



Teaching Guide

Teaching Guide				
Identifying Data				2023/24
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	Díaz Díaz, Ana María	E-mail	ana.ddiaz@udc.es	
	Tarrio Saavedra, Javier		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, ?)			

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



Understand and quantify the damage caused by thermomechanical fatigue in materials	AR1	BR2	
	AR7	BR4	
	AR8	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	7	14	21
Supervised projects	B2 B4 B7 B10 B13 C2 C6 C7 C8	1	14	15
Objective test	A7 A8 B2 B4 B7 C2 C6	1	0	1
Laboratory practice	A1 A7 A8 B2 B10 B13	4	8	12
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	Resolution of questions regarding any aspect of the subject.
Supervised projects	No academic dispensation is accepted.
Laboratory practice	

Assessment

Methodologies	Competencies / Results	Description	Qualification
Objective test	A7 A8 B2 B4 B7 C2 C6	Assesment test.	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.

The evaluation criteria for the second opportunity and the extraordinary opportunity are the same as for the first opportunity.

The fraudulent completion of exams or evaluation activities, once confirmed, will directly result in a failing grade in the session in which it occurs: the student will be awarded a 'fail' (numerical grade of 0) in the corresponding academic year session, whether the offense is committed during the first opportunity or the second. To this end, their grade will be modified in the first opportunity transcript, if necessary.

Sources of information

Basic	<ul style="list-style-type: none">- Weronski A., Hejwowski T. (1991). Thermal fatigue of metals. Marcel Dekker- Callister, W.D. (2007). Materials Science and Engineering. John Wiley & Sons- Bresser J., Rémy L. (1995). Fatigue under thermal and mechanical loading. Springer- Prime B., Menczel J. (2009). Thermal Analysis of Polymers, Fundamentals and Applications. Wiley- Strait, L. (1994). Thermo-mechanical fatigue of polymer matrix composites. The Pennsylvania State University, APPLIED RESEARCH LABORATORY
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 to achieve a sustainable 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":

- 1.- The delivery of the documentary works carried out in this subject:
 - 1.1. It will be requested in virtual format and/or computer support.
 - 1.2. It will be done through Moodle, in digital format without the need to print them.
 - 1.3. If done on paper:
 - Plastics will not be used.
 - Double-sided prints will be made.
 - Recycled paper will be used.
 - Draft printing will be avoided.
- 2.- A sustainable use of resources and the prevention of negative impacts on the natural environment must be made.
- 3.- The importance of ethical principles related to the values of sustainability in personal and professional behavior must be taken into account.
- 4.- As it is included in the different regulations of application for 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, intervention in student class will be encouraged and students...).
- 5.- We will work to identify and modify prejudices and sexist attitudes, and the environment will be influenced to modify them and promote values of respect and equality.
6. Situations of discrimination based on gender must be detected and actions and measures will be proposed to correct them.
7. The full integration of students who, due to physical, sensorial, psychic or sociocultural reasons, experience difficulties in an ideal, egalitarian and profitable access to university life will be facilitated

(*)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.