Teaching Guide				
Identifying Data				2023/24
Subject (*)	Applications in Energy and Enviromental Sustentability		Code	731550009
Study programme	Máster Universitario en Fabricación Aditiva			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Optional	6
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Enxeñaría Naval e IndustrialFísica e Ciencias da Terra			
Coordinador	Tobar Vidal, María José	E-mail	maria.jose.tobar@udc.es	
Lecturers	Abad López, María José Amado Paz, José Manuel Tobar Vidal, María José	E-mail	maria.jose.abad@udc.es jose.amado.paz@udc.es maria.jose.tobar@udc.es	
Web				
General description	This course addresses the use of recycled polymers and polymeric biocomposites in additive manufacturing, with the aim of reducing dependence on virgin resources and promoting the generation of more sustainable applications. Additionally, the potential of functional polymers will be explored to improve energy efficiency and develop innovative solutions. Furthermore, improvements in efficiency and sustainability in energy generation through additive manufacturing with metals will be studied, providing knowledge about their applications in turbines, generators, and energy storage systems, among others.			

Study programme competences / results	
Code	Study programme competences / results
A9	RA9. Define the 3D printing method taking into account the characteristics of the object to be produced.
A11	RA11. Recognise the possibilities of additive manufacturing compared to traditional manufacturing.
B1	RA12. Knowing and applying characterisation and analysis techniques of materials (metals, ceramics, composites, polymers...) in order to understand their properties and identify potential uses.
B4	RA15. Select materials for specific manufacturing applications based on the specifications of the additive manufacturing tools and printers to be used, as well as the different types of existing modelling.
B6	RA18. Analyse the characteristics of the objects to be produced in order to select the most suitable printing method.
B8	RA20. Repair high added value parts and produce replacement parts through the use of additive manufacturing tools and technologies.

Learning outcomes			
Learning outcomes	Study programme competences / results		
Define the 3D printing method taking into account the characteristics of the object to be produced.	AJ9		
Recognise the possibilities of additive manufacturing compared to traditional manufacturing.	AJ11		
Knowing and applying characterisation and analysis techniques of materials (metals, ceramics, composites, polymers...) in order to understand their properties and identify potential uses.		BJ1	
Repair high added value parts and produce replacement parts through the use of additive manufacturing tools and technologies.		BJ8	
Analyse the characteristics of the objects to be produced in order to select the most suitable printing method.		BJ6	
Repair high added value parts and produce replacement parts through the use of additive manufacturing tools and technologies.		BJ8	
Select materials for specific manufacturing applications based on the specifications of the additive manufacturing tools and printers to be used, as well as the different types of existing modelling.		BJ4	

Contents	
Topic	Sub-topic
Metallic alloys in propulsion and generation of energy	.
Application of the technologies L-DED and L-PBF in the manufacture and repair of metallic parts	Experience with a L-DED system and high performance alloys. Additive manufacturing standards
Recycled polymers and polymeric biocomposites for more sustainable energy applications.	.
Functional polymers for energy applications	.
Fabricación multimaterial.	.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A9 A11 B1 B4 B6 B8	16	40	56
Laboratory practice	A9 B1 B4 B6 B8	25	25	50
Supervised projects	A9 A11 B1 B4 B6 B8	6	31.2	37.2
Oral presentation	A9 A11 B1 B4 B6 B8	0.5	3.3	3.8
Directed discussion	A9 A11 B1 B4 B6 B8	1	0	1
Personalized attention		2	0	2
(*)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	In the lecture session, the main concepts of each topic that makes up the subject will be presented in the classroom. They will be supported by available technical resources such as PowerPoint presentations, videos, etc.
Laboratory practice	The majority of interactive teaching will take place during laboratory practices. In these practices, students, divided into small groups, will observe the application of the main theoretical concepts reviewed in the previous class. These classes may include interactive videos, where they will work on the content, processing exercises, conferences, etc.
Supervised projects	As part of the course, students will complete one or two supervised assignments. The idea is for students to apply the concepts learned in the subject in a practical real-world scenario, learn to consult specialized bibliographic sources, work in groups, use technical and inclusive language, etc.
Oral presentation	Students will give a brief oral presentation to the rest of the class.
Directed discussion	The debate will begin with an opening by the professor, followed by a question and answer session related to the topic presented

Personalized attention	
Methodologies	Description
Supervised projects Laboratory practice	Guidance in the development of individual/group work.

Assessment			
Methodologies	Competencies / Results	Description	**Qualification**
Supervised projects	A9 A11 B1 B4 B6 B8	The quality of the presented report will be assessed.	40
Oral presentation	A9 A11 B1 B4 B6 B8	During the presentation, they will demonstrate the knowledge they have acquired and their communication skills by explaining the relevant aspects of their work in a clear and concise manner.	30

Directed discussion	A9 A11 B1 B4 B6 B8	Related questions will be asked on the topic, to which they must respond accurately and substantiated, demonstrating their deep understanding of the subject and their ability to apply the concepts learned	30

Assessment comments
In case the student commits an infraction in the subject (according to the Student Disciplinary Regulations): the student will be graded with a "fail" (numerical grade 0) in the corresponding exam session, whether the infraction is committed at the first or second opportunity. For this, the student's grade will be modified in the first opportunity report, if necessary.The special situations of students who cannot take the course in person or with recognition of part-time dedication and academic dispensation of exemption from attendance, must be communicated to the teacher at the beginning of the term and adequately justified. The lecturer will give the appropriate instructions so that the student can follow the course without any problems.The evaluation criteria will be identical in the two opportunities of the call (January and July) and in the extraordinary call (December call).

Sources of information	
Basic	- Peyre, Patrice, and Eric Charkaluk (2022). Additive Manufacturing of Metal Alloys 1: Processes, Raw Materials and Numerical Simulation.. Newark: John Wiley & Sons, Incorporated, - Sarker, Dyuti et al, (2021). Metal Additive Manufacturing. Newark: John Wiley & Sons, Incorporated - Brandt, Milan (2017). Laser Additive Manufacturing: Materials, Design, Technologies, and Applications. Ed. Milan Brandt. Amsterdam: Elsevier - Froes, Francis, and Rodney Boyer (2019). Additive Manufacturing for the Aerospace Industry. Ed. Francis Froes and Rodney Boyer.: Elsevier - Bandyopadhyay, Amit, and Susmita Bose (2020). Additive Manufacturing. 2nd ed. Boca Ratón:CRC Press - Marlene G. Rosato, Dominick V. Rosato (2001). Plastics Design Handbook. ato Ed. Kluwer Academic Publishers - Peter C. Powel (1983). Engineering with Polymers. Ed. Chapman and Hall,
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
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.