SUBJECT TEACHING GUIDE

G337 - TOPOOGRAPHY AND GEODESY

Degree in Civil Engineering

Academic year 2018-2019

1. IDENTIFYING DATA					
Degree	Degree in Civil Engineering			Type and Year	Compulsory. Year 1
Faculty	School of civil Engineering				
Discipline	Subject Area: Topography and Geodesy Module: Training in Applied Technology				
Course unit title and code	G337 - TOPOOGRAPHY AND GEODESY				
Number of ECTS credits allocated	6	Term		Semester based (2)	
Web					
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. INGENIERIA GEOGRAFICA Y TECNICAS DE EXPRESION GRAFICA
Name of lecturer	JAVIER MARIA SANCHEZ ESPESO
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Office	E.T.S. de Ingenieros de Caminos, Canales y Puertos. Planta: + 2. DESPACHO PROFESOR (2037)
Other lecturers	RAUL PEREDA GARCIA ELENA CASTILLO LOPEZ

3.1 LEARNING OUTCOMES
- Know the necessity of different reference surfaces: ellipsoid and geoide. Know like they are materialized in the practice of the Engineering.
- Enumerate the available main cartographic bases in Engineering, as well as their characteristics. Know how to manage digital cartography, for the habitual scales: adding new elements, changing symbology, making simple mensurations, incorporating symbolic elements and getting printouts, using a CAD tool. To create and to edit a digital model of terrain. Obtain profiles, longitudinal and cross, for a simple alignment. Calculation of volumes among surfaces.
- Data collection and use of basic observables captured by the surveying equipment: angles, distances and height differences, as well as the determination of the associated uncertainty. Know how to design, execute and verify the different topographical methodologies for project development, obtaining positions with a given accuracy. Know and suitably use the different geodesic corrections must be applied to observables made with surveying equipment to obtain planimetric positions using the UTM projection: reduction and scale factor.
- Know and know how to use the different corrections geodesic that it is necessary to apply to the level differences : trigonometrical or geometric. Know when and how to determine orthometric altitudes.
- Know design, execute and evaluate the production of cartographic databases by modern photogrammetric methods. Plan the precise photogrammetric support, either in a classic flight, either on a fully georeferenced flight. Estimate the total cost of photogrammetric activities. Know the basics of techniques of space Geodesy. Know how to develop the existent differential methodologies. Know availability and functionality of active GNSS networks in real time. Necessity and application of a geoid model.
- To know the main characteristics of other methodologies used in Civil Engineering: 3D terrestrial laser, LIDAR flights and bathymetric surveys.
- Know how to define geometrically and economically evaluate constructions of linear character in Engineering, like roads, defining the essential elements. Know how to define an axis in space plan combining planimetric (straight line, circular and transition curves) and vertical alignment (straight line, parabola), generating a longitudinal profile. Know how to define a cross section and create a transversal profile. Earthwork quantities.
- Know how to design and execute a planimetric geodesic auscultation by angle or distance observations. Know how to design and execute a altimetry geodesic auscultation applied to a load test of a structure.

4. OBJECTIVES
Know the different reference surfaces and their materialization.
Learn the basic techniques for incorporating entities and get numerical measurements on a digital cartographic base, including the generation and simple tasks with a digital terrain model: profiles, volumes.
Know the main methodologies for capture of spatial information using classical instrumentation: total station and digital / automatic level; as well as more modern devices such as terrestrial laser scanner.
Understand the use of the UTM projection for the planimetric coordinates, knowing how to reduce and to project the distance observable.
Know the different corrections required for the levelling in the geodesic field. Learn the basics concepts used by other techniques of capture of spatial information: space Geodesy, photogrammetry, LIDAR and terrestrial laser, remote sensing and bathymetry.
Know how to define geometrically and economically evaluate constructions of linear character in Engineering, including the setting out.
Know the main methodologies of auscultation of movement, planimetric and altimetric, applied to structures and earthworks.

6. COURSE ORGANIZATION

CONTENTS	
1	PART 1.1 Introduction to Surveying and Geodesy. Surveying and Geodesy. Reference systems. Map Projections: UTM projection. Processing and exploitation of numerical cartographic bases. Cartographic bases of reference in Civil Engineering. Treatment of cartographic bases in CAD environment. Creation of digital terrain models of terrain. Basic operations with MDT: profiles, volume calculations and measurements. PART 1.2. Topographic instruments. Angle measurements: theodolite. Distance measurements. Total station and terrestrial laser scanner. Levelling: automatic and digital levels. Topographical classic methodologies with total station: radiation, traverse and intersection.
2	BLOCK 2.1: Basics of Geodesy and Cartography. Geometrical Geodesy. Geodesic treatment of classic observations in planimetry: atmospheric correction and reduction to ellipsoid. UTM projection. Elevation geodetic aspects: visual reciprocal, simultaneous and orthometric correction. Stakeout. BLOCK 2.2: Advanced Topographic-Geodetic Methodologies. Global positioning system using spatial vehicles (GNSS). Photogrammetric Methodologies. Other Methodologies: airborne laser (LIDAR), remote sensing and bathymetry. BLOCK 2.3. Geometric design of roads in Engineering. Creating the MDT. Basic alignments in plant: straight line, circumference and clothoid. Basic alignments in elevation: straight line and parabole. Definition of the cross section. Stakeout. Earthwork Quantities. Obtaining project documents: plans and basic reports. BLOCK 2.4: Geodesic auscultation. Planimetric (with angular observable and observable distance) and altimetry.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Test of contents of the first block.	Activity evaluation with Virtual Media	No	No	5,00
Project about skills with digital cartography.	Work	No	No	10,00
Exam of the first block	Written exam	No	Yes	30,00
Use of total station or automatic level.	Laboratory evaluation	No	No	10,00
Test of contents of the second block.	Activity evaluation with Virtual Media	No	No	5,00
Project about skills with topographical methodologies, GIS and design of roads.	Work	No	No	10,00
Exam of the second block	Written exam	Yes	Yes	30,00
TOTAL				100,00

Observations

The dates of the assessment tests are indicative.
They will be observed the resolutions adopted in the ordinary session of the School meeting celebrated on June 10, 2010.
It will be considered the equivalence among the numeric qualification and the qualitative one established in the Real Decreto RD1125 /2003.

Observations for part-time students

The evaluation will consist of two types of activities:
1. Projects. Corresponding to blocks 1 and 2. On the dates fixed along the course. Percentage: 20%.
2. Exam. Composed of the following parts:
> Theoretical and parctical exam. Percentage: 50%. Minimum grade: 4.
> Laboratory evaluation, instruments and tools. Percentage: 30%. minimum grade: 4.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

Ferrer Torio, R; Piña Patón, B. Topografía aplicada a la Ingeniería Civil. Servicio publicaciones ETSI Caminos, Canales y Puertos, Santander.
Chueca Pazos, M., Herráez Boquera, J.; Berné Valero, J.L.: "Tratado de Topografía". Ed. Paraninfo. Madrid. 1.996.
Leick, Alfred: "GPS Satellite Surveying". Editorial John Wiley & Sons. Nueva York. 1.995.
Petrie, B.; Kennie, T.J.: "Terrain Modelling in Surveying and Civil Engineering". Editor Whittles Publishing. Londres. 1.990.
Vázquez Maure, F.; Martín López, J.: "Lectura de mapas". Madrid. 1.995.