Course guides
310608 - 310608 - Surveying Instruments and Methods

Unit in charge: Barcelona School of Building Construction
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.
Degree: BACHELOR’S DEGREE IN GEOINFORMATION AND GEOMATICS ENGINEERING (Syllabus 2016).
(Compulsory subject).
Academic year: 2020  ECTS Credits: 6.0  Languages: Spanish

LECTURER
Coordinating lecturer: AMPARO RUBIO CERDÀ
Others:

PRIOR SKILLS
The student must have consolidated his knowledge in trigonometry that he worked in previous courses.
In addition will be helpful if the student has high capacity of vision.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES
Specific:
2. Knowledge, use and application of instruments and topographic methods appropriate for the fulfillment of raisings and surveyings.

General:
1. Use of teams and instrumental: Capacity to select the necessary ressources to the achievement of the planned goals according to
the quality requirements. Use of the teams, in adequate conditions, with professional efficiency and taking into account the
limitations of the instruments and its context of use, in relation with the required precisions.

TEACHING METHODOLOGY
The teaching methodology is based on the participative expositive class, that includes the exposition of theoretical foundations and the
resolution of practical examples, in the realization of instrumental practices in the field with small groups and in the autonomous work
of assimilation of the subject.

LEARNING OBJECTIVES OF THE SUBJECT
Exhaustive comprehension of the foundation from work of the different instruments of distance measuring, angles and slopes, its using
and optimal conditions of use.
Knowledge of the kind of errors that operate in the measurement of these magnitudes and its transmission according to the different
techniques of observation.
Solvency in the determination of the most probable value of a magnitude and of the associated confidence to this data.
Command in the practical manipulation of the different instruments in a quick and efficient way.
STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Hours large group</td>
<td>24.0</td>
<td>16.00</td>
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<tr>
<td>Hours medium group</td>
<td>36.0</td>
<td>24.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90.0</td>
<td>60.00</td>
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Total learning time: 150 h

CONTENTS

C1 Topographic Elements.

Description:
Definition and object of the topography.
- Representation and reference systems. Coordinate calculus.
- Process of a topographic hoisting.
- Topographic magnitudes. Units of measurement.

Related activities:
- P1: Basic trigonometric calculus for the obtention of coordinates in a point.
- P2: Change of angular units.

Full-or-part-time: 17h
Theory classes: 3h
Practical classes: 4h
Self study: 10h

C2 Errors committed in the measurements for direct observation.

Description:
- Precision and accuracy.
- Systematic and accidental errors.
- Errors that define precisión.
- Transmission of errors.

Full-or-part-time: 13h
Theory classes: 3h
Self study: 10h

C3 Direct measurement of distances.

Description:
- The metallic tape. Use methods of different precisión. Errors and corrections.
- Invar threads
- Rulers.

Related activities:
P3: Practice in the field about the use of the tape and the surveying rod.

Full-or-part-time: 7h
Theory classes: 1h
Practical classes: 2h
Self study: 4h
C4 Measurement of angles in topography I. The theodolite.

Description:
- Previous definitions.
- Scheme of a goniometer.
- Components of horizontalization and of collimation.
- Lay in station.
- Vertical and horizontal angles medition.

Related activities:
P4, P5, P6: Field practice of parking of a theodolite and angular lectures.

Full-or-part-time: 20h
Theory classes: 4h
Practical classes: 6h
Self study: 10h

C5 Measurement of angles in topography II. Errors in the measuring.

Description:
- Sistematic errors. Definition, comprovation and correction / compensation.
- Accidental errors. Analysis of the sources and trasmission.
- Estimation of the precisión of data.

Related activities:
P7: Field practice about the comprobation of systematic errors of a theodolite.

Full-or-part-time: 35h
Theory classes: 8h
Practical classes: 2h
Self study: 25h

C6 Indirect measurement of distances by stadimetric methods. The tachymeter.

Description:
- Foundation of the stadiametric rangefinding.
- Calculation of the distance with leaning visuals.
- Calculation of the slope.
- Units of precisión. Stadiametric prism and horizontal stay invar.

Related activities:
P8, P9, P10, P11, P12: Field practices in the class about the observation of taquimetric data and calculation of distances and slopes.

Full-or-part-time: 13h
Theory classes: 1h
Practical classes: 10h
Self study: 2h
C7 Electromagnetic measurement of distances.

Description:
- Foundation of electronic distanometer.
- Notions about wavy movement.
- Fundamental equation of the waves distanometer. Expression of distance.
- Precision in the measurement. Errors.
- Use of an integrated instrument, the total station.

Full-or-part-time: 19h
Theory classes: 4h
Self study: 15h

C8 Instruments for the determination of slopes.

Description:
- Levelling systems.
- Barometric nivelation. Foundation. Types of barometer.
- Geometric nivelation. Foundation.
- Types of levels. Classification.

Related activities:
P13, P14, P15: Field practices of levelling with line and automatic levels.

Full-or-part-time: 26h
Theory classes: 6h
Practical classes: 6h
Self study: 14h

ACTIVITIES

P1: TRIGONOMETRY. CALCULATION OF COORDINATES.

Description:
Exercises of applied trigonometry

Specific objectives:
Assimilation of the official measurement units and its use.

Material:
Problems to solve.

Delivery:
Memory of practices.

Full-or-part-time: 2h
Practical classes: 2h
### P2: UNITS OF MEASUREMENT. ANGLES AND DISTANCES.

**Description:**
Exercises to solve about the change of measurement units.

**Specific objectives:**
Assimilation of the calculation processes in topography.

**Material:**
Problems to solve.

**Delivery:**
Memory of practices

**Full-or-part-time:** 2h
Practical classes: 2h

### P3: MEASUREMENT OF DISTANCES BY DIRECT METHODS.

**Description:**
Direct measurement of distances with metallic tape.

**Material:**
Tapes and surveying rods of the topographic laboratory.

**Delivery:**
Memory of practices

**Related competencies:**
08 UEI. Use of teams and instrumental: Capacity to select the necessary resources to the achievement of the planned goals according to the quality requirements. Use of the teams, in adequate conditions, with professional efficiency and taking into account the limitations of the instruments and its context of use, in relation with the required precisions.
CEM7. Knowledge, use and application of instruments and topographic methods appropriate for the fulfillment of raisings and surveyings.

**Full-or-part-time:** 2h
Practical classes: 2h

### P4: PARKING OF A THEODOLITE.

**Description:**
Field practices of parking a theodolite and identification of its elements.

**Material:**
Theodolites of the topographic laboratory.

**Delivery:**
Memory of practices.

**Related competencies:**
08 UEI. Use of teams and instrumental: Capacity to select the necessary resources to the achievement of the planned goals according to the quality requirements. Use of the teams, in adequate conditions, with professional efficiency and taking into account the limitations of the instruments and its context of use, in relation with the required precisions.
CEM7. Knowledge, use and application of instruments and topographic methods appropriate for the fulfillment of raisings and surveyings.

**Full-or-part-time:** 2h
Practical classes: 2h
**P5: MEASUREMENT OF ANGLES WITH THEODOLITE.**

**Description:**
Field practices of angles measurement with theodolite.

**Material:**
Theodolites at the topographic laboratory.

**Delivery:**
Memory of practices

**Related competencies:**
08 UEI. Use of teams and instrumental: Capacity to select the necessary resources to the achievement of the planned goals according to the quality requirements. Use of the teams, in adequate conditions, with professional efficiency and taking into account the limitations of the instruments and its context of use, in relation with the required precisions.
CEM7. Knowledge, use and application of instruments and topographic methods appropriate for the fulfillment of raisings and surveyings.

**Full-or-part-time:** 2h
Practical classes: 2h

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**P6: MEASUREMENT OF ANGLES AND DISTANCES WITH TAQUIMETER.**

**Description:**
Field practices about angle and distance measurement with taquimeter.

**Material:**
Taquimeters of the topographic laboratory.

**Delivery:**
Memory of practices

**Related competencies:**
08 UEI. Use of teams and instrumental: Capacity to select the necessary resources to the achievement of the planned goals according to the quality requirements. Use of the teams, in adequate conditions, with professional efficiency and taking into account the limitations of the instruments and its context of use, in relation with the required precisions.
CEM7. Knowledge, use and application of instruments and topographic methods appropriate for the fulfillment of raisings and surveyings.

**Full-or-part-time:** 3h
Practical classes: 2h
Self study: 1h
### P7: COMPROVATION OF SYSTEMATIC ERRORS OF A THEODOLITE

**Description:**
Field practices about the comprobation of systematics errors of a theodolite.

**Material:**
Theodolites of the topographic laboratory.

**Delivery:**
Mamory of practices

**Related competencies:**
08 UEI. Use of teams and instrumental: Capacity to select the necessary resources to the achievement of the planned goals according to the quality requirements. Use of the teams, in adequate conditions, with professional efficiency and taking into account the limitations of the instruments and its context of use, in relation with the required precisions.

CEM7. Knowledge, use and application of instruments and topographic methods appropriate for the fulfillment of raisings and surveyings.

**Full-or-part-time:** 2h
Practical classes: 2h

### P8: POLIGONAL I

**Description:**
Beginning of a complete itinerary's observation.

**Material:**
Taqimeters of the topographic laboratory

**Delivery:**
Memory of practices

**Related competencies:**
08 UEI. Use of teams and instrumental: Capacity to select the necessary resources to the achievement of the planned goals according to the quality requirements. Use of the teams, in adequate conditions, with professional efficiency and taking into account the limitations of the instruments and its context of use, in relation with the required precisions.

CEM7. Knowledge, use and application of instruments and topographic methods appropriate for the fulfillment of raisings and surveyings.

**Full-or-part-time:** 2h
Practical classes: 2h

### P9: THE ITINERARY METHOD OR POLIGONAL.

**Description:**
Explanation about the purpose of the method and his processes of observation and calculation.

**Delivery:**
Memory of practices

**Full-or-part-time:** 2h
Practical classes: 2h
P10: ERRORS IN THE OBSERVATIONS. TOLERANCE.

**Description:**
Exposition about the accidental errors that operate in an angular observation and the processes of estimation calculation

**Delivery:**
Memory of practices

**Full-or-part-time:** 2h
Practical classes: 2h

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P11: POLIGONAL II

**Description:**
Field practices of development of observation in a poligonal.

**Material:**
Taquimeters of the topographic laboratory

**Delivery:**
Memory of practices

**Related competencies:**
08 UEI. Use of teams and instrumental: Capacity to select the necessary resources to the achievement of the planned goals according to the quality requirements. Use of the teams, in adequate conditions, with professional efficiency and taking into account the limitations of the instruments and its context of use, in relation with the required precisions.

CEM7. Knowledge, use and application of instruments and topographic methods appropriate for the fulfillment of raisings and surveyings.

**Full-or-part-time:** 3h
Practical classes: 2h
Self study: 1h

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P12: POLIGONAL III

**Description:**
Field practices of observation of a poligonal.

**Material:**
Taqimeters of the topographic laboratory

**Delivery:**
Memory of practices

**Related competencies:**
08 UEI. Use of teams and instrumental: Capacity to select the necessary resources to the achievement of the planned goals according to the quality requirements. Use of the teams, in adequate conditions, with professional efficiency and taking into account the limitations of the instruments and its context of use, in relation with the required precisions.

CEM7. Knowledge, use and application of instruments and topographic methods appropriate for the fulfillment of raisings and surveyings.

**Full-or-part-time:** 3h
Practical classes: 2h
Self study: 1h
P13: LEVELLING I

Description:
Exposition about taking data of a levelling and the correspondant calculation of heights and precissions.

Delivery:
Memory of practices

Full-or-part-time: 2h
Practical classes: 2h

P14: LEVELLING II

Description:
Field practices of observation of a levelling itinerary.

Material:
Line and automatic levels of the topographic laboratory.

Delivery:
Memory of practices

Related competencies:
08 UEI. Use of teams and instrumental: Capacity to select the necessary resources to the achievement of the planned goals according to the quality requirements. Use of the teams, in adequate conditions, with professional efficiency and taking into account the limitations of the instruments and its context of use, in relation with the required precisions.
CEM7. Knowledge, use and application of instruments and topographic methods appropriate for the fulfillment of raisings and surveyings.

Full-or-part-time: 3h
Practical classes: 2h
Self study: 1h

P15: LEVELLING III

Description:
Field practices of observation of a levelling

Material:
Line and automatic levels of the topographic laboratory.

Delivery:
Memory of practices

Related competencies:
08 UEI. Use of teams and instrumental: Capacity to select the necessary resources to the achievement of the planned goals according to the quality requirements. Use of the teams, in adequate conditions, with professional efficiency and taking into account the limitations of the instruments and its context of use, in relation with the required precisions.
CEM7. Knowledge, use and application of instruments and topographic methods appropriate for the fulfillment of raisings and surveyings.

Full-or-part-time: 3h
Practical classes: 2h
Self study: 1h
GRADING SYSTEM

Midterm exams: 20%
Individual memory of practices: 20%
Individual and team projects: 20%
Final exam: 40%
The attendance and work in class will be valued.

EXAMINATION RULES.

The attendance to the practices and the delivery of the memories and projects is mandatory and, therefore, necessary condition to be evaluated.

BIBLIOGRAPHY

Basic:
- Gim : international for geomatics. Lemmer: GITC,
- Professional surveyor. Arlington: American Surveyors,

Complementary: