Universitat Autònoma de Barcelona

2023/2024

Geographical Information Systems and Image Processing

Code: 101031
ECTS Credits: 4

Degree	Type	Year	Semester
2500254 Geology	OB	2	1

Contact

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Teaching groups languages

You can check it through this link. To consult the language you will need to enter the CODE of the subject. Please note that this information is provisional until 30 November 2023.

Teachers

Félix Sacristán Solano

Prerequisites

The students will have to use their own external storage system (pen drive, external hard drive, ...) to manage all the information and data used throughout the course.

Objectives and Contextualisation

Within the concept of Information Technology, Geographic Information Systems (GIS) are a set of tools of great interest for its versatility and multidisciplinarity.

The application of GIS in cartography for natural resouces, prevention of natural hazards, tracking and simulation of dynamic processes (changes in land uses, water management ...) make the GIS basic tools in numerous scientific disciplines and in the field of research.

GIS also represents a powerful spatial-temporal information management tool for all fields related to Geology and the Environment.

The overall purpose is that students integrate the theoretical and practical aspects of these technologies and be able to apply these skills to the management and resolution of problems.

Competences

- Learn and apply the knowledge acquired, and use it to solve problems.
- Suitably transmit information, verbally, graphically and in writing, using modern information and communication technologies.
- Use geographical information systems applied to geology.
- Work independently.

Learning Outcomes

1. Learn and apply the knowledge acquired, and use it to solve problems.
2. Manage georeferenced information using suitable GIS computer programmes.
3. Master the different ways of acquiring and managing geographical information as a tool for territorial interpretation, especially maps and images of the Earth.
4. Suitably transmit information, verbally, graphically and in writing, using modern information and communication technologies.
5. Work independently.

Content

Block 1. Introduction to geographic information systems and basic mapping concepts.

- What is a GIS? Types of information contained.
- Elements of a map. WMS services and downloading of geo-information. Layouts.
- Cartographic projections. What are they and what implications exist in their definition.
- Cartographic elements and layout generation.

Block 2. Vector data

- Basic concepts Vector data. Topology: point, line, route, polygon.
- Digitization of vector data. Creation of geological map, from GEODataBases.
- Tables associated with vector entities. Generating displaying BBDD.
- Database queries. Know and use the different display options for each layer. Calculation of statistical values.

Block 3. Raster data

- Basic concepts. What is a raster and how is it structured according to the type of information represented in this format: MDE, Orthophotos.
- Elaboration of a raster using different sources of information (isolines, points, lidar, vegetation, land use, etc.).
- MDE analysis: shading, topographic profiles, slopes, orientation, flow extraction.
- Satellite images. Statistical data and band algebra.
- Generation of a raster. Interpolation techniques.

Block 4. Analysis of the information

- Calculation of zonal and focal statistical values.
- Processing of a satellite image: statistical data and band algebra. Physical meaning.
- Analysis of vector data. Overlap, proximity and zonal operations. Spatial measurements on objects.
- Analysis with raster-vector data. Example.

Methodology

Master classes with computer support

Through the attending of classes the students will acquired their own knowledge of the subject. At all times, work will be done in the computer to consolidate the use of specific software and analysis techniques.

Laboratory practices

Practice time is distributed to learn GIS programs (ArcMap and QGIS), to use geological data, and to solve practical problems.

The group of students enrolled will be divide in two groups of equal number of students .

In the case of remote virtual classes, the activities are designed for each student to work with a computer individually.

Autonomous work:

Study/Practice of topics should carry out through exercises using the specific SIG programs.

Estudent evaluation of the class:

The teacher will assign approximately 15 minutes of the class to allow that his students tp answer the surveys of evaluation on contents and professor's performance.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Computer lab practices	40	1.6	1, 2
Master classes with information technology support	40	1.6	1, 3, 2
Type: Autonomous			
Practicing using specific software and recommended bibliography	16	0.64	1, 4

Assessment

Continued evaluation

- Mandatory Attendance. There will be attendance control.

- Optional Work: Generation of practical guides for each exercise in class. To be delivered individually.
- Two theoretical-practical partial exams: 1st Partial 35% + 2nd partial 35%.
- Analysis work: 30% individual.

Recover gradings

- The recovery can only be done for the exams, not for the analysis work.
- Students who do not pass the course can choose which partial exam they will present again, to improve their grade and pass.
- Students that approved during the continued avaluation can choose what partial exam the present again to improve their grade.
- The best grade (in partial exams or in recovery exam) will be kept for the final avaluation.

Unique evaluation.

- If the student wishes to do a single evaluation, he/she must notify the teacher during the first two weeks of the course. Academic Management of the Faculty of Sciences will make available to the student a form to formalize the request to take part in the unique evaluation.
- The unique evaluation will be carried out on the day of the recovery test. It will consist of three parts:

1. A theoretical exam (20%) of the content of the entire course.
2. A practical exam (50%) of the entire course content.
3. A digitalization/incorporation of georeferenced information/analysis project to be defined at the beginning of the semester with the professor (30%).

- The student who has opted for this single evaluation can present himself/herself to recovery exam only if he/she has previously submitted the three parts of the unique evaluation as described in the previous section.
- The same recovery grading criteria will be applied as for continuous evaluation.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Theoretical and practical exams	100%	4	0.16	1, 3, 2, 4, 5

Bibliography

Longley, P.A., Goodchild, M.F. Maguire, D.J., Rhind, D.W. (2001), ***Geographical Information Systems and Science***. Wiley. 454 p.

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Chuvieco, E. (2002), ***Teledetección ambiental***. Ariel. Barcelona. 586 p

Gutiérrez Puebla, J., Gould, M. (1994). ***SIG: sistemas de información geográfica***. Editorial Síntesis, Madrid.

Laurini, R., Tompson, D. (1992) ***Fundamentals of Spatial Information Systems***. Academic Press. Londres. 680 p.

Maguire, D.J., Goodchild, M.F., Rhind, D.W. (eds.) (1991) Geographical Information Systems. Principles and Applications. 2 Vol. Longman Scienti Technical. Essex. 1096 p.

Moldes Teo, F.J. (1995). ***Tecnología de los sistemas de información geográfica***. Ra-Ma, Madrid. 190 p.

Nogueras-Iso, J., Zarazaga-Soria, F.J., Muro-Medrano, P.R. (2005) ***Geographic Information Metadata for SpatialData Infrastructures: Resources, Interoperability and Information Retrieval***. Springer. 264 p.

Santos Preciado Santos Preciado, J.M. (2004) ***Sistemas de información geográfica. Unidad didáctica***. (60105UD01A01) UNED. Madrid. 460 p. ISBN: 84-362-2006-4.

Software

Arc GIS desktop 10.8.2 and QGIS 3.1 "A Coruña"