

Inspection, Analysis and Restoration of Historical Constructions (250710)

General Information

School	ETSECCPB
Departments	Departament d'Enginyeria Civil i Ambiental (DECA)
Credits	5.0 ECTS
Programs	MÀSTER UNIVERSITARI EN ENGINYERIA ESTRUCTURAL I DE LA CONSTRUCCIÓ (pla 2015)
Course	2024/25

Main teaching language at each group

- Group 10EN1 English (Q1)

Faculty

Responsible Faculty: Luca Pela

Faculty: Emerson Julio Cuadros Rojas, Anastasios Drougkas, Luca Pela, Pedro Roca Fabregat

Objectives of Education

Subject to know the materials and typological features of heritage buildings, modern heritage conservation criteria, structural analysis of masonry or wood, inspection techniques and strengthening

Capacity for analysis of structures masonry or wood using traditional and advanced methods . Ability to design applicable to the conservation and enhancement of historic buildings solutions.

Criteria for the conservation and restoration of heritage buildings. Presentation of international regulations and codes . Main features (materials, components , types) of historical buildings. Criteria, classical and historical methods for analysis and structural design. Static and kinematic limit analysis. Mechanics of masonry, stone and wood. Introduction to computational methods for the analysis of historic structures. Seismic behavior. Specific techniques of inspection and monitoring. Intervention. Stabilization, repair and strengthening.

* Apply modern criteria of conservation and restoration of architectural heritage structures in accordance with regulations and international documents.

* Analyze the characteristics of materials and typologies of heritage buildings.

* Analyze the behavior of existing timber structures, brick and stone masonry structures, under static and seismic actions, by means of classical and advanced methods.

* Conceive and design specific activities of non destructive and minor destructive inspection. Applying modern techniques for the monitoring of historical structures.

* Develop design solutions applicable to the conservation, repair, stabilization and strengthening of heritage buildings.

Total hours of student work

		Hours	Percentage
Supervised Learning	Large group	25.5 h	56.67 %
	Medium group	9.75 h	21.67 %
	Laboratory classes	9.75 h	21.67 %
	Guided Activities	0.0 h	0.00 %
Self Study		80.0 h	

Contents

Basic concepts and criteria of Conservation and Restoration

Introduction to the criteria for the conservation and restoration of heritage buildings. Presentation of charts, documents and international regulations.

Examples

Structural analysis methods

Methods Classics: Graphic Statics

Problems of graphic statics

Classical Methods: Kinematic Analysis

Problems of kinematic analysis

Seismic behavior of masonry structures

Examples

Advanced methods: introduction to computational methods

Structural behavior of traditional materials

Behavior of masonry structures

Behavior of timber structures

Damage and collapse mechanisms

Mechanisms of damage and collapse

Examples

Group work - Case studies

Workshop 1 - Historic and Visual Inspection. Damage Diagnosis

Examples of integrated studies of historical structures

Workshop 2 - Structural analysis and design of interventions

Inspection and monitoring techniques

Inspection and monitoring techniques

Examples

Intervention

Repair and strengthening

Teaching Methodology

The teaching method combines educational sessions about the basic concepts with practical sessions on the methods presented (for analysis, inspection and intervention) and critical discussion of case-studies.

An essential aspect of the teaching method relies on the realization by groups of students of a study of a real building, including the analysis of previous studies, the diagnosis, the project of inspection and monitoring activities, the structural analysis and the design of interventions. The proposals by the students are presented and discussed regularly during scheduled sessions, where the participation of teachers and students is important to assess the accuracy of the diagnosis and the adequacy of the proposal interventions.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.

Grading Rules

() The evaluation calendar and grading rules will be approved before the start of the course.*

The grade is obtained from continuous assessment and final exam.

Continuous assessment involves different activities, both individual and in group, made during the year (in the classroom and outside of it).

The evaluation tests consist of questions on theoretical concepts and practical exercises.

The final grade is defined by adding the contributions of each activity performed by the student, according to the weights listed below:

- Individual assignments: 40%
- Group work: 25%
- Final exam of theory: 35%

Test Rules

If one of the activities scheduled during the period is not done, it will be considered with zero grade.

Office Hours

Email the lecturer of the course.

Bibliography

Basic

- ICOMOS/ISCARSAH Committee. [Recommendations for the analysis, conservation and structural restoration of architectural heritage](#). Charenton-le-Pont, France: ICOMOS, 2003.
- Italian Ministry for Cultural Heritage and Activities. [Guidelines for evaluation and mitigation of seismic risk to cultural heritage](#). Rome: Gangemi, 2007. ISBN 9788849212693.
- European Committee for Standardization. [EN 1996-1-1:2005. Eurocode 6: design of masonry structures](#). Brussels: European Committee for Standardization, 2005.
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- Giuffrè A. Sicurezza e conservazione dei centri storici. Il caso Ortigia (in Italian). Laterza, 1993. ISBN 9788842042501.

Complementary

- Como, M. Statics of historic masonry constructions. 3rd ed. Cham: Springer International Publishing, 2017. ISBN 9783319547381.
- Hendry, A.W. [Structural masonry](#). 2nd ed. London: Macmillan, 1998. ISBN 9780333733097.
- Porteous, J.; Kermani, A. [Structural timber design to Eurocode 5](#). 2nd ed. Chichester, West Sussex: Wiley-Blackwell, 2013. ISBN 9781118597286.
- Lourenço, P.B.; Gaetani, A. [Finite Element Analysis for Building Assessment. Advanced Use and Practical Recommendations](#). Abingdon, Oxon: Routledge, 2022. ISBN 9781032228396.

- Roca, P.; Lourenço, P.B.; Gaetani, A. [Historic Construction and Conservation. Materials, Systems and Damage](#). New York: Routledge, 2020. ISBN 9780367145743.
- Dizhur, D. [Structural Performance](#). Auckland: Dmytro Dizhur, 2021. ISBN 9780473564322.

