COURSE DATA

DATA SUBJECT

Code: 41053
Name: Techniques for the analysis and processing of geographical information
Cycle: Master's Degree
ECTS Credits: 14
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
2001 - Master's Degree in Environmental and Territorial Management Techniques	Facultat de Geografia i Història	1	First quarter

SUBJECT-MATTER

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

COORDINATION

IRANZO GARCIA EMILIO

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 / LEARNING OUTCOMES

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Aprender a elaborar catálogos de paisaje y estudios de integración paisajística

Capacidad de analizar y caracterizar los procesos naturales y de degradación y evaluar las posibilidades de restauración medioambiental.

Capacidad de organización, planificación y gestión de la información ambiental y territorial

Capacidad de percibir y gestionar los problemas ambientales que afectan al territorio considerando las diferentes perspectivas de los actores implicados.

Capacidad de realizar la planificación territorial: análisis, diagnóstico y propuestas.

Manejo de Sistemas de Información Geográfica aplicados a los problemas medioambientales y territoriales

Manejo de técnicas de análisis y representación

cartográfica medioambiental y territorial.

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.

Técnicas de Teledetección espacial

DESCRIPTION OF CONTENTS

1. Basic concepts of cartographic design

Principles of cartographic design: semiology, symbolization, labeling, hyerarchy 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

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	2,00
Theory	10,00
Seminar	6,00
Other activities	4,00
Computer classroom practice	54,00
Classroom practices	10,00
Total hours	**86,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	0,00
Independent study and work	100,00
Preparation of lessons	0,00
Preparation for assessment activities	64,00
Resolution of case studies	100,00
Total hours	**264,00**

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).

- Individual written work and practical exercises (100%).

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 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

Basic:

ANDER EGG, E. (2000). *Cómo elaborar un proyecto. Guía para diseñar proyectos*.

CHUVIECO, E. (1996). F*undamentos de teledetección espacial.* Rialp S.A.

CONSELLERIA DE INFRAESTRUCTURAS, TERRITORIO Y MEDIO AMBIENTE (2012). *Guía metodológica. Estudio de Paisaje*.

GÓMEZ, J., y RIESCO. P. (2010). *Marco conceptual y metodológico para los paisajes españoles. Aplicación a tres escalas espaciales*. Consejería de Obras Públicas y Vivienda. Junta de Andalucía.

MORENO, A. (2008). *Sistemas y Análisis de la Información Geográfica. Manual de autoaprendizaje con Arc-Gis*. Ra-Ma.

SORIA, E., RODRÍGUEZ, P., GARCÍA, Q., VAQUER, F., VICENT, J., y VILA, J. (2022). *Inteligencia artificial*. Ra-Ma.

Complementary:

BALAGUER-PUIG, M., MARQUÉS-MATEU, A., LERMA, J. L., y IBAÑEZ, S. (2017). Estimation of small-scale soil erosion in laboratory experiments with Structure from Motion photogrammetry. *Geomorphology*, (295), 285-296.

COBO, H. (1998). *Glosario de Metodología*. Impretec.

COMISIÓN EUROPEA (2001). *White Paper. European Transport Policy for 2010: time to decide*, Bruselas, 12.09.01, COM(2001) 370 final.

COMISIÓN EUROPEA (2007). *Libro Verde. Hacia una nueva cultura de la movilidad urbana*, Bruselas, 25.09.2007, COM(2007) 551 final.

COMISIÓN EUROPEA (2009). *A sustainable future for transport Towards an integrated, technology- led and user-friendly system*, Luxembourg, Publications Office of the European Union.

EIBEN, A. E., y SMITH, J. E. (2015). *Introduction to evolutionary computing*. Springer-Verlag Berlin Heidelberg.

ELTNER, A. (2016). *Photogrammetric techniques for across-scale soil erosion assessment. Developing methods to integrate multi-temporal high resolution topography data at field plots*.

ELTNER, A., y SOFIA, G. (2020). Structure from motion photogrammetric technique. En P. TAROLLI, y S. M. MUDD (ed.), *Introduction to remote sensing of geomorphology*. Developments in Earth Surface Processes. Volume 23.

ESPAÑOL, I. (1998). *Las obras públicas en el paisaje. Guía para el análisis y evaluación del impacto ambiental en el paisaje*. Centro de Publicaciones. Secretaría General Técnica. Ministerio de Fomento.

ESPAÑOL, I. (2006). *Manual de Ecología del Paisaje*. Colegio de Ingenieros de Caminos, Canales y Puertos.

GHISLANZONI, M. (2014). *Guía de integración paisajística de parques eólicos en Andalucía*. Sevilla, Consejería de Medio Ambiente y Ordenación del Territorio.

GÓMEZ, M., y BARREDO, J. I. (2005). *Sistemas de Información Geográfica y evaluación multicriterio en la ordenación del territorio*, Ra-Ma.

HASSANIEN, A., BHATNAGAR, E., y DARWISH, J. (2021). *Artificial Intelligence for Sustainable Development: Theory, Practice and Future Applications*.

MATA, R. (2006a). Un concepto de paisaje para la gestión sostenible del territorio. En R. MATA, y A. TARROJA (ed.), *El paisaje y la gestión del territorio. Criterios paisajísticos en la ordenación del territorio y el urbanismo*, Diputació de Barcelona.

MATA, R. (2006b). Métodos de estudio del paisaje e instrumentos para su gestión. Consideraciones a partir de experiencias de planificación territorial. En R. MATA, y A. TARROJA (ed.), *El Paisaje y la gestión del territorio. Criterios paisajísticos en la ordenación del territorio y el urbanismo* (pp. 100-239). Diputació de Barcelona.

NOGUÉ, J., y SALA, P. (2006). *Prototipus de catàleg de paisatge. Bases conceptuals, metodològiques i procedimentals per a elaborar els catàlegs de paisatge de Catalunya*. Observatori del Paisatge.

ORTEGA, M., y CERDÀ LL. (2004). *Gestió local de la mobilitat sostenible i segura*. Fundació Pi i Sunyer d¿Estudis Autonomics i Locals.

SÆTRA, H. S. (2022). *AI for the Sustainable Development Goals* (1st ed.). CRC Press.

SANCHO, J. (2019). De la realidad al mapa: ¿un proceso creativo más allá de la técnica? *Estudios Geográficos*, 80 (286), e002.