

# Course guide 310185 - 310185 - Material Diagnostic and Characterisation Techniques

Last modified: 15/05/2023

Unit in charge: Teaching unit:	Barcelona School of Buildir 753 - TA - Department of A	ng Construction Architectural Technology.	
Degree:	MASTER'S DEGREE IN DIAGNOSIS AND INTERVENTION TECHNIQUES IN BUILDING CONSTRUCTION (Syllabus 2020). (Compulsory subject).		
Academic year: 2023	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 ant its later rehabilitation. CE9MUDITIE. To acquire knowledge about the technics of materials characterization and the resolution of problems related to it. CE10MUDITI. To acquire an evaluation methodology starting from observed or measured data and from the results of the analysis processes with numerical support.

#### Generical:

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.

CB10MUDITI. 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**

Туре	Hours	Percentage
Hours large group	15,0	12.00
Self study	90,0	72.00
Hours medium group	5,0	4.00
Hours small group	5,0	4.00
Guided activities	10,0	8.00

#### 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 exercices

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 strutures
- 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:**

- Kasal, Bohumil; Tannert, Thomas. In situ assessment of structural timber : state of the art report of the RILEM Technical Committee 215-AST [on line]. Dordrecht [etc.]: Springer, cop. 2010Available on: https://renoir.upc.edu/login/tipus.php?url=http%3A%2F%2Flink.springer.com%2F10.1007%2F978-94-007-0560-9&logup=false. ISBN 9789400705593.

- Arriaga Martitegui, Francisco. Intervención en estructuras de madera. Madrid: AITIM, 2002. ISBN 9788487381249.