Geographic Information Systems and Remote Sensing (250258)

General Information

School	ETSECCPB
Departments	Departament d'Enginyeria Civil i Ambiental (DECA)
Credits	4.5 ECTS
Programs	GRAU EN ENGINYERIA D'OBRES PÚBLIQUES (pla 2010)
Course	2024/25

Main teaching language at each group

- Group 10Q1 Catalan (Q1)

Faculty

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

Objectives of Education

Conèixer els mètodes més moderns de presa i tractament de dades espacials. Aprofundint en els mètodes d'adquisició i les tècniques de tractament i interpretació de les dades de teledetecció.
Conèixer els conceptes bàsics de l'estructura de dades i el funcionament dels Sistemes d'Informació Geogràfica
Conocer los métodos más modernos de toma y tratamiento de datos espaciales. Profundizando en los métodos de adquisición y las técnicas de tratamiento e interpretación de los datos de teledetección.
Conocer los conceptos básicos de la estructura de datos y el funcionamiento de los Sistemas de Información Geográfica.Learn the latest methods of collection and processing of spatial data. Deepening the acquisition methods, interpretation and treatment techniques of remote sensing data.
Learn the basics of the data structure and possibilities of Geographic Information Systems.

Competencies

Especific

Knowledge of the essential topography techniques for obtaining measurements, drawing up plans, determining layouts, taking defined geometries onto the terrain and controlling the movements of structures and earthworks.

Total hours of student work

		Hours	Percentage
Supervised Learning	Large group	18.0 h	36.36 %
	Medium group	18.0 h	36.36 %
	Laboratory classes	9.0 h	18.18 %
	Guided Activities	4.5 h	9.09 %
Self Study		63.0 h	

Contents

Item 01. Introduction to GIS

Basic description of the theoretical issues and activities undertaken during the course
Basics of Geographic Information Systems. Applications and software

Specific Objectives

Give the student an overview of the subject
Introduction to the basics of Geographic Information Systems

Item 02. Metadata and Reference Systems

Metadata
Data Infrastructure
Inspire and services OGC: WMS, WFS, WCS
Reference Systems and Cartographic Projeccions
Explanation of the basic functions for displaying spatial data and metadata through a number of different GIS tools.

Specific Objectives

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Knowing the major differences in the modules, formats and function of different GIS tools

Item 03. Raster and vectorial models

Data Model: Creating raster and vector topology. Topological errors. Creating raster and vector structures.
Conversion of formats: raster to vector and vector to raster.
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Specific Objectives

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Item 04. Georreferencing

Georeferencing of maps and images. Transformation and resample methods.
Scanning a paper map on which are drawn geologic features interpreted in the field. Georreferencing and digitization of these elements in the GIS.

Specific Objectives

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Item 05. Databases

Concepts of relational databases. Entity-relationship model. Primary and foreign keys. Data relations. Practical problems in relational databases.
Structuring information in the GIS. Join of additional information to the maps. Query and selection by attributes of information associated to the maps.

Specific Objectives

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Item 06. Spatial Analysis

Tools and techniques of combining GIS vector and raster maps: connectivity, proximity, inclusion.
From a series of maps,obtain thematic maps using spatial GIS tools

Specific Objectives

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Item 07. 3D Information Management

Elements for creating models and digital elevation models and digital terrain in vector format (TIN) and raster (GRID)
Generation of a DEM in TIN format, viewing and subsequent conversion to raster format. 3D spatial analysis tools in order to obtain profiles, histograms, slope maps, aspect maps, flowaccumulation maps, etc ...
To solve a problem with the GIS from some available maps and tables.

Specific Objectives

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Technical knowledge and ability to apply GIS to solve basic and applied technological problems.
Get information or thematic maps required for decision-making raised.

Item 08. Remote Sensing Introduction

Introduction and physical foundations of Remote Sensing: the spectrum and radiometric terminology.
Systems acquisitions. Platforms and sensors
Combination of spectral bands
Visual image interpretation.
Criteria for interpretation

Specific Objectives

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Item 09. Analysis and classification of images

Analysis tools, image filters and supervised classification of images for obtaining thematic maps
Supervised classification of satellite image that allows to create a thematic map in GIS format.

Specific Objectives

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Item 10. Applications and Projects

Radar images (Radio Detection and Ranging) and applications (subsidence estimations)
GOCE Project, for obtaining the geoid model.
New sensors in orbit and its applications
Description and application of new geomatics.
Especially the developments in the data acquisition sources: GNSS (GPS, GLONASS, Galileo, etc), LIDAR and photogrammetry

Specific Objectives

New sensors for measuring and Earth observation. Applications
Show the latest advances in geomatics

Activities

Workgroups

The student must perform a specific GIS work, which should apply all the theoretical knowledge with an specific GIS tool.
Each group is assigned a work area and will provide some data on paper and digital format. The remaining information will be obtained through the Internet or generated by the student.

Dedication

3h 30m

Individual Activities

After sessions in class, students are asked to carry out a series of directed activities. Some consist of end-to-face practice and analyze the results to answer specific questions. Deliveries are single and Atena interface.

Dedication

1h

Teaching Methodology

This subject is not taught in the first semester of the 2024-25 academic year, it will be taught according to the timetable and teaching guide of the common optional subject in the second semester (Q2) Instrumentation and Remote Sensing (2500033) of civil engineering (plan 2020) , check the teaching guide of that subject for more information.

Although most of the sessions will be given in the language indicated, 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.

This subject is not taught in the first semester (Q1) of the 2023-24 academic year, it will be taught according to the timetable and teaching guide of the common optional subject in the second semester (Q2) Instrumentation and Remote Sensing (2500033) of civil engineering (plan 2020). See your teaching guide for that new subject for more information.

Bibliography

Basic

- Bosque Sendra, J. Sistemas de información geográfica. 2a ed. corr. Madrid: Rialp, 1997. ISBN 8432131547.
- 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. 2a ed. San Vicente (Alicante): Club Universitario, 2006. ISBN 8484544931.
- Chuvieco, E. Fundamentos de teledetección espacial. 3a ed. (4a reimpr. corretgida 2000). Madrid: Rialp, 1996. ISBN 843213127X.
- Olaya, V. Sistemas de información geográfica. 2014. OsGeo, 2014.

Complementary

- Burrough, P.A.; McDonnell, R.A. Principles of geographical information systems. 3rd ed. Oxford: Oxford University Press, 2015. ISBN 9780198742845.
- Lantada Zarzosa, N.; Núñez Andrés, M. A. Sistemas de información geográfica. Barcelona: Edicions UPC, 2002. ISBN 8483016125.
- 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.