Teaching Guide				
Identifying Data				2021/22
Subject (*)	Surface Treatments		Code	730497231
Study programme	Mestrado Universitario en Enxeñaría Industrial (plan 2018)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	1st four-month period	Second	Optional	3
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Enxeñaría Naval e Industrial			
Coordinador	Amado Paz, José Manuel	E-mail	jose.amado.paz@udc.es	
Lecturers	Amado Paz, José Manuel Tobar Vidal, María José	E-mail	jose.amado.paz@udc.es maria.jose.tobar@udc.es	
Web				
General description	Study of processes, materials and technologies for surface modification of materials.			
Contingency plan	1. Modifications to the contents The contents will be the same. 2. Methodologies *Teaching methodologies that are maintained The same methodologies are maintained, except that it would not be possible to carry out laboratory practices and teaching would become online. *Teaching methodologies that are modified 3. Mechanisms for personalized attention to students Moodle and Teams. 4. Modifications in the evaluation Supervised jobs 80% Objective test 20%. *Evaluation observations: The evaluation will be done in the same way as indicated in the teaching guide except that the exam will be done online and there will be no practice. 5. Modifications to the bibliography or webgraphy			

Study programme competences / results	
Code	Study programme competences / results
B1	CB6 - Possess and understand knowledge that provides a basis or opportunity to be original in the development and / or application of ideas, often in a research context.
B2	CB7 - That students know how to apply the knowledge acquired and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of ??study.
B3	CB8 - That students are able to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of their knowledge and judgments.
B4	CB9 - That the students know how to communicate their conclusions -and the knowledge and ultimate reasons that sustain them- to specialized and non-specialized audiences in a clear and unambiguous way.
B5	CB10 - That students have the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous.

B6	G1 - Have adequate knowledge of the scientific and technological aspects in Industrial Engineering.
B13	G8 - Apply the knowledge acquired and solve problems in new or unfamiliar environments within broader and multidisciplinary contexts.
B14	G9 - Be able to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of their knowledge and judgments.
B15	G10 - Knowing how to communicate the conclusions -and the knowledge and ultimate reasons that sustain them- to specialized and non-specialized publics in a clear and unambiguous way.
B16	G11 - Possess the learning skills that allow to continue studying in a self-directed or autonomous way.
C1	ABET (a) - An ability to apply knowledge of mathematics, science, and engineering.
C2	ABET (b) - An ability to design and conduct experiments, as well as to analyze and interpret data.
C3	ABET (c) - An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
C6	ABET (f) - An understanding of professional and ethical responsibility.
C7	ABET (g) - An ability to communicate effectively.
C8	ABET (h) - The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
C9	ABET (i) - A recognition of the need for, and an ability to engage in life-long learning.
C11	ABET (k) - An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Learning outcomes			
Learning outcomes	Study programme competences / results		
Know in a generic way the characteristics and applications of the different surface modification techniques.		BJ1 BJ2 BJ3 BJ4 BJ5 BJ6 BJ13 BJ14 BJ15 BJ16	CJ2 CJ3 CJ6 CJ7 CJ8 CJ9 CJ11
To know in a specific way the technologies of deposition of protective coatings in metallic materials.		BJ1 BJ2 BJ3 BJ4 BJ5 BJ6 BJ13 BJ14 BJ15 BJ16	CJ1 CJ2 CJ3 CJ6 CJ7 CJ8 CJ9 CJ11

Seleccionar las aleaciones más idóneas en función de sus propiedades funcionales.		BJ1 BJ2 BJ3 BJ4 BJ5 BJ13 BJ14 BJ15 BJ16	CJ1 CJ2 CJ3 CJ6 CJ7 CJ8 CJ9 CJ11

Contents	
Topic	**Sub-topic**
The following chapters and topics develop the contents established in the Verification Report.	Surface modification techniques. Protective coatings: superalloys, light alloys, advanced materials. Micromachining. Biocompatibility.
Coatings and alloys.	Superalloys. Light alloys. Advanced materials.
Surface modification techniques.	Surface hardening. Mechanical processes. Thermal spray technologies. Diffusion and implantation of ions. Physical deposition. Chemical deposition. Electrochemical processes. Liquid coatings.
Laser processing.	Laser cladding. Micromachining and texturing. Cleaning.
Biocompatibility.	Introduction to biocompatibility. Biocompatible materials.

Planning				
Methodologies / tests	**Competencies / Results**	**Teaching hours (in-person & virtual)**	**Student?s personal work hours**	**Total hours**
Guest lecture / keynote speech	B1 B13 B14 B16 B6 C1 C2 C6 C11	14	28	42
Laboratory practice	B1 B2 B3 B5 B13 B14 B6 C3	5	11	16
Supervised projects	B1 B2 B3 B4 B5 B13 B15 B14 B16 C1 C2 C3 C6 C7 C8 C9	1	11	12
Objective test	B1 B2 B3 B4 C1 C11	1	2	3
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	Oral presentation complemented with the use of audiovisual media and the introduction of some questions addressed to students, in order to transmit knowledge and facilitate learning.
Laboratory practice	Methodology that allows students to learn effectively through the realization of practical activities, such as demonstrations, exercises, experiments and research.
Supervised projects	Methodology designed to promote the autonomous learning of students, under the tutelage of the teacher and in varied scenarios (academic and professional). It is referred primarily to the learning of "how to do things." It is an option based on the assumption by students of the responsibility for their own learning. This teaching system is based on two basic elements: the independent learning of the students and the monitoring of that learning by the tutor.
Objective test	Written test used to evaluate learning.

Personalized attention	
Methodologies	**Description**
Supervised projects Laboratory practice	Student with full dedication: la) Laboratory practices: Resolution of doubts during the practice sessions. b) Supervised projects : Monitoring the work of the student during the development of the proposed supervised projects. Part-time students: la) Laboratory practices: Resolution of doubts during the practice sessions. b) Supervised projects: Monitoring the work of the student during the development of the proposed supervised projects.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Supervised projects	B1 B2 B3 B4 B5 B13 B15 B14 B16 C1 C2 C3 C6 C7 C8 C9	Projects done by the student.	70
Laboratory practice	B1 B2 B3 B5 B13 B14 B6 C3	Practices carried out by the student.	10
Objective test	B1 B2 B3 B4 C1 C11	The objective test consists of passing a final exam that includes all the contents seen throughout the course.	20

Assessment comments
The final test will cover all the contents of the subject. Attendance at the laboratory is mandatory and must be done during the first year of enrollment. The practice note will be maintained. Unjustified faults are not allowed. Second opportunity will be evaluated on the same terms as the first opportunity. The students with recognition of part-time dedication according to the "Standard that regulates the regime of dedication to the study of the students of Degree in the UDC" will have to put it in knowledge of the coordinator of the subject. The evaluation will be carried out in the same terms as that of full-time students. The possible academic exemption of class attendance exemption will not be applicable in the laboratory practices, which must attend compulsorily and at the established time, as well as the corresponding final exam.

Sources of information

Basic	- Cartier, Michael (coordinator) (2003). Handbook of Surface Treatments and Coatings. . Professional Engineering Publishing Limited. - (2004). Handbook of Thermal Spray Technology.. ASM International. - Toyserkani, Ehsan (2002). Laser cladding.. CRC Press. - Schaaf, Peter (editor) (2010). Laser processing of materials : fundamentals, applications and developments.. Springer. - Misawa, Hiroaki (editor) (2006). 3D laser microfabrication : principles and applications.. Wiley-VCH. - Phipps, Claude R. (editor) (2007). Laser ablation and its applications.. Springer.
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
To help achieve a sustained immediate environment and comply with the objective of action number 5: "Healthy and sustainable environmental and social teaching and research" of the "Green Campus Ferrol Action Plan":The delivery of the documentary works that are made in this matter:They will be requested in virtual format and / or in computer supportDelivery will be made through Moodle, in digital format without the need to print themIf it is necessary to make them on paper:No plastics will be used.Double-sided prints will be made.Recycled paper will be used.The printing of drafts will be avoided.A sustainable use of resources and the prevention of negative impacts on the natural environment must be made.

(*)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.