Course guide
2500010 - GECGEOMATI - Geomatics

Last modified: 01/10/2023

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

Degree: BACHELOR'S DEGREE IN CIVIL ENGINEERING (Syllabus 2020). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: MARIA DE LAS NIEVES LANTADA ZARZOSA

Others: JOSE ANTONIO GILI RIPOLL, MARIA DE LAS NIEVES LANTADA ZARZOSA, ROGELIO LOPEZ BRAVO, CAROLINA PUIG POLO

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
14393. 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. (Basic training module)
14394. Basic knowledge about the use and programming of computers, operating systems, databases and computer programs with engineering application. (Basic training module)

Generical:
14380. Scientific-technical training for the exercise of the profession of Technical Engineer of Public Works and knowledge of the functions of advice, analysis, design, calculation, project, construction, maintenance, conservation and exploitation.

TEACHING METHODOLOGY

The subject in a typical week consists of 2 hours of face-to-face class in the classroom (large group) plus 2 hours of field practice or laboratory (amb computers). The subject pays a lot of attention to practices, as a teaching methodology to achieve knowledge in an applied way. They also play an important role in the continuous assessment and final grade.
In the theoretical class hours, the teachers explain the basic concepts and materials of the subject, present examples and do exercises and problems; it also guides guided activities and autonomous learning.
The rest of the weekly hours are devoted to practices.
Support material available through the ATENEA virtual campus is used: contents, programming of assessment and directed learning activities and bibliography.

Except the group in English, the language of the course will be in both Catalan and Spanish in the classroom (with notes in Catalan), depending on the teacher. In general, the classes in block 1: Spatial Reference Systems, block 2: land surveying, and block 3: data acquisition will be taught in Catalan and block 4 of GIS will be taught in Spanish. Pay attention as the practices may be given in a different language than the one used for lectures. It is not ruled out that some activity (guest conference, special visit, substitution due to illness) may be carried out in a different language, in a timely manner.

LEARNING OBJECTIVES OF THE SUBJECT

Shape of earth and oceans. Spatial reference systems. Cartographic projection systems. Geomatic Techniques for capturing geographic information (IG). Treatment and visualization of Geographic Information (GI). Introduction to GIS for Geographic Information (GI) Management.

1 Ability to conduct a topographic survey in the field.
2 Ability to interpret material from aerial photogrammetry.
3 Ability to interrelate topographic information, for example, starting from a survey until reaching an analysis through geographic information systems in the field of a Civil Engineering work.

Knowledge of the topographical / geomatic techniques essential to obtain measurements, drawing up plans, establish layouts, take defined geometries to the ground or control movements of structures or earthworks. Basic skills for the management and programming in computers of Geographic Information Systems. Knowledge of topography to carry out surveys and stakeouts. Knowledge of the appropriate geomatic techniques for obtaining and processing Geographical Information: for large areas, remote sensing techniques and earth observation sensors that allow acquiring territorial and environmental information based on the correct intervention and management of the environment; for minor extensions and work, the topographic techniques used to obtain measurements, to develop drawings, to establish layouts, to take projected geometries to the ground and to control movements of structures or the terrain itself.

STUDY LOAD

Type	Hours	Percentage
Guided activities	6,0	4.00
Hours small group	6,0	4.00
Hours large group	30,0	20.00
Hours medium group	24,0	16.00
Self study	84,0	56.00

Total learning time: 150 h

CONTENTS

0. Introduction to Geomatics and geoinformation

Description:
Introduction to the subject and to Geomatics and Topography
1st and 2nd continuous assessment tests (PAC1 & 2)

Full-or-part-time: 14h 23m
Theory classes: 6h
Self study : 8h 23m

1. Coordinate reference systems (CRS)

Description:
Geodesy (geoid, ellipsoid). Geographic coordinates. Topographic representation in maps and plans. Cartographic projections. Geographic changes to projected coordinates. Types of maps; map formats
Practices of the subject

Full-or-part-time: 14h 23m
Theory classes: 4h
Practical classes: 2h
Self study : 8h 23m

2. Land surveying

Description:
How an uprising is done. Topographic devices (Total Stations, Levels...). Main topographic methods: Planimetric (Intersection, Itinerary and Radiation); Altimetric (geometric and trigonometric leveling)
Practices of the subject

Full-or-part-time: 28h 47m
Theory classes: 6h
Laboratory classes: 6h
Self study : 16h 47m

4. Satellite positioning systems (GNSS / GPS)

Description:
Fundamentals of satellite navigation and positioning systems. Appliances. Working methods. Observation of points with GPS
Practices of the subject

Full-or-part-time: 28h 47m
Theory classes: 2h
Laboratory classes: 10h
Self study : 16h 47m

5. Data capture techniques: Photogrammetry, Remote Sensing and LIDAR

Description:
Introduction to Aerial Photogrammetry. Earth Observation Satellites; Active or Passive Remote Sensing.
Practices of the subject

Full-or-part-time: 28h 47m
Theory classes: 6h
Laboratory classes: 6h
Self study : 16h 47m

6. Spatial analysis and geoinformation management

Description:
Level curves. Digital Terrain Models. Operations on cartographic / topographic products: Calculation of areas and volumes. Methods of rethinking isolated points or by alignments; calculation of the coordinates of the points and of the rethinking elements Practices of the subject

Full-or-part-time: 28h 47m
Theory classes: 6h
Laboratory classes: 6h
Self study : 16h 47m

GRADING SYSTEM

This subject is passed by Continuous Learning and Assessment (AAC).
The Qualification Method is summarized below. Additional details of the method will be given on the first day of class.

Exam mark and practices mark.
The ordinary qualification of the subject is computed from the qualifications of continuous evaluation, Ne and Np:
1) Ne, Mark of Exams:
We will do two exams for Continuous Evaluation (PAC1 and PAC2) qualified with the marks Ne1 and Ne2 respectively. These are individual tests for evaluating the theoretical and applied concepts associated with the learning objectives of the subject. In these PACs there will be a small probative question related with 'change of units'; demonstrating a high level of development on this question (> 80%) is a sinequanon condition for having an exam grade above the unit.
The final mark of the exam part will be:
Ne= (Ne1+Ne2)/2
2) Np, Mark for Practical Activities: problems, questionnaires, deliveries and work of practices so much in group as individual, of additive and formative character, realized during the course, so much in inside and out of the classroom. The Np grade integrates the exercises done in the classroom or at home, the practice reports, the questionnaires done by Atenea, the group work developed during the field and laboratory practices (including attendance, which must be higher than 80 %)), and final deliveries.

Final grade, Nf:
The Ne is the result of an individual assessment of the student, while the Np is largely the result of group work and outside the classroom. As in the present subject, among the programmed activities, there are many practical laboratory and field works, the present guide, in accordance with the NAGRAMA and the specific regulations of the School, establishes that in order to pass the subject it is a necessary condition to have followed all the mentioned activities (including attendance, which must be higher than 80 %), and to have presented the associated reports in an appropriate way. The reports will have to follow the standards of quality that indicate the professor to be evaluated.
For the students having Np approved (Np>=5, normal case), the final grade, Nf is computed as follows:
If the exam grade, Ne, is also passed, the Nf is the average between Ne and Np:
Nf = 0.50 * Ne + 0.50 * Np (this average will always go up, i.e. Nf>= Ne)
If the exam mark Ne does not reach 5, the Nf is calculated with the following formula:
Nf = 0.85 * min (Ne, Np) + 0.15 * max (Ne, Np)
If Nf> = 5, the student is approved; otherwise, he/she can go to Re-evaluation.

Criteria of qualification and of admission to the Re-avaluation:
The students suspended in the ordinary evaluation that have presented to the PAC1 and the PAC2, and that have attended sufficiently the practicals (> 80%): they will have the option of taking a re-assessment test in the period set in the academic calendar. Students who have already passed the subject or students who have not been presented will not be able to take the re-assessment test.
As in the present subject there are many practical works (laboratory and/or field, the present guide establishes that in order to be eligible for the re-evaluation exam it is necessary to have carried out the aforementioned practical works, and have submitted the associated reports, in an appropriate way. The reports will have to follow the quality standards indicated by the teacher to be evaluated. Due to the large size of the practical activities of the subject, and its distribution throughout the semester, there is no possibility of conducting a re-evaluation exam of the practical part at the end of the semester.
The maximum grade in the case of taking the re-assessment exam will be five (5.0). The non-attendance of a student to the re-evaluation test, may not lead him/her the right to the perfo

EXAMINATION RULES.

If one activity is not carried out in the scheduled period, the corresponding score will be zero.

Extraordinary assessment:
See last paragraph in the 'Qualification method' section.

BIBLIOGRAPHY

Basic:
- Corral Manuel de Villena, I. de. Topografía de obras [on line]. Barcelona: Edicions UPC, 2001 [Consultation: 29/04/2020]. Available on: http://hdl.handle.net/2117/105482. ISBN 8483015439.
- 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.
- Heritage, G.L; Large, A.R.G. Laser scanning for the environmental sciences. Chichester, UK ; Hoboken, NJ: Wiley-Blackwell, 2009. ISBN 9781405157179.
- Chuvieco, E.. Fundamentos de teledetección espacial. 3a ed. Madrid: Rialp, 1996. ISBN 843213127X.
- Burrough, P.A. Principles of geographical information systems. 3rd ed. Oxford: Oxford University Press, 2015. ISBN 9780198742845.

Complementary:
- Martín-Morejón, L. Topografía y replanteos. Barcelona: L'autor, 1987-1988. ISBN 8440417748.
- Lekkerkerk, H.-J. GPS handbook: for professional GPS users. Emmeloord: CMedia Productions, 2007. ISBN 9789081275415.
- Leick, A.; Rapoport, L.; Tatarnikov, D. GPS satellite surveying. 4th ed. New York: John Wiley & Sons, 2015. ISBN 9781118675571.
- Lantada Zarzosa, N.; Núñez Andrés, M. A. Sistemas de información geográfica [on line]. Barcelona: Edicions UPC, 2002 [Consultation: 29/04/2020]. Available on: http://hdl.handle.net/2099.3/36816. ISBN 8483016125.