Universitat de Lleida

DEGREE CURRICULUM

GPS, DTM AND CAD

Coordination: ESCOLÀ AGUSTÍ, ALEXANDRE

Academic year 2021-22

GNSS, MDT i CAD 2021-22

Subject's general information

<table>
<tr><td>Subject name</td><td>GPS, DTM AND CAD</td></tr>
<tr><td>Code</td><td>102576</td></tr>
<tr><td>Semester</td><td>2nd 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 Agricultural and Food Engineering</td><td>3</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>
<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>0.6</td><td>3.1</td><td>2.3</td></tr>
<tr><th>Number of groups</th><td>1</td><td>1</td><td>1</td></tr>
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<tr><td>Coordination</td><td>ESCOLÀ AGUSTÍ, ALEXANDRE</td></tr>
<tr><td>Department</td><td>AGRICULTURAL AND FOREST ENGINEERING</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>In-person: 60 h
Autonomous: 90 h</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: 83%
Castellà: 17%</td></tr>
<tr><td>Distribution of credits</td><td>See table of Type of activity, credits and groups</td></tr>
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GNSS, MDT i CAD 2021-22

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
ESCOLÀ AGUSTÍ, ALEXANDRE	alex.escola@udl.cat	2	
LAVAQUIOL COLELL, BERNAT	bernat.lavaquiol@udl.cat	1	
LLORENS CALVERAS, JORDI	jordi.llorens@udl.cat	2	
SANZ CORTIELLA, RICARDO	ricardo.sanz@udl.cat	1	

Subject's extra information

Subject / subject in the whole curriculum

Currently, GPS / GNSS, MDTs and CADs constitute the usual instrumentation and applications used by Topography for the representation of the territory. The constellation of GPS satellites (Global Positioning System) was the first and for a long time, the reference one, but there are other global systems with the same functions as the GLONASS system (Russia), the Galileo system (Europe) and Beidou (China) that can be used together. In short, they can position us at any point on the Earth with a specific accuracy. From the most elementary to the most accurate receiver used in Topography, there is a wide range of devices, as well as different methodologies to perform topographical surveys. The Digital Land Models (MDT) constitute the final result of topographical surveys. Its construction based on different types of coordinates and reference systems, can lead to 3D views and a better description of the terrain. This 3D vision of the terrain has been generated with the help of CAD programs giving a very localized perspective and at the same time accurate data taken in the field or from digital cartography.

Recommendations

Basic knowledge of the use of computers and computer programs, as well as the English language at the level of reading and understanding is required.

Learning objectives

Knowledge objectives. The student who passes the subject must understand and demonstrate knowledge in:

- In the use of GPS instrumentation in the field, as its subsequent development in the cabinet.
- Creation and construction of digital terrain models based on field data or from digital and analog maps.
- Understand and demonstrate knowledge of drawing and computer-aided design for handling and making plans in two dimensions.
- Understand and demonstrate basic knowledge of computers and computer methods of drawing and design in three dimensions.
- The main sources of complementary information and other resources related to these geographic information technologies and their application in all fields.

Capacity objectives (competences). The student who passes the subject must be able to:

- Know how to apply knowledge about field data in the representation of territory information.
- Define and apply calculation techniques for the further development of the MDT construction.
- Demonstrate theoretical and practical knowledge of the methods and computer equipment necessary for the management and preparation of plans (handling, drawing and design) in 2D and 3D.
- Solve problems raised from real field data.
- Prepare and present the digital cartography from which the modifications and measurements will be executed in the digital models of the terrain at different scales.

Competences

General competences

At least the following basic competencies must be guaranteed:

CB1. That students have demonstrated to possess and understand knowledge in a study area that is based on the subjects that precede it in previous courses, and also includes some aspects that involve knowledge derived from the avant-garde of their field of study. 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 issue judgments that reflect on relevant issues of a social, scientific or ethical nature

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

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

In addition, the graduate must be able to:

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.

CG7. Knowledge of basic, scientific and technological subjects that allow continuous learning, as well as an ability to adapt to new situations or changing environments.

CG13. Correction in the oral and written expression

CG14. Domain of a foreign language

CG15. Domain of information and communication technologies

CG16. Regarding the fundamental rights of equality between men and women, the promotion of Human Rights and the values of a culture of peace and democratic values

Specific competencies

The graduate in AGRICULTURE AND FOOD ENGINEERING. ESPECIALITY IN RURAL AND ENVIRONMENTAL ENGINEERING after completing their studies will have acquired the following knowledge and skills:

Basic training module

CEFB2. Capacity for spatial vision and knowledge of graphic representation techniques, both by traditional methods of metric geometry and descriptive geometry, as well as by computer-aided design applications.

CEFB3. Basic knowledge about the use and programming of computers, operating systems, databases and software with application in engineering.

CEFB6. Basic knowledge of geology and field morphology and its application in problems related to engineering.

CEMC6. Surveys and topographic stakeouts. Cartography, Photogrammetry, geographic information systems and remote sensing in agronomy.

Transversal competencies

CT1. Apply the gender perspective to the functions of the professional field

Subject contents

Topic 0. Presentation of the subject.

Module 1: CAD

Topic 1. DRAWING AND DESIGN ASSISTED BY COMPUTER FOR THE MANAGEMENT AND CONFECTION OF 2D PLANS.
Hardware and Specific Software. Drawing management. Creation and advanced editing of complex objects. Layer management Restraint Printing and Scale. Settings and customization.

Topic 2. INTRODUCTION TO 3D DRAWING AND DESIGN COMPUTER EQUIPMENT AND METHODS.
Differences between 2D and 3D. 3D coordinate systems. Point of view switch. Multiple graphic windows. Models with wires. Surface models. Solid Models: Solids Primitives 3D, Solids for extrusion, Solids for revolution, Boolean editing operations, Basic Edition, Advanced Edition, Properties. 3D model printing.

Module 2: GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS)

Topic 1. SPACIAL AND CONTROL SEGMENTS.
Introduction and description of the spatial segments and control of the different SSNGs.

Topic 2. SEGMENT OF USERS. DETERMINATION OF POSITION
Positioning. Measure distances Errors Coordinates

Topic 3. CORRECCIÓN SYSTEMS.
Differential satellite and terrestrial systems.

Module 3: MDT

Topic 1. INTRODUCTION TO DIGITAL LAND MODELS (TDM).
Antecedents Concept Representation systems. Digital lift models (MDE).

Topic 2. DATA TICKET (MDT).
Direct methods for the construction of MDT. Classical Topography: Total Station Handling. LiDAR systems. Indirect methods: Analog and digital cartography.

Topic 3. CONSTRUCTION OF DIGITAL MODELS.

Graphic formats Analog and digital vectorization. Description software to use. Construction of 2D models.

Topic 4. PRACTICAL APPLICATIONS OF DIGITAL MODELS.
Triangulation Elevation of entities. Meshes Heights maps Pending maps Maps of Direction of water flows. Visibility of the models. Profiles.

PRACTICAL ACTIVITIES

Module 1: CAD

All theoretical and practical classes will be held in the computer room. Theoretical and practical explanations will be alternated in periods not exceeding 1 h.

- Practices Unit 1. Completion of a set of sheets proposed by the teacher.
- Practice Topic 2. Perform a set of 3D exercises.

Module 2: GNSS.

- Field practice 1. Evaluation of the accuracy and the precision of two GNSS receivers with two correction systems.
- Field practice 2. Acquisition of field data through a mobile phone receiver and through a portable RTK receiver with correction via GPRS.
- Practice in the computer room 1. Management and representation of the data obtained.
- Practice in the computer room 2. Use of GIS to manage and represent information obtained with GNSS.
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Module 3: MDT.

- Practice sessions in Computer room: Representation of 2D points. Layer management
- Computer classroom practice sessions: Triangulation. Construction curves of level. Meshes 3D view

Development plan

A detailed planning of the subject will be loaded in the Resources section of the Virtual Campus at the beginning of the course. The planning will contain the distribution of the credits in the different activities and the dates, places and professors of each one.

Evaluation

The evaluation of the subject will be done through continuous evaluation and will consist of several activities.

Module 1 - CAD will be evaluated by means of a 2 hour exam. Module 1 represents 16.67 % of the final grade of the subject.

Module 2 - GNSS will be evaluated by means of a test type exam to evaluate the theoretical contents and 2 exercises derived from the practice sessions. The grade of Module 2 will be the arithmetic mean of the 3 grades and will represent the 33.33% of the final grade.

Module 3 - MDT will be evaluated through a work and through several practical exercises (the appropriate instructions will be given at the beginning of the course). Regarding the grade of Module 3, the work will consist of 2 geographic studies with DTM analysis of each zone, one of them and agricultural area with few plots and the other of a wider area. The work will represent a 70 % of the Module 3 grade and the remaining 30 % will correspond to the submission of exercices to be done along the year. Module 3 represents the 50 % of the final grade.

The subject is passed obtaining 5 points out of 10 or more in the sum of the weighted grades of each module.

Observations:

- The students who can not follow the continuous assessment for justified reasons must contact the course coordinator before the classes begin or, at most, during the first week.
- To be able to pass the subject it is mandatory to attend and to carry out all the practices.
- It is necessary to draw a minimum of 40 % of the maximum grade of each module in order to be able to pass the subject. If not, the final grade will be a maximum of 4 point out of 10.
- In order to be able to make a fair evaluation of all the students, the plagiarism in the activities carried out will be meticulously pursued. Any plague activity will count 0 points in the evaluation.

Bibliography

Module 1: CAD

- The help of the Autocad software

Module 2-3: GNSS/MDT

- Ruiz-Morales, M., 2003. Nociones de Topografía y Fotogrametría Aérea. Universidad de Granada, Granada. 529 pp.
- Domínguez García, F. - 1991 - Topografía general y aplicada. 10ª edición, Editorial DOSSAT,Madrid, 823 pp.
- Chueca, M.- 1982 – Topografia (tomos I,II), Editorial DOSSAT,Madrid
- Hofmann-Wellenhof, B., Collins, J., Lichtenegger, H. 2000. GPS Theory and Practice. 5th ed. SpringerWienNewYork, New York, 382 pp.
- Xu, G. 2007. *GPS: theory, algorithms, and Applications*. Berlin: Springer