Teaching Guide				
Identifying Data				2024/25
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	Martín Gutiérrez, Emilio	E-mail	emilio.martin@udc.es	
Lecturers	De la Rosa García, María del Pilar Martín Gutiérrez, Emilio Otero Chans, M. Dolores	E-mail	pilar.delarosa@udc.es emilio.martin@udc.es dolores.otero.chans@udc.es	
Web	campusvirtual.udc.gal - dea.home.blog			
General description	Structures 3 is a compulsory subject in the 3rd year (6th semester) of the Degree in Architecture Studies. It aims to provide adequate training in the field of the design of steel building structures. Part of it takes the form of an interdisciplinary workshop, in the framework of which a project is developed taking into consideration the different approaches and skills promoted from the different areas that comprise it.			

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 light roof structures	Nomenclature Main frames End frames Roof purlins and wall girts Stability Graphic representation
Design of portal frame building structures	Systems with direct load paths Systems with indirect load paths Suspended systems Stability Floor systems Stairs Graphical representation
Joint design	Classification by strength Stiffness classification Bolted joints Dowel pins Welded joints Design details
Basis of design	Materials Structural safety Resistance of cross-sections Calculation of internal forces Cross-section classification Behavioral models Initial imperfections Global lateral stability Deformation estimation
Strength of cross-sections	Tension Compression Shear Bending Torsion Combined forces
Compressed parts	General concepts Theoretical fundamentals European buckling curves Sizing of simple parts Design of built-up columns
Solid-web beams	General concepts Lateral buckling Web buckling Combined bi-axial bending and axial force Plated beams Variable depth beams Beams reinforced with plates Composite beams

Castellated beams	General concepts Modeling Tee dimensioning Post dimensioning Calculation of deflection
Triangulated beams and Vierendeel beams	Types and classification Trusses Vierendeel beams
Support bases	General concepts Pinned supports with tensile axial force Base plates with combined bending and compression

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.	20
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.	80

Assessment comments

Assessment,
as a system for collecting information aimed at issuing value judgements (and, where appropriate, merit) on the learning process, requires continuous development with constant student involvement. With this premise, student attendance and participation are considered fundamental, in such a way that an unjustified and repeated absence may have an unfavourable effect on the grade obtained per course, in a similar proportion to 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 structure 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 of which it is composed, in particular.
The
continuous assessment system is configured with mixed tests (theoretical-practical exam) to be carried out during the teaching period, and workshop practice, with each of these items representing the aforementioned percentage of the overall grade.
In
order to pass the course, the following requirements must be met:
?
To
have handed in the student form correctly by the stipulated deadline.
?
Attendance
of no less than 80%, applicable to each of the categories of face-to-face classes (expository, interactive and workshop). This condition will not be required for students enrolled part-time or with academic dispensation, except for the workshop follow-up.
?
Obtain
a minimum mark of 4 out of 10 in each of the two mixed tests.
?
Obtain
a minimum mark of 3 out of 10 in the workshop exercise, and have completed the partial deliveries established for this purpose. It should be noted that the workshop qualification requires continuous monitoring of its development, so that, if this is insufficient, the exercise will be graded with a 0. The conditions for the workshop exercise will be identical regardless of whether or not the student has previously passed Projects 5.
?
Obtain
a final course grade of at least 5 out of 10.
Students
who do not pass the course must present themselves in any of the two official opportunities of the same course. In both opportunities the grade obtained in the workshop will be kept, since the delivery of this exercise is unique, on the date defined for this purpose.
In
accordance with article 14 of the Rules for assessment, review and claims of

grades for Bachelor's and Master's degree courses, any finding of plagiarism, fraud, or relevant non-compliance with the conditions established for the development of deliveries and/or exams, will result in a grade of failure (0), of the disciplinary responsibilities that may arise after the corresponding procedure.

Sources of information	
Basic	Proyecto de estructuras de acero. Martín, E.; Otero, D. Reprografía Noroeste. 2023.Estructuras de acero. Ejercicios y taller de estructura. Estévez, J. et al. Reprografía Noroeste. 2017.NORMATIVACódigo Técnico de la Edificación. Documento Básico SE-A. Seguridad estructural. Acero. Ministerio de la Vivienda. 2008.Código Estructural. Volumen IV. Dimensionamiento y comprobación de estructuras de acero. Ministerio de la Presidencia, Relaciones con las Cortes y Memoria Democrática. 2021.
Complementary	DISEÑOSistemas de estructuras. Engel, H. Gustavo Gili. 2018.Estructuras para arquitectos. Salvadori, M.; Heller, R.CP67. 1987.Estructuras o por qué las cosas no se caen. Gordon, J.E. Calamar. 2004.Razón y ser de los tipos estructurales. Torroja, E. Instituto de Ciencias de la Construcción Eduardo Torroja. 2000.TIPOLOGÍASEstructuras de acero en edificación. Hurtado, C. et al. Apta. 2008.Naves industriales con acero. Arnedo, A. Apta. 2009.PROYECTOSConstruir con acero. Arquitectura en España. Araujo ,R.; Seco, E. Ensidesa. 1994.Construir con acero. Arquitectura en España. 1993-2007. Araujo, R.; Seco, E. Apta. 2009.ANÁLISIS Y CÁLCULOEstructuras de acero. Fundamento y cálculo según CTE, EAE y EC3. Argüelles, R. et al. Bellisco. 2013.Estructuras de acero 2. Uniones y sistemas estructurales. Argüelles, R. et al. Bellisco. 2007.PRONTUARIOSProntuario Ensidesa. Tomo 0* Bases de cálculo.Dimensionamiento de elementos estructurales. Tomo 2 Acero para estructuras de edificación. Valores estáticos. Elementos estructurales. Ensidesa. 1990.Prontuario de estructuras metálicas. Rodríguez-Borlado, R. et al. Cedex. 2002.CONSULTA Y AMPLIACIÓNLa estructura metálica hoy. Tomo 1. Volúmenes 1 y 2.Teoría y práctica. Tomo 2. Volumen 1. Proyectos. Texto y tablas. Tomo 2.Volumen 2. Proyecto. Planos. Argüelles, R. Bellisco. 2010.Estructuras metálicas para edificación. Adaptado al CTE. Monfort, J. Universidad Politécnica de Valencia. 2008.Problemas de estructuras metálicas adaptados al código técnico. Monfort, J. et al. Universidad Politécnica de Valencia. 2008.Curso de estructuras metálicas de acero laminado.Rodríguez, L.F. Colegio Oficial de Arquitectos de Madrid. 1983.Vigas alveoladas. Estévez, J. et al. Bellisco. 2000.CYPE 3DCype 3D 2016. Diseño y cálculo de estructuras metálicas. Reyes, A.M. Anaya Multimedia. 2015.

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.