Teaching Guide				
Identifying Data				2020/21
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	Muñoz Vidal, Manuel	E-mail	manuel.munoz@udc.es	
Lecturers	Muñoz Vidal, Manuel Suárez Riestra, Félix Leandro Tabernero Duque, Fernando Maria	E-mail	manuel.munoz@udc.es felix.suarez@udc.es fernando.tabernero@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.			

Contingency plan	1. Changes in content The contents are maintained. 2. Methodologies * Teaching methodologies that are maintained All * Teaching methodologies that are modified Depending on the possibilities or needs of the teaching, it can be in face-to-face, hybrid or non-face-to-face mode. In any case, the exhibition, interactive classes and / or supervised works will be adapted to the necessary online means, maintaining in any case the schedule assigned by the center. 3. Mechanisms for personalized attention to students e-mail: Permanent for queries Moodle: Forums and Delivery of tasks Teams: Weekly in general for clarification of doubts and permanent for online tutoring, by appointment. 4. Modifications in the evaluation The evaluation is already planned so that the same assessment criteria can be maintained, either face-to-face, hybrid or non-face-to-face. * Evaluation observations: In the case of online mode, if during the objective test any technical problem arises, it will be immediately communicated to the teaching staff to fix a solution. Therefore it is recommended to have the mobile phone available with the mail application and operational Teams for these emergency notifications 5. Modifications of the bibliography or webgraphy The initially indicated bibliography and webgraphy are maintained. All the documentation of the classes taught is provided in Moodle, as well as resolved examples on the topics developed.

Study programme competences / results	
Code	Study programme competences / results

Learning outcomes			
Learning outcomes	Study programme competences / results		
Conocimientos de las bases de cálculo estructural.		B21	
Evaluación de acciones en edificación.		B21	C7
Métodos numéricos e informáticos de análisis estructural.	A6	B11 B15 B21 B22 B23 B24	C3

El alumno adquirirá aptitudes para el predimensionamiento, diseño, cálculo y comprobación de estructuras y para dirigir su ejecución material	A2 A6	B1 B2 B4 B5 B7 B11 B15 B18	C3 C7

Contents	
Topic	**Sub-topic**
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.
06 CALCULATION BASIS	1 Structural analysis. Limit states. 2 The probabilistic concept of failure. 3 Method of Partial Coefficients. 4 Combination of actions. Hypothesis.

Planning				
Methodologies / tests	**Competencies / Results**	**Teaching hours (in-person & virtual)**	**Student?s personal work hours**	**Total hours**
Guest lecture / keynote speech	A2 A6 B2 B11 B21	14	14	28
Problem solving	B2 B11 B18 B21	35	42	77
Objective test	B2 B11 B18 B21	4	16	20

Supervised projects	B1 B4 B5 B7 B15 B18 B22 B23	2	14	16
Seminar	B24 C3	2	3	5
Directed discussion	B21 C7	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	Se imparten para todo el grupo. En ellos, se desarrollan los aspectos que se consideran necesarios para el desarrollo de la asignatura.
Problem solving	Resolución práctica de problemas relacionados con la asignatura. Esta resolución puede ser efectuada por el profesor, por los alumnos o de forma mixta
Objective test	Prácticas individuales a lo largo del curso
Supervised projects	Desarrollo de trabajos a lo largo del curso con asistencia del profesor
Seminar	Clase especial desarrollo para enfocar alguna de las prácitcas propuestas
Directed discussion	Discusión cuestiones teóricas

Personalized attention	
Methodologies	**Description**
Supervised projects	Atención directa ó alumno para o enfoque do traballo tutelado e para a discusión e solución de dudas teóricas e resolución de problemas

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Supervised projects	B1 B4 B5 B7 B15 B18 B22 B23	CONTINUED PRACTICE - Work planning and tutoring assistance - Original Contributions - Structure and presentation - Quality of documentation	30
Objective test	B2 B11 B18 B21	PARTIAL/FINAL TEST - Troubleshooting - Mastery of theoretical knowledge - Structuring content - Planning, clarity and precision - Mastering the art of operational	50
Problem solving	B2 B11 B18 B21	BULLETIN PRACTICES. - Realization of practical cases - Attendance and active participation in class - Application of knowledge acquired in the bulletins.	20

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 recomendase un repaso da materia do curso anterior sobre a que setraballará reiteradamente, como é:- resolución de estructuras articuladas- diagramas de esforzos de vigas e pórticos- estado tensional do sólido- estado de deformacions- ley de Hooke xeralizadaPolo tratamento continuado da materia recomendase un repaso cada día deo tratado na clase, planteando as dudas que poidan surxir na próxima clase o nas horas de tutoría.Aparte do seguimento das clases, o alumno debe consultala bibliografía e material recomendado para cada parte da materia.