

**COURSE DATA****Data Subject**

Code	43822
Name	Processing and analysis of environmental data
Cycle	Master's degree
ECTS Credits	3.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
2227 - M.U. en Ingeniería Ambiental	School of Engineering	2	First term

Subject-matter

Degree	Subject-matter	Character
2227 - M.U. en Ingeniería Ambiental	8 - Optativas Comunes	Optional

Coordination

Name	Department
SECO TORRECILLAS, AURORA	245 - Chemical Engineering

SUMMARY

UPV lecturer: Daniel Aguado García

The subject of Processing and Analysis of Environmental Data is an optional 3-credit course that is taught throughout the first semester of the second course of the "Master in Environmental Engineering".

With a very practical approach, this course aims to provide the necessary training to be able to objectively and consistently analyze the data available from an environmental system or an environmental facility to support decision-making and actions based on the information contained in the data.

Technological advances in data measurement, acquisition and storage equipment have led to the availability of large amounts of data from both environmental systems and environmental facilities. The large amount of data available in many contexts makes us find ourselves in the era of Big Data.

This course will explain and apply powerful data processing techniques that are very efficient for analyzing thousands and even millions of data, and that allow the extraction of relevant information, greatly facilitating the analysis and visual interpretation of the data.



Extracting the relevant information contained in the data to improve decision-making and management can be useful for each and every one of the objectives of sustainable development (it allows monitoring of compliance with discharge limits, tracking deforestation, mapping and predict the spread of infectious diseases, help reduce traffic congestion and associated pollution ...).

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

No restrictions.

OUTCOMES

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- 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.
- Assume with responsibility and ethics the Environmental Engineer role in a professional context.
- 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.
- Identify, declare and entirely analyze environmental problems.
- Apply standard methodologies for the analysis and evaluation of environmental risks.
- 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..

LEARNING OUTCOMES

Be able to analyse objectively and consistently the available data of an environmental system in order to make decisions and actions based on the information contained in the data.

Know and be able to apply different data processing techniques as a tool for analysis and interpretation of data to help in decision making in the field of environmental engineering.

Know the general problem of the analysis of large data matrices, with the presence of missing values, with strong multicollinearity among the variables or even with more variables than observations.

Know several multivariate statistical techniques based on projection on latent structures capable of analysing this type of data matrices of great dimension: principal component analysis, principal component regression and partial least squares regression.

Be able to select and apply the most appropriate data analysis technique depending on the type of problem to be solved: synthesize or compress vs. classify vs. predict; as well as interpreting the results obtained.

Handle specialized data analysis software with ease.

Know and be able to use various techniques of data analysis from the field of artificial intelligence - neural networks: multilayer perceptron and self-organized maps.

Know, understand and use the own language and the specific terminology used in the field of data processing and analysis.

**DESCRIPTION OF CONTENTS****1. Introduction to the processing and analysis of environmental data****2. Obtaining information and basic data analysis****3. Projection on latent structures techniques****4. Other advanced techniques****WORKLOAD**

ACTIVITY	Hours	% To be attended
Theory classes	12,00	100
Computer classroom practice	10,00	100
Classroom practices	6,00	100
Theoretical and practical classes	2,00	100
Development of group work	15,00	0
Study and independent work	10,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	5,00	0
Preparation of practical classes and problem	5,00	0
TOTAL	75,00	

TEACHING METHODOLOGY

The teaching-learning methodology applied in this subject is predominantly participatory: in most classes, after a presentation by the teacher of the essential contents (master lesson), students immediately apply the concepts on specific numerical data and interact with each other and with the teacher to promote a meaningful learning of the explained contents.



EVALUATION

The evaluation of the subject will be carried out as follows:

- A written exam that can include both theoretical questions and the resolution of numerical exercises. It will be valued with 30% of the final grade (minimum grade 4).
- Evaluation of practical activities: It will be carried out from the evaluation of the corresponding reports made throughout the semester. It will be valued with 60% of the final grade (minimum grade 4).
- Observation of classroom work throughout the semester: based on regular attendance at face-to-face classes, participation and degree of involvement of the student in the teaching-learning process. It will be valued with 10% of the final grade.

The final grade for the course will be obtained by weighing the grades obtained in each of the parts described above. To pass the subject, it is necessary to obtain an average grade greater than or equal to 5. For those students who do not pass the subject, a final recovery test will be taken.

Intentional fraud in an act of evaluation implies its qualification with zero points, without prejudice to any disciplinary measures that may arise.

REFERENCES

Basic

- Análisis de datos experimentales (Soria Olivas, Emilio - Martín Guerrero, José David - Aguado García, Daniel - Serrano López, Antonio José)

Quimiometría (Ramis Ramos, Guillermo - García Álvarez-Coque, María Celia)

Minería de datos : técnicas y herramientas (Pérez López, César - Santín González, Daniel)

Regresión y diseño de experimentos (Peña, Daniel) URL:

<https://polibuscador.upv.es/prim-explore/search?institution=UPV&query=any,contains,990001691440203706&vid=bibupv>

Ciencia de datos : técnicas analíticas y aprendizaje estadístico

: en un enfoque práctico (García Herrero, Jesús - Molina López, José Manuel - Berlanga de Jesús, Antonio - Patricio Guisado, Miguel Ángel - Luis Bustamante, Álvaro - Padilla, Washington R)

URL: [https://polibuscador.upv.es/prim-explore/search?](https://polibuscador.upv.es/prim-explore/search?institution=UPV&query=any,contains,996938759103706&vid=bibupv)

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Applied multivariate statistical analysis (Johnson, Richard A -



Wichern, Dean W) URL: [https://polibuscador.upv.es/primoeexplore/search?](https://polibuscador.upv.es/primoeexplore/search?institution=UPV&query=any,contains,996971360203706&vid=bibupv)
[institution=UPV&query=any,contains,996971360203706&vid=bibupv](https://polibuscador.upv.es/primoeexplore/search?institution=UPV&query=any,contains,996971360203706&vid=bibupv)

Introducción al big data(Aldana Montes, José Francisco -
Baldominos Gómez, Alejandro - García Nieto, José Manuel -
Gonzálvez Cabañas, Juan Carlos - Mochón Morcillo, Francisco -
Navas Delgado, Ismael) URL: [https://polibuscador.upv.es/primoeexplore/search?](https://polibuscador.upv.es/primoeexplore/search?institution=UPV&query=any,contains,990006587020203706&vid=bibupv)
[institution=UPV&query=any,contains,990006587020203706&vid=bibupv](https://polibuscador.upv.es/primoeexplore/search?institution=UPV&query=any,contains,990006587020203706&vid=bibupv)