Universitat de Lleida

DEGREE CURRICULUM

TOPOGRAPHY, GIS AND REMOTE SENSING

Coordination: MARTÍNEZ CASASNOVAS, JOSÉ ANTONIO

Academic year 2021-22

TOPOGRAPHY, GIS AND REMOTE SENSING 2021-22

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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</td></tr>
<tr><td>Coordination</td><td>MARTÍNEZ CASASNOVAS, JOSÉ 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 2021-22

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
LAVAQUIOL COLELL, BERNAT	bernat.lavaquiol@udl.cat	1,2	
LLORENS CALVERAS, JORDI	jordi.llorens@udl.cat	2,7	
MARTÍNEZ CASASNOVAS, JOSÉ ANTONIO	joseantonio.martinez@udl.cat	3,5	
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.

* For the Master's program in Forest Engineering, there are 3,5 ECTS of the 6 that are included in the enrollment, given that the part of Topography is validated by having been taught in the degree of access.

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. Read distances and angles.

- Practice 3 (Computer Room): Collection of 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 (Prof. J.A. Martínez Casasnovas and Damià Vericat, MACS)

Item 1. INTRODUCTION AND CHARACTERISTICS OF GEOINFORMATION

Practice 1. Introduction to ArcGIS, 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

Module 3: Remote Sensing (Prof. J.A Martínez Casasnovas and Damià Vericat, MACS)

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 + (Exams 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 3 parts: Topography, GIS and Remote Sensing which are evaluated separately.

• To pass the course you must obtain a grade ≥ 5.0 in at least two of the parts and a third with a grade ≥ 4.0.

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 PRACTICES:

• The penalty for non-attendance is not contemplated as all practices (5) are mandatory and must be submitted within the established deadlines. If it is the case that is not possible to attend the practice the student needs to justify the non-attendance (previous to the planned date), then an alternative activity will be proposed.

GIS and REMOTE SENSING PRACTICES: consists of A) continuous evaluation of the exercises, so it is mandatory to perform and deliver all the practical exercises within the established deadlines. The weight of this part is 70% of the internship grade. The delivery of the questionnaires with the questions and results of each exercise is obligatory within the established term. The delay in delivery of these results will be penalized with -30% ofthe mark of the exercise. The copy of some part of the totally of an exercise will suposse the direct failling of the subject. B) individual internship exam at the end of the GIS and Remote Sensing part The weight of this part is 30% of the internship grade. To pass this exam is a requirement to pass the GIS and Remote Sensing parts of the subject.•

The final mark of the subject will be only calculated if you have reached the minimum grade required in each of the parts. In case of not arriving there, the final note that will appear in the acts will be the one that leaves the calculation or, at the most, 4.0 NOT APROVED.

Repeating students: The notes of both theory and practice approved during the previous year will be saved, but not from two years or more before. If there is any part of theory and/or practices approved 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.

Bibliography

Basic

- Bernhardsen, T., 2002. Geographic Information Systems. An Introduction. 3rd edition. John Wiley & Sons, Inc., New York, 448 pp.
- 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.
- Domínguez García, F. - 1991 - Topografia general y aplicada . 10.ª edición**,** Editorial DOSSAT,Madrid, 823 pp.
- Domínguez García, F. - 1991 - Topografia abreviada. 10.ª edición**,** Editorial DOSSAT,Madrid, 448pp.
- Chueca, M.- 1982 – Topografia (tomos I,II), Editorial DOSSAT, Madrid.
- Martin Asin, F.- 1987 – Geodesia y Cartografia Matemática.- Instituto Geográfico Nacional, 422 pp.
- Lillesand, T.M. y Kiefer, R.W., 1999. Remote sensing and image interpretation, 4th Edition. John Wiley & Sons, Inc., New York, 736 pp.

Complementary

- Arctur, D., 2004. Designing geodatabases: case studies in GIS data modeling. ESRI, Redlands, CA.
- 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.
- Mather, P.M., 1999. Computer processing of remotely-sensed images. An introduction. 2ª Edición. John Wiley & Sons, Chichester, 306 pp.
- Skidmore, A. y Prins, H., 2000. Environmental modelling with GIS and remote sensing. Taylor & Francis, Basingstoke, 304 pp.
- Star, J.L., McGwire, K.C. y Estes, J.E. (coordinadores), 1997. Integration of Geographical Information Systems and remote sensing. Cambridge University Press, Cambridge, 248 pp.

- **http://rsgistutorial.blogspot.com.es/**