Course guide
310748 - 310748 - 21st Century Buildings: a Case Study for Finite Elements and Durability

Last modified: 15/05/2023

Unit in charge:	Barcelona School of Building Construction
Teaching unit:	749 - MAT - Department of Mathematics.

Degree:	BACHELOR'S DEGREE IN ARCHITECTURAL TECHNOLOGY AND BUILDING CONSTRUCTION (Syllabus 2019). (Optional subject).

Academic year: 2023   **ECTS Credits:** 3.0   **Languages:** Catalan

LECTURER

Coordinating lecturer:	Serrat Pie, Carles
Others:	Serrat Pie, Carles

TEACHING METHODOLOGY

Work on projects will be promoted, and master classes will occupy a smaller percentage of the face-to-face sessions. The essential elements to understand the applicability of the methods will be provided essentially, avoiding an excessively theoretical treatment. Instead, the use of software to solve practical situations in building will be worked on profusely.

LEARNING OBJECTIVES OF THE SUBJECT

1) Expand the culture on mathematical methods indispensable in modern building sciences and technologies.
2) Understand the main functionalities of the calculation methods and strategies involved.
3) Apply the methods to practical situations in the world of construction through specialized software.
4) Understand the different types of censorship in data collection in building.
5) Know how to manage Durability and Life Cycle Analysis.
6) Model the durability of elements and systems in building.
NOTE: The aims and contents of the course will depend on the professors' profile.

STUDY LOAD

Type	Hours	Percentage
Self study	45,0	60.00
Hours large group	30,0	40.00

Total learning time: 75 h

CONTENTS

The Finite Element Method in building construction: basic concepts and application examples

Description:
1. Introduction to variational methods of approximation.
2. General concepts of finite element theory.
3. Examples of application: loaded steel column, concrete pillar, fluid flows in pipes, torsion of circular section rods, bar and beam structures, heat conduction, transverse displacements of a beam,...

Related activities:
1. Solving 'familiarization' exercises with the finite element method applied to simple geometric elements.
2. Individual or collaborative project of study of a constructive element by means of the finite elements method.

Full-or-part-time: 37h 30m
Theory classes: 6h
Practical classes: 9h
Self study : 22h 30m

Building durabilitat in the XXIst century

Description:
1. Censorship in data acquisition. Types of censorship.
2. Durability. Definitions and properties / consequences.
3. Nonparametric / parametric / semiparametric durability estimators.

Related activities:
1. Solving introductory exercises on the different concepts, estimation methods and analysis.
2. Individual or collaborative project on analysis of durability data.

Full-or-part-time: 37h 30m
Theory classes: 6h
Practical classes: 9h
Self study : 22h 30m

GRADING SYSTEM

Exercises' solving: 30%
Project: 50%
Final knowledge-validation exam: 20%

BIBLIOGRAPHY

Basic:

- Gómez Melis, Guadalupe; . Fiabilitat industrial . 2a ed. Barcelona : Edicions UPC, 1997. ISBN 978-84-8301-006-8.
- Masdemont Soler, Josep. Curs d'elements finits amb aplicacions . Barcelona : Edicions UPC, 2002. ISBN 84-8301-595-1.

RESOURCES

Computer material:
- R Project for Statistical Computing. https://www.r-project.org/- Matlab (FEM library). https://www.mathworks.com/discovery/finite-element-analysis.html

Hyperlink:

- Numerical factory, Finite Elements Method. https://numfactory.upc.edu/blog/2018/09/03/finite-element-introduction-course/- R (llibreries d'anàlisi de supervivència). Resourhttps://rviews.rstudio.com/2017/09/25/survival-analysis-with-r/