Last update: 04-12-2018

250125 - GEOINFGEOG - Geomatics and Geographic Information

Coordinating unit: 250 - ETSECCPB - Barcelona School of Civil Engineering

Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering

Academic year: 2018

Degree: BACHELOR'S DEGREE IN CIVIL ENGINEERING (Syllabus 2017). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN CIVIL ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)

ECTS credits: 6 Teaching languages: Catalan, Spanish, English

Teaching staff

Coordinator: MARIA DE LAS NIEVES LANTADA ZARZOSA

Others: JOSE ANTONIO GILI RIPOLL, MARIA DE LAS NIEVES LANTADA ZARZOSA, ROGELIO LOPEZ BRAVO, FRANCISCO JAVIER MUÑOZ CAPILLA, CAROLINA PUIG POLO, M. AMPARO RUBIO CERDÀ

Opening hours

Timetable: TBD

Degree competences to which the subject contributes

Specific:

3020. Knowledge of and ability to apply the concepts and techniques of topography and cartography necessary for obtaining measurements, drawing up plans, determining layouts, taking defined geometries onto the terrain and controlling the movements of structures and earthworks.

3022. Knowledge of and ability to apply the concepts and techniques of astronomy, geodetics, digital models of the terrain and geographical information systems that underlie, complement and strengthen topographical and cartographic techniques.

3054. Students will acquire basic knowledge of the use and programming of computers, operating systems, databases and applications for engineering.

Transversal:

592. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 2. Using strategies for preparing and giving oral presentations. Writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors.

595. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

599. EFFECTIVE USE OF INFORMATION RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.

602. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

584. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

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Teaching methodology

TThe course consists of approx. 2 hours a week of classes in a classroom (large group) and approx. 2 hours per week in the small group practices.
In the lecture classes the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises to consolidate the objectives of general and specific learning.
Laboratory practices are carried out with different programs.They are devoted to solving practical problems with greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.
It uses material support through the virtual campus ATENEA: theoretical content, guidelines for evaluation and directed learning, teaching videos and literature.

Learning objectives of the subject

Students will learn to use essential topographical/geomatic techniques for taking measurements, creating maps, drawing up plans, applying defined geometries to the terrain, and monitoring structural movements or earthworks. They will also develop the computer skills to handle and program geographic information systems.

Upon completion of the course, students will have acquired the ability to: 1. Carry out a topographical field survey. 2. Interpret material obtained by aerial photogrammetry. 3. Interrelate topographical information, for example from a topographical survey, in order to conduct an analysis using geographic information systems in the context of a civil engineering project.

Geomatic techniques for obtaining and processing geographical information, including (for large areas) remote sensing and earth observation sensors, which can acquire information about the terrain and the environment in order to enable correct intervention and environmental management, and (for smaller areas and construction sites) topographical techniques for taking measurements, creating maps, drawing up plans, applying projected geometries to the terrain, and monitoring the movements of structures or of the land itself; Handling and computer processing of existing geographic information, in particular with geographic information systems

Study load

Total learning time: 150h	Hours large group:	27h	18.00%
	Hours medium group:	4h	2.67%
	Hours small group:	29h	19.33%
	Guided activities:	6h	4.00%
	Self study:	84h	56.00%

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Content

Item 01. Spatial reference systems

Learning time: 4h 48m
Theory classes: 2h
Self study : 2h 48m

Description:
Geodesy (geoid, ellipsoid). Geographic coordinates.

Item 02. Cartographic projections

Learning time: 4h 48m
Theory classes: 2h
Self study : 2h 48m

Description:
Representation on topographic maps and plans. Cartographic projections. Changes in geographic coordinates to projected coordinates. Type maps, maps formats.

Item 03. Geographic information. Data Structures and databases

Learning time: 26h 24m
Theory classes: 4h
Laboratory classes: 7h
Self study : 15h 24m

Description:
INSPIRE directive and spatial data infrastructures (SDI).
Metadata
Web Map Services of the OGC, to visualize and download geoinformation on web (web mapping)
Spatial data formats: vector and raster
LAB. GIS tools. Introduction and data integration
Organization and structure of thematic information in a relational database in order to query it and future spatial analyst applications.

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Item 04. Introduction to topographic measurements

Learning time: 31h 12m

Theory classes: 7h
Practical classes: 2h
Laboratory classes: 4h
Self study : 18h 12m

Description:
Geometric and trigonometric leveling.
intrumentation: Levels and total stations
Observation and calculation
Understanding the operation of digital levels, positioning and observe a small network of leveling in order to obtain the final elevation of network points.
Positioning methods and topographic surveying with total station.
Knowing the different parts of a total station.
Practice of positioning a total station.
Observation of angles and distances.
Errors and compensation of different topographic methods

Specific objectives:
Understanding the operation of digital levels, observe a small network of leveling
Intersection and levelling methods
Knowing the different parts of a total station.
Practice of positioning and observation with a total station.
To obtain the final XYZ coordinates of the topographic surface points with a total station

Item 05. GNSS/GPS Theory

Learning time: 14h 23m

Theory classes: 2h
Laboratory classes: 4h
Self study : 8h 23m

Description:
Fundamentals of systems of navigation and positioning satellite. Receivers
Working methods. Observation points with GPS
Introduction to GPS Data Adqusition and observation and post-process of a GPS network.

Specific objectives:
Know the different methods of working with GPS, its requirements and its accuracy.

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Item 06. 3D Data. Volumes and 3D analyst	Learning time: 19h 12m Theory classes: 2h Laboratory classes: 6h Self study : 11h 12m

Description:
Contour. Digital Terrain Models. Operations on cartographic / topographic: Calculation of areas and volumes. CAMP4. RTK-GPS. Levelling and digital elevation model

Item 07. Photogrammetry, Remote Sensing and LIDAR	Learning time: 19h 12m Theory classes: 5h Laboratory classes: 3h Self study : 11h 12m

Description:
Introduction to the processes used to acquire spatial data, these spatial data will feed the geographic information system. photogrametry and remote sensing concepts. Ortophotos and images from satellites.
Method to ghater LIDAR data with a Terrestrial Laser System (TLS) with different scales, precisions amb objetcs; and also with targets in order to fusion diferent point clouds. Characteristics, types of instruments, precision and limitations. Applications in civil and environmental engineering. Information of files .LAS and .LAZ

Specific objectives:
Knowing the different systems of laser capture data from different platforms, airplane, helicopter, UAVs car or personal system. Management of information generated by different sofwares: Cloud Compare, Autocad, Arcgis, etc in order to or classificate/filter points of the cloud, to create 3D model of surfaces or to extract primitives for example.

Item 08. Geoprocessing and management of geoinformation	Learning time: 24h Theory classes: 4h Practical classes: 2h Laboratory classes: 4h Self study : 14h

Description:
Bases dades and spatial analyst
Thematic maps and GIS projects
Design the GIS database and define codes of items in the GPS receiver.
Measurement with GPS receiver of: coordinates, picture, and attributes and code in GIS format, of each item of an area assigned to the group
Problems with geoinformation

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Qualification system

The grade for the course grades obtained from continuous assessment as follows:
1) Nt: There will be two assessment tests (PAC1 and PAC2) of theoretical concepts associated with learning objectives in terms of subject knowledge or understanding. The final theoretical grade will be: Nt= [((PAC1+5)*(PAC2+5))^(1/2)]-5.
2) Practical activities(Np): laboratory and field practices, of both individual and group training and additive in nature, made during the year (in the classroom and outside it). An attendance >65% is necessary to pass this part.
Np=questionnaires on virtual camus Atenea (10%)+ field and laboratory practices (90%).
-Atenea's grade for first questionnaire (conversion of units) could be replaced if the student does not show a minimum knowledge of this subject during PAC1 and/or PAC2.
-The optional (not mandatory) activities can add up a maximum of 1.0 extra point to Np, but will only be taken into account for students who have a Nt >=4.5.

If the grade Nt>=5 and the grade Np > = 5, the final grade will be Nf=Nt(60%)+Np(40%), but the final grade is the minimum of the two.

Criteria for RE-EVALUATION qualification and eligibility: Students that failed the ordinary evaluation with Nt>2.0 and have regularly attended all evaluation tests will have the opportunity of carrying out a re-evaluation test during the period specified in the academic calendar. Students who have already passed the test or were qualified as non-attending will not be admitted to the re-evaluation test. The maximum mark for the re-evaluation exam will be five out of ten (5.0).
The non-attendance of a student to the re-evaluation test, in the date specified will not grant access to further re-evaluation tests. Students unable to attend any of the continuous assessment tests due to certifiable major force will be ensured extraordinary evaluation periods. These tests must be authorized by the corresponding Head of Studies, at the request of the professor responsible for the course, and will be carried out within the corresponding academic period.

Regulations for carrying out activities

Failure to perform a laboratory or continuous assessment activity in the scheduled period will result in a mark of zero in that activity.
The attendance is mandatory to the all field practices, and to some of the laboratory practices in order to obtain a mark of them
Extraordinary Evaluation: The reserved week for it, the students that didn't attend some of two test (PAC) for justified cause (and approved by the Head of Studies) they will be able to make a recovery exam

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Bibliography

Basic:

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Nuñez-García, A.; Valbuena; J.L.; Velasco, J. G.P.S.: la nueva era de la topografía. Madrid: Ediciones de las ciencias sociales, 1992. ISBN 8487510310.

Olaya, V. Sistemas de información geográfica [on line]. [S.l.]: [OsGeo], 2012 [Consultation: 03/04/2019]. Available on: <http://volaya.github.io/libro-sig/>.

Burrough, P.A.; McDonnell, R.A. Principles of geographical information systems. 3rd ed. Oxford: Oxford University Press, 2015. ISBN 9780198742845.

Riveiro, B.; Solla, M. Non-destructive techniques for the evaluation of structures and infrastructure. Boca Raton: CRC Press, 2016. ISBN 9781138028104.

Heritage, G.L; Large, A.R.G. Laser scanning for the environmental sciences. Chichester, UK ; Hoboken, NJ: Wiley-Blackwell, 2009. ISBN 9781405157179.

Complementary:

Chuvieco, E. Fundamentos de teledetección espacial. 3a ed. (4a reimpr. corretgida 2000). Madrid: Rialp, 1996. ISBN 843213127X.

Peña Llopis, J. Sistemas de información geográfica aplicados a la gestión del territorio : entrada, manejo, análisis y salida de datos espaciales. Teoría general y práctica para ESRI ArcGIS 9. San Vicente (Alicante): Club Universitario, 2008. ISBN 9788484549192.

Martin Asin, F. Geodesia y cartografía matemática. 3a ed. Madrid: L'autor, 1990. ISBN 843980248X.