



Teaching Guide

| Teaching Guide | | | | |
|--------------------------|--|--------|--|-----------|
| Identifying Data | | | | 2018/19 |
| 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 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

| Code | Study programme competences |
|------|---|
| 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 | | |
|--|-----------------------------|---------------------|-------------------|
| 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 | BR7 | CR2 |
| | AR3 | BR10 | CR6 |
| | AR6 | BR13 | |
| | AR7 | | |
| | AR8 | | |
| 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 | Ordinary class hours | 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. |



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|---------------------|--|
| 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 | 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 |
|---|
| Academic dispensation will not be accepted. |

| Sources of information | |
|------------------------|--|
| Basic | <ul style="list-style-type: none"> - 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 |
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| Subjects that it is recommended to have taken before |
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| Subjects that are recommended to be taken simultaneously |
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| 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 support - It 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 used Double-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.

(*)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.