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

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<tr><td>Code</td><td>102528</td></tr>
<tr><td>Semester</td><td>2nd Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
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<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Agricultural and Food Engineering</td><td>2</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
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<tr><th>Activity type</th><th>PRACAMP</th><th>PRALAB</th><th>TEORIA</th></tr>
<tr><td>Number of credits</td><td>0.4</td><td>2.4</td><td>3.2</td></tr>
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<tr><td>Coordination</td><td>MARTÍNEZ CASASNOVAS, JOSÉ ANTONIO</td></tr>
<tr><td>Department</td><td>ENVIRONMENT AND SOIL SCIENCES</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</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
MARTINEZ PASCUAL, NURIA	nuria.martinezpascual@udl.cat	4,9	
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.

TOPOGRAPHY, GIS AND REMOTE SENSING 2021-22

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 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.

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 forefront 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.
CG1. Capacity for the prior preparation, conception, drafting and signing of projects that have as their object the construction, reform, repair, conservation, demolition, manufacture, installation, assembly or exploitation of movable or immovable property that due to its nature and characteristics are included in the own technique of agricultural and livestock production (facilities or buildings, farms, infrastructures and rural roads), the agri-food industry (extractive, fermentation, dairy, canning, fruit and vegetable, meat, fishing, salting industries and, in general, any other dedicated to the elaboration and / or transformation, conservation, handling and distribution of food products) and gardening and landscaping (urban and / or rural green spaces - parks, gardens, nurseries, urban trees, etc. -, public or private sports facilities and environments subjected to landscape recovery).
CG2. Adequate knowledge of physical problems, technologies, machinery and water and energy supply systems, the limits imposed by budgetary factors and construction regulations, and the relationships between facilities or buildings and agricultural holdings, agri-food industries and spaces related to the gardening and landscaping with their social and environmental surroundings, as well as the need to relate those and that environment with human needs and the preservation of the environment.
CG3. Ability to direct the execution of the works object of the projects related to agri-food industries, agricultural

operations and green spaces and their buildings, infrastructures and facilities, the prevention of risks associated with this execution and the management of multidisciplinary teams and human resource management, in accordance with deontological criteria.
CG4. Ability to write and sign measurements, segregations, subdivisions, evaluations and appraisals within the rural environment, the technique of the agri-food industry and spaces related to gardening and landscaping, whether or not they have the character of expert reports for judicial bodies or administrative, and regardless of the use to which the movable or immovable property object of the same is destined.

CG8. Ability to solve problems with creativity, initiative, methodology and critical reasoning.
CG9. Leadership, communication and transmission of knowledge, abilities and skills in the social fields of action.
CG10. Ability to search and use the rules and regulations related to its scope of action.
CG12. Ability to work in multidisciplinary and multicultural teams.
CT1. Correction in oral and written expression.
CT3. Mastery of Information and Communication Technologies.
CEMC6. Ability to know, understand and use the principles of: Surveys and topographic stakeouts. Cartography, Photogrammetry, geographic information systems and remote sensing in agronomy.
CEMC7. Ability to know, understand and use the principles of: Rural engineering: calculation of structures and construction, hydraulics, motors and machines, electrical engineering, technical projects.
CEMCR2. Ability to know, understand and use the principles of: Bases and technology of rural buildings. Soil mechanics. Materials. Material resistance. Structure Design and calculation. Agricultural constructions. Infrastructures and rural roads.
CEMCR3. Ability to know, understand and use the principles of: Agricultural mechanization. Agricultural engines and machines. Characteristics and design of machinary to agrary instalations. Agricultural automatic.
CEMCR4. Ability to know, understand and use the principles of: Facilities engineering. Rural electrification. Irrigation and drainage technology. Hydraulic works and installations. Facilities for animal health and welfare.

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	**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**. 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, 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

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- 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.

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- 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.
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- 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/**