Teaching Guide				
Identifying Data				2019/20
Subject (*)	Structural Engineering		Code	730497214
Study programme	Mestrado Universitario en Enxeñaría Industrial (plan 2018)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Optional	4.5
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Enxeñaría Naval e Industrial			
Coordinador	Reinosa Prado, Jose Manuel	E-mail	j.reinosa@udc.es	
Lecturers	Loureiro Montero, Alfonso Reinosa Prado, Jose Manuel	E-mail	a.loureiro@udc.es j.reinosa@udc.es	
Web	http://https://sites.google.com/site/structuralanalysislab/			
General description	Nesta materia perséguese adquirir as competencias especificas básicas necesarias para o deseño e análise de diferentes tipos de estruturas, baseadas en distintas técnicas de análise estructural.			

Study programme competences / results	
Code	Study programme competences / results
A19	EI3 - Knowledge and skills for the calculation and design of structures.
B1	CB6 - Possess and understand knowledge that provides a basis or opportunity to be original in the development and / or application of ideas, often in a research context.
B2	CB7 - That students know how to apply the knowledge acquired and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of ??study.
B3	CB8 - That students are able to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of their knowledge and judgments.
B6	G1 - Have adequate knowledge of the scientific and technological aspects in Industrial Engineering.
B7	G2 - Project, calculate and design products, processes, facilities and plants.
B13	G8 - Apply the knowledge acquired and solve problems in new or unfamiliar environments within broader and multidisciplinary contexts.
B14	G9 - Be able to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of their knowledge and judgments.
B17	G12 - Knowledge, understanding and ability to apply the necessary legislation in the exercise of the profession of Industrial Engineer.
C1	ABET (a) - An ability to apply knowledge of mathematics, science, and engineering.
C2	ABET (b) - An ability to design and conduct experiments, as well as to analyze and interpret data.
C3	ABET (c) - An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
C5	ABET (e) - An ability to identify, formulate, and solve engineering problems.
C6	ABET (f) - An understanding of professional and ethical responsibility.
C8	ABET (h) - The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
C11	ABET (k) - An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Learning outcomes	
Learning outcomes	Study programme competences / results

Theoretical and practical knowledge applied in the structural analysis.	AJ19	BJ1 BJ2 BJ3 BJ6 BJ7 BJ13 BJ14 BJ17	CJ1 CJ2 CJ3 CJ5 CJ6 CJ8 CJ11
Knowledge and skills for the calculation and design of steel structures and concrete.	AJ19	BJ1 BJ2 BJ3 BJ6 BJ7 BJ13 BJ14 BJ17	CJ1 CJ2 CJ3 CJ5 CJ6 CJ8 CJ11

Contents	
Topic	**Sub-topic**
Chapter 0. The following topics develop the contents set up in the verification memory.	Matrix analysis. Basis of calculation. Analysis and design of structures. Concrete structures. steel structures. Soil mechanics. Design of foundations
Chapter 1. Introduction to matrix structural analysis.	Introduction. Structure idealization. System redundances and degrees of freedom. Method of flexibility. Direct stiffness method. Comparison between the two methods. Global and local coordinates. Transformations of spatial coordinates. Transformation matrix.
Chapter 2. Stiffness matrix of structural elements	Introduction. Axial force member with plane movement. General axial force member. Beam bending member with plane movement. Beam torsional and bending member. General beam member. Problems.
Chapter 3. Stiffness matrix of the frame	Compatibility equations. Equilibrium at nodes. Stiffness matrix properties. Problems.
Chapter 4. Boundary conditions.	Needs for boundary conditions. Introduction of null displacement. Introduction of prescribed displacement. Other techniques of introduction of boundary conditions. Elastic supports. Inclined supports. Problems.
Chapter 5. Forces.	Introduction. Loads between nodal points. Calculation of fix end forces, bending moment diagrams and reactions. Initial or thermal strain conditions. Problems.
Chapter 6. Analysis and design of structures and fundations	Analysis of metallic structures, concrete and fundations

Planning				
Methodologies / tests	**Competencies / Results**	**Teaching hours (in-person & virtual)**	**Student?s personal work hours**	**Total hours**
Problem solving	A19 B1 B2 B3 B13 B14 B17 B7 B6 C1 C2 C3 C5 C6 C8 C11	4.5	20.5	25
Supervised projects	A19 B1 B2 B3 B13 B14 B17 B7 B6 C1 C2 C3 C5 C6 C8 C11	4.5	20.5	25
Laboratory practice	A19 B1 B2 B3 B13 B14 B17 B7 B6 C1 C2 C3 C5 C6 C8 C11	10	2.5	12.5

Objective test	A19 B1 B2 B3 B13 B14 B17 B7 B6 C1 C2 C3 C5 C6 C8 C11	0	2.5	2.5
Guest lecture / keynote speech	A19 B1 B2 B3 B13 B14 B17 B7 B6 C1 C2 C3 C5 C6 C8 C11	12.5	25	37.5
Personalized attention		10	0	10
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	**Description**
Problem solving	Methodology that allows the realization of activities of practical character, with computer, such as modelization and structural analysis
Supervised projects	Methodology designed to promote autonomous learning of students, solving a problem that involves the contents of the course and involves specific skills, under teacher supervision.
Laboratory practice	Metodoloxía que permite que os estudiantes aprendan efectivamente a través da realización de actividades de carácter práctico.
Objective test	Exame sobre os coñecementos adquiridos na asignatura.
Guest lecture / keynote speech	Guest lecture / keynote speech Oral lecture supplemented with the use of audiovisual means, aiming transmit knowledge and facilitate the learning within the scope of structural analysis

Personalized attention	
Methodologies	**Description**
Supervised projects Laboratory practice	Guidance and revision about specific problems posed at the development of the different activities proposed in the course. Revision and help when making supervised projects.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Supervised projects	A19 B1 B2 B3 B13 B14 B17 B7 B6 C1 C2 C3 C5 C6 C8 C11	The work involves the contents theoretical and practical in the subject. It must be made individually, in practical session and at the homework hours. It will track the work performance in the practical sessions.	30
Objective test	A19 B1 B2 B3 B13 B14 B17 B7 B6 C1 C2 C3 C5 C6 C8 C11	Realizarase un exame final sobre os coñecementos adquiridos na asignatura.	70

Assessment comments

The student, whose presence along the quarter is insufficient to perform the monitoring and the assessment of their work, by academic waiver or other causes, will also have to develop and submit it for their evaluation. Support and monitoring of such work shall be carried out in tutoring sessions. The assessment is done through the presentation of supervised work and/or the objective test. In this case, the evaluation process can include a session practical, individually or in group, in which the student addresses manually or with the computer the problems posed by the teacher. For the second chance you can present the supervised work and/or improve the already accomplished. Support and monitoring is done in tutorial sessions. The assessment is done through the presentation of supervised work pending and/or improved and/or the objective test. The process of evaluation may include, in addition to the above, a practice session individually or in group, in which the student addresses manually or with the computer the problems posed by the teacher.

Sources of information	
Basic	- Celigüeta Lizarza, Juan Tomás (2003). Curso de análisis estructural . Eunsa, Ediciones Universidad de Navarra. Pamplona - McCormac, Jack C (2011). Análisis de estructuras : métodos clásico y matricial. México : Alfaomega - Hibbeler, Russell C. (2012). Análisis estructural . Naucalpan de Juárez : Pearson - W. McGuire, R. H. Gallagher, R.D. Ziemian (2000). Matrix Structural Analysis. John Wiley & Sons, Inc.
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Simulation of Mechanic and Structural Systems/730497224
Other comments
To help achieve a sustained environment and meet the objective of the action number 5: "Teaching and healthy and sustainable environmental and social research" of the "Plan of action Green Campus Ferrol": documentary work that where delivered in this subject: ? should be requested in virtual format and/or support computer ? be made through Moodle, in digital format without having to print them if necessary ? do them on paper: -   Plastics will not be utilized - will be double-side printing.   -Will use recycled paper.   -Prevent printing drafts. You should make a sustainable use of resources and the prevention of negative impacts on the natural environment

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.