Teaching Guide				
Identifying Data				2020/21
Subject (*)	Structural Analysis of Historical Buildings		Code	630567118
Study programme	Mestrado Universitario en Rehabilitación Arquitectónica (Plan 2016)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Optional	3
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Construcións e Estruturas Arquitectónicas, Civís e AeronáuticasEnxeñaría Civil			
Coordinador	Martín Gutiérrez, Emilio	E-mail	emilio.martin@udc.es	
Lecturers	Martín Gutiérrez, Emilio	E-mail	emilio.martin@udc.es	
Web	moodle.udc.es			
General description	The focus of the subject is oriented to the practical application of numerical methods in stability and structural behavior studies related to buildings with historical value and rehabilitation works in general. Thus useful instrumental skills are developed in expert work or when comparatively assessing the incidence of different intervention alternatives.			
Contingency plan	A single contingency plan is formulated, foreseen for possible situations in which the health context, the limitation of the capacity of academic spaces or other causes lead to a transition either to hybrid teaching or to a scenario of total non-attendance. 1 MODIFICATION OF CONTENTS No changes will be made at this point. 2 METHODOLOGIES MAINTAINING TEACHING METHODOLOGIES All those included in the original writing of the guide: master session, workshop, problem solving and supervised work. TEACHING METHODOLOGIES THAT ARE CHANGED No modification is contemplated, understanding that the planned methodologies will be developed online. 3 MECHANISMS OF PERSONALIZED ATTENTION TO STUDENTS Moodle will host a specific virtual forum through which students can ask questions and interact. Teachers will respond to possible queries either in the forum itself or during the online sessions that are scheduled. Teams will also be used for the purpose of establishing individualized and/or group communication channels, in order to answer questions and analyze the progression of supervised work. 4 MODIFICATIONS IN THE EVALUATION There is no change in the evaluation criteria, as it is asynchronous. As an exception, and in view of the possible difficulties that the students may face, the requirement of minimum attendance may be replaced, at the student's request, by a digital portfolio that facilitates the monitoring of their work. 5 OBSERVATIONS OF THE BIBLIOGRAPHY OR WEBGRAPHY No changes will be made at this point.			

Study programme competences	
Code	Study programme competences
A5	E05 - Aptitude ou capacidade para a conservación da obra pesada, mediante a inspección, a análise, o control de calidade, a definición das condicións de mantemento e a estimación da seguridade das estruturas de edificación, incluídas as súas posibles cimentacións, podendo igualmente afrontar a redacción de proxectos de reparación e reforzo, e a dirección da execución asociada.

A8	E08 - Aptitude ou capacidade para redactar informes técnicos e proxectos de rehabilitación do patrimonio edificado, incluídas actividades de asesoramento e consultoría.
B1	CB6 - Posuír e comprender coñecementos que proporcionen unha base ou oportunidade para ser orixinais no desenvolvemento e/ou a aplicación de ideas, a miúdo nun contexto de investigación.
B2	CB7 - Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornos novos ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
B4	CB9 - Que os estudantes saiban comunicar as súas conclusións e os coñecementos e as razóns últimas que as sustentan a públicos especializados e non especializados dun modo claro e sen ambigüidades.
C1	T01 - Capacidade de análise e síntese
C4	T04 - Coñecementos de informática relativos ao ámbito de estudo
C5	T05 - Capacidade para a xestión da información
C6	T06 - Resolución de problemas
C12	T12 - Comprensión numérica
C13	T13 - Intuición mecánica

Learning outcomes			
Learning outcomes	Study programme competences		
Acquire generic knowledge of instrumental techniques for auscultation and monitoring of historical constructions.	AJ5 AJ8		
Deepen the study of the mechanical behaviour of the masonry work and the models that allow its analytical characterization to be addressed.	AJ5 AJ8		
Propose an approach to the structural diagnosis techniques of buildings with historical value and rehabilitation works in general, using computer applications based on the programming of numerical methods.	AJ5 AJ8	BJ1 BJ2	CJ4 CJ6 CJ12 CJ13
Become familiar with the use of tools that facilitate the tasks of inspection and technical control, and that can be used to analyze the repercussions to be taken into account when faced with a specific intervention.	AJ5 AJ8	BJ1 BJ2	CJ4 CJ6 CJ12 CJ13
Encourage the development of autonomous attitudinal capacities: a tendency to continuous learning, ability to solve problems effectively, capacities for analysis and synthesis, organization and personal planning, productive management of documentation, and use of information and comunication technologies.		BJ4	CJ1 CJ5

Contents	
Topic	Sub-topic
Principles, techniques and tools for data collection.	
Complementarity of instrumental and analytical techniques.	
Mechanical behaviour of the masonry work.	
Numerical simulation techniques.	

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A5 B1 B2	12	12	24
Workshop	A5 B1 B2 C4 C6 C12 C13	9	13.5	22.5
Problem solving	A5 B1 B2 C4 C6 C12 C13	0	5	5

Supervised projects	A5 A8 B1 B2 B4 C1 C4 C5 C6 C12 C13	0	22.5	22.5
Personalized attention		1	0	1
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	**Description**
Guest lecture / keynote speech	An exhibition methodology complemented by audiovisual means is applied in order to significantly illustrate the contents treated and to facilitate their understanding. However, and independently of the above, during these sessions the aim is to achieve a certain quota of participation by the students, enhancing their involvement, promoting feedback on the process (and therefore the two-way nature of communication), and energizing the learning mechanisms through interaction techniques.
Workshop	The exercise is proposed through guided practices developed with computer means. It contemplates the acquisition of an operational methodology based on practical assumptions with an increasing level of complexity.
Problem solving	Practical tests are proposed, in which specific problematic situations have to be faced, designed from the previously worked content.
Supervised projects	The teaching methodology is basically oriented according to the criterion of learning in action, in order to enhance the acquisition of specific skills. In this context, the elaboration of a comprehensive work takes center stage, where the professional skills of the subject come together, therefore linked to the use of numerical analysis applications, with others of a transversal nature, such as, among others, the search for documentation (often making use of new technologies), the organization and planning of activities, the management of information, or oral and written expression. Schematically, the following steps are distinguished: topic selection, preparation of a generic work script, on-site examination, photographic report, planimetric survey, location and consultation of reference sources, construction and adjustment of models, interpretation of results, and writing a final report that covers the entire work. Given the supervised nature of the same, regular follow-up sessions must be held with the teaching staff, in order to optimize or, where appropriate, redirect the activities in progress.

Personalized attention	
Methodologies	**Description**
Supervised projects	Given the specificity of the contents linked to the subject, and the different level of computer training with which students can access it, it is understood to be crucial to articulate personalized attention mechanisms that attend to possible singularities. To this end, the development of face-to-face tutorials and consultations through the resources of the virtual platform is used.

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Supervised projects	A5 A8 B1 B2 B4 C1 C4 C5 C6 C12 C13	Its development is fully understood individually and of a non-presential nature. In order to guarantee the authorship of the work, and the adequate acquisition of competences, in its evaluation the successive control sessions are considered relevant, and therefore the degree of compliance in relation to the indications formulated in each case by the teaching staff. Other aspects to assess are: the depth and rigor of development; the search for information sources; the relationships built between the different sections; analysis and synthesis capabilities; the correction of the methodological study, the constructive and structural diagnosis, the modeling and the appropriate conclusions; argumentation; and the grammatical, graphic and technical quality of the final documentation.	100

Assessment comments
As in the other subjects that make up this postgraduate degree, attendance is also required not less than 80% relative to all the scheduled face-to-face sessions.This requirement will have no effect with students who have recognized part-time dedication according to the Norm that regulates the regime of dedication to study and the permanence and progression of undergraduate and master's students at the UDC.

Sources of information	
Basic	Hendry, A.W, 1998. Structural Masonry. Macmillan.León, J., 2000. Planteamiento del análisis estructural. Identificación de modos de fallo y criterios de decisión.Lombillo, I., Villegas, L., Silió, D., Hoppe, C., 2008. Evaluación no destructiva del patrimonio construido. Revista Internacional Construlink 16, 40?53.Macchi, G., 1992. Diagnosis estructural y rehabilitación de edificios históricos, Cuadernos INTEMAC. INTEMAC, Madrid.Martínez, J.L., Martín-Caro, J.A., León, J., 2001. Comportamiento mecánico de la obra de fábrica, Monografías sobre el análisis estructural de construcciones históricas de fábrica. Universidad Politécnica de Madrid, Madrid.Schuller, M.P., 20003. Nondestructive testing and damage assessment of masonry structures. Prog. Struct. Engng Mater. 5, 239?251. doi:10.1002/pse.160Vázquez M., López, E., 2001. El método de los elementos finitos aplicado al análisis estructural. Noela, Madrid.Bibliografía

Complementary	A. Zucchini, Lourenco, P.B, 2007. Mechanics of masonry in compression: Results from a homogenisation approach. Computers & Structures 85, 193?204. doi:10.1016/j.compstruc.2006.08.054Alawadhi, E.M, 2010. Finite element simulations using Ansys. CRC Press, Boca Raton.Álvarez de Buergo, M., González, T., 1994. Restauración de edificios monumentales: estudio de materiales y técnicas instrumentales. Centro de Estudios y Experimentación de Obras Públicas, Madrid.Anzani, A, L. Binda, Mirabella, G., 2000. The effect of heavy persistent actions into the behaviour of ancient masonry. Materials and Structures 33, 251?261. doi:10.1007/BF02479335Arede, A., Costa, A., 2002. Inspecção e Diagnóstico Estrutural de Construções Históricas. Algumas contribuições da FEUP. Presented at the 1o Seminário quot;A Intervenção no Património. Práticas de Conservação e Reabilitação.Asteris, P.G, 2008. On the structural analysis and seismic protection of historical masonry structures. 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First historical, experimental and numerical investigations. Presented at the Historical constructions 2001: possibilities of numerical and experimental techniques, Guimarães, pp. 431?444.Betti, M., Galano, L, 2012. Seismic Analysis of Historic Masonry Buildings: The Vicarious Palace in Pescia (Italy). Buildings 2, 63?82. doi:10.3390/buildings2020063Binda, L., Baronio, G., Palma, M., Penazzi, D., n.d. Il patrimonio storico architettonico ed il terremoto: la diagnosi e gli interventi di recupero. Località di roccanolfi di preci e montesanto di sellano: redazione di schede per il rilievo tipológico e dei danni sismici agli edifici.Binda, L., Cantini, L., Fernandes, F., Saisi, A., Tedeschi, C., Zanzi, L., 2004. Diagnostic investigation on the historical masonry structures of a castle by the complementary use of non destructive techniques. Presented at the 13 th International Brick and Block Masonry Conference, Amsterdam.Binda, L., Cardani, G., Saisi, A., Valluzzi, M.R, 2006. 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Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Other comments
Certain skills are required in the use of computer-aided design tools, as well as elementary knowledge about the theoretical bases of the finite element method.

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