SUBJECT TEACHING GUIDE

G587 - TOPOOGRAPHY AND GEODESY

Degree in Energy Resources Engineering
First Degree in Energy Resources Engineering

Academic year 2024-2025

1. IDENTIFYING DATA					
Degree	Degree in Energy Resources Engineering First Degree in Energy Resources Engineering			Type and Year	Compulsory. Year 2 Compulsory. Year 2
Faculty	School of Mines and Energy Engineering				
Discipline	Subject Area: Fundamentals of Cartographic Engineering Module: Training in Common with the Mining Branch				
Course unit title and code	G587 - 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	JULIO MANUEL DE LUIS RUIZ
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Other lecturers	FELIPE PIÑA GARCIA

3.1 LEARNING OUTCOMES
--Measurement of lengths, areas, volumes, etc. on mapping at different scales and formats. -calculation of earthworks by longitudinal and transverse profiles, horizontal layers, etc. -determine errors in the observable, through a treatment of error as a random variable -fundamental knowledge of geodetic astronomy to understand the scientific basis on which GPS is supported.
--Determination, management of the observable and calculation of the uncertainty observing angles with compass, optical theodolite and electronic theodolite -determination, handling the observable and calculation of the uncertainty to observe distances with tape, wire and rules invar, tachometer, Horizontal stay, range finders determination, management of the observable and calculation of uncertainties to observe with topographical stations. -determination, handling the observable and calculation of the uncertainty observed heights with optical level electronic or laser.
--Project, to control and run the various classical topographic methodologies most appropriate to carry out a station topographic -project, to control and run the various classical topographic methodologies most appropriate to carry out with a theodolite -projecting, control and run the various classical topographic methodologies most appropriate to carry out with a range finder
--Knowledge of the basic fundamentals in which sits the Photogrammetry -Fotointerpretar and carry out measurements on aerial photographs isolated - project, to control and to run the methods most appropriate photogrammetric mapping requirements and availability of existing media -rating economically photogrammetric products and activities.

4. OBJECTIVES
Didactic Unit I El main objective is this thematic block is to inform students of the most elementary concepts of the surveying, geodetic, mapping, etc. in a way that these definitions will serve as introduction to the topo-geodesico world. In addition a small RAID is conducted on the study of error as a random variable and geodetic astronomy, with the aim to know basic but fundamental aspects in cartographic areas.
Didactic Unit II The main objective of this thematic block is that students know and are able to capture the observable, process such observable and also calculate the expected tolerances result of uptake of observable with the most common topographical instruments currently. In order to achieve clarity in the structuring of equipment, these are divided according to the observable which are able to capture, angles, distances and heights.
Didactic Unit III Main objective of this thematic block is to show students the different techniques and methods of observation and calculation that can develop in topography with the objective of optimizing yields in time of observation in countryside and Cabinet, the necessary human resources, different instruments and the accuracy that can be obtained from each of the different teams studied in the previous unit didactics.

6. SUBJECT PROGRAM
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1	DIDACTIC UNIT I. INTRODUCTION TO SURVEYING AND GEODESY 1. DEFINITION OF SCENARIOS AND BASIC CONTENTS 1.1 Surveying and Geodesy 1.1.1 Land form 1.1.2 Geographical elements on surfaces approach 1.1.3 Geographic Referencing 1.1.4 topographic and geodetic networks 1.2 REFERENCE FRAME 1.2.1 General concepts 1.2.2 geometric aspects of a plan or map 1.2.3 Limit of visual perception 1.2.4 Surveying Engineering 1.3.- modeling CONVENTIONAL OF RELIEF 1.3.1 Surveying 1.3.2 Basic systems of representation 1.3.3 Exploitation of cartographic information 1.3.4.- The problem of mapping 1.4.- READING MAPS AND PLANS 1.4.1 General Introduction 1.4.2 particularized aspects of the maps and plans 1.4.3 Introduction to numerical mapping systems 1.4.4 Concluding remarks on the information contained in the plans 2. MEASUREMENT UNCERTAINTY. APPLICATION TO surveying and geodesy 2.1 NEED AND LIMITS study. MEASURE AS RANDOM VARIABLE Inevitability 2.1.1, causes and types of errors 2.1.2 Introduction to the study of a random variable 2.2 DENSITY FUNCTIONS that rely on the normal distribution 2.2.1 Normal distribution 2.2.2 distributions derived from normal 2.2.3 Approach to the use of normal and its derivatives in basic metrology 2.2.4 Simplified Treatment of measurement errors 2.3 Additional Considerations Parameter estimation 2.3.1 2.3.2 Determination of precision instruments 3. GEODETIC ASTRONOMY BASICS 3.1 INTRODUCTION TO ASTRONOMY 3.1.1 Purpose and division of Astronomy 3.1.2 notions of cosmography 3.1.3 Movements earth 3.1.4 Geographical coordinates 3.1.5 The solar system. Introduction to celestial mechanics 3.1.6 Reminder of the main units and astronomical constants 3.2 COORDINATE SYSTEMS 3.2.1 Introduction 3.2.2 Horizontal coordinates 3.2.3 equatorial coordinates Time 3.2.4 equatorial absolute coordinates 3.2.5.- ecliptic coordinates 3.2.6 Summary of coordinate systems 3.3 EARTH IN THE UNIVERSE 3.3.1 Setting the cosmos 3.3.2 The distances in astronomy 3.3.3 The Milky Way and solar system

	3.3.4 The HR diagram 3.3.5 Radio astronomy: quasars and pulsars 3.3.6.- Astronomical Observatories 3.3.7.- Latest considerations

2	DIDACTIC UNIT II INSTRUMENTS TOPOGRAFICOS 1. angular measurements 1.1 GENERAL DESCRIPTION OF A goniometer 1.1.1 angles in the horizontal plane and angles in the vertical plane 1.1.2 Essential parts of a goniometer 1.2 OPTICAL THEODOLITE 1.2.1 Essential parts of an optical theodolite 1.2.2 Classification of optical theodolites 1.2.3 - Using theodolite 1.2.4 representative parameters of a theodolite 1.2.5 Checks and corrections 1.3.- THE COMPASS 1.3.1 The Earth's magnetic field 1.3.2 Types of compasses 1.3.3 Checks and uses 1.4.- ELECTRONIC THEODOLITE 1.4.1 Electronic measurement of angles 1.4.2 Assessment Systems angles 1.5.- errors in the angular measurements 1.5.1 systematic and accidental errors 1.5.1.1.- verticality error 1.5.1.2.- address error 1.5.1.3.- pointing error 1.5.1.4.- read error 1.5.1.5.- Total Error 1.5.2 Methods to increase accuracy 2. DISTANCE MEASUREMENT 2.1 DIRECT MEASUREMENT OF DISTANCES 2.1.1 Introduction 2.1.2 Measuring tapes and rulers 2.1.3 Invar Threads 2.2 INDIRECT DISTANCE MEASURING METHODS FOR stadia 2.2.1 Basis of stay 2.2.2 stadia goggles. The tachometer 2.2.2.1.- differentiators 2.2.2.2.- tachometer Functionality 2.2.3. Tacheometric Relations 2.2.3.1.- Assessment distances 2.2.3.3.- coordinate employment Introduction 2.2.4 self-reducing tacheometers 2.2.5.- Horizontal Stay Invar 2.2.5.1.- Constituents 2.2.5.2.- Method of evaluating measurement 2.2.5.3.- accuracy in evaluating the distance MEASURE 2.3 indirect subsidiary DISTANCE BY ELECTROMAGNETIC METHODS 2.3.1 Basis of Electronic Distance Measurement 2.3.1.1.- General 2.3.1.2.- Special evaluation of the distance 2.3.2 Functionality of the Electronic Distance Measurement 2.3.2.1.- Precisions 2.3.2.2.- precautions in using distance meters Additional advantages 2.3.2.3.- 3. topographical STATIONS

	3.1 MEASUREMENT COMPACT 3.2 SIGNIFICANT HIGHLIGHTS CURRENT OFFER 3.3 TOPOGRAPHIC STATIONS 3.3.1 widespread improvements 3.3.2 Improvements particularizas 3.3.3 Final Thoughts 4. HEIGHT MEASURE 4.1 INTRODUCTION TO STUDY altimetry 4.2 LEVELING trigonometric 4.2.1 Correction for sphericity and refraction 4.2.1.1.- Correction for sphericity 4.2.2.2.- refraction correction 4.2.2 Errors in trigonometric leveling 4.4.- LEVELING GEOMETRICA 4.4.1-. Foundation 4.4.2 Types of levels Conventional level 4.4.2.1.- 4.4.2.2.- Laser Level 4.4.2.3.- level digital or electronic 4.4.3 Errors in geometric leveling 4.4.3.1.- mistakes apparatus 4.4.3.2.- Additional error due to lack of verticality of stay 4.4.3.3.- Total altimeter Error 4.4.4.- Ways of working with a level 4.4.4.1.- leveling work indoors 4.4.4.2.- leveling work abroad 4.4.4.3.- work with earthmoving machinery 4.4.4.4.- work abroad with advanced instrumentation

3	DIDACTIC UNIT III.- METHODS TOPOGRAPHICS 1. GENERAL INTRODUCTION 1.1.-NEED FOR ESTABLISHMENT METHODOLOGY Participants 1.1.1 Elements 1.1.2 General approach 1.2 BASIC TECHNICAL FIELD AND CABINET Field observations 1.2.1 1.2.1.1.- observation without disorientation 1.2.1.2.- Observation with disorientation 1.2.2 Data Processing 1.3.- MAIN TOPOGRAPHIC METHODOLOGIES 1.3.1 Introduction 1.3.2 Overview of methods 2. METHODS BASED ON THE USE OF TOPOGRAPHIC STATIONS 2.1 PREVIOUS CONCEPTS AND OBJECTIVES Planimetric 2.2 FINDINGS 2.2.1 Method of radiation 2.2.1.1.- Concept and resolution 2.2.1.2.- Tolerances 2.2.2 Method itinerary 2.2.2.1.- Concept and resolution 2.2.2.2.- Tolerances Altimetry 2.3 FINDINGS 2.3.1 Simple trigonometric leveling 2.3.1.1.- Concept and resolution 2.3.1.2.- Tolerances 2.3.1 trigonometric leveling compound 2.3.1.1.- Concept and resolution 2.3.1.2.- Tolerances CALCULATION AND ADJUSTMENT 2.4 polygonal. 2.4.1 Concept of compensation. 2.4.2 Types of polygonal offset. 2.4.3 Condition compensation. 2.4.4 Types and basis for compensation. 2.4.4.1.- planimetric Compensation 2.4.4.2.- Altitude Compensation 3. Methods based on the exclusive use THEODOLITE 3.1 DIRECT intersection method 3.1.1 Introduction 3.1.2 Background and resolution 3.1.2.1.- simple direct Intersection 3.1.2.2.- multiple direct Intersection 3.1.3 Calculation of tolerance 3.2 Method of Resection 3.2.1 Introduction 3.2.2 Background and resolution 3.2.2.1.- single Resection 3.2.2.2.- multiple Resection Procedure 3.2.2.3.- Hamsen 3.2.3 Calculation of tolerance 4. methods based on the exclusive use of EDM 4.1 THE DISTANCIOMETRÍA 4.2 DISTANCE INTERSECTION

	4.3 CALCULATION OF TOLERANCE

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
periodic evaluations not qualifying	Written exam	No	Yes	40,00
evaluating practices	Laboratory evaluation	No	No	20,00
ORDINARY COURSE TEST	Written exam	Yes	Yes	40,00
TOTAL				100,00

Observations

If the student does not achieve the minimum grade in the ordinary/extraordinary assessment (3/10), the overall grade for the subject will be the lower of 4.9 and the weighted average of the assessment tests [article 35 of the UC Assessment Processes Regulations].
All those students who do not pass the course in the Ordinary exam may sit the Extraordinary exam, respecting the grade obtained in the practicals and the periodical evaluations. If the student so wishes in the extraordinary exam, he/she can re-sit the continuous assessment tests of the Didactic Units, respecting the most favourable grades for the student.

Observations for part-time students

Students enrolled part-time will be offered the following alternative assessment:
- Continuous assessments of the Didactic Units will be carried out on a date agreed by the teacher and the student at the beginning of the term.
- The assessment of the practicals will be carried out by means of an equivalent work and the corresponding knowledge test on the practicals, on a date agreed between the teacher and the student at the beginning of the term.
- The ordinary and extraordinary exams of the subject will be the same.

The student will have to contact the lecturer in charge during the first two weeks of the term to arrange the dates of the assessment and the work to be done.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

* Topografía aplicada a la Ingeniería Civil.
Rafael Ferrer Torio y Benjamín Piña Patón.
Servicio de Publicaciones. Escuela Técnica Superior de Ingenieros de Caminos, Canales y Puertos. Santander, 39005.