Universidad Zaragoza

Academic Year/course: 2024/25

60402 - Geographic Information Analysis: Geographic Information Systems

Syllabus Information

Academic year: 2024/25
Subject: 60402 - Geographic Information Analysis: Geographic Information Systems
Faculty / School: 103 - Facultad de Filosofía y Letras
Degree: 352 - Master's in Geographic Information Science and Technology for Land Management: Geographic Information Systems and Remote Sensing
ECTS: 12.0
Year: 1
Semester: Annual
Subject type: Compulsory
Module:

1. General information

This subject enables the student to generate, work and model different spatial information in order to create knowledge with a rigorous scientific basis to manage and solve problems of a territorial nature, in application to issues of territorial and environmental planning.

These approaches are aligned with the following Sustainable Development Goals of the United Nations 2030 Agenda so that the learning results of the subject provide training and competence to contribute to: Goal 2 - Zero Hunger, Goal 6 - Clean Water and Sanitation, Goal 11 - Sustainable Cities and Communities, Goal 13 - Climate Action, Goal 14 - Undersea Life and Goal 15 - Life of Terrestrial Ecosystems.

2. Learning results

- Know the variety of spatial functions incorporated in GIS, and their most usual classifications referring to information search, reclassification, overlapping, neighbourhood and distance, and connectivity.
- Argue the theoretical foundations of spatial analysis by means of GIS and adequately use the terminology of the subject. Define the most common spatial analysis functions and describe their meaning and usefulness.
- Apply theoretical knowledge to the resolution of real cases by modelling spatial problems of a geographic nature, selecting the necessary GIS functions and data models.
- Implement the problem-solving cartographic models in one of the most popular and widely used GIS programs.
- Explain the theoretical foundations necessary for DEM generation and use the basic concepts and terminology appropriately.
- Elaborates DEMs from digital topographic cartography, selecting the most suitable method for the characteristics of the data and applying the appropriate methods for the detection and/or correction of systematic and random errors.
- Apply the procedures to generate digital models derived from DEMs.
- Apply network analysis to the resolution of complex tasks using GIS and properly use the terminology of this type of analysis (arcs, nodes, flow).
- Define network analysis, identifies the types of network analysis that exist, and adequately prepare the spatial basis for this type of task.
- Appropriately use of available resources to reinforce previously acquired knowledge.
- Work well in a team, constructively criticizing the opinions of others, sharing information and knowledge with peers and seeking joint solutions.
- Identify the type of geographic phenomena whose management may require the use of network analysis and discriminate them from those for which it is not useful.
- Argue the importance of having continuous surfaces of information on significant environmental variables for use in territorial studies.
- Explain the most usual methods of spatial interpolation - inverse to distance, radial functions, trend surfaces, kriging, cokriging and regression models and apply them correctly, modifying their parameters and choosing the most appropriate one for the spatial representation of the data using ArcGIS.
- Model environmental variables from the existing statistical relationship with a set of independent variables and to elaborate, with these models, detailed cartographies from the parameters obtained in the modelling.
- Correctly apply the procedures that, based on error statistics, help to select the most appropriate cartography for the analysed variable.
- Argue the importance of the quality of the original data for the final cartographic result.

- Explain the fundamentals of the Linux operating system and the features of the open source software environment, and be able to use them at an intermediate user level.
- Explain the fundamental aspects of parametric and non-parametric statistical models and apply them to the analysis of geographic information.
- Explain and apply a standardized methodology for nonparametric data analysis.
- Describe the fundamental elements of programming in Python, ArcP and R and be able to implement small programs and modules that can be integrated into other GIS software by programming in these languages.

3. Syllabus

3.1.- Basic spatial analysis. Spatial analysis and GIS. Spatial analysis with vector and raster data. Searches and interrogations. Distance and proximity. Map algebra.
3.2.- Digital Elevation Models. Concept of MDE. Methods to generate DEMs. Validation and error analysis.
3.3.- Network analysis. Definition and basic concepts. Editing and preparation of a network. Direct networks, Indirect networks
3.4.- Interpolations. Theoretical foundations of interpolation. Adjustment and validation of the main interpolation methods.
3.5.- Free Geographic Information Systems. Replication of block 3.1 using free software (QGIS).
3.6.- Programming for spatial analysis: Scripting, Phyton and R.

4. Academic activities

The development of the subject will be carried out mainly through:

- Theoretical sessions, in the form of a master class, promoting student participation (type 1 activities).
- Practical sessions led by the teacher for the presentation of practical cases solved by means of computer equipment competition (type 3 activities).
- For the correct development of the contents the student will dedicate hours of individual study (type 7), in addition to the corresponding evaluation activities (type 8 activities).

5. Assessment system

First Call:

Continuous assessment
This subject is evaluated separately according to the thematic blocks that compose it, participating in the grade as follows:
3.1.- 30%: (1) Written test (50%) containing: a) questions on theoretical aspects; b) resolution, without computer, of a practical case; (2) practical exercises (50%) solved with a GIS.
3.2.- 8%: Development of a DEM.
3.3.- 8%: Team work: preparation of cartographic bases. Practice with direct/indirect type networks.
3.4.- 12%: (1) written test of concepts (60%); (2) completion and presentation of an individual paper, related to problems and practical cases (40%).
3.5.- 12%: Performance of exercises.
3.6.- 30%: Performance of exercises.

A minimum grade of 4 points in each block is required for averaging. Continuous evaluation will take place within the class period. Criteria: accuracy and precision of definitions, correct use of terminology, accuracy and degree of structuring of approaches, coherence of argumentation, originality and clarity, selection and adequacy of analytical functions.

Global assessment.

identical to the continuous evaluation. It will be held on the date of the exam period set by the Faculty.

Second Call:

Global evaluation: identical to the first call.

6. Sustainable Development Goals

2 - Zero Hunger
6 - Clean Water and Sanitation
11 - Sustainable Cities and Communities