Universitat de Lleida

DEGREE CURRICULUM

TOPOGRAPHY, GIS AND REMOTE SENSING

Coordination: MARTINEZ CASASNOVAS, JOSE ANTONIO

Academic year 2022-23

TOPOGRAPHY, GIS AND REMOTE SENSING 2022-23

Subject's general information

<table>
<tr><td>Subject name</td><td>TOPOGRAPHY, GIS AND REMOTE SENSING</td></tr>
<tr><td>Code</td><td>102424</td></tr>
<tr><td>Semester</td><td>1st Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Forest Engineering</td><td>2</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
<tr><td>Double degree: Bachelor's degree in Forest Engineering and Bachelor's degree in Nature Conservation</td><td>2</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
<tr><td>Master's Degree in Forestry Engineering</td><td></td><td>COMPLEMENTARY TRAINING</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><td>PRACAMP</td><td>PRALAB</td><td>TEORIA</td></tr>
<tr><th>Number of credits</th><td>0.4</td><td>2.4</td><td>3.2</td></tr>
<tr><th>Number of groups</th><td>3</td><td>2</td><td>1</td></tr>
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<tr><td>Coordination</td><td>MARTINEZ CASASNOVAS, JOSE ANTONIO</td></tr>
<tr><td>Department</td><td>ENVIRONMENT AND SOIL SCIENCES</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>Hores presencials: 60
Hores no presencials: 90</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Català: 70
Castellà: 30</td></tr>
<tr><td>Distribution of credits</td><td>Topografia: 2,5
SIG i Teledetecció: 3,5</td></tr>
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TOPOGRAPHY, GIS AND REMOTE SENSING 2022-23

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
CARRILLO MAHIQUES, GUSTAVO	gustavo.carrillo@udl.cat	2,7	
LAVAQUIOL COLELL, BERNAT	bernat.lavaquiol@udl.cat	1,2	
MARTINEZ CASASNOVAS, JOSE ANTONIO	joseantonio.martinez@udl.cat	1,7	
RIBA CHACON, ANTONIO	antonio.riba@udl.cat	1,8	
SANDONIS POZO, LEIRE	leire.sandonis@udl.cat	1,8	

Subject's extra information

Subject / subject in the whole curriculum

The subject is included in the module common to the forestry branch of the Degree in Forestry Engineering, forming part of the field Forestry Engineering. It is a basic subject in which techniques and methods for the representation and spatial analysis of the terrain and territory (in the broadest sense) are taught, which will have the ultimate purpose of being applied to solve problems of planning and management of the territories

Specifically, **Topography** is the science that studies the set of principles and procedures that aim at the graphic representation of the surface of the Earth, with its forms and details, both natural and artificial (planimetry and altimetry). This representation takes place on flat surfaces, limiting itself to small extensions of land, using the denomination of geodesy for larger areas. **Remote sensing** is the science that includes the detection, identification, classification and analysis of vegetation coverings, land uses and phenomena that occur on the earth's surface through remote sensors installed on aerial or space platforms. For its part, **Geographic Information Systems (GIS)** constitute the science and technology oriented to the management, consultation, updating, analysis and modeling of the territorial information generated through topographical and / or remote sensing methods in a way integrated

Currently, both **Topography, GIS and Remote Sensing** are based on the management of specific computer equipment and programs. The use of these technologies is of great interest and application in other subjects of the degree, in particular the relationships with the cartography of land uses and vegetal covers, management of forest systems, territorial and environmental planning, forest fires, reforestation, analysis of changes in vegetation cover, landscape analysis, environmental impact assessment, or hydrological analysis of basins, among others.

In summary, the basic descriptors of the subject are: Topography. Planimetric and altimetric elevations, Replacements and leveling. Calculation of surfaces. Remote sensing Physical fundamentals of remote sensing. Techniques for data acquisition by remote sensing. Digital image process. Geographic Information Systems. Structures of data in GIS (Vectorial and Raster). Spatial analysis of territorial information.

Requirements to take it Prerequisites: There are no prerequisites. Core requirements: There are no core requisites.
It is necessary to have basic knowledge of the use of computers and computer programs, as well as the English language at the level of reading and understanding.

Learning objectives

Knowledge objectives. Understand and demonstrate knowledge in:

- The role of Surveying, GIS and Remote Sensing in the acquisition, processing and analysis of the territory's information with the purpose of inventory, planning and management.
- Concepts and methods for the realization of planimetric and altimetric surveys, replanting, leveling and calculation of surfaces.
- The physical bases of Remote Sensing, its advantages and limitations in studies on the territory.
- The techniques of image analysis (visual interpretation and digital processing).
- Data models in GIS.
- The techniques and functions of GIS analysis for the resolution of particular cases in the territorial analysis.
- The main sources of complementary information and other resources related to these technologies of geographic information and its application.

The student that exceeds the subject will have to be able to:

- Carry out planimetric and altimetric surveys, replanting, leveling and calculation of surfaces.
- Know how to apply knowledge about data structures in the representation of the territory information in the creation of geographic databases.
- Define and apply the techniques for the analysis of remote sensing images (visual interpretation and digital processing) and geographic information analysis techniques and functions through GIS programs, for the resolution of particular cases of planning, analysis and forest management.
- Solve problems posed, oriented to the planning and management of forest resources through the application of integrated remote sensing and GIS techniques, and know where to acquire additional knowledge related to the subject.
- Prepare and present the thematic mapping resulting from the processes of analysis of geographic information as an element of communication in planning and management of the territory.

Competences

CB1. That students have demonstrated to possess and understand knowledge in an area of study that starts from the base of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that imply knowledge from the cutting edge of your field of study

CB2. That students know how to apply their knowledge to their work or vocation in a professional way and possess the competencies that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

CB3. That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant issues of a social, scientific or ethical nature

CB4. That students can transmit information, ideas, problems and solutions to both specialized and non-specialized audiences

CB5. That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy

CG9. Knowledge of hydraulics, construction, electrification, forest roads, machinery and mechanization necessary both for the management of forest systems and for their conservation.CG13. Ability to design, direct, prepare, implement and interpret projects and plans, as well as to write technical reports, recognition reports, evaluations,

expert opinions and appraisals.

CT5. Apply the gender perspective to the functions of the professional field.

CEMC6. Ability to know, understand and use the principles of Topography, Geographic Information Systems and Remote Sensing.

CEMC9. Ability to know, understand and use the principles of forestry machinery and mechanization.

CEMC17. Ability to know, understand and use the principles of Methodology, organization and project management.

Subject contents

Module 1: TOPOGRAPHY (prof. Jordi Llorens, Bernat Lavaquiol)

Item 1. GENERAL NOTIONS.

Item 2. CARTOGRAPHY.

Item 3. GLOBAL POSITIONING SYSTEMS (GNSS).

Item 4. TOPOGRAPHIC INSTRUMENTS.

Item 5. PLANIMETRIC AND ALTIMETRIC METHODS.

Item 6. DIGITAL LAND MODELS (MDT).

Item 7. PHOTOGRAMETRY.

- Practice 1 (Computer Room): Work with digital cartography: superposition and georeferencing of images. Get to know digital cartographic platforms for information.

- Practice 2 (Field): Carry out the relevant operations for the installation of topographic devices.

- Practice 3 (Computer Room): Work with digital information to complement the topographic survey.

- Practice 4 (Field): Work with electronic distance meter and data collection necessary for lifting points.

- Practice 5 (Computer Room): Digitization of field data and georeferencing of points until the construction of the digital terrain model (MDT).

Module 2: Geographic Information Systems and Remote Sensing (Prof. J.A. Martínez Casasnovas and Leire Sandonís, MACS)

Item 1. INTRODUCTION AND CHARACTERISTICS OF GEOINFORMATION

Practice 1. Introduction to GIS progrmas, and visualization of geographic information

Topic 2. THE VECTOR MODEL

Practice 2. Attribute tables and selection queries in vector layers

Practice 3. Creation and editing of vector layers

Topic 4. THE RASTER MODEL

Practice 4. Geoprocessing operations with vector data

Practice 5. Main characteristics of the raster model

Item 4. DIGITAL ELEVATION MODELS

Practice 6. Digital elevation models. Creation and extraction of topographic and hydrological information

Item 5. INTRODUCTION AND ELECTROMAGNETIC ENERGY

Practice 7. Visualization and characteristics of multispectral images

Item 6. SPECTRAL SIGNATURES

Item 7. EXPECTAL INDEX AND VEGETATION INDEX

Practice 8. Spectral signatures and vegetation index

Item 8. CLASSIFICATION OF MULTISPECTRAL IMAGES

Practice 9. Classification of multispectral images

Methodology

Evaluation activity		**Weight**
Procedure	**Number of proofs**	**(%)**
Written exams about concepts in theoretical classes an practical exercises	1 Exam TOPOG 1 Exam SIGTEL	70%
SIGTEL exercises	9 Exercises 1 Exam	30% SIGTEL part (of which 70% corresponds to the continous assessment of the exercises and 30% correspond to the exam)
Topography exercises	3 Computer exercises 2 Field work	30% part Topography

The subject is evaluated according to the following weighting:

Part Topography: 37% of the final grade
GIS and Remote Sensing Part: 63% of the final grade

The final mark of the subject will be calculated as follows: (Exam Topo x 0,7 + Exercises Topo x 0,3) x 0,37 + (Exam SIGTEL x 0,7 + Exercises SIGTELx 0,3) x 0,63

Development plan

According to the schedule and timetable established by the Head of Studies of ETSEA.

Evaluation

THEORETICAL PART:

The theoretical part consists of 2 parts: a) **Topography**, b) **GIS and Remote Sensing** (hereinafter GISRS). These two parts are evaluated separately.
• To pass the course, **a minimum grade of 5.0 must be obtained in each of the parts**. That is, one part does not compensate with the other. For example, taking a grade of 4 in Topography and 6 in SIGTEL, or vice versa, does not mean that the average is 5.0. In this case, it would mean that the Topography part has been suspended, and if

this is the final grade, also that the subject has been suspended, as one of the requirements has not been met. This is independent of the internship grade. That is, internships do not count until the previous minimum requirement is met.

PRACTICAL PART:

The minimum grade to pass the practical part is 5.0. The evaluation of the Practices has the following particularities:

TOPOGRAPHY EXERCISES: assistance and delivery of all exercises (5) is mandatory. Exercises must be submitted within the established deadlines. In case of not being able to attend an internship, the teacher must justify it (prior to the internship) and an alternative solution will be sought.

GISRS EXERCISES: consists of A) **continuous evaluation of the exercises**, so it is mandatory to perform and deliver all the practical exercises within the established deadlines. Delays in the delivery of these results will be penalized with -30% of the grade. After the deadline, the exercises will not be admitted and will be graded with a grade of 0. Very important: the copy of part or all of some report / s of practices will suppose to fail the subject. The weight of this part is 70% of the internship grade, and B) **individual exam at the end of the GISRS part.** The weight of this part is 30% of the internship grade. Passing this exam is a requirement to pass the course.
The final grade of the subject will only be calculated in the case of having reached the minimum grade required in each of the parts. If you do not arrive, the final grade that will appear in the minutes will be the one that comes out of the calculation or, at most, 4.0 FAIL

Repeating students: The notes of the approved parts, both theory and practice, will be saved. In the case of SIGTEL internships, they will be saved as long as the internship exam has been passed in the previous year. Although a student has passed the internship of the previous year, he / she will have the right to do the internship again and the marks that will appear will be those of the current year and not those of the previous one.d in the previous year, the student will have the option of taking the assessment tests corresponding to the current year and the grades will be those of the current year and not the of the above.

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- Bosque, J., 2000. Sistemas de Informació Geográfica. Rialp, S.A., Madrid, 452 pp.
- Chuvieco, E., 2010. Teledetección ambiental: La observación de la Tierra desde el Espacio, 2a Edición, Ariel, Barcelona.
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- Alcántara García, Dante A. Topografía y sus aplicaciones. México D.F: Larousse - Grupo Editorial Patria, 2014. Print.
- Arranz Justel, José Juan; Soler Garcia, C., 2015. Métodos Topográficos. Análisis de los diferentes métodos topográficos planimétricos y altimétricos, abordando diferentes casos, precisiones alcanzadas y su resolución por medio de Mínimos Cuadrados. UPM. S.l.: s.n. ISBN 978-84-16397-06-8. Disponible en: http://pdi.topografia.upm.es/jjarranz/libro/.
- Farjas, Mercedes, 2012. La Topografía y sus métodos: Principios de investigación.Astrolabio. ISBN:978-84-616-2019-7.

Complementary

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- Gómez Delgado, M., Barredo, J.I., 2005. Sistemas de Información Geográfica y evaluación multicriterio en la ordenación del territorio. 2ª Edición, Ra-ma, Madrid, 304 pp.
- Bonham-Carter, G.F., 1995. Geographic Information Systems for geoscientists: Modelling with GIS- Vol 13. Pergamon, Kidlington, 416 pp.
- Peterson G.N., 2009. GIS cartography: a guide to effective map design. CRC Press, cop. Boca Raton.
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- **https://www.icgc.cat/**

- **https://www.ign.es/web/ign/portal**