Universitat de Lleida

DEGREE CURRICULUM

TOPOGRAPHY, GIS AND REMOTE SENSING

Coordination: MARTÍNEZ CASASNOVAS, JOSÉ ANTONIO

Academic year 2020-21

TOPOGRAPHY, GIS AND REMOTE SENSING 2020-21

Subject's general information

Subject name	TOPOGRAPHY, GIS AND REMOTE SENSING
Code	102528
Semester	2nd Q(SEMESTER) CONTINUED EVALUATION
Typology	

Degree	Course	Character	Modality
Bachelor's Degree in Agricultural and Food Engineering	2	COMPULSORY	Attendance-based

Course number of credits (ECTS)	6
Type of activity, credits, and groups	

Activity type	PRACAMP	PRALAB	TEORIA
Number of credits	0.4	2.4	3.2
Number of groups	4	3	1

Coordination	MARTÍNEZ CASASNOVAS, JOSÉ ANTONIO
Department	ENVIRONMENT AND SOIL SCIENCES
Important information on data processing	Consult this link for more information.

TOPOGRAPHY, GIS AND REMOTE SENSING 2020-21

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
LAVAQUIOL COLELL, BERNAT	bernat.lavaquiol@udl.cat	,8	
LLORENS CALVERAS, JORDI	jordi.llorens@udl.cat	4,1	
MARTÍNEZ CASASNOVAS, JOSÉ ANTONIO	joseantonio.martinez@udl.cat	5,3	
VERICAT QUEROL, DAMIAN	damia.vericat@udl.cat	1,8	

Subject's extra information

Subject / subject in the whole syllabus

The subject is included in the common module of the **Degree in Agricultural and Food Engineering**. It is a basic subject in which techniques and methods are taught for the representation and spatial analysis of the terrain and the territory (in the broadest sense), which will have the final purpose of being applied to the resolution of planning and environmental management problems. natural, agricultural or territory.

Concretely, **Topography** is the science that studies the set of principles and procedures that has for its object 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, limited to small tracts of land, using the designation of geodesy for larger areas. **Remote sensing** is the science that includes the detection, identification, classification and analysis of vegetation cover, crops, land uses and phenomena that take place on the earth's surface through remote sensors installed on aerial or space platforms. On the other hand, the **Geographic Information Systems (GIS)** constitute the science and technology oriented to the management, consultation, updating, analysis and modeling of the territorial information generated through topographic methods and / or remote sensing in an integrated manner.

Currently, both **Topography, GIS and Remote Sensing** are based on the management of specific computer equipment and programs. The use of these technologies has great interest and application in other subjects of the degree, in particular those related to the cartography of land uses, land uses, crops, territorial and environmental planning, precision agriculture, landscape analysis, evaluation of the environmental impact, or hydrological analysis of watersheds, among others.

As a summary, the basic descriptors of the subject are: Topography. Planimetric and altimetric surveys, Stakeouts and leveling. Calculation of surfaces. Remote sensing Physical foundations of remote sensing. Techniques for data acquisition by remote sensing. Digital process of images. Geographic information systems. Data structures in GIS (Vectorial and Raster). Spatial analysis of territorial information.

Requirements to take it Prerequisites: There are no prerequisites. Corequisites: There are no corequisites.
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 comprehension.

* In the Master's Program in Agricultural Engineering, 3.5 ECTS of the 6 that are included in the enrollment are taught, given that the Topography part is validated because it was taught in the access qualification.

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.

Competences

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 agricultural land management.
- Solve problems posed, oriented to the planning and management of agricultural 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 agricultural land.

Subject contents

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

Topic 1. GENERAL NOTIONS.

Topic 2. CARTOGRAPHY.

Topic 3. GLOBAL POSITIONING SYSTEMS (GNSS).

Topic 4. TOPOGRAPHIC INSTRUMENTS.

Topic 5. PLANIMETRIC AND ALTIMETRIC METHODS.

Topic 6. CREATION OF DIGITAL TERRAIN MODELS (DTM).

- 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	**SIGTEL part 30%** (of which 70% corresponds to the continous assessment of the exercises and 30% correspond to the exam). **Aprove this exam will be a requirement to aprove the subject.**
Topography exercises	3 Computer exercises 2 Field work	**Topography. part 30%**. This part has not practical exam.

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.

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, I **B) individual practical 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 aprove the subject.

• The delivery of the questionnaires with the questions and results of each exercise is obligatory within the established term. Delay in delivery of these results will be penalized with -30% of the note. The copy of a part or of an entire exercise will be qualified as failling the whole 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 kept, but not from two years or more before. The marks of the practical exercises will be kept if the student approved the practical exam. 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

- Martínez-Casasnovas, J.A., 2020. Sistemas de Información Geográfica (SIG) y Teledetección - Conceptos. Departamento de Medio Ambiente y Ciencias del Suelo, Universidad de Lleida, Lleida.

- 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/**