

SUBJECT TEACHING GUIDE

M2095 - Pathology, Rehabilitation and Maintenance of Structures

Master's Degree in civil Engineering, Canal and Port Engineering

Academic year 2022-2023

1. IDENTIFYING DATA					
Degree	Master's Degree in civil Engineering, Canal and Port Engineering			Type and Year	Compulsory. Year 2
Faculty	School of civil Engineering				
Discipline	PATHOLOGY, REHABILITATION AND MAINTENANCE OF STRUCTURES				
Course unit title and code	M2095 - Pathology, Rehabilitation and Maintenance of Structures				
Number of ECTS credits allocated	4,5	Term	Semester based (1)		
Web					
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. INGENIERIA ESTRUCTURAL Y MECANICA				
Name of lecturer	IGNACIO LOMBILLO VOZMEDIANO				
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Office	E.T.S. de Ingenieros de Caminos, Canales y Puertos. Planta: + 2. ALUMNOS DOCTORADO (2068)				
Other lecturers	YOSBEL BOFFILL ORAMA HAYDEE BLANCO WONG				

3.1 LEARNING OUTCOMES

- Understand the general concepts related to refurbishment and maintenance of structures.
- Understand the methodology of investigation of pathological processes.
- Be familiar with different tools and procedures for the evaluation of the resistant capacity and residual service life of existing structures.
- Identify the structural typology and the resistant and deterioration mechanisms of existing constructions.
- Recognize, pre-diagnose, analyse and diagnose problems appearing in structural elements.
- Propose structural repair and reinforcement solutions, both from the point of view of improving durability (life extension) and resistance capacity.
- Establish a maintenance plan for an existing construction.

4. OBJECTIVES

- Understanding the general concepts related to pathology, rehabilitation and maintenance of structures.
- Being familiar with the methodology for the investigation of structural defects.
- Being familiar with the main N-MDT (non-minor destructive tests) applicable to the different structural types, as well as the structural monitoring techniques (SHM).
- Being familiar with the usual anomalies and defects that structures present.
- Being familiar with the main repair methods and the main reinforcement systems for structures.

6. COURSE ORGANIZATION

CONTENTS	
1	GENERAL CONCEPTS: Pathology and refurbishment of structures. General methodology of investigation.
2	ASSESSMENT OF EXISTING STRUCTURES: Proping systems and bracing. Diagnostic tools. Examples of pathology reports and pre-refurbishment studies.
3	REFURBISHMENT OF HISTORICAL BUILDINGS: Foundations. Masonry structures (load bearing walls, arches, vaults and domes). Timber structures. Examples.
4	REFURBISHMENT OF MODERN BUILDINGS: Concrete structures. Steel structures and cast iron elements. Examples.
5	Effect of earthquakes on existing structures
6	Control and maintenance strategies

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Written exam	Written exam	Yes	Yes	50,00
Group work	Work	No	No	20,00
Activities carried out in class during the course	Others	No	No	20,00
Classroom participation	Others	No	No	10,00
TOTAL				100,00
Observations				
<p>The marks obtained during the course in the different assessment activities are retained until the extraordinary exam . Note: According to RD 1125/2003, the results obtained by the student will be graded according to the following numerical scale from 0 to 10, with one decimal, to which the corresponding qualitative grade may be added: 0.0-4.9: Fail 5,0-6,9: Pass 7,0-8,9: Good 9.0-10.0: Outstanding</p> <p>Only for duly justified reasons (e.g. health restrictions) may the examinations be organised remotely, with the prior authorisation of the Dean of the School.</p> <p>In the event that, due to health restrictions, it is not possible to objectively verify that the student is following the course (classroom participation), this evaluation component may not be considered, and as a result the percentages will be redistributed among the rest of the components as follows: Written exam: 50%. Group work: 25%. Activities carried out in class during the course: 25%.</p>				
Observations for part-time students				
In the case of part-time course students, the evaluation consists on a written exam.				

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC
<ul style="list-style-type: none"> • ADDLESON Lyall. Fallos en los edificios (Manual de patología de la construcción). Consejo Superior de colegios oficiales de aparejadores y arquitectos técnicos de España. • CALAVERA RUIZ José. Cálculo, construcción y patología de forjados de edificación. INTEMAC, 4ª ed, Madrid 1988. • CALAVERA RUIZ José. Patología de estructuras de hormigón. Intemac, 2009. • CALAVERA RUIZ José. Manual para la redacción de informes técnicos en construcción. Intemac 2009. • DEPARTAMENTO DE CONSTRUCCIÓN Y TECNOLOGÍA ARQUITECTÓNICAS-UPM (AUTORES VARIOS). Tratado de rehabilitación (5 tomos). Editorial Munilla-Lería (Madrid, 1999). • ESBERT R.M., ORDAZ J., ALONSO F.J. & MONTOTO M. Manual de diagnosis y tratamiento de materiales pétreos y cerámicos. Col·legi d'Arquitectes Tècnics de Barcelona (Barcelona 1997). • FERNÁNDEZ CANOVAS, Manuel. Patología del Hormigón. 2001. • HEYMAN Jacques. El esqueleto de piedra. Mecánica de la arquitectura de fábrica. Textos sobre teoría e historia de las construcciones. Instituto Juan de Herrera. CEHOPU. CEDEX. Ministerio de Fomento. (1999). • LÓPEZ COLLADO Gabriel. Ruinas en construcciones antiguas. Causas, consolidaciones y traslados. Ministerio de Obras Públicas y Urbanismo. 2ª ed. Madrid 1976. • LOZANO APOLO Gerónimo & LOZANO MARTÍNEZ-LUENGAS Alfonso. Curso: Técnicas de intervención en el patrimonio arquitectónico (tomo I: reestructuración en madera; tomo II: reestructuración de edificios de muros de fábrica). Consultores técnicos de construcción, C.B. 1995. • TRILL John & BOWYER Jack T. Construcción. El caso de la esquina rota y otros problemas constructivos. Una aproximación científica a la patología. Gustavo Gili S.A. Barcelona 1982. • VARIOS AUTORES. Evaluación de la capacidad resistente de estructuras de hormigón. Intemac, 2007.

