



Teaching Guide

Teaching Guide				
Identifying Data				2021/22
Subject (*)	Estruturas I		Code	632G02024
Study programme	Grao en Tecnoloxía da Enxeñaría Civil			
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, Cívís e Aeronáuticas			
Coordinador	Jurado Albarracin-Martinon, Jose Angel	E-mail	jose.angel.jurado@udc.es	
Lecturers	Jurado Albarracin-Martinon, Jose Angel	E-mail	jose.angel.jurado@udc.es	
Web	https://campusvirtual.udc.gal/ 632G020242122			
General description	Structures I studies methods for the analysis of bars structures. Statically and none statically determinate structures are calculated. Methods for the analysis of plates are also teaching. A lot of examples showing analysis of structures with these elements are solved.			
Contingency plan	1. Contents modifications No changes 2. Methodologies No changed methodologies All methodologies will carry on Moodle. 3. Students personal attention: Any official system of UDC: e-mail, Moodle forum or Teams 4. Assessment modification Objective proves won´t be face to face. It will carry on Moodle. 5. Sources of information: No changes.			

Study programme competences

Code	Study programme competences
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Learning outcomes

Learning outcomes	Study programme competences
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Capacidade para analizar e comprender como as características das estruturas inflúen no seu comportamento, así como coñecer as tipoloxías máis usuais na Enxeñería Civil. Capacidade para utilizar métodos tradicionais e numéricos de cálculo e deseño de todo tipo de estruturas de diferentes materiais, sometidas a esforzos diversos e en situacións de comportamentos mecánicos variados. Coñecemento das diferentes tipoloxías de pontes metálicas, de formigón e mixtas, o seu comportamento estrutural, os métodos de cálculo e os procedementos construtivos empregados	A17	B1	C1
	A18	B2	C2
	A20	B3	C3
		B4	C4
		B5	C5
		B6	C6
		B7	C7
		B8	C8
		B9	C9
		B10	C10
		B11	C11
		B12	C12
		B13	C13
		B14	C14
		B15	C15
		B16	C16
		B17	C17
		B18	C18
		B19	C19
			C20
			C21

Contents	
Topic	Sub-topic
1. Virtual work principles	1.1 Concepto de trabajo virtual 1.2 Principio de los movimientos virtuales 1.3 Principio de las fuerzas virtuales 1.4 Calculo de movimientos
2. Energetic theorems of structural analysis	2.1 Energía potencial total de una estructura 2.2 Energía potencial total complementaria 2.3 Teorema de Clapeyron 2.4 Teroremas de Enguesser 2.5 Teroemas de Castigliano 2.6 Teorema de reciprocidad
3. Cable structures	3.1 Definición de cable 3.2 Deformada de un cable cargado
4. Non isostatic structures	4.1 Hiperestaticidad 4.2 Analogía entre el principio de las fuerzas virtuales y el teorema de Enguesser 4.3 Estructuras compuestas por barras articuladas y barras a flexión
5. Elastic instability of bars structures	5.1 Teoría de segundo orden 5.2 Padeo de barras comprimidas 5.3 Método de Euler 5.4 Método de Rayleigh 5.5 Pandeo global de estructuras de múltiples barras
6. Bending of thin rectangular plates	6.1 Elemento placa 6.2 Ecuación diferencial de la flexión de placas delgadas en coordenadas cartesianas 6.3 Condiciones de conorno en enlaces 6.3 Método de Navier 6.4 Método de Levy-Nadai



7. Bending of plates in polar coordinates	7.1 Ecuación diferencial de la flexión de placas en coordenadas polares 7.2 Método de Clebsch 7.3 Flexión axisimétrica de placas circulares
8. Buckling of plates	8.1 Flexión de placas con cargas en su plano medio 8.2 Ecuación diferencial de la flexión de placas rectangulares con cargas en su plano medio 8.3 Pandeo de placas 8.4 Carga crítica de pandeo y modos de pandeo

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student's personal work hours	Total hours
Guest lecture / keynote speech	A17 A18 A20 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B19 B13 B14 B15 B16 B17 B18 C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21	15	22	37
Case study	A17 A18 A20 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B19 B13 B14 B15 B16 B17 B18 C21 C20 C19 C18 C17 C16 C15 C14 C13 C12 C11 C10 C9 C8 C7 C6 C5 C4 C3 C2 C1	15	22	37
Document analysis	A17 A18 A20 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B19 B13 B14 B15 B16 B17 B18 C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21	5	10	15
Problem solving	A17 A18 A20 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B19 B13 B14 B15 B16 B17 B18 C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21	20	36	56



Online forum	A17 A18 A20 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B19 B13 B14 B15 B16 B17 B18 C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21	0.5	0.5	1
Objective test	A17 A18 A20 B1 B2 B3 B4 B5 B6 B7 B8 B10 B11 B12 B19 B13 B14 B15 B16 B17 B18 C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21	4	0	4
Personalized attention		0	0	0
(*)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 explicarán los métodos de cálculo de estructuras comentados en los contenidos
Case study	El profesor mostrará como resolver ejemplos clásicos de cálculo de estructuras y analizará los resultados obtenidos.
Document analysis	Recopilación de ejemplos de cálculo de estructuras de la bibliografía propuesta para analizar su resolución.
Problem solving	El profesor propondrá problemas de cálculo de estructuras para que el alumno los resuelva. Posteriormente el profesor mostrará en clase cómo se solucionan algunos de ellos.
Online forum	Se establece en el campus virtual para que cualquiera pueda plantear preguntas, dudas, hacer comentarios, aportar soluciones y compartir documentación de forma pública. Cualquier persona involucrada con la asignatura puede ver lo que se publica en el foro.
Objective test	Examen escrito de teoría y problemas de cálculo de estructuras.

Personalized attention	
Methodologies	Description
Problem solving	Los estudiantes que encuentren dificultades en las teorías explicadas en las sesiones magistrales, en la solución de los problemas planteados, en los estudios de casos y en el análisis de fuentes, deberían acudir a tutoría para aclararlas. También pueden preguntarse cuestiones aclaratorias durante la prueba objetiva.
Guest lecture / keynote speech	
Objective test	
Document analysis	
Case study	
Online forum	Pueden acudir presencialmente en las horas de tutoría establecidas o contactar por cualquier medio oficial de la UDC. correo de UDC, foros de Moodle o Teams. Otra opción es usar el foro del campus virtual y así se hace pública la consulta.

Assessment			
Methodologies	Competencies	Description	Qualification



Problem solving	A17 A18 A20 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B19 B13 B14 B15 B16 B17 B18 C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21	The behavior and attention of the student, the active participation, the contributions and questions, the answers to professor questions, the resolution of proposed exercises and activities, and in general any aspect related with the capabilities written in this guide will be evaluated so it can modify the obtain mark.	2
Guest lecture / keynote speech	A17 A18 A20 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B19 B13 B14 B15 B16 B17 B18 C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21	The behavior and attention of the student, the active participation, the contributions and questions, the answers to professor questions, the resolution of proposed exercises and activities, and in general any aspect related with the capabilities written in this guide will be evaluated so it can modify the obtain mark.	2
Objective test	A17 A18 A20 B1 B2 B3 B4 B5 B6 B7 B8 B10 B11 B12 B19 B13 B14 B15 B16 B17 B18 C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21	Structures 1 has two evaluation methods: Continuous evaluation: This method tries to worth the work carried out during the course by the students. It consists on a series of tasks (from 8 to 12). They are structural analysis and theory questions. Most of them will be in class and student can't consult documentation. Others tasks use Moodle. Exercises of the objective test of the first opportunity also will be considered as tasks. Each task marks with a maximum of 3 points. A student approves by this system if at least 50% of the maximum possible points are obtained. Objective test: It consists on the realization of 3 exercises with theory and problems that will do in class without documentation. The mark of each exercise will be proportional to the spent time to course the subject. To pass it is necessary to get 5 points on a total of 10. Also is necessary to get points in all the exercises, so if one exercise is marked with 0 point, student can't pass the test. For the second opportunity the assessment is by means of objective test.	90
Document analysis	A17 A18 A20 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B19 B13 B14 B15 B16 B17 B18 C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21	The behavior and attention of the student, the active participation, the contributions and questions, the answers to professor questions, the resolution of proposed exercises and activities, and in general any aspect related with the capabilities written in this guide will be evaluated so it can modify the obtain mark.	2



Case study	A17 A18 A20 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B19 B13 B14 B15 B16 B17 B18 C21 C20 C19 C18 C17 C16 C15 C14 C13 C12 C11 C10 C9 C8 C7 C6 C5 C4 C3 C2 C1	The behavior and attention of the student, the active participation, the contributions and questions, the answers to professor questions, the resolution of proposed exercises and activities, and in general any aspect related with the capabilities written in this guide will be evaluated so it can modify the obtain mark.	2
Online forum	A17 A18 A20 B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B19 B13 B14 B15 B16 B17 B18 C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21	The behavior and attention of the student, the active participation, the contributions and questions, the answers to professor questions, the resolution of proposed exercises and activities, and in general any aspect related with the capabilities written in this guide will be evaluated so it can modify the obtain mark.	2

Assessment comments

Sources of information

Basic	- JURADO J. A. (2012). Ejercicios de cálculo de estructuras. ETSICCP de la Universidade da Coruña - JURADO J. A. HERNÁNDEZ S. (2002). Análisis estructural de placas y láminas. Edicions Tórculo - TIMOSHENKO S. (1961). Teoría de la estabilidad elástica. EDIAR Soc. Añón. Editores Tucuman - ODEN J. T. (1967). Mechanics of Elastic Structures. McGraw-Hill - HERNÁNDEZ S. (1996). Análisis lineal y no lineal de estructuras de barras. ETSICCP de la Universidade da Coruña
Complementary	- ALLEN H. G. BALSON P. S (1980). Background to Buckling. Mc. Graw-Hill - ZINGONI A. (1997). Shell Structures in Civil and Mechanical Engineering. Thomas Telford - JAWAD M. H. (1994). Theory and design of plate and shell structures. Chapman & Hall.

Recommendations

Subjects that it is recommended to have taken before

Cálculo infinitesimal I/632G02001
 Cálculo infinitesimal II/632G02002
 Debuxo en enxeñaría civil I/632G02003
 Física aplicada I/632G02004
 Física aplicada II/632G02005
 Álgebra lineal I/632G02007
 Álgebra lineal II/632G02008
 Ecuacións diferenciais/632G02017
 Resistencia de materiais/632G02018

Subjects that are recommended to be taken simultaneously



Mecánica/632G02014

Métodos Numéricos e Programación/632G02023

Historia da Enxeñaría (plan 2010)/632G02036

Ciencia de Materiais (plan 2010)/632G02038

Subjects that continue the syllabus

Estruturas II/632G02025

Formigón Estrutural, Edificación e Prefabricación I/632G02029

Formigón Estrutural, Edificación e Prefabricación II/632G02030

Estruturas Metálicas e Mixtas/632G02031

Other comments

(*)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.