Teaching Guide				
Identifying Data				2023/24
Subject (*)	Design and Product Development		Code	731550001
Study programme	Máster Universitario en Fabricación Aditiva			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	1st four-month period	First	Obligatory	6
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Enxeñaría CivilEnxeñaría Naval e IndustrialMatemáticas			
Coordinador	Gutierrez Fernandez, Ruth Maria	E-mail	ruth.gutierrez@udc.es	
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Web				
General description				

Study programme competences / results	
Code	Study programme competences / results
A6	RA6. Perform simulation and modelling processes for 3D design and prototyping of materials, as well as for the simulation of structures and manufacturing processes.
A10	RA10. Make adaptations to the object design taking into account the printing method used and the corresponding safety, efficiency and sustainability criteria.
B9	RA21. Apply reverse engineering techniques to reproduce elements by means of 3D printing.
C7	RA28. Design and redefine objects using parametric design tools for 3D printing.

Learning outcomes			
Learning outcomes	Study programme competences / results		
RA6. Perform simulation and modeling for 3D design and prototyping of materials, as well as for the simulation of structures and manufacturing processes.	AJ6		
RA10. Make adaptations of the object design taking into account the printing method used and the corresponding safety, efficiency and sustainability criteria.	AJ10		
RA21. Apply reverse engineering techniques to reproduce elements by 3D printing.		BJ9	
RA28. Design and redefine objects using parametric design tools for 3D printing.			CJ7

Contents	
Topic	Sub-topic
1. DESIGN AND PRODUCT.	1.1. PROJECT SPECIFICATIONS. 1.2. INFORMATION PHASE. 1.3. CONCEPTUALIZATION PHASE. 1.4. DEVELOPMENT PHASE. 1.5. FINAL PHASE. 1.6. DOCUMENTATION. 1.7. PRESENTATION. 1.8. DRAWINGS.

2. GEOMETRIES IN ADDITIVE MANUFACTURING	2.1. Capture of geometries 2.2. Geometry manipulation. 2.3. CAD. Parametric and non-parametric modeling. 2.4. Export and exchange between CAD and CAM 2.5. CAM. Geometry lamination
3. STRUCTURAL ANALYSIS IN FA	3.1 General formulation of the finite element method. 3.2 Finite element modeling. Finite element families. Continuous and structural elements. Materials and mechanical properties. Assembly. Imposition of constraints. Interactions. 3.2 Finite element simulation. Imposition of loads and boundary conditions. Problem solving and evaluation of results.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Laboratory practice	A6 A10 B9 C7	15	15	30
Case study	A6 A10 B9 C7	1.5	2.7	4.2
Supervised projects	A6 A10 B9 C7	3.7	30.3	34
Objective test	A6 A10 B9 C7	1.5	2.7	4.2
Guest lecture / keynote speech	A6 A10 B9 C7	27.4	48.6	76
Personalized attention		1.6	0	1.6
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Laboratory practice	Methodology that allows students to learn effectively through practical activities such as demonstrations, exercises, experiments and research.
Case study	Group work technique that has as its purpose the intensive study of a subject. It is characterized by discussion, participation, elaboration of documents and conclusions to be reached by all the components of the seminar.
Supervised projects	Methodology designed to promote the autonomous learning of students, under the supervision of the professor and in various scenarios (academic and professional). It is primarily referred to the learning of "how to do things". It is an option based on the assumption by students of responsibility for their own learning. This teaching system is based on two basic elements: independent learning by students and monitoring of this learning by the teacher-tutor.
Objective test	Test based on the formulation of questions, with the objective of evaluating the knowledge, abilities and skills acquired in the subject through the answers.
Guest lecture / keynote speech	Oral exposition complemented with the use of audiovisual media and the introduction of some questions addressed to the students, with the aim of transmitting knowledge and facilitating learning.

Personalized attention	
Methodologies	Description
Supervised projects Laboratory practice Case study	The student goes to the professor or professors of the subject to consult the doubts that arise during the realization of the laboratory practices and tutored work. In addition, through this personalized attention, the student's work process is monitored and critically oriented.

Assessment			
Methodologies	Competencies / Results	Description	**Qualification**

Supervised projects	A6 A10 B9 C7	The follow-up of the realization of the work is done in the practical sessions. The evaluation is done through the presentation of the tutored work.	30
Objective test	A6 A10 B9 C7	Test based on questions and answers structured in different parts.	30
Laboratory practice	A6 A10 B9 C7	It is necessary to attend systematically to the practices and to elaborate them during the practical sessions of the subject and in the assigned non face-to-face hours. The follow-up of the work is done in these practical sessions. The evaluation is done through the presentation of the internship reports.	40

Assessment comments
The course is designed to systematically attend the face-to-face sessions and develop the proposed teaching activities, with a follow-up and/or evaluation of the same in these practical sessions. The evaluation criteria for the second opportunity will be the same as those of the first opportunity, except for the tutored work, which will be evaluated only in the first opportunity, maintaining that qualification for the second opportunity, in the case of having to attend this one. The academic waiver is accepted. This student, whose presence throughout the term is insufficient to perform the work or the follow-up of the work, will be evaluated with the same criteria as those of the second opportunity. The evaluation criteria for the early December call will be the same as those of the second opportunity of the previous year. The proven fraud in any work activity, test or evaluation will result in a failing grade of "0" in the work activity, test or evaluation in question. The course is designed to systematically attend the face-to-face sessions and develop the proposed teaching activities, with a follow-up and/or evaluation of the same in these practical sessions. The special situations of students who, with recognition of part-time dedication and academic dispensation of exemption from attendance or for other duly justified reasons, cannot take the subject in person, must be communicated at the beginning of the term and adequately justified. The appropriate instructions will be given so that the student can follow the subject without problems, following up the teaching activities in tutorials. The evaluation criteria for the second opportunity will be the same as those of the first opportunity, except for the tutored work, which will be evaluated only in the first opportunity, maintaining that qualification for the second opportunity, in the case of having to attend this one. The evaluation criteria for the December advanced call will be the same as those for the second opportunity of the previous year. The fraudulent performance of tests or evaluation activities, once verified, will directly imply the qualification of failure in the call in which it is committed: the student will be graded with "suspense" (numerical grade 0) in the corresponding call of the academic year, whether the commission of the fault occurs in the first opportunity as in the second. For this, the student's grade will be modified in the first opportunity report, if necessary.

Sources of information	
Basic	- R. Gutiérrez, E. Bayo, A. Loureiro, LE Romera (2010). Estructuras II. Reprografía del Noroeste. Santiago de Compostela - Bathe K.J. (2006). Finite Elements Procedures. Prentice-Hall, Pearson Education, Inc. USA - Dassault Systèmes Simulia Corp. (2014). Abaqus 2014 documentation . © Dassault Systèmes. Providence, RI, USA. - Liou, Frank W. (2019). Rapid prototyping and engineering applications: a toolbox for prototype development. CRC Press - Cooper, Kenneth G. (2001). Rapid prototyping technology selection and application. CRC Press - Gebhardt, Andreas (2003). Rapid prototyping. Hanser Publishers - Chee Kai Chua y Kah Fai Leong (2017). rapid prototyping principles and applications. World Scientific - (). http://reprap.org. - Munari, Bruno (2016). Cómo nacen los objetos. Editorial GG - Gustavo Gili - Wong, Wucius (1995). Fundamentos del diseño. Editorial GG - Gustavo Gili - Powell, Dick (1986). Técnicas de Presentación. Editorial Blume - Shen, Janet & Walker, Theodore D (1992). Sketching and rendering for design presentations. Van Nostrand Reinhold
Complementary	- Eugenio Oñate (1995). Calculo de estructuras por el método de elementos finitos. CIMNE,Barcelona, España - (). Rapid Prototyping Journal. Emerald

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Advance Design for 3D Printing/731550010
Other comments
Recommendations on sustainability and the environment-Students will be taught the importance of ethical principles related to the values of sustainability so that they can apply them not only in the classroom, but also in their personal and professional behaviour.-To help achieve an immediate sustainable environment and meet the objective of action number 5: "Healthy, environmentally and socially sustainable teaching and research" of the "Green Campus Ferrol Action Plan":-The delivery of the documentary work carried out in this subject :It will be requested in digital format and/or in computer support.It will be done through Moodle, in digital format without the need to print it.If it is necessary to do them on paper:No plastics will be usedDouble-sided printing will be used.Recycled paper should be used.Drafts should not be printed.Sustainable use of resources and prevention of negative impacts on the natural environment should be made.Recommendations on Gender Equality and respect for diversityAccording to the different regulations applicable to university teaching, the gender perspective must be incorporated in this subject (non-sexist language will be used, bibliography of authors of both sexes will be used, the intervention of male and female students in class will be encouraged...).-We will work to identify and modify sexist prejudices and attitudes, and we will influence the environment to modify them and promote values of respect and equality.-Situations of gender discrimination will be detected and actions and measures to correct them will be proposed.The full integration of students who, for physical, sensory, mental or socio-cultural reasons, experience difficulties in gaining suitable, equal and beneficial access to university life will be facilitated.