Teaching Guide				
Identifying Data				2024/25
Subject (*)	Structures 2		Code	630G02023
Study programme	Grao en Estudos de Arquitectura			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	Third	Obligatory	6
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Construcións e Estruturas Arquitectónicas, Civís e AeronáuticasEnxeñaría Civil			
Coordinador	Suárez Riestra, Félix Leandro	E-mail	felix.suarez@udc.es	
Lecturers	Barreiro Roca, José Carlos Guindos Bretonnes, Pablo Rey Rey, Juan Ignacio Suárez Riestra, Félix Leandro	E-mail	jose.barreiro@udc.es pablo.guindos@udc.es j.rey.rey@udc.es felix.suarez@udc.es	
Web				
General description	Calculation basis. Actions in the building. Energy methods. Structural analysis using the matrix method. Structural analysis using the finite element method. Computational computing applications.			

Study programme competences / results	
Code	Study programme competences / results
A7	"Knowledge of the principles of general mechanics, statics, mass geometry and vector and tensor fields, adapted and applied to architecture and urbanism "
A72	Coñecemento avanzado de aspectos específicos da materia de Estruturas no contemplados expresamente na Orde EDU/2075/2010
B1	Students have demonstrated knowledge and understanding in a field of study that is based on the general secondary education, and is usually at a level which, although it is supported by advanced textbooks, includes some aspects that imply knowledge of the forefront of their field of study
B3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgements that include reflection on relevant social, scientific or ethical issues
B5	Students have developed those learning skills necessary to undertake further studies with a high level of autonomy
B9	Understanding the problems of the structural design, construction and engineering associated with building design and technical solutions
C6	Critically evaluate the knowledge, technology and information available to solve the problems they must face

Learning outcomes			
Learning outcomes	Study programme competences / results		
Coñecementos das bases de cálculo estrutural.	A7 A72	B1 B3	C6
O alumnado adquirirá aptitudes para o predimensionamento, deseño, cálculo e comprobación de estruturas e para dirixir a súa execución material	A7 A72	B1 B3	C6
Avaliación de accións en edificación.	A72	B1 B3	C6

Métodos numéricos e informáticos de análise estrutural.	A7 A72	B1 B3 B5 B9	C6

Contents	
Topic	**Sub-topic**
00 CONCEPTO DE SEGURIDADE	1 Seguridade Estrutural. Esixencias 2 Criterios de Seguridade 3 Criterios de Resistencia
01 ACTIONS IN THE BUILDING	1 Permanent actions. CTE-DB SE-AE 2 Permanent actions: Land action. CTE-DB SE-C 3 Variable use and climatic actions. CTE-DB SE-AE 4 Consideration of actions in accidental situations: CTE-DB SE and NCSE-02 5 Combination of actions
02 ENERGY METHODS	1 Clapeyron's Law. 2 Axial deformation, bending and cutting work. 3 Castigliano's theorems. 4 Mohr-Maxwell unit load method. 5 Menabrea's Minimum Work Theorem.
03 THE MATRIX METHOD	1 Idealizations for calculation 2 Methods of matrix analysis. Flexibility and Rigidity 3 The Rigidity method 4 Flat structures 5 Compatibility and balance 6 Links and Boundary Conditions 7 Reactions and efforts
04 THE FINITE ELEMENT METHOD	1 General principles. 2 Constitutive equation. 3 Interpolation functions. 4 Isoparametric formulation 5 Flat stress and strain. 6 Element balance
05 ANALYSIS OF STRUCTURES BY COMPUTER	1 Topological definition of structures in software 2 Accurate data entry - sequencing 3 Calculation with general numerical calculation software. 4 Matrix and finite element calculation software. 5 Problems and limitations of the software.

Planning				
Methodologies / tests	**Competencies / Results**	**Teaching hours (in-person & virtual)**	**Student?s personal work hours**	**Total hours**
Guest lecture / keynote speech	A7 A72 B5	14	30	44
Problem solving	B1 C6	24	36	60
Objective test	B1 B3 C6	4	20	24
Practical test:	B3 B9	6	12	18
Directed discussion	B1	1	1	2
Personalized attention		2	0	2
(*)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	Impártense para todo o grupo. En elas desenvólvense os aspectos que se consideran necesarios para o bo desenvolvemento da asignatura.
Problem solving	Resolución práctica de problemas relacionados coa asignatura. Esta resolución pode ser efectuada polo profesor, polo alumnado ou de forma mixta
Objective test	Resolución de exercicios teóricos e prácticos da asignatura, de maneira individual, con tempo limitado. Só se pode utilizar a folla formulario
Practical test:	Resolución de exercicios prácticos da asignatura, de maneira individual, con tempo limitado, podendo consultar dúbidas puntuais co profesor. Só se pode usar a folla formulario.
Directed discussion	Discusión cuestións teóricas

Personalized attention	
Methodologies	Description
Problem solving	Atención directa ó alumnado para o enfoque do traballo titorado e para a discusión e solución de dúbidas teóricas e resolución de problemas

Assessment			
Methodologies	Competencies / Results	Description	**Qualification**
Problem solving	B1 C6	BULLETIN PRACTICES. - Realization of practical cases - Attendance and active participation in class - Application of knowledge acquired in the bulletins.	0
Practical test:	B3 B9	Son os denominados Boletíns ou probas de resolución de problemas a realizar polo alumnado ao longo o do curso. Permítense os apuntamentos de clase e a folla formulario. Poderanse consultar dúbidas puntuais co profesor.	20
Objective test	B1 B3 C6	PARTIAL/FINAL TEST - Troubleshooting - Mastery of theoretical knowledge - Structuring content - Planning, clarity and precision - Mastering the art of operational	80

Assessment comments

The evaluation will be as continuous as possible. For the evaluation and qualification of the subject, the following aspects will be assessed, which will have a different weight in the final grade of the course, as broken down in the previous Table that appears in the evaluation section:
* Attendance to class is understood as compulsory, verified through a list or another system.
* Interactive practices will be developed, where the student will be able to consult the doubts that arise.
* Throughout the course a continuous practice will be developed, directed and proposed by the teachers and that the students must develop and complete independently.
* Throughout the course a series of partial tests will be carried out, which will consist of problem-type questions, and may also include conceptual topics. They will be individual and no bibliography will be available. During its development, only a summary form will be allowed. They will count during the course as the equivalent of the objective test.
* A minimum grade will be required in each of the three evaluable sections (interactive practices, objective / partial tests, continuous practice) of 40% of the section mark, to be eligible for the pass. Once this minimum is exceeded, the three sections will measure according to the weights indicated in the previous section.
* By satisfactorily overcoming the above aspects, it will be possible to pass the course without having to go to any of the final tests. The students of 2nd enrollment or later, must follow the course in the same conditions as the first enrollment to be eligible for the course approved.
* If the subject is not passed by course, the written test of the first final opportunity of the course will be taken. The result of this test will be computed as the partial tests during the course, maintaining the assessment of interactive and continuous practices. (The minimum 40% will continue to be required in each section to qualify for the approved one).
* In the so-called second opportunity at the end of the course, it will be evaluated through the objective test and a new supervised work similar to that developed during the course. The only requirement to be able to take this final test will be to appear in the minutes of this course. In this case, the subject score will be 60% the objective test and 40% the new supervised work. (The minimum 40% grade is still required in each section to qualify for the pass).
* In the case of students who have a waiver of attendance and who can therefore present themselves at the first and second opportunity without requiring continuous evaluation, the assessment will be similar to the second general opportunity on both occasions: 60% the objective test and 40% the supervised work. (The minimum 40% grade is still required in each section to qualify for the pass). It is understood that the supervised work of the first and second opportunity will be the same as for the rest of the students.
For the realization of practices and examination, the allowed materials will only be:
- DNI or other identification
- Writing and drawing material
- Calculator
- A summary sheet of formulas
- Mobile phones are expressly prohibited
Teaching to students of mobility programs will be adapted to pedagogical conditions and special supervised work, as well as assessment tests and exams. If the mobility dates do not allow a reasonable follow-up of the course, they may opt in any case for the first and second opportunity exams on the same conditions as the students with no attendance.

Sources of information	
Basic	

Complementary	1 RODRÍGUEZ MARTÍN, L. F. Curso de estructuras metálicas de acero laminado. Colegio Oficial deArquitectos . Madrid, 1984. _____ 2 AGUIAR FALCONI, R. Análisis Matricial deEstructuas. CEINCI, 3ª edición. 2004. 3 ALARCÓN ÁLVAREZ, E. - ÁLVAREZ CABAL, GÓMEZ LERA,Ma. S. Gómez Lera. Cálculo Matricial deEstructuras Ed. Reverté. 1990. 4 BRAY, K.H.M; CROXTON, P.C.L, MARTIN, L.H. Análisis Matricial deEstructuas. Paraninfo. 1978. _____ 5 BELTRÁN, FRANCISCO. Teoría General del Método delos Elementos Finitos. Notas de clase / Curso deDoctorado 1998-1999. Departamento de MecánicaEstructural y Construcciones Industriales. ETS Ingenieros industriales Madrid. 6 COOK, R. D. Finite Element Modeling forStress Analysis. John Wiley & Sons Inc.1995. 7 DE LA ROSA OLIVER, EMILIO. Modelos diferenciales ynuméricos en la Ingeniería. Métodos de Fourier; de diferencias y elementosfinitos. Ed. Bellisco. Madrid 1999. 8 FORNONS GARCÍA, JOSÉ MARÍA. El Método de los ElementosFinitos en la ingeniería de estructuras. Ed. Marcombo - UniversidadPolitécnica Barcelona. 9 HSIEH, Y. Teoría Elemental deEstructuras. Prentice Hall. 1979. 10 MARTÍ MONTRULL, P. Análisis de Estructuras. Horacio Escarbajal. 2ª ed.2007. 11 OÑATE, E. Cálculo de Estructuras porel Método de los Elementos Finitos. CIMNE. Barcelona. 1995 12 PRZEMIENIECKI, J. S. Theory of Matrix StructuralAnalysis. Mc Graw Hill. 1968.

Recommendations
Subjects that it is recommended to have taken before
Mathematics 1/630G01004 Physics 2/630G01013 Structures 1/630G01019
Subjects that are recommended to be taken simultaneously
Construction 3/630G01022
Subjects that continue the syllabus
Structures 3/630G01028
Other comments
Previamente recoméndase un repaso da materia do curso anterior sobre a que se traballará reiteradamente, como é: - resolución de estruturas articuladas - diagramas de esforzos de vigas e pórticos - estado tensional do sólido - estado de deformacións - lei de Hooke xeralizada Polo tratamento continuado da materia recoméndase un repaso cada día do tratado na clase, prantexando as dúbidas que poidan xurdir na próxima clase ou nas horas de titoría. A maiores do seguimento das clases, o alumnado debe consultar a bibliografía e material recomendado para cada parte da materia.