

Course guide

310624 - 310624 - Digital Photogrammetry

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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: 2024 **ECTS Credits:** 7.5 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Buill Pozuelo, Felipe

Others: Muñoz Capilla, Francisco Javier
Buill Pozuelo, Felipe

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

CE10EGG. Knowledge, application and analysis of the processes of digital image treatment and spatial information, proceeding from airborne and satellite sensors.

CE15EGG. Knowledge about: Security, health and labour risks inside the scope of this engineering and the surroundings of its application and development

CE16EGG. Knowledge and application of methods and geometric techniques inside the scope of the different engineering

CE8EGG. Knowledge, using and application of instruments and appropriate topographic methods in order to carry out cartography.

CE9EGG. (ENG) Coneixement, utilització i aplicació de les tècniques de tractament. Anàlisi de dades espacials. Estudi de models aplicats a l'enginyeria i arquitectura. (Mòdul comú a la branca Topografia)

Generical:

CG1EGG. Design and develop geomatic and topographic projects.

CG5EGG. Determine, measure, evaluate and represent the ground, tridimensional objects, points and trajectories.

CG8EGG. Planification, project, direction, execution and management of measurements processes, information systems, image exploitation, positioning and navigation; modeling, representation and visualization of the territorial information in, under and above the ground surface.

CG10EGG. Planning, project, direction, execution and management of processes and products of application in the environment, agronomy, forest and mining engineering inside the geomatic field

CG13EGG. Use of teams and instruments. Using of precision instruments, their characteristics, and also its use, transfer of data, treatment and interpretation of themselves.

CG12EGG. Planning, project, direction, execution and management of processes and products of application in the register, ordination of territory and valuation inside the geomatic field.

CG7EGG. Management and execution of investigation projects, development and innovation inside the scope of this engineering.

Transversal:

CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

Basic:

CB1EGG. The students have demonstrated possess and comprehend knowledge in a field of study that comes from high school, and is used to a level that, while is supported in advanced textbooks, it also includes some aspects that involve knowledge from the field of study in the vanguard.

CB2EGG. The students must know how to apply their knowledge to the work or vocation in a professional way and possess the competences that are used to be demonstrated by the elaboration and defense of arguments and the resolution of problems inside their own field of study.

TEACHING METHODOLOGY

The guided learning hours consist in, give theoretical classes (big group) where the professor does a brief exposition to introduce the general goals of learning related with the basic concepts of the subject. Later and by practical exercises, the professor tries to motivate and involve the students to make them participate in its learning.

Support material in ATENEA is used: goals of learning by contents, concepts, examples, programation of evaluation activites, guided learning and bibliography. Also consists in giving classes, where is worked by the resolution of exercises or problems related with the specific learning goals of each one of the contents of the subject.

In this problem sessions is pretended to add some generic competences.

After each session, tasks are proposed outside the classroom, to be worked on individually.

Also it have to be considered other hours of autonomous learning, like the ones that are dedicated to oriented lectures and the resolution of the proposed problems about the different contents, by the virtual campus ATENEA.

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the subject the student must be capable of:

- Know, use and apply the techniques of treatment and analysis of special data
- Know, use and apply intruments and adequated photogrametric methods for the realization of cartography
- Know, use and apply intruments and adequated photogrametric methods for the realization of non cartographic surveying
- Know, use and apply the processes of difital image treatment and special information, from aerotransported sensors and satellites
- Knowledge and application of minimum quadratic adjustment in the environment of topo-geodesic observations, photogrametric and cartographic.

STUDY LOAD

Type	Hours	Percentage
Self study	112,5	60.00
Hours medium group	45,0	24.00
Hours large group	30,0	16.00

Total learning time: 187.5 h

CONTENTS

Introduction to photogrammetry

Description:

In this chapter is introduced the concept of photogrammetry, its different acceptations and analyse its historic evolution. There is shown a description of the photogrammetric methods where it will be seen the applications of photogrammetry, the flux of work, the photographic coverage, the phases of the process of restitution, reconstruction of bundle and his position in the space. It will enter in the coordinate systems used in photogrammetry and the changes of coordinates in the different systems. Also there will be seen the systematic errors that appear and how should be corrected.

Related activities:

Activity 1
Activity 2

Full-or-part-time: 7h

Theory classes: 2h
Practical classes: 1h
Self study : 4h

Digital instrumentation

Description:

The instruments used in the productive digital processes are analyzed. The different types of restitutors and photogrammetric digital stations, and the boxes or informatic modules are characterized and are looked over. The different digital photographic cameras, photogrammetric and the digital video cameras are evaluated. Topics:

- Generalities
- Capture instruments
- Digital photogrammetric systems
- Digital photogrammetric stations

Full-or-part-time: 5h

Theory classes: 2h
Self study : 3h

Analytical and digital photogrammetry

Description:

The mathematical models used in photogrammetry are presented in a general way. This topic introduces the collinearity equations, spatial resection and the intersection of two or more images. Relative orientation with the coplanarity condition and with the collinearity condition will be discussed. Finally, a section will be devoted to external orientation and another to self-calibration.

Related activities:

Activities 3 and 4

Full-or-part-time: 20h

Theory classes: 5h
Practical classes: 3h
Self study : 12h

Aerotriangulation

Description:

The present content is dedicated to the aerial triangulation, where it will be seen the adjustment of bundles in block and the adjustment of independent models. Also will be done a study about source of errors and an analysis of residues after the adjustment.

Related activities:

Activity 5

Full-or-part-time: 26h 40m

Theory classes: 6h

Practical classes: 4h

Self study : 16h 40m

Non cartographic photogrammetry

Description:

The instruments and techniques used in the non cartographic photogrammetry are shown, where we will see:

- 1) Introduction
- 2) Instruments, cameras, restitutors
- 3) Calibration of non metric cameras
- 4) Photogrametric products

Related activities:

Activity 6

Full-or-part-time: 12h 30m

Theory classes: 2h

Practical classes: 4h

Self study : 6h 30m

Generation of Digital Models of the Ground

Description:

Revision of the different digital models (MDT, MDE, MDS...)

Sections:

- Digital models of the ground
- Type
- Applications

Related activities:

Activity 7

Full-or-part-time: 25h

Theory classes: 3h

Practical classes: 4h

Self study : 18h

LiDAR

Description:

Foundations of the Lidar rechnology. Basic process of data. Introduction to the capture and production of MDT by LiDAR data. Application of LiDAR technology and MDT in engineering and environment. Combination of LiDAR sensors with digital cameras about aerial platforms (planes, UAV, etc)

Full-or-part-time: 5h

Theory classes: 1h

Practical classes: 1h

Self study : 3h

Photographic rectification. Ortoprojection

Description:

Analysis of the processes for the obtention of photgraphic rectification, the ortoimages, digital ortophotographies (true and conventional) and the mosaics.

Sections:

- Rectification
- Ortoprojection
- Digital ortography
- Mosaic confection
- Products

Related activities:

Activity 8

Full-or-part-time: 23h

Theory classes: 4h

Practical classes: 4h

Self study : 15h

Photogrametry from satellite

Description:

Application of satellite images in photogrametric processes.

Sections:

- Introduction
- Systematic errors
- Rectification of satellite image

Full-or-part-time: 5h

Theory classes: 1h

Practical classes: 1h

Self study : 3h

Photogrametric processes

Description:

Are shown the different algorithms that allow the processing and automatization of photogrametric processes.

Sections:

- Geometric processing of images
- Correspondence of images
- Automatization of photogrametric processes

Full-or-part-time: 5h

Theory classes: 2h

Self study : 3h

Photogrametric project

Description:

Realization of a small photogrametric project

Sections:

- Memory of technical specifications
- Quality in photogrametry
- Quality control
- PNOA

Related activities:

Activity 9

Full-or-part-time: 6h

Theory classes: 1h

Practical classes: 1h

Self study : 4h

ACTIVITIES

1 PHOTOGRAPHIC COVERAGE

Description:

Project of photogrametric coverage

Material:

Exercises to do in class. File with information in the virtual campus (ATENEA)

Delivery:

Memory of the practice

Full-or-part-time: 3h

Self study: 2h

Practical classes: 1h

2 REFINEMENT OF PHOTOCOORDINATES

Description:

Transformation of coordinates. Correction of systematic errors

Material:

Exercises to do in the calculus center or laboratory. File with information in the virtual campus (ATENEA)

Delivery:

Memory of the practice

Full-or-part-time: 4h

Self study: 3h

Practical classes: 1h

3 ORIENTATION OF A PHOTOGRAMMETRIC BLOCK

Description:

Automatic orientation process in a photogrammetric block.

Material:

Practice to do in the laboratory. File with information in the virtual campus (ATENEA)

Delivery:

Memory of the practice

Full-or-part-time: 5h

Self study: 3h

Practical classes: 2h

4 SPACIAL RESSECTION AND RESTITUTION

Description:

Orientation of an even photographic and restitution of the characteristic lines of the photogrammetric model

Material:

Practice to do in the laboratory. File with information in the virtual campus (ATENEA)

Delivery:

Memory of the practice

Full-or-part-time: 5h

Self study: 3h

Practical classes: 2h

5 AEROTRIANGULATION

Description:

Aerotriangulation by adjustment of bundles of a photogrametric block

Material:

Practice to do in the laboratory. File with information in the virtual campus (ATENEA)

Delivery:

Memory of the practice

Full-or-part-time: 7h

Self study: 3h

Practical classes: 4h

6 SURVEYING BY NON CARTOGRAPHIC PHOTOGRAMETRY

Description:

Terrestrial photogrammetric survey of a small heritage element on a large scale.

Material:

Practice to do in the laboratory. File with information in the virtual campus (ATENEA)

Delivery:

Memory of the practice

Full-or-part-time: 6h

Self study: 3h

Practical classes: 3h

7 CREATION OF MDT. INTERPOLATION OF MDT

Description:

Creation of an MDT. Edition and obtaining of derivated products

Material:

Practice to do in the laboratory. File with information in the virtual campus (ATENEA)

Delivery:

Memory of the practice

Full-or-part-time: 7h

Self study: 3h

Practical classes: 4h

8 RECTIFICATION. OBTENTION OF ORTOIMAGES

Material:

Practice to do in the laboratory. File with information in the virtual campus (ATENEA)

Delivery:

Memory of the practice

Full-or-part-time: 7h 20m

Self study: 3h 20m

Practical classes: 4h

9 QUALITY CONTROL

Material:

Practice to do in the laboratory. File with information in the virtual campus (ATENEA)

Delivery:

Memory of the practice

Full-or-part-time: 2h

Self study: 1h

Practical classes: 1h

EVALUATION FINAL EXAM

Description:

For students who have not passed the continuous assessment tests.

It will be resolved linked exercises to the explained contents and worked until the moment.

Full-or-part-time: 2h

Theory classes: 2h

GRADING SYSTEM

The final grade is the sum of the following partial grades:

Activity 1 Continuous evaluation 30%

Activity 2 Exercises developed in class 30%

Activity 3 Laboratory practices 40%

Final grade = $0.3 * \text{activity 1} + 0.3 * \text{activity 2} + 0.4 * \text{activity 3}$

For students who have not passed the continuous assessment tests (activity 1), a final test will be carried out.

Recovery exam is NOT performed

EXAMINATION RULES.

It is mandatory to carry out the exercises and laboratory practices (activities 2 and 3).

All activities are mandatory. Failure to carry out and deliver the exercises and laboratory practices implies the consideration of not being presented in the final evaluation.

Recovery exam is NOT performed.

BIBLIOGRAPHY

Basic:

- Albertz, J Lorg; Kreiling, Walter; Wiesel, Joachim. Photogrammetrisches taschenbuch = Manual Fotogramétrico. 4ª ed. Wichmann: Karlsruhe, 1989.
- Atkinson, K.B. Close range photogrammetry and machine vision. Caithness, UK: Whittles, 2001. ISBN 978-1870325738.
- Buill, F. [et al]. Fotogrametría analítica [on line]. Barcelona: Edicions UPC, 2003 [Consultation: 22/07/2013]. Available on: <http://ebooks.upc.edu/product/fotogrametra-analitica-generacin-de-cartografa>. ISBN 8483016710.
- Hartley, Richard; Zisserman, Andrew. Multiple view geometry in computer vision. 2nd ed. Cambridge [etc.]: Cambridge University Press, 2003. ISBN 9780521540513.
- Kraus, Karl. Photogrammetry : geometry from images and laser scans. 2a. Berlin: Walter de Gruyter, 2007. ISBN 9783110190076.
- Lerma García, José Luis. Fotogrametría moderna: analítica y digital. València: Universitat Politècnica de València, 2002. ISBN 8497052102.
- Linder, Wilfried. Digital photogrammetry: a practical course. 2nd ed. Berlin: Springer, 2006.
- McGlone, J. Ch.. Manual of photogrammetry. 5th ed. Virginia: American Society of Photogrammetry, 2004.
- Mikhail, Edward M.. Introduction to modern photogrammetry. New York: Wiley, 2001.

Complementary:

- ISPRS journal of photogrammetry & remote sensing [on line]. Amsterdam: International Society of Photogrammetry and Remote Sensing, [Consultation: 22/07/2013]. Available on: <http://www.sciencedirect.com/science/journal/09242716>.- Photogrammetric engineering and remote sensing. Falls Church: American Society of Photogrammetry,
- GW : geomatics world. Lemmer: GITV bv,
- GIM [on line]. The Netherlands: Geomares Publishing, Available on: <http://www.gim-international.com/>.