Teaching Guide				
Identifying Data				2020/21
Subject (*)	Thermo-mechanical fatigue		Code	730495008
Study programme	Mestrado Universitario en Materiais Complexos: Análise Térmica e Reoloxía (plan 2012)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Optional	2
Language	English			
Teaching method	Face-to-face			
Prerequisites				
Department	Enxeñaría Naval e IndustrialMatemáticas			
Coordinador	Tarrio Saavedra, Javier	E-mail	javier.tarrio@udc.es	
Lecturers	Tarrio Saavedra, Javier	E-mail	javier.tarrio@udc.es	
Web				
General description	This course aims to describe the basics to fatigue taking into account both mechanical and thermal effects (resistance, voltage, damage, growth / propagation of fractures, ?)			
Contingency plan	1. Modifications to the contents The contents are not modified 2. Methodologies *Teaching methodologies that are maintained Guest lecture/keynote speech (via Teams) Supervised projects (tutored via Teams or email) Objective test (online) *Teaching methodologies that are modified Laboratory practice. It is replaced by the presentation of practical cases in the Keynote sessions and the reading and discussion of scientific articles (analysis of documentary sources). 3. Mechanisms for personalized attention to students - Email: Daily. Used to make queries, request virtual meetings to resolve doubts and monitor the work being supervised. - Microsoft Teams: Personalized tutoring of students - Moodle: This will be used as a repository for documentation provided to students. 4. Modifications in the evaluation Keynote Sessions 20% - Continuous evaluation by assessing active participation and achievement. Supervised projects 40% - Presentation of supervised works Objective test 20% - It will be performed orally after the presentations of the supervised projects Analysis of documentary sources 20% -Reading and discussion of articles from scientific journals related to the subject *Evaluation observations: - 5. Modifications to the bibliography or webgraphy No change.			

Study programme competences / results	
Code	Study programme competences / results
A1	Set up and conduct tests using the techniques of thermal analysis and rheology most appropriate in each case, within the scope of complex materials

A7	Knowing the different types of thermal thermo-mechanical behaviors in materials subjected to fatigue
A8	Understand and quantify the damage caused by thermomechanical fatigue in materials
B2	The students have the skill to apply their knowledge and their ability to solve problems in new or unfamiliar contexts within broader (or multidisciplinary) contexts related to their field of study
B4	That the students can communicate their conclusions and the knowledge and last reasons behind that conclusions to specialized and non specialized audience in a clear and unambiguous way
B7	Solving problems effectively
B10	Working in a collaborative way
B13	Analysis-oriented attitude
C2	Have a good command of spoken and writing expression and understanding of a foreign language.
C6	Critically assessing the knowledge, technology and information available to solve the problems they face with.
C7	To assume as a professional and citizen the importance of learning throughout life.
C8	To assess the importance of research, innovation and technological development in the socio-economic and cultural progress of society.

Learning outcomes			
Learning outcomes	Study programme competences / results		
To know and evaluate the thermal / mechanical fatigue performance of materials	AR1 AR7	BR2 BR4 BR7	CR6 CR8
To know and evaluate the thermal / mechanical fatigue performance of materials	AR7 AR8	BR7 BR10 BR13	CR6 CR7 CR8
Understand and quantify the damage caused by thermomechanical fatigue in materials	AR1 AR7 AR8	BR7 BR10 BR13	CR2 CR6
Understand and quantify the damage caused by thermomechanical fatigue in materials	AR1 AR7 AR8	BR2 BR4 BR13	

Contents	
Topic	Sub-topic
The following blocks or topics develop the contents established in the Verification Report, which are:	1. Basic Introduction of Fatigue: Fatigue Resistance. Fatigue Voltage Parameters. Fatigue loads. 2. Mechanical Fatigue: Fatigue tests. Resistance curves. Factors that affect the fatigue life. 3. Thermal Fatigue: Tensions and thermal deformations. Propagation and growth of cracks. Microstructural changes.
1. Introduction to fracture mechanics	1.1. Fracture 1.2. Fatigue 1.2.1. S-N curves 1.3. Creep
2. Fatigue	2.1. Fatigue parameters 2.2. HCF 2.3. LCF 2.4. Paris equation
3. Thermal fatigue	3.1. Thermal stress and strain 3.2. Crack growth and propagation

4. Fatigue of complex materials	4.1. Fatigue of complex materials 4.2. Thermomechanical and dynamic mechanical analysis

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A1 A7 A8 B4 B7 B13 C6 C7 C8	8	8	16
Supervised projects	B2 B4 B7 B10 B13 C2 C6 C7 C8	4	12	16
Objective test	A3 A7 A8 B2 B4 B7 C2 C6	1	2	3
Laboratory practice	A1 A7 A8 B2 B10 B13	7	7	14
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	Presentation by the teacher of the concepts contained in the agenda of the subject.
Supervised projects	You can choose one of the following options: a) Performing a Bibliographical search in relation to recent research in the field related to the subject. b) Research using laboratory equipment. c) Simulation and modelization of fatigue processes by computer programs.
Objective test	Evaluation test
Laboratory practice	Practical activities such as computer practice, exercises, experiments, research, etc.

Personalized attention	
Methodologies	Description
Guest lecture / keynote speech Supervised projects Laboratory practice	Resolution of questions regarding any aspect of the subject. No academic dispensation is accepted.

Assessment			
Methodologies	Competencies / Results	Description	**Qualification**
Objective test	A3 A7 A8 B2 B4 B7 C2 C6	In this test will be a test to assess the assimilation by students of the fundamental concepts	20
Guest lecture / keynote speech	A1 A7 A8 B4 B7 B13 C6 C7 C8	Continuous assessment through monitoring of student work in the classroom, laboratory and / or tutorials	10
Supervised projects	B2 B4 B7 B10 B13 C2 C6 C7 C8	Report will be assessed in relation to the work suggested to the student	40
Laboratory practice	A1 A7 A8 B2 B10 B13	Continuous assessment through monitoring of student work in the classroom, laboratory and / or tutorials	30

Assessment comments
Academic dispensation will not be accepted.

Sources of information	
Basic	- Weronski A., Hejwowski T. (1991). Thermal fatigue of metals. - Callister, W.D. (2007). Materials Science and Engineering. John Wiley & Sons - Bresser J., Rémy L. (1995). Fatigue under thermal and mechanical loading. - Prime B., Menczel J. (2009). Thermal Analysis of Polymers, Fundamentals and Applications. - Strait, L. (1994). Thermo-mechanical fatigue of polymer matrix composites.
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 meet 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 work carried out in this subject:They will be requested in virtual format and/or computer supportIt will be done through Moodle, in digital format without the need to print them.If it is necessary to make them on paper:Plastics shall not be usedDouble-sided printing shall be carried out.Recycled paper will be used.Printing of drafts shall be avoided.- A sustainable use of resources and the prevention of negative impacts on the natural environment must be made.- It will work to identify and change gender biases and attitudes, and influence the environment to change them and promote values of respect and equality.- Situations of discrimination should be identified and actions and measures proposed to correct them.