

**Geographical Information Systems**

Code: 104536  
ECTS Credits: 6

Degree	Type	Year	Semester
2503743 Management of Smart and Sustainable Cities	OB	2	2

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

**Contact**

Name: Daniel Illa Montserrat  
Email: Daniel.Illa@uab.cat

**Use of Languages**

Principal working language: catalan (cat)  
Some groups entirely in English: No  
Some groups entirely in Catalan: Yes  
Some groups entirely in Spanish: No

**Teachers**

Lluís Pesquer Mayos  
Francesc Coll Pujol

**Prerequisites**

In order to follow this subject without any difficulties, it is important to have gained the knowledge of the first year's subject *Bases per a la Geoinformació* (Basis for the Geoinformation), as well as having IT abilities, especially of office software and statistics

**Objectives and Contextualisation**

Theoretical and practical subject that provides an introduction to the field of Geographic Information Systems (GIS). One of the main objectives is to gain a good knowledge of how to deal with and analyse the located data on the land, by consolidating the theoretical aspects and the use of specific programs. The objective of teaching Geographic Information Systems is to gain some knowledge based on the conceptual and methodological basis. When finishing this subject, students need to know how to apply the acquired abilities to the needs required in other subjects through the consolidation of both the theoretical and practical aspects that have been developed. This implies knowing not only how to use GIS, but also to understand what is done when we work with them and why they are used.

Therefore, a double objective related to the theoretical and practical content of the subject is set: The conceptual context around GIS and all the abilities that require the use of GIS. At a general level, the main aim is to know and understand what GIS are, why they are used, how they work and when you need to use them within the framework of *Gestió de Ciutats Intel·ligents i Sostenibles* (Management of Intelligent and Sustainable cities).

At a conceptual level, the following objectives are set:

- Understanding the nature of geographic information and the tools needed for its use
- Knowing and understanding the two data structures used for modelling the reality

- Knowing how to introduce, structure and store geographic information, as well as the main handling and analysis functions of GIS
- Knowing the main data sources of GIS
- Understanding and knowing how to make the most of information systems as a tool to obtain answers to specific types of questions
- Knowing what types of actions are correct in each case in order to solve specific needs
- Gaining practical experience in solving problems typically found in the field

In the second case, the acquisition of skills, it is expected to provide students with the methodological tools that enable them to use GIS so they know what can be done, how it can be done and where it can be applied:

- Understanding and knowing how to make the most of information systems as a tool to obtain answers to specific types of questions
- Knowing what types of actions are correct in each case in order to solve specific needs
- Gaining practical experience in solving problems usually found in the geographic and territorial field.

From the objectives defined before, we are aiming to achieve a continuous interaction between theory and practice.

## Competences

- Analyse and model urban and regional dynamics using methodological instruments for qualitative and quantitative analysis.
- Critically analyse work carried out and demonstrate a desire to improve.
- Design platforms of management, integration of public and government services applying technologies and systems of sensorization, acquisition, processing and communication of data.
- Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.

## Learning Outcomes

1. Critically analyse work carried out and demonstrate a desire to improve.
2. Develop data-management platforms: user-generated servers and mapped browsers.
3. Georeference alphanumeric databases of diverse types.
4. Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
5. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
6. Use the information obtained from remote sensors (vegetation indexes, thematic cartography) for the quantitative analysis of territorial dynamics.
7. Work with databases having different reference systems or projections.

## Content

Block 0: GIS background

Block 1: Geographic information

Information on the land and on phenomena in the land

Geographic and non-geographic organisations

Nature of the geographic information

The value of georeferenced information

## Block 2: Georeference

Localisation as a connecting factor

Basic georeference methods

## Block 3: Data models in GIS

Raster model

Vector model

Data sources and publishing on the Internet

## Block 4: Spatial analysis applied to the management and planning of cities

Optimal localisation of resources

Buffer and distance maps

Optimal routes

## **Methodology**

The theoretical knowledge is introduced and reinforced by the teacher in class and also through the students' own individual work when they study the specific materials or with dynamic learning activities set by the teacher of this subject. Students will also need to read a book, book chapter/s or an article (students' individual follow-up activity outside the class).

The technical and instrumental knowledge will be developed through a number of guided practical tasks during the class and other individual practical tasks and/or in small groups that students will need to do on their own.

In these activities, we will work with the competences that enable students to gain the ability to prevent and solve problems, adapt oneself to unexpected situations and take decisions. They will also need to communicate efficiently, both orally and in writing, their knowledge, results and abilities by using their own IT tools correctly.

All the subject's data and materials will be available on the Virtual Campus through an IT platform used by the teachers (Moodle) that provides a Virtual Learning Environment to support the studies.

It is intended for the students to use specific GIS programs to develop their practical tasks: Qgis (free), ArcGis (commercial) or MiraMon (free license for students).

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			
Master classes	18	0.72	4
Practical tasks in class guided by the teachers	32	1.28	3, 7
Type: Autonomous			

## Assessment

### Evaluation

The evaluation process is continuous and it includes four evaluation activities distributed throughout the course:

- Mid-term theory exams (25%)
- Mid-term practical exams (25%)
- Practical exercises (50%)

The average between the theory and practical exams is done through a mark of 3 and students will only pass the exams if the average of their qualifications is at least a 5. It is mandatory to hand in the practical tasks. Students cannot take an exam if all the practical tasks have not been delivered.

### Reevaluation

Once the normal evaluation finishes, students will have the possibility to do a reevaluation exam within the dates set by the Faculty. In order to do this retake exam, students need to be evaluated previously in a number of activities. The weight of these activities has to be equivalent to at least two thirds of the total qualification of the subject or module. A minimum qualification in the average of the subject has to be obtained if the student wants to do this retake exam. This qualification can't be more than a 3.5. (These conditions are adapted to the legislation of UAB's evaluation system in the Article 112 ter. Retake [http://www.uab.cat/doc/Modificacio\\_normativa\\_academica\\_CG120717](http://www.uab.cat/doc/Modificacio_normativa_academica_CG120717)).

### Review of Qualifications

For each assessment activity, a place, date and time of review will be indicated where the student can review the activity with the teacher. In this context, complaints can be made about the grade of the activity, which will be evaluated by the teacher responsible for the subject. If the student does not submit to this review, this activity will not be reviewed at a later date.

### Not Evaluated

If the student has not delivered anything, not attended to any laboratory session and not done any exam, the corresponding result will be "not evaluated". In any other case, "not delivered" counts as a 0 for the weighted average that will be maximum a 4.5. Therefore, if students participate in an evaluated activity, it implies taking into account the "not delivered" in other activities as zeros. For instance, if a student has not attended a laboratory session, s/he will obtain a zero in that activity.

### First Class Honours

First class honours will be awarded to those students that obtain a result of 9.0 or over in each part, up to 5% of those registered following a descending order of the final result.

### Repeats Students

Students who are repeating the subject will not be treated differently.

### Copies and Plagiarisms

When we talk about copies, we refer to the evidence that the project or the exam has been partially or totally created without the intellectual contribution of the author. In this definition, we also include the proven attempt to copy in the exams and delivered projects and the violation of the laws that assure intellectual authorship. Plagiarisms refer to the projects and texts from other authors that someone pretends to be his/her own creation. It is a crime against intellectual property. In order to avoid committing plagiarism, quote all the

sources that you use when writing the report of a project. According to UAB's law, copies and plagiarisms or any other attempt to alter the results of one's own evaluation or someone else's -allowing to copy, for example, implies a result of the corresponding part (theory, problems or practical tasks) of a 0 and in this case, the student will fail the subject. This does not limit the right to take academic and legal actions against those who have participated.

## Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Mid-term practical exams	25%	3	0.12	3, 4, 7, 6
Mid-term theory exams	25%	3	0.12	1, 5
Practical exercises delivered throughout the subject	50%	40	1.6	2, 3, 5, 4, 7, 6

## Bibliography

- Bolstad, Paul. (2016), GIS Fundamentals. Available in: <http://www.paulbolstad.net/gisbook.html>
- Bonham-Carter, Graeme F. (1994) **Geographic information systems for geoscientists modelling with GIS**, Pergamon. Kidlington. 398 p.
- Burroughs, Peter.A. McDonnell, Rachael.A. (1998), Principles of Geographical Information Systems (2nd Edition). Oxford University Press.
- Chuvieco, Emilio. (2002), **Teledetección ambiental**. Ariel. Barcelona. 586 p
- Gutiérrez Puebla, Javier; Gould, Michael. (1994). **SIG: sistemas de información geográfica**. Editorial Síntesis, Madrid.
- Laurini, Robert., Tompson, Derek. (1992) Fundamentals of Spatial Information Systems. Academic Press. Londres. 680 p.
- Longley, P.A. Goodchild, M.F. Maguire, D.J. Rhind, D.W. (2001), **Geographical Information Systems and Science**. Wiley.
- Maguire, David.J., Michael.F. Goodchild y David.W. Rhind (eds.) (1991) **Geographical Information Systems. Principles and Applications**. 2 Vol.
- Moldes Teo, Francisco.Javier. (1995). **Tecnología de los sistemas de información geográfica**. Ra-Ma.
- Noguera-Iso, Javier., Zarazaga-Soria, Francisco.J., Muro-Medrano, Pedro.R. (2005) Geographic Information Metadata for Spatial Data Infrastructures: Resources, Interoperability and Information Retrieval. Springer. 264 p.
- Pons, Xavier. (1996) "Els sistemes d'Informació Geogràfica: la nova carta", Butlletí de la Institució Catalana d'Història Natural, 64:37-52
- Santos Preciado, José.M (2004) Sistemas de información geográfica. Unidad didáctica. (60105UD01A01) UNED. Madrid. 460 p. ISBN: 84-362-2006-4.
- Oyala, Victor. (2011). Sistemas de Información Geográfica. [http://wiki.osgeo.org/wiki/Libro\\_SIG](http://wiki.osgeo.org/wiki/Libro_SIG).

## Software

ArcGIS, MiraMon, QGIS