will check whether students have acquired the competences of the subject. Therefore, the assessment in the extraordinary exam will use the same types of assessment techniques that are used in the ordinary exam (EX, ET, TG, etc.), and will be carried out on the dates and times approved by the School Board for the current academic year and semester, except for those activities for the assessment of learning outcomes that are difficult to grade in a final exam. In this case, these assessment activities will be carried out throughout the course.

Attendance and active participation of the student in the classes will be taken into account in the evaluation. Partial exams on specific contents may be proposed, which will be announced by the teachers in the classroom well in advance.

The activities carried out in the laboratory consist of practical sessions over several days carried out during the teaching period of the laboratory, related to the assessment of learning outcomes that are difficult to grade in a final exam as they involve the use of specific laboratory equipment, instruments and technical support material necessary to acquire certain competences. Therefore, laboratory activities are **MANDATORY ACTIVITIES NOT RECOVERABLE**, they are part of ALL assessment modalities, and must be carried out by ALL students on the dates scheduled for this purpose during the teaching period as they are activities of progressive assessment throughout the duration of their completion.

Assessment of the laboratory is carried out by means of daily monitoring by the teachers with the students, as well as on the basis of the reports handed in on the laboratory exercises carried out. The delivery of the reports in due time and form is compulsory and necessary to pass in ALL the exams and evaluation modalities. Partial exams may be proposed for certain specific laboratory contents, which will be announced by the teachers sufficiently in advance.

The grade obtained in the non-recoverable compulsory activities of the laboratory exercises may be retained exclusively for the following year (not for subsequent years) upon written request by the student, through the School Secretary's Office Register, addressed to the subject coordinator. The request to maintain the grade for the previous year's practicals must be submitted before the end of the **THIRD WEEK** of the semester.

An exam will be held in the period of the ordinary official exam (after week 15) to assess the knowledge corresponding to the theory taught in the classroom and the knowledge acquired in the laboratory doing the

exercises. The weight of this exam in the final mark will be 65%. The remaining 35% will be obtained from the student's work in the laboratory, and from the reports that must be handed in on this work. In order to be able to average both parts, it will be necessary to obtain a minimum mark of 3.5 points in each of them (separately).

For those students who require it, another exam will be held during the period of the official extraordinary exam (in the period set for this purpose by the Head of Studies) to assess the knowledge corresponding to the theory taught in the classroom and the knowledge acquired in the laboratory during the laboratory exercises. The weight of this extraordinary exam in the final mark will be 65%. The remaining 35% will be obtained from the student's work in the performance of the compulsory non-recoverable tests in the laboratory, and from the reports that must be handed in before the examination of the ORDINARY exam. In order to be able to average both parts, it will be necessary to obtain a minimum mark of 3.5 points in each of them (separately).

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
D. Austerberry, "Digital asset management". Focal Press, 2006.	Bibliography	
A. Kovalick, "The Essentials of Professional Networked Media", Focal Press, 2006.	Bibliography	
D. Peña. "Análisis de datos multivariantes" Mc Graw Hill, 2002.	Bibliography	
C. C. Aggarwal & C. Zhai. "Mining text data". Springer Science & Business Media, 2012.	Bibliography	
S. Bhattacharyya, H. Bhaumik, S. De, & G. Klepac. "Intelligent Analysis of multimedia information". IGI Global. 2016.	Bibliography	
G. Blokdyk. "Feature extraction". 5Starcooks, 2019.	Bibliography	
M. Nixon & A. S. Aguado. "Feature Extraction and Image Processing for Computer Vision", Academic Press, 2019.	Bibliography	
J. VanderPlasPython. "Python Data Science Handbook: Essential Tools for Working with Data". O'Reilly Media, Inc, 2016.	Bibliography	
A. Geron. "Hands On Machine Learning with Scikit Learn and TensorFlow". O'Reilly Media, Inc, 2017.	Bibliography	

O. Embarak. "Data Analysis and Visualization Using Python Analyze Data to Create Visualizations for BI Systems". Academic Press, 2018.	Bibliography	
W. McKinney, "Python for data analysis: Data wrangling with Pandas, NumPy, and IPython"., O'Reilly Media, Inc, 2012	Bibliography	
T. Segaran, "Programming collective intelligence: building smart web 2.0 applications", O'Reilly Media, Inc, 2007.	Bibliography	
W. McKinney, "Python for Data Analysis". O'Reilly, 2018.	Bibliography	
Web page of the subject http://moodle.upm.es/titulaciones/oficiales	Web resource	
Laboratory of Signals and Communications A.202-L	Equipment	
Group work room: Laboratory A.202-L	Equipment	

9. Other information

9.1. Other information about the subject

The subject supports the Sustainable Development Objectives from the United Nations, making emphasis in the following items:

- Increase the number of people with the professional and technical skills needed to access employment, decent work and entrepreneurship.
- Ensure that all students acquire the knowledge and skills necessary to promote sustainable development.
- Develop reliable, sustainable, resilient and quality infrastructure, with particular emphasis on affordable and

equitable access for all.

- Increase access to ICTs and strive to provide universal and affordable access to the Internet in the least developed countries.
- Improve cooperation on and access to science, technology and innovation, and increase knowledge sharing on mutually agreed terms.