Course guide
310618 - 310618 - Geographic Information Systems

Last modified: 04/04/2025

Unit in charge: Barcelona School of Building Construction
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.

Degree: BACHELOR'S DEGREE IN GEOINFORMATION AND GEOMATICS ENGINEERING (Syllabus 2016). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: XABIER BLANCH GORRIZ

Others:

PRIOR SKILLS

Basic computer skills: Familiarity with operating systems, basic software, and file management.
Skills in basic mathematics and statistics: To understand data analysis and models used in the management of spatial information.
Skills in basic use of cartographic data.

REQUIREMENTS

Have passed the Digital Cartography course.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
4. Design and develope geomatic and topographic projects.
5. (ENG) Determinar, mesurar, avaluar i representar el terreny, objectes tridimensionals, punts i trajectòries.
6. (ENG) Reunir i interpretar informació del terreny i tota aquella relacionada geogràficament i econòmicament amb ell.
7. (ENG) Planificació, projecte, direcció, execució i gestió de processos de mesura, sistemes d'informació, explotació d'imatges, posicionament i navegació; modelització, representació i visualització de la informació territorial en, sota i sobre la superfície terrestre.
8. (ENG) Planificació, projecte, direcció, execució i gestió de processos i productes d'aplicació a l'enginyeria medioambiental, agronòmica, forestal i minera, dins l'àmbit geomàtic.
9. (ENG) Planificació, projecte, direcció, execució i gestió de processos i productes d'aplicació a la societat de l'informació dins l'àmbit geomàtic.
10. (ENG) Planificació, projecte, direcció, execució i gestió de processos i productes d'aplicació en cadastre i registre, ordenació del territori i valoració, dins l'àmbit geomàtic.
11. Knowledge, use and application of the treatment techinques. Analysis of special data. Study of models applied to the engineering and architecture.
12. Design, production and difusion of the basic cartographic; implementation, management and explotation of Geographic Information Systems (SIG).
13. Knowledge about application of the geomatic methods and techniques in the the scope of the different enginneries.

Transversal:
1. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.
2. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.
3. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.

TEACHING METHODOLOGY

Lectures (teacher-led)
Participatory expository classes (student-focused)
Guided practices
Independent work (pre and post lectures)
Cooperative work
Project-based work (individual and group)
Problem-based learning (PBL)

LEARNING OBJECTIVES OF THE SUBJECT

The student should be able to interpret and create cartographic documents, perform advanced raster analysis, integrate raster and vector data, and automate workflows using modeling tools, applying best practices in spatial data management and processing.

STUDY LOAD

Type	Hours	Percentage
Hours large group	24,0	16.00
Hours medium group	36,0	24.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

T1: Fundamentals of Raster Analysis

Description:
Raster data model: structure and characteristics
Spatial properties (Resolution and cell size)
Coordinate systems and projections
Data sources, formats, compression, and metadata

Specific objectives:
Understand the raster model, its spatial properties, and data formats.

Full-or-part-time: 30h
Theory classes: 5h
Practical classes: 7h
Self study : 18h

T2: Basic Raster Operations

Description:
Reclassification operations
Local operations
Generalization operations

Specific objectives:
Apply reclassification, local, and generalization operations to raster data.

Full-or-part-time: 30h
Theory classes: 4h
Practical classes: 8h
Self study : 18h

T3: Advanced Raster Analysis

Description:
Operations across multiple raster layers
Neighborhood analysis
Zonal analysis
Temporal operations

Specific objectives:
Perform advanced analysis using multiple raster layers and zonal and temporal techniques.

Full-or-part-time: 37h
Theory classes: 5h
Practical classes: 8h
Self study : 24h

T4: Raster-Vector Integration

Description:
Conversion processes (raster-vector, vector-raster)
Mixed operations
Integrated analysis

Specific objectives:
Integrate raster and vector data through conversions and mixed operations.

Full-or-part-time: 26h
Theory classes: 5h
Practical classes: 6h
Self study : 15h

T5: Process Automation

Description:
Workflow design
Modeling tools (ModelBuilder, Model Designer)
Processing scripts (Python)

Specific objectives:
Automate workflows using modeling tools and Python scripts.

Full-or-part-time: 27h
Theory classes: 5h
Practical classes: 7h
Self study : 15h

ACTIVITIES

P1: Georeferencing and raster products

Description:
Image downloads, georeferencing, and generation of a validated Digital Elevation Model (DEM) from raster data.

Full-or-part-time: 3h
Self study: 3h

P2: Raster operations and neighborhood analysis

Description:
Application of local operations on raster layers and neighborhood analysis to study spatial relationships.

Full-or-part-time: 6h
Self study: 6h

P3: Vector-Raster Analysis

Description:
Integration of raster and vector data through mixed operations and extraction of zonal statistics.

Full-or-part-time: 6h
Self study: 6h

P4: GIS Automation

Description:
Creation of an automated model for GIS processes, model parameterization, and workflow documentation.

Full-or-part-time: 6h
Self study: 6h

GRADING SYSTEM

Continuous Assessment (50%):
- 4 mini-projects (10% each)
- Cooperative exercises in class, online quizzes, participation (10%)

Mid-term Exam (25%)

Final Integration Project (25%)

EXAMINATION RULES.

Attendance at practical activities, exams, and the submission of all deliverables are mandatory and, therefore, a necessary condition for evaluation. Failure to submit the practical assignments will result in a grade of NS (Not Submitted).

BIBLIOGRAPHY

Basic:
- Bosque Sendra, Joaquín. Sistemas de información geográfica. 2ª ed. Madrid: Rialp, 1997. ISBN 8432131547.
- Aronoff, Stanley. Geographic information systems : a management perspective. Otawa, Canadá: WDL Publications, 1989. ISBN 0921804911.
- Laurini, Robert ; Thompson, Derek. Fundamentals of spatial information systems. Londres: Academic Press, 1992. ISBN 0-12-438380-7.
- Moreno Jiménez, Antonio [et al.]. Sistemas y análisis de la información geográfica : manual de autoaprendizaje con ArcGIS. 2ª ed. Madrid: RA-MA, 2007. ISBN 9788478978380.
- ESRI. Tutoriales online ArcGIS PRO [on line]. [Consultation: 05/07/2022]. Available on: https://pro.arcgis.com/es/pro-app/get-started/pro-quickstart-tutorials.htm.

RESOURCES

Computer material:
- ArcGIS PRO. Resource
- ArcGIS Desktop. Resource

Other resources:
QGIS