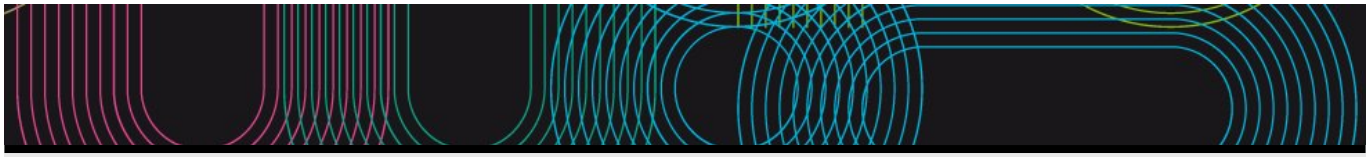

IDENTIFYING DATA

Geomatics Applied to Energy Efficiency

Subject	Geomatics Applied to Energy Efficiency			
Code	V09G291V01408			
Study programme	Grado en Ingeniería de la Energía			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Soilán Rodríguez, Mario			
Lecturers	Lorenzo Cimadevila, Henrique Martínez Sánchez, Joaquín Soilán Rodríguez, Mario			
E-mail	msoilan@uvigo.es			
Web	http://moovi.uvigo.es			
General description	In this subject, students are expected to acquire concepts related to geomatics and the use of topographic, photogrammetric and LiDAR sensors, with a perspective of energy efficiency applications in buildings.			

Training and Learning Results

Code	
B1	Ability to draw links between the different elements of all the knowledge acquired, understanding them as components of a body of knowledge with a clear structure and strong internal cohesion.
C14	Knowledge of topography, photogrammetry and cartography.
C40	Understanding and ability to use concepts pertaining to energy efficiency and saving, as well as their management and application for solving problems specific to the field of energy engineering.
C59	Ability to use tools of cartographic engineering, photogrammetry and remote sensing to solve problems of energy efficiency.
D2	Ability to organize, understand, assimilate, produce and handle all the relevant information to develop their professional work, using appropriate computing, mathematics, physics tools, etc. when these are required.

Expected results from this subject

Expected results from this subject	Training and Learning Results		
Master the techniques of as-built geometric modeling of envelopes and interiors.	B1	C59	D2
To know the currently existing techniques for data collection in the field using different types of sensors, which allow the preparation of maps and plans.	B1	C14	D2
To acquire skills to obtain, from different data sources, point clouds that subsequently allow the preparation of plans at different scales.	B1	C14 C59	D2
To know and apply non-destructive techniques for thermal monitoring.	B1	C40 C59	D2
To know and apply software for processing and analysis of geospatial data and information.	B1	C40 C59	D2
To master information modeling applied to construction.	B1	C40	D2

Contents

Topic

Fundamentals of Cartography and Geodesy	Concept of Geodesy. Geoid and terrestrial ellipsoid. Concept of Cartography. Geographic and cartographic coordinates. Reference systems. Datum. Cartographic projection systems. UTM system. Data sources in classic supports, digital support and in network. Information available through Internet.
Fundamentals of aerial and terrestrial photogrammetry	Principles of photogrammetry. Basic concepts, image space - 3D space relationships. General method of photogrammetry. Photogrammetric processes, relative and absolute orientation. Photogrammetric cameras, calibration. Photogrammetric restitution. Rectification and orthophotography. Photogrammetric survey. Flight planning and project.
Fundamentals of LiDAR sensors and data	Introduction to laser scanning systems. Typologies. Fundamentals of terrestrial, mobile and airborne LiDAR sensors. Error sources. Applications. Definition of LiDAR point cloud. Basic fundamentals of LiDAR processing. Public data sources.
Energy analysis and monitoring applications.	Fundamentals of Geographic Information Systems (GIS). Data types and management. Cartographic resources. GIS for geospatial information analysis. Solar potential applications. Non-destructive techniques for energy monitoring: Infrared thermography. Fundamentals and applications.
Energy efficiency applications in construction	BIM (Building Information Modeling) fundamentals. Definition, implementation, relationship with digitalization. OpenBIM concepts. Geospatial information processing software with BIM applicability.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	20	20	40
Problem solving	6	20	26
Practices through ICT	16	30	46
Laboratory practical	8	10	18
Problem and/or exercise solving	1	5	6
Objective questions exam	1	5	6
Report of practices, practicum and external practices	0.5	7.5	8

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	Presentation by the teacher of the contents of the subject, theoretical bases and/or guidelines of an assingment, exercise or project to be developed by the students.
Problem solving	Activity in which problems and/or exercises related to the subject are formulated. Students must develop the appropriate or correct solutions through the exercise of routines, application of formulas or algorithms, application of transformation procedures of the available information, and interpretation of the results. It is normally used as a complement to lecturing.
Practices through ICT	Activities of application of knowledge to concrete situations and acquisition of basic skills and procedures related to the subject, developed in ICT classrooms.
Laboratory practical	Activities of application of knowledge to concrete situations and acquisition of basic skills and procedures related to the subject, developed in spaces with specialized equipment.

Personalized assistance

Methodologies	Description
Practices through ICT	Guidance, support and motivation for the learning process will be provided face-to-face in the classroom and at the times when teachers are assigned office hours. For all teaching modalities, tutoring sessions may be held by telematic means, by prior arrangement.
Laboratory practical	Guidance, support and motivation for the learning process will be provided face-to-face in the classroom and at the times when teachers are assigned office hours. For all teaching modalities, tutoring sessions may be held by telematic means, by prior arrangement.

Assessment

	Description	Qualification	Training and Learning Results

Problem and/or exercise solving	Evaluation of the teaching-learning process and the acquisition of skills and knowledge through problem-solving tests and exercises. With this methodology all the expected results from this subject are assessed.	40	B1	C14 C40 C59	D2
Objective questions exam	Evaluation of the teaching-learning process and the acquisition of skills and knowledge through multiple-choice or short-answer tests. With this methodology all the expected results from this subject are assessed.	20	B1	C14 C40 C59	D2
Report of practices, practicum and external practices	Evaluation of the teaching-learning process and the acquisition of skills and knowledge through the completion of assignments and/or projects. With this methodology all the expected results from this subject are assessed.	40	B1	C14 C40 C59	D2

Other comments on the Evaluation

The evaluation will preferably be continuous. The global evaluation will be available to students who resign to the continuous evaluation within the deadlines to be defined at the beginning of the teaching period.

Minimum grades: It will be necessary to achieve a minimum grade, which will be indicated at the beginning of the term, in all the tests that are part of the evaluation. Obtaining the minimum grade in all of them will be an indispensable condition to pass the course.

Having passed the minimum grades, the grade of the subject will be the result of averaging, with the weight indicated in the teaching guide, the grades of the tests taken.

The second opportunity of continuous evaluation (extraordinary) will consist in the resolution of problems and/or exercises and in the realization of multiple-choice or short answer tests, on the official date indicated in the exam calendar. The grade obtained with the practice reports will be retained. In case this grade does not reach the minimum required, a report of the failed practical block or an equivalent test must be taken. The calculation of the final grade will follow the same methodological parameters as in the first evaluation opportunity.

The calendar of exams will be available on the School's web page. http://minaseenerxia.uvigo.es/gl/docencia/exames

Sources of information

Basic Bibliography

de Sanjosé Blasco, José Juan; López González, Mariló; Atkinson, Alan D.J.,, **Topografía para estudios de grado: geodesia, cartografía, fotogrametría, topografía (instrumentos, métodos y aplicaciones), replanteo, seguridad del topógrafo en el trabajo**, 3ª ed, Bellisco, 2015

Delgado Pascual, Mercedes (et al.), **Problemas resueltos de topografía**, 1ª ed, Universidad de Salamanca, 2011

Lerma García, José Luis, **Fotogrametría moderna: analítica y digital**, 2ª ed, Universidad Politécnica de Valencia, 2002

Chuvieco Salinero, Emilio, **Fundamentos de la teledetección espacial**, 3ª ed, Rialp, 1996

Complementary Bibliography

Luhmann, Thomas y Robson, Stuart, **Close Range Photogrammetry: Principles, Methods and Applications**, 1ª ed, Whittles Publishing, 2011

Vosselman, George y Maas, Hans-Gerd, **Airborne and Terrestrial Laser Scanning**, 1ª ed, CRC Press, 2010

Pereira,Vítor; Santos, José; Leite, Fernanda; Escórcio, Patricia, **Using BIM to improve building energy efficiency A scientometric and systematic review**, https://doi.org/10.1016/j.enbuild.2021.111292, Elsevier, 2021

Petri, Ioan; Rezgui, Yacine, **BIM for energy efficiency - Decarbonising the built environment through informed decision-making using digital simulation and analysis**, 978-1-84806-477-5, IHS MARKIT, BRE Electronic Publications, 2019

Recommendations

Subjects that continue the syllabus

Computer-Assisted Design/V09G291V01410
Final Year Dissertation/V09G291V01991
Efficient Use of Electric Power/V09G291V01414

Subjects that are recommended to be taken simultaneously

Management and Use of Electric Power/V09G291V01402

Subjects that it is recommended to have taken before

Computing: Computing for Engineering/V09G291V01110
Electric Power Plants/V09G291V01304