



COURSE DATA

Data Subject

Code	41053
Name	Techniques for the analysis and processing of geographical information
Cycle	Master's degree
ECTS Credits	14.0
Academic year	2024 - 2025

Study (s)

Degree	Center	Acad. year	Period
2001 - Master's Degree in Environmental and Territorial Management Techniques	Faculty of Geography and History	1	First term

Subject-matter

Degree	Subject-matter	Character
2001 - Master's Degree in Environmental and Territorial Management Techniques	2 - Techniques for the analysis and processing of geographic information	Obligatory

Coordination

Name	Department
IRANZO GARCIA, EMILIO	195 - Geography

SUMMARY

Over the past two decades, geographic information systems have emerged as an essential tool for cartographic editing, and for the management of land and the natural environment. These programs and platforms handle geographical information in various media (conventional mapping, aerial photographs, and satellite images), integrate cartographic and alphanumeric information (databases), and execute various operations of spatial analysis, as well as generating new spatial information.

The use of geographic information systems is therefore essential for the monitoring and analysis of territorial and environmental processes, and for the translation of results to papers and projects within this area.

These systems are a leading tool for territorial diagnosis and analysis, insofar as they permit the use of large amounts of very different types of information (such as physical environment, infrastructure, population, and land use). At the same time, tools of spatial analysis and geostatistics that incorporate GIS



enable the use of innovative and in-depth approaches that would otherwise be unthinkable. Satellites provide a wealth of information for the recognition and assessment of the planet's resources and the processes taking place, and this information is being further extended by the increasing resolution of spectral and spatial imagery.

Moreover, artificial intelligence (AI) has emerged as a powerful tool in environmental and land management. It offers numerous advantages, such as increased efficiency, accuracy in decision-making and the ability to handle large volumes of complex data. AI can significantly improve GIS through predictive analytics, pattern detection, processing large geospatial datasets, identifying trends in natural ecosystems or in urban systems.

The module addresses the application of these methodologies to plans and projects with an environmental dimension, which are the fundamental instrument for the implementation of conservation and impact mitigation policies, and a key element for the development of public policy in this field, with particular attention to landscape analysis and planning and the study of sustainable mobility.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

None

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

2001 - Master's Degree in Environmental and Territorial Management Techniques

- Capacidad de percibir y gestionar los problemas ambientales que afectan al territorio considerando las diferentes perspectivas de los actores implicados.
- Capacidad de organización, planificación y gestión de la información ambiental y territorial
- Manejo de técnicas de análisis y representación cartográfica medioambiental y territorial.
- Manejo de Sistemas de Información Geográfica aplicados a los problemas medioambientales y territoriales
- Técnicas de Teledetección espacial
- Capacidad de realizar la planificación territorial: análisis, diagnóstico y propuestas.



- Capacidad de analizar y caracterizar los procesos naturales y de degradación y evaluar las posibilidades de restauración medioambiental.
- Aprender a elaborar catálogos de paisaje y estudios de integración paisajística
- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

Handling of tools (drones) and software that enable the development of territorial and environmental projects and studies.

Carrying out environmental projects and reports.

Carrying out studies of environmental and territorial problems with GIS, remote sensing and Artificial Intelligence tools.

Handling of topographic information and extraction of useful data for territorial and environmental management.

Implementation of landscape studies and landscape integration.

Elaboration of sustainable mobility studies.

DESCRIPTION OF CONTENTS

1. Basic concepts of cartographic design

Principles of cartographic design: semiology, symbolization, labeling, hierarchy and lay-out.

Case analysis: characteristics of good maps.

Exercises of cartographic expression.



2. Remote sensing

Remote sensing concepts and spectral response.

Sensors and satellites.

Physical principles for remote sensing. Diversity of current sensors and data.

Digital images processing. Classification.

Development of study case on image processing.

3. Techniques for the analysis of environmental and territorial problems with GIS

Obtaining digital elevation models for the analysis of environmental problems

Preparation and analysis of digital elevation models with LiDAR.

Elaboration and analysis of digital elevation models from photogrammetry with SfM-MVS.

Applications of high resolution digital elevation models.

Introduction to spatial statistics with GIS

Raster Model Generation: Description of Interpolation Methods

Geographically weighted regression (GWR). Theory, examples and analysis of results

Modeling using nonparametric estimation

4. Drones and territorial modelling

Basics of drone operation

Obtaining and analysing topographic information from drones

5. Instruments for landscape management and regulation

Basic concepts for landscape conception: terms and perspectives

The New Culture of Territory and the EU Landscape Convention.

Spanish and Valencian landscape policies (instruments for planning, regulation and management)

Valencia Region landscape instruments: legal framework, Territorial Action Plans, Landscape studies, Landscape Integration studies, proposals and projects for landscape action.

6. Introduction to Artificial Intelligence

Description of artificial intelligence from the basic elements: data, model, cost function and training.

Examples of use.

7. Applications of Artificial Intelligence for sustainable land management

The introductory AI programme starts with a definition and basic concepts of artificial intelligence, followed by the relevance and benefits of AI in sustainability through examples and case studies. Next, the most common AI techniques and tools are addressed along with practical demonstrations. Finally, future trends and research opportunities at the intersection of AI and sustainability are explored.



8. Sustainable daily mobility

The basic concepts of sustainable mobility: urban form and mobility.
Sustainability assessment criteria.
Regulatory instruments: mobility laws, SUMP (Sustainable Urban Mobility Plan), metropolitan plans.
Information on daily mobility: sources and indicators.
Mobility supply: infrastructures and equipment.
Study of mobility demand: traffic and passengers. O/D matrices: census data, mobile phone data, O-D surveys, screen surveys.

9. Artificial Intelligence applications for sustainable mobility planning

AI techniques for mobility: optimisation, simulation and coordination methods

10. Design and presentation of reports and documents

Acquisition of the necessary skills to organise a panel and a document combining graphics, images, maps and text in a way that is accessible, rigorous and aesthetically appealing.
Use of layout tools
Strategies for organising information and prioritising content, and incorporating basic concepts of layout, chroma
basic concepts of layout, colour and typography.

WORKLOAD

ACTIVITY	Hours	% To be attended
Computer classroom practice	54,00	100
Theory classes	10,00	100
Classroom practices	10,00	100
Seminars	6,00	100
Other activities	4,00	100
Tutorials	2,00	100
Study and independent work	50,00	0
Preparation of evaluation activities	64,00	0
Resolution of case studies	50,00	0
TOTAL	250,00	



TEACHING METHODOLOGY

The course combines theoretical sessions led by a lecturer with practical exercises for students working inside and outside the classroom.

The goal is for students to independently solve practical exercises with GIS, remote sensing tools, AI and drones, so that the lecturer's role is increasingly unnecessary. At the end of the course, students will be asked to independently perform a practical application.

In theory classes, fundamental concepts are taught by lecturers – and an analysis and commentary of texts, documents, and plans is made. Texts, documents, and plans will be read individually, in some cases prior to class and in other cases after class, in order to facilitate participation and discussion, as well as any written work.

Students must produce individual written work from readings of texts on aspects of the subject matter.

EVALUATION

The final grade will be based on the following:

- Class attendance (minimum of 80% attendance).
- Short tests at the end of each part of the course (15%).
- Individual written work and practical exercises (85%).

Regarding the assessment and grading, the appropriate provisions of Chapter VI of the Regulations of assessment and grading of the Universitat de València for bachelor's and master's degrees will be followed. ACGUV 108/2017 (http://www.uv.es/graus/normatives/2017_108_Reglament_avaluacio_qualificacio.pdf).

Regarding the plagiarism of any of the works requested in the framework of this module, the CEC approves, in the meeting of 26 March 2024, that the deliveries with 20% or more of plagiarism will be automatically suspended.

We also recommend accessing and reading the Protocol of action against fraudulent practices at the Universitat de València. ACGUV 123/2020 (<https://www.uv.es/sgeneral/Protocols/C83sp.pdf>).

REFERENCES

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Additional

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