Course guide
310629 - 310629 - 3D Data Processing

Last modified: 29/01/2024

Unit in charge: Barcelona School of Building Construction
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.

Degree: BACHELOR'S DEGREE IN GEOINFORMATION AND GEOMATICS ENGINEERING (Syllabus 2016). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 4.5 **Languages:** Catalan

LECTURER

Coordinating lecturer: Albert Prades Valls

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
6. Basic knowledge about use and computer programmation, operative systems, databases and software programmes with application in the enginnering.
7. Capacity of spatial vision and knowlege of the graphic representation techniques, for traditional methods of metric and geometric geometry but also for applications of assisted design by a computer.

8. Knowledge, use and application of instruments and appopriate photogrametric methods for the fullfilment of cartographic.
9. Knowledge, use and application of the treatment techinques. Analysis of special data. Study of models applied to the engineering and architecture.
10. (ENG) Determinar, mesurar, avaluar i representar el terreny, objectes tridimensionals, punts i trajectòries.
11. Knowledge and application of methods of minimun adjust quadratic in the scope of topo-geodesic observations, photogrametric and cartographic.
1. (ENG) Determinar, mesurar, avaluar i representar el terreny, objectes tridimensionals, punts i trajectòries.
2. (ENG) Planificació, projecte, direcció, execució i gestió de processos de mesura, sistemes d'informació, explotació d'imatges, posicionament i navegació; modelització, representació i visualització de la informació territorial en, sota i sobre la superfície terrestre.
3. Capacity for the resolution of mathematic problems that can be set out in engineering. Aptitude to apply the knowledge about: linear algebra, geometry, differential geometry, differential and integral calculus, differential equations and in partial derivates, numeric methods, numeric algorithm, stadistics and optimization.
4. Knowledge, application and analysis of the processes of treatment of digital images and special information, proceding from airborne and satelite sensors.
5. Knowledge, use and application of instruments and fotogrametric methods and topographic adequated to the realization of non-cartographic raisings.

Generical:
16. Use of teams and instrumental: Capacity to select the necessary ressources to the achievement of the planned goals according to the quality requirements. Use of the teams, in adequated conditions, with professional efficiency and taking into account the limitations of the instruments and its context of use, in relation with the required precissions.

Transversal:
12. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.
13. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.
14. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.
15. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

TEACHING METHODOLOGY

The guided learning hours consist in theoretical classes (big group) where the professor will do an exposition of the concepts that should be dominated about the contents that are treated. Afterwards, and by the practices, is attempt to motivate and involucrate the students to practice actively in their learning.

LEARNING OBJECTIVES OF THE SUBJECT

It is pretended that the student achive the enough knowledge to operate with tridimensional data and extract information of topography relevance.

STUDY LOAD

Type	Hours	Percentage
Hours medium group	27,0	24.00
Hours large group	18,0	16.00
Self study	67,5	60.00

Total learning time: 112.5 h

CONTENTS

Introduction

Description:
Representation of ground surfaces. Descriptors of the ground and strategies in the data collection: frequence spectre, curving, covariance, semivariogramme, gradient

Full-or-part-time: 11h
Theory classes: 2h
Self study : 9h

Data collection

Description:
Strategy for the acquisition of the 3D data collection.
Selective data collection: most important points.
Data collection with a fix fdmension: edges and profiles
Data collection with two fix dimensions: regular network and progressive data collection.
Compound data collection.

Related activities:
Activity 1

Full-or-part-time: 15h
Theory classes: 2h
Practical classes: 3h
Self study : 10h

Surface models

Description:
Basic concepts for the surface modelization: Interpolation
Approachfor the ground surface modelization: triangle, grid, modelization of hybrid surfaces.
The continuity of the surfaces
Formation of a triangular network. Priciples: Delaunay triangulation, static and dynamic (Bowyer-Watson, Walk-Through). Unions, Voronoi diagrams.
Interpolation techiques: Simple linear interpolation, bilinear, spline
Adjustment by minimum squares of a local surface

Related activities:
Activity 2
Activity 3
Activity 5

Full-or-part-time: 55h
Theory classes: 10h
Practical classes: 15h
Self study : 30h

Quality control of the surface models

Description:
Quality control: Concepts and strategies. Quality control in the aquisition of the photogrametric data. Screen of the random errors of the original data.
Detection of serious errors in the grid of the 3D data based on the remaining information.
Detection of rude mistakes.
Evaluation of the exactitude of a DTM: Measurements of precision of a DTM.
Empiric models of the exactitude of a derived DTM.

Full-or-part-time: 19h 30m
Theory classes: 2h
Practical classes: 7h
Self study : 10h 30m

Model representation of multiple scales

Description:
Model representation: a general vision of multiple scales (scale, resolution, and simplification of the representations).
Hierarchic representation of the models in discreet scales (pyramid shaped structure for the hierarchic representation, quadtree structure for the hierarchic representation).
Multiscale metrics and model representation of continuous scales.

Related activities:
Activity 4

Full-or-part-time: 12h
Theory classes: 2h
Practical classes: 2h
Self study : 8h

ACTIVITIES

BIBLIOGRAPHIC RESEARCH

Description:
Bibliographic ressearch referring to topics of tridimensional modelization.

Material:
The activity will be done between the first and the fifth week and is evaluated with a 25% of the final mark.

Delivery:
It will be done a brief exposition in class about the topic treated.

Full-or-part-time: 9h
Practical classes: 1h
Self study: 8h

INTERPOLATION METHODS

Description:
It must be interpretated a little program (in excel, Mapple, or in C language) that allows to compare different methods of interpolation.

Material:
The activity will be done between the second and the fourth week and is evaluated with a 10% of the final mark. The necessary material will be available in Atenea.

Delivery:
The report of the activity will be delivered during the fifth week.

Full-or-part-time: 4h
Practical classes: 2h
Laboratory classes: 2h

BASIC TREATMENT OF TRIDIMENSIONAL DATA

Description:
In this activity will be carried out a basic data treatment: elimination of wrong points, generation of the model, etc. above a cloud of points obtained with scaner laser.

Material:
The activity will be done between the fifth and the seventh week and is evaluated with a 10% of the final mark. The necessary material will be available in Atenea.

Delivery:
The report of the activity will be delivered during the eighth week.

Full-or-part-time: 4h
Practical classes: 2h
Laboratory classes: 2h

MULTISCALE TREATMENT OF A MODEL

Description:
Are used two nets from the model of heights of the same territorial zone (for example, the model of ICC and the SAR model of the NASA). The activity consists in changing the scale of one of them in order to be comparable.

Material:
The activity will be done between the eighth and the tenth week and is evaluated with a 15% of the final mark. The necessary material will be available in Atenea.

Delivery:
The report of the activity will be delivered during the eleventh week.

Full-or-part-time: 4h
Practical classes: 2h
Laboratory classes: 2h

SURFACE ADJUSTMENT

Description:
Given a cloud of points a minimum adjustment quadratic of a surface must be done.

Material:
The activity will be done between the eleventh and the fifteenth week and is evaluated with a 20% of the final mark. The necessary material will be available in Atenea.

Delivery:
The report will be delivered ath the end of the course.

Full-or-part-time: 4h
Theory classes: 1h
Practical classes: 3h

WRITTEN SCORING TEST

Description:
Written exam where the theoretical knowledge will be evaluated.

Material:
It will be done in the last week of the course and is evaluated with a 20% of the final mark.

Full-or-part-time: 2h
Practical classes: 2h

GRADING SYSTEM

The final qualification is the addition of the following qualifications:

Final mark = 0,25*mark activity 1 + 0,10*mark activity 2 + 0,10*mark activity 3 + 0,15*mark activity 4 + 0,20*mark activity 5 + 0,20*written exam

BIBLIOGRAPHY

Basic:
- Zhilin, Li ; Gold, Christopher. Digital terrain modeling : principles and methodology [on line]. 2005. Boca Raton-Florida: CRC Press, 2005 [Consultation: 16/06/2020]. Available on: https://www.taylorfrancis.com/books/9780429205071. ISBN 0-415-32462-9.