Course guide
250808 - 250808 - Geographic Information Systems

Last modified: 25/01/2024

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

Degree: MASTER'S DEGREE IN GEOTECHNICAL ENGINEERING (Syllabus 2015). (Optional subject).

Academic year: 2023 **ECTS Credits:** 5.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: MARIA DE LAS NIEVES LANTADA ZARZOSA

Others: MARIA DE LAS NIEVES LANTADA ZARZOSA, CAROLINA PUIG POLO

TEACHING METHODOLOGY

The course consists of 3 hours per week of classroom activity.

The 1 hour in the large size groups 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 project and do an oral presentation of it at the end of the course.

The 2 hours in the medium or small size groups is 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 and lectures 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.

LEARNING OBJECTIVES OF THE SUBJECT

To conceive soils and rocks as porous media governed by Solid and Fluid Mechanics.
To interpret laboratory tests and field observations so as to identify the mechanisms responsible for soil response. To propose laboratory testing programmes.
To formulate and implement Finite Element and Finite Differences numerical models with the objective to analyze the processes that govern ground response, to interpret field information and to predict soil response.

* To apply oral presentation techniques.
* To use advanced calculation tools to analyze Civil Engineering problems, design big-scale models and suggest design solutions for prototypes.
* To know and be able to use advanced techniques to geo-referentially represent data.
* To have powerful tools for the geospatial analysis of geo-referentiated data.

- Introduction to GIS.
- Structures of data: vector and raster formats.
- New technologies for data capture.
- Georeferencing.
- Metadata.
- Topology errors and editing data.
- Database.
- Spatial analysis and digital terrain models.

STUDY LOAD

Type	Hours	Percentage
Hours small group	9,8	7.83
Hours medium group	9,8	7.83
Self study	80,0	63.95
Hours large group	25,5	20.38

Total learning time: 125.1 h

CONTENTS

Spatial Data Infrastructure (SDI)

Description:
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Several kind of cartography and metadata, located on remote servers, will be displayed through a WMS from a GIS program.

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 maps on the web, through catalogs and Web services

Full-or-part-time: 7h 11m
Theory classes: 1h
Laboratory classes: 2h
Self study : 4h 11m

Data structure

Description:
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.
Open maps in different formats and structures programs SIG

Full-or-part-time: 24h
Theory classes: 6h
Laboratory classes: 4h
Self study : 14h

Global Navigation Satellite System

Description:
DGPS or GPS for GIS

Specific objectives:
Measuring elements enters a GNSS receiver in GIS format, with attributes associated with the method differential GPS (DGPS).
Managing this information in a GIS tool for future reference and use.

Full-or-part-time: 4h 48m
Laboratory classes: 2h
Self study : 2h 48m

Other sensors of Earth observation

Description:
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
Remote sensing assignment

Specific objectives:
Introduce other methods of obtaining geographic information, which can be built and managed in a GIS.
Techniques of remote sensing by satellite or airborne platform
Know the options and applications of laser scanner instrumentations.
To generate DTM from LIDAR point cloud
Using image processing software with GIS

Full-or-part-time: 21h 36m
Theory classes: 4h
Laboratory classes: 5h
Self study : 12h 36m

Spatial analysis

Description:
spatial analysis with raster, vector data and from digital elevation models (MDE)
Multi-criteria analysis for decision making, using raster, vector data and from digital elevation models (DEM)

Specific objectives:
Combine maps of various formats for response to a specific problem or take decisions. Perform simulations of events. Generate new spatial information from maps available.

Full-or-part-time: 19h 12m
Theory classes: 4h
Laboratory classes: 4h
Self study : 11h 12m

Projects and GIS applications

Description:
Diagram Design GIS workflow tool for solving problems in real projects.
GIS project

Specific objectives:
Knowing the database tools, analysis and design conversiónque allow the optimum workflow to solve specific problems in GIS

Full-or-part-time: 31h 12m
Practical classes: 5h
Laboratory classes: 8h
Self study : 18h 12m

GRADING SYSTEM

The rating will be obtained from the continuous assessment marks:
1) Note exams (Ne): the mean of two individual written assessment test (at the middle and the end of the semester) theoretical concepts associated objectives learning course regarding knowledge or understanding of the GIS and remote sensing topics.
2) Note of practical activities (Np): problems and practice both individual and group training and additive nature, made during the year (in the classroom and outside of it). The Np will be elaborated by an average (weighted by the importance of each activity); in general Np will be: the GIS project (65%)+ Remote Sensing (20%) + DGPS or GPS for GIS (10%)+Georeferencing (5%)
The practices will be carried individually or by subgroups and some of them must be presented orally in the classroom.
#3) The final grade NF = Ne * (20%) + Np (80%)

EXAMINATION RULES.

Deliveries in a proper way of continuous assessment activities (field and laboratory) out of the scheduled period (min 80%) will result in a mark of zero in that activity. The attendance to the DGPS for GIS field practice is mandatory.

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 [on line]. [S.l.]: [OsGeo],, 2012 [Consultation: 27/04/2020]. Available on: http://volaya.github.io/libro-sig/.
- 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.

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.