Teaching Guide				
Identifying Data				2023/24
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			
Coordinador	Estévez Cimadevila, Francisco Javier	E-mail	javier.estevezc@udc.es	
Lecturers	Estévez Cimadevila, Francisco Javier Freire Tellado, Manuel Jose Martín Gutiérrez, Emilio Otero Chans, M. Dolores	E-mail	javier.estevezc@udc.es manuel.freire.tellado@udc.es emilio.martin@udc.es dolores.otero.chans@udc.es	
Web	campusvirtual.udc.gal - dea.home.blog			
General description	The subject addresses, in a first part, the concept and design of steel structures, including the two fundamental types: light roof structures and framed building structures. This first part focuses on the design and pre-dimensioning of all the members composing each structural type. In the second part of the subject, the structural analysis and dimensioning of said elements are delved into.			

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
Introduction. The structure in Architecture.	.

DESIGN OF STEEL STRUCTURES	.
Design of light roof structures.	.
Design of framed building structures.	.
Supports and base plates.	.
Solid-web beams and castellated beams.	.
Trusses and Vierendeel beams.	.
Types of joints.	.
DIMENSIONING OF STEEL STRUCTURES	.
Bases of calculation and structural analysis.	.
Resistance of sections.	.
Sizing of compression members.	.
Sizing of base plates.	.
Dimensioning of solid-web 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. 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 design, 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 collecting information aimed at issuing valuejudgments (and, where appropriate, merit) about the learning process, requirescontinuous development with constant student involvement. With this premise,the attendance and participation of the student are understood as fundamental,so that an unjustified and repetitive absence can have an unfavorable impact onthe grade obtained for the course, in a similar proportion as a lack ofparticipation or a negative attitude. The correction criteria include not onlythe accuracy of the results, but also the clarity of the presentation, thestructuring of the analysis carried out, the use of units, the correctapplication of the normative criteria, and the terminology used, as well as theresolution, 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 is established in the following terms:

EVALUATION BY COURSE

It consists of:

A mixed test (theoretical-practical exam) corresponding to thecontents of the first part of the subject (A. Design of steel structures). This test will be carried out during the development of the term on a date to be determine for the pourpose.A mixed test (theoretical-practical exam) that corresponds to thecontents of the second part of the subject (B. Dimensioning of steelstructures). This test will be carried out during the development of the term on a date to be determine for the pourpose.Workshop practice. In order to pass the subject by continuos assessment, the following requirements must be met:

A minimum attendance of 80% in both the lectures and interactive classes and workshops.Obtain 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 have made the partial deliveries established for this purpose.Obtain a final grade for the course of 5 out of 10. In the final grade, the first mixed test represents 30%, the second mixed test 40% and the workshop mark 30%.The same conditions described above will apply to students who have passed Architectural design 5 in order to pass Structures 3 by continuous assessment.

Students who accredit partial enrollment 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 minimum lectures (expository teaching).

Students who have not passed the subject by continuous assessment may take the exam on the first and second opportunities.

EVALUATION IN FIRST AND SECOND OPPORTUNITY AND ADVANCE OPPORTUNITY

The tests corresponding to the first and second opportunity, as well as to the advanced opportunity, will consist of a first theoretical part that will compute 30% in the final grade, a second part of resolution of practical exercises, which will compute 40%, and a third practical part of solving a structure, which 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) provided that they have achieved the minimum grade of 3 out of 10 in the workshop, adopting in such a case the qualification obtained in the workshop instead of taking the third part of the exam.

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

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 Multimedia2015ENGLISH REFERENCESThe behaviour and design of steel structures to EC3Trahair, N.S. et al Taylor&Francis2008Designers' Guide to Eurocode 3: Design of Steel BuildingsGardner, L.& Nethercot, D.A.ICE Publishing2011 (2nd edition)Building with steel. Detail. Principles. Examples.Reichel, A. et alEdition Detail book2007Structures 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.