UNIVERSIDADE DA CORUÑA

Teaching Guide					
Identifying Data					2021/22
Subject (*)	Structures 3			Code	630G02028
Study programme	Grao en Estudos de Arquitectura				
Descriptors					
Cycle	Period	Year		Type	Credits
Graduate	2nd four-month period	Third		Obligatory	6
Language	SpanishEnglish				
Teaching method	Face-to-face				
Prerequisites					
Department	Construcións e Estruturas Arquitectónicas, Civís e Aeronáuticas				
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General description	Conception, design and dimensioning of steel structures for buildings				

Contingency plan	Two contingency plans have been designed. SCENARIO 1 A first scenario arises in which, due to the capacity of the classrooms or for other reasons, face-to-face teaching of the lectures (master sessions) is not feasible, both interactive and workshop teaching, since they are groups that can continue to teach in person to fewer students. In this situation, the only planned change affects the teaching methodology used in the lectures that will be held online with the help of the Teams platform included in Office365. There are no changes in the content of the subject, nor in the mechanisms for personalized attention to the student, nor in the evaluation criteria. SCENARIO 2 A second scenario is proposed in which, faced with a possible confinement, no type of face-to-face teaching is feasible. In this case, the expected changes are as follows: 1. Modifications to the contents No changes are made 2. Methodologies * Teaching methodologies that are maintained No one * Teaching methodologies that are modified Lectures, problem solving, workshop, diagramming, mixed test. The impossibility of continuing to use these methodologies in face-to-face format forces us to adopt alternative strategies that facilitate learning regardless of possible contingencies related to the equipment and connection of the students. For this reason, it is decided to provide the necessary documentation through the Moodle platform to continue advancing in the training program, and the rest of the tasks are carried out with the help of the Teams platform included in Office365. 3. Mechanisms for personalized attention to students Moodle, virtual forum. The forum remains open throughout the school period, with teachers responding to possible queries both during the virtual sessions and during the official tutoring hours. Teams, virtual meetings and channels. The communication channels (general and by groups) are kept open so that the student can raise questions. 4. Modificacións na avaliación Mixed tests. Value in the assessment: 70%. To be developed online using Forms or some other institutional tool that facilitates the electronic contribution of answers, images or other types of documents that allow assessing the level of competence acquired by the student in the subject. Workshop. Value in the assessment: 30%. Development of the steel structure project corresponding to the project exercise carried out within the framework of the interdisciplinary workshop of the sixth semester. *Evaluation observations: The indicated assessment criteria are maintained. Students who for justified reasons related to computer or connection equipment, duly accredited, could not take the exams corresponding to the mixed tests online, will have the right to take said mixed tests orally, being an essential requirement to request it by email the same day of the exam, after which they will be called for its completion. 5. Modifications to the bibliography or webgraphy No changes are made

Study programme competences / results	
Code	Study programme competences / results
A12	Ability to conceive, calculate, design, integrate in buildings and urban units and execute building structures (T)
A17	Ability to apply technical and construction standards and regulations
A18	Ability to maintain building structures, foundations and civil works
A63	Development, presentation and public review before a university jury of an original academic work individually elaborated and linked to any of the subjects previously studied
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
B2	Students can apply their knowledge to their work or vocation in a professional way and have competences that can be displayed by means of elaborating and sustaining arguments and solving problems in 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
B4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist public
B5	Students have developed those learning skills necessary to undertake further studies with a high level of autonomy
B6	Knowing the history and theories of architecture and the arts, technologies and human sciences related to architecture
B9	Understanding the problems of the structural design, construction and engineering associated with building design and technical solutions
B11	"Knowing the industries, organizations, regulations and procedures involved in translating design concepts into buildings and integrating plans into planning "
B12	Understanding the relationship between people and buildings and between these and their environment, and the need to relate buildings and the spaces between them according to the needs and human scale
C1	Adequate oral and written expression in the official languages.
C3	Using ICT in working contexts and lifelong learning.
C4	Exercising an open, educated, critical, committed, democratic and caring citizenship, being able to analyse facts, diagnose problems, formulate and implement solutions based on knowledge and solutions for the common good
C5	Understanding the importance of entrepreneurial culture and the useful means for enterprising people.
C6	Critically evaluate the knowledge, technology and information available to solve the problems they must face
C7	Assuming as professionals and citizens the importance of learning throughout life
C8	Valuing the importance of research, innovation and technological development for the socioeconomic and cultural progress of society.

Learning outcomes			
Learning outcomes	Study programme competences / results		
Skills related to the modelling and analysis of structural systems, including the idealization of links, joins, materials and actions.	A12 A17 A18	B2 B3 B4 B5 B11 B12	
Capacities related to the conception and technical development of projects of metallic structures in the field of construction.	A12 A17 A18 A63	B1 B2 B3 B4 B5 B6 B9 B11	C1 C3 C4 C5 C6 C7 C8

Determine the geometric configuration associated with the different constituent elements of a building structure solved with steel pieces, in order to satisfy the necessary limit state conditions	A12 A17 A18	B3 B5 B9	C1 C3 C6 C7 C8
Project joints and construction details in the field of metal building structures	A12 A17 A18	B3 B5 B9	C1 C3 C6 C7 C8
Become familiar with the consultation, interpretation and application of current regulations in the field of metal building structures.	A12 A17 A18	B3 B9	C3 C6 C8
Get started in the use of computer applications for structural analysis, and basic tools related to the implementation of information and communication technologies.	A17 A18		C3 C6 C7 C8
Encourage the development of capacities and attitudes of an autonomous nature (tendency to continuous learning, ability to solve problems effectively, capacities for analysis and synthesis, personal organization and planning, productive information management) or collaborative (effective communication, grounded behaviour in shared responsibilities).		B1 B2 B3 B4 B5 B6 B9 B11	C1 C3 C4 C5 C6 C7 C8

Contents	
Topic	**Sub-topic**
DESIGN OF STEEL STRUCTURES	.
Introduction. The structure in Architecture.	.
Design of light roof structures.	.
Design of framed building structures.	.
Floors and stairs.	.
Solid beams and castellated beams.	.
Trusses and Vierendeel beams.	.
Supports and base plates.	.
Types of joints.	.
DIMENSIONING OF STEEL STRUCTURES	.
Bases of calculation and structural analysis.	.
Resistance of sections.	.
Sizing of compressed parts	.
Sizing of base plates.	.
Dimensioning of full solid beams.	.
Dimensioning of beams with web openings.	.

Planning				
Methodologies / tests	**Competencies / Results**	**Teaching hours (in-person & virtual)**	**Student?s personal work hours**	**Total hours**

Guest lecture / keynote speech	A12 A17 A18 B1 B2 B3 B4 B5 B6 B9 B11 B12 C1 C3 C4 C5 C6 C7 C8	30	25	55
Problem solving	A12 A17 A18 A63 B3 B5 B9 C1 C3 C6 C7 C8	13	36	49
Workshop	A12 A17 A18 A63 B2 B3 B4 B5 B6 B9 B11 C1 C3 C6 C7 C8	12	27	39
Diagramming	B3 B9	0	2	2
Mixed objective/subjective test	A12 A17 A18 B2 B9 B11 C1 C6	4	0	4
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	A relevant fraction of the face-to-face activity uses the lecture method, whose responsibility falls fundamentally on the teaching staff, either orally or with the complement of audio-visual media. However, and regardless of the above, during these sessions the aim is to achieve a certain level of participation by students, enhancing their involvement, encouraging feedback from the process (and therefore the two-way nature of communication), and stimulating the mechanisms of learning through interaction techniques.
Problem solving	There will be practical tests, designed from the contents previously worked on, and which must be solved in a limited time. The progressive nature of such tests obeys criteria of continuous training, so that the conclusions of each phase can serve to redirect the teaching and learning processes conveniently, adapting them to the particularities of the group in order to achieve the intended competencies.
Workshop	The subject participates in the Sixth Semester Workshop, which also integrates Architectural design 5, Construction 4 and Urbanism 3. The workshop is understood as a work space and exchange designed to facilitate the confluence of the contents of the different subjects around the architectural project, and by both are based on multidisciplinary integration on case study resolution.
Diagramming	In the resolution of problems and mixed tests it is intended to use as a support a synoptic document that the student will make throughout the course. Attempts are thus made to reinforce meaningful learning through the structured synthesis of the main contents of the subject. The elaboration is understood progressive, ordering of continuous form concepts and expressions, schematizing processes of analyses, and affecting the deduction of possible relations between the successive subjects of the program.
Mixed objective/subjective test	Written tests are presented as a diagnostic and formative assessment tool. The design adjusts in each statement to the profile of knowledge and abilities that is intended to be valued, focusing on the understanding of the theoretical contents and the skills associated with the analysis and resolution of practical cases.

Personalized attention	
Methodologies	**Description**
Problem solving Workshop	A learning-oriented methodology requires consideration of the singularities that distance some students from others within the same group, in terms of prior training, possible deficiencies, attitudes and aptitudes, expectations and motivations. Given the progressive nature of the subject, it is advisable to resolve all possible doubts as they arise, as soon as possible and making use of the corresponding tutorials. This issue is intensified, if possible, in the development of the projects proposed at workshop level, whose methodology only makes sense if there is regular and daily contact with teachers in order to optimize and, where appropriate, redirect ongoing activities.

Assessment			
Methodologies	Competencies / Results	Description	**Qualification**
Workshop	A12 A17 A18 A63 B2 B3 B4 B5 B6 B9 B11 C1 C3 C6 C7 C8	The results obtained in the workshop will be valued taking into account their follow-up by the student, the complexity of the structural solution, its adequacy to the architectural proposal, as well as its development both in terms of calculation and graphic representation.	30
Mixed objective/subjective test	A12 A17 A18 B2 B9 B11 C1 C6	These tests will include the resolution of theoretical-practical exercises and the development of certain aspects related to the design of building structures.	70

Assessment comments

Assessment, as a system for gathering information aimed at issuing value judgments (and where appropriate merit) on the learning process, requires continuous development with constant student involvement. With this premise, student attendance and participation are understood to be fundamental, so that an unjustified and repetitive absence can adversely affect the grade obtained per course, in a similar proportion as a lack of participation or a negative attitude. The correction criteria include not only the accuracy of the results, but also the clarity of the presentation, the structuring of the analysis carried out, the use of units, the correct application of the normative criteria, and the terminology used, as well as the resolution, detail and graphic quality of the representation of the structure, in general, and of the different elements that compose it, in particular.

The continuous evaluation system (1ª opportunity) is configured with:

· A mixed test (theoretical-practical exam) that corresponds to the contents of the first part of the subject (A. Design of steel structures). This test will be carried out during the development of the course on the date that is established in due
course.

· A mixed test (theoretical-practical exam) that corresponds to the contents of the second part of the subject (B. Dimensioning of steel structures). This test will be
held on the date set by the ETSAC for the first opportunity exam.

· Workshop practice.

In order to pass the subject per course (1ª opportunity) it is necessary to satisfy the following requirements:

. A minimum attendance of 80% to both lectures and interactive and workshop classes.

. Get a minimum grade of 3 out of 10 in each of the two mixed tests.

. Obtain a minimum grade in the workshop of 3 out of 10 and make the partial deliveries established for the purpose.

. Obtain a final grade per course of 5 out of 10. In the final grade the first mixed test represents 30%, the second mixed test 40% and the workshop grade 30%.

In the event that some deliveries or established tests are not made, the grade will be non-presented. All of them are met, but they do not meet any two requirements, the qualification will correspond to the numerical value obtained with the previous percentages without ever exceeding 4.0. Students who do not pass a subject per course (1st opportunity) will be able to present themselves for their second opportunity assessment (july).

The test corresponding to the 2ª opportunity and the advance call will consist of a first theoretical part that will compute 30% in the final qualification, a second part of resolution of practical exercises, that will compute 40%, and a practical third part of resolution of a structure, that will compute the remaining 30%. On the date established for this purpose, students who have followed the course may dispense with the third part of the exam

(resolution of a structure) as long as they have reached the minimum grade of 3 out of 10 in the tall, in which case adopting the grade obtained.

To pass the subject in the second opportunity, identical minimum qualification requirements of each of the parts of the test indicated for the 1st opportunity will be applied.

Students who have passed the subject of Architectural Design 5 in order to pass Structures 3 per course(1ª opportunity) will be subject to the same conditions described above.

Students who prove partial enrolment will be subject to the same conditions as those described for the rest of the students, with the sole exception that they will not be required to attend a minimum of lectures (expository teaching).

Pursuant to article 14 of the RULES OF EVALUATION, REVIEW AND CLAIM OF THE QUALIFICATIONS OF TWO UNDERGRADUATE STUDIES AND MASTER'S DEGREE of the UDC, if fraud commission is detected in the evaluation tests the student will obtain in both opportunities of the subject a qualification equal to 0.

This Teaching Guide is written in Spanish, Galician and English. All language versions are considered to be equally authentic. In the event of any discrepancy between the three aforementioned versions, the Spanish version shall prevail in determining the spirit, intent and meaning of this Guide.

Sources of information	
Basic	
Complementary	SEGUIMIENTO DE LA MATERIAEstructuras de acero. Proyecto y representaciónEstévez, J. et alReprografía Noroeste2017Estructuras de acero. Ejercicios y taller de estructuraEstévez, J. et alReprografía Noroeste2017NORMATIVACódigo Técnico de la Edificación. Documento Básico SE-ASeguridad estructural. Acero2008https://www.codigotecnico.org/index.php/menu-seguridad-estructural.htmlDISEÑO ESTRUCTURALSistemas de estructurasEngel, H.Gustavo Gili2018Estructuras para arquitectosSalvadori, M.; Heller, R.CP671987Estructuras o por qué las cosas no se caenGordon, J.E.Calamar2004Estructuras o por qué las cosas no se caenGordon, J.E.Celeste1999Razón y ser de los tipos estructuralesTorroja, E.Colegio de Ingenieros de Caminos, Canales y Puertos de Madrid2007Razón y ser de los tipos estructuralesTorroja, E.Instituto de Ciencias de la Construcción Eduardo Torroja2000TIPOLOGÍASEstructuras de acero en edificaciónHurtado, C. et alApta2008Naves industriales con aceroArnedo, A.Apta2009PROYECTOSConstruir con acero. Arquitectura en EspañaAraujo, R.; Seco, E.Ensidesa1994Construir con acero. Arquitectura en España. 1993-2007Araujo, R.; Seco, E.Apta2009ANÁLISIS Y CÁLCULOEstructuras de acero. Fundamento y cálculo según CTE, EAE y EC3Argüelles, R. et alBellisco2013Estructuras de acero 2. Uniones y sistemas estructuralesArgüelles, R. et alBellisco2007PRONTUARIOSProntuario EnsidesaTomo 0*Bases de cálculo. Dimensionamiento de elementos estructuralesTomo 2Acero para estructuras de edificación. Valores estáticos. Elementos estrucuralesEnsidesa1990Prontuario de estructuras metálicasRodríguez-Borlado, R. et alCedex2002CONSULTA Y AMPLIACIÓNLa estructura metálica hoyTomo 1. Volúmenes 1 y 2. Teoría y prácticaTomo 2. Volumen 1. Proyectos. Texto y tablasTomo 2. Volumen 2. Proyecto. PlanosArgüelles, R.Bellisco2010Estructuras metálicas para edificación. Adaptado al CTEMonfort, J.Universidad Politécnica de Valencia2008Problemas de estructuras metálicas adaptados al código técnicoMonfort, J. et alUniversidad Politécnica de Valencia2008Curso de estructuras metálicas de acero laminadoRodríguez, L.F.Colegio Oficial de Arquitectos de Madrid1983Vigas alveoladasEstévez, J. et alBellisco2000CYPE 3DManual imprescindible CYPE 3D. Diseño y cálculo de estructuras metálicasReyes, A.M.Anaya Multimedia2015BIBLIOGRAFÍA EN INGLÉSThe behaviour and design of steel structures to EC3Trahair, N.S. et alTaylor&Francis2008Structures by designWhitehead, R.Routledge2020

Recommendations
Subjects that it is recommended to have taken before
Structures 1/630G02019 Structures 2/630G02023
Subjects that are recommended to be taken simultaneously
Construction 4/630G02027 Architectural Design 5/630G02021 Urbanism 3/630G02029
Subjects that continue the syllabus
Structures 4/630G02034
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.