Space Risk Analysis and Remote Sensing (250MEG010)

General Information

School	ETSECCPB
Departments	Departament d'Enginyeria Civil i Ambiental (DECA)
Credits	5.0 ECTS
Programs	MÀSTER UNIVERSITARI EN ENGINYERIA GEOTÈCNICA (pla 2025)
Course	2025/26

Main teaching language at each group

- Group 10Q1 Spanish (Q1)

Faculty

Responsible Faculty: Maria De Las Nieves Lantada Zarzosa
Faculty: Maria De Las Nieves Lantada Zarzosa, Carolina Puig Polo

Objectives of Education

* To apply oral presentation techniques.
* To know and be able to use advanced techniques to geo-referentially represent data.
* To have powerful tools for the geospatial analysis of geo-referenciated data.
* To acquire technical skills in the use of GIS and remote sensing for spatial analysis, aimed at assessing natural hazards, and managing territorial data.

Total hours of student work

		Hours	Percentage
Supervised Learning	Large group	45.0 h	100.00 %
	Medium group	0.0 h	0.00 %
	Laboratory classes	0.0 h	0.00 %
	Guided Activities	0.0 h	0.00 %
Self Study		80.0 h	

Contents

Topic 1.1. Introduction to natural risk assessment

content english

Tema 1.3. Remote sensing

Physical foundations of remote sensing. The electromagnetic spectrum and radiometric terminology. Platforms and sensors Project Copernicus. Combination of spectral bands and visual interpretation of the image
Analysis tools, supervised and unsupervised classification of spectral images to obtain thematic maps in GIS format. Explanation of different remote sensing applications.

Radar images and applications (subsidence estimation)
Description instrumentation, types and details
Treatment of satellite images from different sensors and times with GIS software

Contingut Lab

Practices with specific software for satellite images processing Remote sensing assignment

Specific Objectives

Introduce other methods of obtaining geographic information (with techniques of remote sensing by satellite or airborne platform, such as LIDAR), which can be built and managed in a GIS. Using image processing software with GIS

Topic 1.2. GIS and geoinformation

Data structures: vector, raster, 3D and network
Description of concepts and GIS files with graphic and alphanumeric information with different data structures.

Specific Objectives

To know files and data format of the model vector, raster and 3D. Make conversions formats.
Visualize and manage maps in different formats and structures with GIS software

Topic 2. Spatial data acquisition

2.1. Geoinformation downloads from Earth observation platforms, such as Sentinel Hub and Copernicus Open Access Hub.
2.2. Spatial Data Infrastructures (SDIs) and Databases. Historical event inventories.
2.3. Terrain characterization using SRTM or TanDEM-X Terrain Models (DTMs) or geomatic techniques (LIDAR, GNSS, photogrammetry).
2.4. Climate data acquisition

Contingut Lab

Obtain spatial data from a specific area to carry out the subject project. Gathering terrain information with LIDAR and GNSS receiver

Specific Objectives

To use browsers and GIS tools to search geographic information. Edit its metadata, and assign or change its cartographic reference system
Search and download satellite images, and maps on the web, through catalogs and Web services
Several kind of cartography and metadata, located on remote servers, will be displayed through a WMS (Web Map Service) from a GIS software.

Topic 3. Spatial and temporal data analysis tools

Spatial analysis tools with geoinformation
Combine maps of different formats to obtain answers to a specific problem or make decisions. Generate new spatial information from available maps.
Analysis with climate data
Integration and visualization of spatial and climate information from different sources.
Multi-criteria analysis for decision-making. Practical applications for assessing landslide susceptibility, hazards, soil holding capacity, analysis of alternatives, etc.

Specific Objectives

Learn different tools and techniques for analyzing spatial data and databases

Topic 4. GIS and remote sensing applications for natural risk assessment

Escola de Camins

Knowing the database tools and spatial analysis that allow the optimum workflow to solve specific problems in GIS
Diagram design GIS&remote sensing workflow tool for geological risk assesment.
GIS and remote sensing project

Contingut Lab

Subject project (individual)

Specific Objectives

Learn about specific case studies and reproduce the risk assessment process in part or in full.
Evaluate the impact of the event(s) on the territory and infrastructure.

Tutoring the subject project

The objective(s) of the project will be established, the work area will be delimited, the minimum work to be done will be established, and the scope of the project will be delimited.

Contingut Lab

Individual subject project

Activities

Monitoring and tutoring of the subject project

The student will work in a specific area to conduct a risk or multi-risk assessment of the area and its impact on the territory.

Objectives

The student must propose the risk assessment workflow for the study area, from hazard to final damage, using data already available from some of the phases and generating new information and calculations in others.

Material

The student must search for available information, or generate it using image processing and remote sensing techniques and/or GIS.

Delivery

Final report, dades and maps, and oral presentation

Dedication

6h

Teaching Methodology

The course consists of 3 hours per eek of classroom activity.
The first hour is devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.The objective of these practical exercises is to consolidate the general and specific learning objectives.
Each student must develop a GIS&Remote sensing project and do an oral presentation of it at the end of the course.
The 2 hours are devoted to solving practical problems and doubts about the GIS project, or laboratory practices, with greater interaction with the students (in general in a classroom with computers and software necessary to the subject practice).
Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

Materials of the remote sensing topic will be in Catalan. Although most of the sessions will be given in Spanish, sessions supported by other occasional guest experts may be held in other languages.

Grading Rules

(*) The evaluation calendar and grading rules will be approved before the start of the course.

The final grade of the subject is obtained from the following continuous assessment grades. This final grade, Navac, is drawn up by averaging (weighted to the importance of each activity according to the course), between individual and group problems and practices, of an additive and formative nature, carried out during the course (inside and outside the classroom).
Typically Navac= 70% GIS&remote sensing individual Project + 30% other practices such as: DGPS for GIS, georeferencing and/or LIDAR, etc.
The practices can be done individually or in groups, and some, like the GIS&Remote Sensing project is individual and must be presented orally in the classroom at the end of the course.

Test Rules

Deliveries of practical activities must be done in a proper way during the scheduled period (min 80%), if not, they will result in a mark of zero in that activity. The attendance to some specific practices (to collect data at field with DGPS for GIS or LIDAR for example) are mandatory to obtain a qualification greater than zero.
The final project must contain a report, input data and results, and an oral presentation of approximately 10 minutes.

Office Hours

It shall be determined during the first class (from Monday to Friday)

Bibliography

Basic

- Burrough, P.A. Principles of geographical information systems. 3rd ed. Oxford: Oxford University Press, 2015. ISBN 9780198742845.
- Olaya, V. Sistemas de información geográfica. [S.l.]: [OsGeo], 2012.
- Peña Llopis, J. Sistemas de información geográfica aplicados a la gestión del territorio: entrada, manejo, análisis y salida de datos espaciales: teoría general y práctica para ESRI ArcGIS 9. San Vicente (Alicante): Club Universitario, 2006. ISBN 9788484549192.
- Chuvieco, E. Fundamentos de teledetección espacial. 3a ed. (4a reimpr. corretgida 2000). Madrid: Rialp, 1996. ISBN 843213127X.
- Chuvieco Salinero, Emilio. Fundamentals of satellite remote sensing. 3rd ed. Boca Raton: CRC Press, 2020. ISBN 9780429014468.

Complementary

- Gómez Delgado, M.; Barredo, J.I. Sistemas de información geográfica y evaluación multicriterio en la ordenación del territorio. 2a ed. Paracuellos de Jarama: Ra-Ma, 2005. ISBN 8478976736.

Resources

Specialized programs are available such as ArcGis, QGIS+SAGA+GRASS, SNAP, Google Earth Engine, among others.