COURSE DATA

Data Subject	
Code	43826
Name	GIS and remote sensing
Cycle	Master's degree
ECTS Credits	3.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
2227 - Master's Degree in Environmental Engineering	School of Engineering	2	First term

Subject-matter

Degree	Subject-matter	Character
2227 - Master's Degree in Environmental Engineering	8 - Optativas Comunes	Optional

Coordination

Name	Department
SECO TORRECILLAS, MARIA AURORA	245 - Chemical Engineering

SUMMARY

Professors UPV: Jorge Abel Recio Recio, Luis Ángel Ruiz Fernández

The subject provides knowledge and skills for the management and use of Earth observation data and its integration with other georeferenced data and products to solve environmental problems and for the sustainable management of natural resources. In particular, it will contribute to the following sustainable development objectives: 13. Climate action: data, products and methods will be used to manage climate change (climate indicators), through knowledge of programs such as Copernicus that provide products of essential climate variables and space missions and data for the extraction of monitoring variables .15. Life of terrestrial ecosystems: Terrestrial observation data (satellite imagery and digital terrain models) will be used and their applications will be analyzed, including sustainable forest management, characterization and evolution of land uses and cover, and monitoring of biodiversity in the various natural spaces.

Theory: Spatial analysis and digital terrain models.

Study of the spectral properties of the Earth's surface.

Sensors and Earth observation platforms.

Preprocessing techniques and image enhancement.

Analysis of multispectral images and classification of images applied to environmental studies.

Techniques for the analysis of environmental changes through remote sensing.

Integration of GIS and images in environmental applications.

PRACTICES:

1.Exercises of spatial analysis

2. Digital terrain models

3.Interpretation, enhancement and radiometric adjustment of images

4. Geometric corrections

5. Multispectral analysis techniques

6.Classification of images for obtaining thematic maps

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

There are no prerequisites. Basic knowledge of cartography is recommended.

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

2227 - Master's Degree in Environmental Engineering

- 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.
- Identify and apply technologies, tools and techniques in the field of environmental engineering.
- Adapt to changes, being able to apply the principles of Environmental Engineering to unknown cases and use new and advanced technologies and other relevant developments, with initiative and entrepreneurial spirit.
- Be able to organize their own work as well as the material and human resources necessary to achieve the objectives stated.
- Identify, declare and entirely analyze environmental problems.
- Design and calculate engineering solutions to environmental problems, comparing and selecting technical alternatives and identifying emerging technologies.
- Apply different tools and environmental management systems.
- Evaluate the environmental quality of water from a global point of view, especially when there is a risk to public health.
- Evaluate the environmental quality of the air from a global point of view, especially when there is a risk to public health.
- Evaluate the environmental quality of soils from a global point of view, especially when there is a risk to public health..
- Apply techniques for the analysis and resolution of regional planning problems.

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

1 Understand the concept of a GIS, acquire the basic knowledge for its design and its application in environmental management.

2 Learn to identify the elements of the landscape, its alteration and evolution through the interpretation of multispectral images.

3 Establish technical criteria for the appropriate selection of spatial images in environmental applications, and identification of sources of acquisition and distribution.

4 Know and know how to apply the basic techniques for geometric and radiometric preprocessing of satellite images and areas.

5 Ability to apply methodologies of digital image processing for the analysis and quantification of natural phenomena.

6 Learn to integrate and process images and cartographic data for the generation of risk maps, land occupation and damage estimation due to natural disasters.

7 Understand methodologies of image processing to quantify processes of evolution and degradation of landscape and territory.

DESCRIPTION OF CONTENTS

1. Spatial analysis and digital terrain models.

The Geographic Information Systems. Definitions. GIS functions in the context of environmental management.
Properties of geographic information. Cartographic representation and databases. Models and data structures.
Digital terrain models
Geographical analysis Spatial and attribute queries. Process modeling

2. Spectral properties of the earth's surface.

The electromagnetic spectrum. Radiation laws. Influence of the atmosphere on electromagnetic energy
Spectral response of water, soil and vegetation Interpretation of images and natural phenomena

3. Sensors and Earth observation platforms

Resolución de un sistema sensorResolution of a sensor system
Types of orbits, space platforms and Earth observation sensors
Database distribution of images. Criteria for selecting images for environmental applications
National and international programs: National Remote Sensing Program (PNT), PNOA, Copernicus).

4. Preprocessing and enhancement of images

Distortions and geometric errors of the images
Radiometric image correction models
Methods of histogram modification and contrast enhancement

5. Multispectral analysis and classification of images

Analysis of main components: concept and applications
Indices of vegetation and tasseled cap components: analysis of biomass, density and state of vegetation
Classification of images: Application to the elaboration of maps of uses and covers of the ground

6. Analysis of environmental changes

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	18,00	100
Computer classroom practice	8,00	100
Theoretical and practical classes	2,00	100
Classroom practices	2,00	100
Development of group work	10,00	0
Study and independent work	5,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	5,00	0
Preparation of practical classes and problem	5,00	0
Resolution of case studies	10,00	0
TOTAL	**75,00**	

TEACHING METHODOLOGY

o Classes of problems and questions in the classroom

o Discussion and problem solving sessions and exercises previously worked by the students

o Programmed tutoring (individualized or in groups)

· Student's personal work.

Description: Realization (outside the classroom) of monographic works, directed bibliographic search, resolution of issues and problems, as well as the preparation of classes and exams (study). This task will be carried out individually and tries to promote autonomous work.

· Work in small groups.

Description: Realization, by small groups of students (2-4) of work and problem solving outside the classroom. This task complements the individual work and fosters the capacity for integration in work

groups.

· Evaluation.

Description: Completion of individual evaluation questionnaires in the classroom with the presence of

teacher.

The e-learning platform (Virtual Classroom of the Universitat de València and / or PoliformaT of the Polytechnic University of Valencia) will be used as a communication support tool with the students. Through it you will have access to the didactic material used in class, as well as the problems and exercises to solve.

EVALUATION

Objective tests (test type) Observation Case Academic work No of acts 2 1 1 5 Weight (%) 50 7 8 35 2 objective tests with short questions of evaluation of theoretical concepts (50%). The student must obtain a minimum of 4/10 in each test.	Nº de actos	Peso (%)

Reports or memory of the exercises carried out in the practices (35%) Other continuous assessment activities (4 oral presentations, discussion and group work, inverse class methodologies) (15%). Maximum percentage of absence: Activity Percentage Observations Classroom theory 20 Seminar theory 0 Classroom Practice 0 Laboratory Practice 20 Computer Practice 0 Field Practice		

REFERENCES

Basic

-

Moreno Jiménez, A. (2005, coord.): Sistemas y análisis de la información geográfica. Manual de autoaprendizaje con ArcGIS. (Cocero Matesanz, David)
Teledetección ambiental : la observación de la tierra desde el espacio (Emilio Chuvieco Salinero)
Remote sensing : models and methods for image processing (Robert A. Schowengerdt)
Remote sensing and image interpretation (Thomas M. Lillesand)
Prácticas de teledetección : (Idrisi, Erdas, Envi) (*)