Course guide
310185 - 310185 - Diagnosis Techniques and Materials Characterization

Unit in charge: Barcelona School of Building Construction
Teaching unit: 753 - TA - Department of Architectural Technology.
Degree: MASTER'S DEGREE IN DIAGNOSIS AND INTERVENTION TECHNIQUES IN BUILDING CONSTRUCTION (Syllabus 2020). (Compulsory subject).
Academic year: 2022
ECTS Credits: 5.0
Languages: Spanish

LECTURER
Coordinating lecturer: Haurie Ibarra, Laia
Others: Navarro Ezquerra, Maria Antonia
Rosell Amigo, Juan Ramon

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE8MUDITIE. To design a methodology guide to confront the knowledge and the diagnosis of a building and its later rehabilitation.
CE9MUDITIE. To acquire knowledge about the techniques of materials characterization and the resolution of problems related to it.
CE10MUDITIE. To acquire an evaluation methodology starting from observed or measured data and from the results of the analysis processes with numerical support.

General:
CG1MUDITIE. To apply the knowledge acquired in the complex problem's resolution in any sector of the existing building.
CG2MUDITIE. To use the tools for the research activities, as can be the data analysis and processing, as well as research techniques and methodology.

Transversal:
CT3MUDITIE. (ENG) Treball en equip. Ser capaç de treballar com a membre d’un equip interdisciplinar, ja sigui com un membre més o realitzant tasques de direcció, amb la finalitat de contribuir a desenvolupar projectes amb pragmatisme i sentit de la responsabilitat, assumint compromisos, tenint en compte els recursos disponibles.
CT4MUDITIE. (ENG) Ús solvent dels recursos de la informació. Gestionar l’adquisició, l’estructuració, l’anàlisi i la visualització de dades i informació en l’àmbit de la seva especialitat i valorar de forma crítica els resultats d’aquesta gestió.
CT5MUDITIE. Third language. To know a third language, preferably English, with an oral and written adequate level and in agreement with the necessities that the graduates will have.

Basic:
CB6MUDITIE. To possess and comprehend the knowledge that provides a basis or opportunity of being original on the development and/or implementation of ideas, often in an investigation context.
CB7MUDITIE. For the students to know how to apply the knowledge acquired and their problem-solving capacity in new environments or slightly familiar, within wider contexts (or multidisciplinary) related to their area of study.
CB9MUDITIE. For the students to know how to communicate their conclusions and the knowledge and underlying reasons to a specialised and a non-specialised public on a clear and concise way.
CB10MUDITIE. For the students to obtain learning skills that allows them to continue studying on a mainly autonomous and self-taught way.
TEACHING METHODOLOGY

Theoretical and laboratory classes
Technical visits
Supervision of the individual and team activities

LEARNING OBJECTIVES OF THE SUBJECT

This course aims to introduce the students to the main techniques used in the diagnosis of the state of a building and to the characterization techniques used to identify the materials of the building.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Guided activities</td>
<td>10,0</td>
<td>8.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>15,0</td>
<td>12.00</td>
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<tr>
<td>Self study</td>
<td>90,0</td>
<td>72.00</td>
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<tr>
<td>Hours medium group</td>
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<td>4.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>5,0</td>
<td>4.00</td>
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Total learning time: 125 h

CONTENTS

Basic concepts

Description:
In this lesson the scientific method and the criteria to select analytical techniques will be discussed. The differences among qualitative, semi-quantitative and quantitative analysis will be explained, as well as the differences between destructive, semi-destructive and non-destructive tests. Aspects such as sampling, reproducibility, accuracy, precision and measurement error will be explained.

Related activities:
One session of exercises

Full-or-part-time: 3h
Theory classes: 3h
**Diagnosis methods and tools**

**Description:**
Description of the existing tools used to perform the diagnose of a building. The techniques will be grouped according with the nature of the inspected constructive element:

1) Concrete structures  
2) Masonry structures  
3) Wood structures  
4) Slabs  
5) Floor and wall covering

**Related activities:**
1 or 2 sessions of case studies will be done.  
Site visit to put into practice some of the tools explained in class.

**Full-or-part-time:** 21h  
Theory classes: 15h  
Practical classes: 3h  
Laboratory classes: 3h

**Materials characterization**

**Description:**
In this module it will be covered the characterization of materials from in situ and laboratory techniques (Porous network characterization, chemical-molecular-crystalline composition, FRX, FTIR, DRX, .., optical, petrographic, SEM microscopic techniques, analysis techniques thermal, TG, dTG, DSC, ..).

The following topics will be addressed:
- Characterization of physical properties: related to the porous network and the mobility of water in the material (density, capillary absorption, porosity, permeability, ...).
- Introduction to instrumental techniques: types of instrumental techniques and quality parameters that must be taken into account to assess whether the technique is adequate, both quantitative: precision, sensitivity, detection limit, selectivity, ...; as qualitative: speed, cost, difficulty of preparation, ...
- X-ray diffraction: characterization of crystalline phases.
- Chemical analysis: Qualitative and quantitative determination of the chemical elements present in a sample.
- Microscopic techniques: binocular magnifying glass, petrographic optical microscope, electron microscope.
- Techniques based on interaction with the electromagnetic spectrum: Infrared spectroscopy (FTIR), UV-visible spectroscopy, Raman spectroscopy.
- Thermal analysis

**Related activities:**
Two laboratory sessions.  
One session to study cases.  
Visit to a centre where we can see some of the techniques explained in class.

**Full-or-part-time:** 21h  
Theory classes: 15h  
Laboratory classes: 6h

**GRADING SYSTEM**

Throughout the course a team work will be carried out based on a case study common to other subjects and also several tests and individual activities will be performed.
BIBLIOGRAPHY

Basic: