

**COURSE DATA****DATA SUBJECT**

Code: 33102
Name: Geographical information systems
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1104 - Degree in Environmental Sciences	Facultat de Ciències Biològiques	2	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1104 - Degree in Environmental Sciences	Geographic information systems	COMPULSORY

COORDINATION

FANSA SALEH GHALEB

SUMMARY

Geographic Information Systems is one of the two subjects of the module 'instrumental subjects' degree of Environmental Sciences. It is a 6-credit trunk course that is designed to be imparted in second year.

Scholars and environmental professionals manage geographic information, which is complex and diverse, from different sources, highlighting its thematic components, and space. The geographical information is expressed by maps or digital-analog-which are, in turn, sources of information, tools for analysis and synthetic medium of expression results. At present, the Geographic Information Systems (GIS) are key tools for storing, integrating and managing all types of geographic information systems (traditional maps, aerial photographs, satellite images, statistics, data from field works, etc) allowing conduct complex spatial analysis and cartographic representation.

This subject, based on the description of basic concepts of mapping and information sources (aerial photography and satellite images), introduces students to the creation and management of geographic information systems (components and functions), an instrument essential for the treatment of information relating to the territory.

PREVIOUS KNOWLEDGE**RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE**

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



OTHER REQUIREMENTS

COMPETENCES / LEARNING OUTCOMES

1104 - Degree in Environmental Sciences

Capacidad para analizar la información geográfica con sus componentes temática, espacial y temporal.

Capacidad para manejar fuentes analógicas y digitales diversas de información geográfica.

Capacidad para representar la información geográfica mediante mapas, eligiendo el tipo de mapa adecuado al tipo de información.

Lectura e interpretación de documentos cartográficos (mapas topográficos y mapas temáticos diversos).

Manejo de tecnologías de información geográfica y programas informáticos con aplicación medioambiental.

DESCRIPTION OF CONTENTS

1. From paper maps to GIS. Cartographic sources on the Internet

Definition of GIS as a set of programs and applications that allow the management of spatially georeferenced data that can be displayed on maps.

Professional fields that have developed GIS.

Series of basic and environmental mapping. Designation of sheets. Scales. Cartographic sources on the internet. Formats.

2. General and topographical mapping

Basics of cartography and the representation of the Earth maps: includes knowledge of the shape and dimensions of the Earth (geoid and ellipsoid), projection systems, coordinate systems, the concept of scale, types of maps, topographic map, the representation language and the main series of maps.

Item 2: Representation of the Earth: Scale, shape and dimensions of the Earth, projection systems, coordinate systems. The UTM projection. Types of maps (topographic and thematic).

Item 3: The language mapping and the construction of a map, geographical and visual variables. The process of generalization.



2. The representation of the Earth: Scale, shape and dimensions of the earth. systems projection and coordinate systems. The UTM projection

The shape of the earth. Ellipsoid, geoid and topographic surface.

Ellipsoid and Datum (the ED 50-ETRS89 to WGS84).

The geodetic network.

Georeferencing. Geographical, meridians and parallel coordinates. Length of meridian and parallel arcs.

Direction and guidance. Types north. Azimut.

Projection types. The Universal Transverse Mercator projection. UTM coordinates. Distribution of zones and their correlation with geographic coordinates.

3. The mapping language and the construction of a map. Types of maps (topographic and thematic).

Types of maps, topographic map, the representation language and the main map series. Scale, north and legend. Generalization.

4. Aerial and satellite remote sensing

Definition. Electromagnetic spectrum. sensors and platforms. Satellites and orbits types. Resolutions. Aerial photography. Laser Altimetry. Remote Sensing Applications

5. GIS components and data structure. Vector and raster structures. Commercial and free software

Elements of a GIS. Functions of a GIS. Models of raster and vector data. Advantages and disadvantages. Examples. Types of GIS software. Raster and vector files on the network.

6. GIS functions: data entry and storage, processing, analysis, representation

Entrada de datos CAD. Tabla atributos. Concepto de campo. Funciones de análisis SIG: Área de influencia (buffer). Recortar (clip). Dissolve (agrupar por adyacencia y criterios alfanuméricos). Juntar (merge). Intersección. Unión. Enlace espacial (Spatial Join). Convex Hull (minimo poligono convexo). Diferencia. Traslación 2D. Reproyección

7. Digital Elevation Models and derived products

TIN and GRID models. Vector to raster. Raster to vector. Algebra of maps. Hydrological basins, drainage basin, slopes, orientation, profiles, visibility.



8. Applications of Geographic Information Systems

Applications of GIS to environmental studies

9. Laboratory and computer practices

Software: QGIS

1. View. Symbology
2. Table of attributes and analysis functions
3. Digitization. Data input.
4. MDT: Interpolation. Drainage basin. Drainage network. Slopes, orientation, profiles, visibility.
5. Zonal statistics
6. Georeferencing
7. Multicriteria analysis.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	3,00
Theory	30,00
Laboratory	12,00
Computer classroom practice	15,00
Total hours	60,00

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	0,00
Independent study and work	40,00
Preparation of lessons	0,00
Preparation for assessment activities	30,00
Resolution of case studies	20,00
Total hours	90,00

TEACHING METHODOLOGY

Master class in the presentation of the theoretical foundations of the subject. Problems (scales, georeferencing, profiles, tracks, measurements) in laboratory practice. Practical computer (lab groups and computer groups) with QGIS software.

EVALUATION



The final grade for the course is obtained from a theoretical and practical final exam with the assistance and delivery of the exercises of practical classes (mandatory). Regular attendance at classes, participation, care, effort and interest shown by the student will be evaluated by the teacher.

The final grade is derived with a score of 3.5 points and practical qualification examination (theoretical and practical) of 6.5. To pass the course and make theory and practice is necessary to achieve a minimum of 2.6 points (equivalent to 4 out of 10) in the theoretical and practical examination.

To request an advance convocation of examination in this discipline, the student must have completed mandatory activities listed in the teaching guide. Specifically, made and approved practices of computer and laboratory details in this teaching guide.

REFERENCES

- BIELZA DE ORY, V , Ed. (1993). Geografía general, Tomo I, capítulo II: "Información geográfica y representación cartográfica", Ed. Taurus, Madrid.
- BOSQUE SENDRA, J. (1997): Sistemas de información geográfica, Madrid, Rialp, 2ª edición corregida, 451 p.
- CHUVIECO, E. (1990), Fundamentos de teledetección espacial, Madrid, Ediciones Rialp, S.A. 453pp. ESTÉBANEZ ALVAREZ, J. , PUYOL, R. (1976), Análisis e interpretación del mapa topográfico, Ed. Tebar Flores, Madrid.
- GUTIERREZ PUEBLA, J. Y GOULD, M. (1994) SIG: Sistemas de Información Geográfica, Ed. Síntesis, Madrid, 251 p.
- La teledetección y sus aplicaciones <https://mappinggis.com/2018/10/50-aplicaciones-de-la-teledeteccion/>.
- Teledetección Nociones y Aplicaciones (2006) Carlos Pérez Gutiérrez y Angel L. Muñoz Nieto Editores. Universidad de Salamanca 378 p.
- OLAYA, V. (2020) Sistemas de Información Geográfica. ISBN: 978-1-71677-766-0
- STRAHLER, A.N. (1977) Geografía Física, Barcelona, Omega
- VÁZQUEZ MAURE, F. (1986) Lectura de mapas, Inst. Geográfico Nacional, 382 pp