Teaching Guide				
Identifying Data				2017/18
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	Optativa	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 Zaragoza Fernandez, Maria Sonia	E-mail	javier.tarrio@udc.es sonia.zaragoza1@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, ?)			

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
A3	Knowing the different types of thermal and rheological behaviors of the materials
A6	Understanding the importance of the environment and of the research focused on the elimination/minimization of final or process wastes
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 AR3 AR6 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 A3 A6 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 A3 A6 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.

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 A3 A6 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 A3 A6 A7 A8 B2 B10 B13	Continuous assessment through monitoring of student work in the classroom, laboratory and / or tutorials	30

Assessment comments

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

(*)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.