



## Teaching Guide

Identifying Data					2024/25
<b>Subject (*)</b>	Viscoelasticity of materials		<b>Code</b>	730495002	
<b>Study programme</b>	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	Obligatory	3	
<b>Language</b>	English				
<b>Teaching method</b>	Face-to-face				
<b>Prerequisites</b>					
<b>Department</b>	Enxeñaría Naval e Industrial				
<b>Coordinador</b>	Artiaga Diaz, Ramon Pedro	<b>E-mail</b>	ramon.artiaga@udc.es		
<b>Lecturers</b>	Artiaga Diaz, Ramon Pedro	<b>E-mail</b>	ramon.artiaga@udc.es		
<b>Web</b>					
<b>General description</b>	This course aims to complete the viscoelasticity introduced during the first module in France (UEF 1) emphasizing the coupling with the thermal properties.				

## 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
A2	Identify and evaluate the different types of complex 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
B8	Applying a critical, logical and creative way of thinking
B13	Analysis-oriented attitude
B21	To assess the importance of research, innovation and technological developments in the socio-economic and cultural progress of society
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.

## Learning outcomes

Learning outcomes	Study programme competences / results		
Determining what type of rheometer is appropriate depending on the material	AR2	BR2 BR8 BR13 BR21	CR6 CR7
To distinguish between different viscoelastic behavior.	AR2	BR4 BR8 BR13 BR21	CR2 CR6 CR7
Properly set up the test conditions.	AR1 AR2	BR2 BR8 BR13	

## Contents



Topic	Sub-topic
Linear and nonlinear viscoelasticity	Ideal elastic and viscous behavior. Viscoelastic behavior of the materials. Range of linearity.
Choosing the most appropriate rheometer	Stress control rheometers. Deformation control rheometers. Geometric configurations. Parameters affecting the choice of the rheometer.
Experimental setup depending on the material	Geometric configurations. Stationary and dynamic tests. Determination of the ranges of linearity in frequency, amplitude and temperature. Choice and optimization of experimental parameters.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student's personal work hours	Total hours
Guest lecture / keynote speech	A1 A2 B21 C6 C7	10	15	25
Laboratory practice	A1 B2 B8 B13	8	12	20
Supervised projects	A1 A2 B2 B4 B8 B13 B21 C2 C6	2	18	20
Objective test	A1 A2 B2 B4 B8 B13 C2	2	2	4
Personalized attention		6	0	6

(\*)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 given by the professor, on a schematic basis, focusing on the main topics, covering both theoretical and practical issues.
Laboratory practice	Performance of practical activities such as demonstrations, exercises, experiments, research, etc..
Supervised projects	Activities whose purpose is that the students enlarge the study of their topics presented in each theme and consolidate their acquired knowledge and capabilities. These activities should also help the students learn and improve their capabilities in literature survey.
Objective test	Exam that will help to evaluate the knowledge and competencies acquired by the students.

Personalized attention	
Methodologies	Description
Guest lecture / keynote speech Laboratory practice Supervised projects Objective test	The personalized attention to students, understood as a support in the teaching-learning process, will take place in the hours of tutoring of the teacher.

Assessment			
Methodologies	Competencies / Results	Description	Qualification
Guest lecture / keynote speech	A1 A2 B21 C6 C7	Continuous assessment through monitoring of student work in the classroom, laboratory and / or tutorials	10
Laboratory practice	A1 B2 B8 B13	Continuous assessment through monitoring of student work in the classroom, laboratory and / or tutorials	10



Supervised projects	A1 A2 B2 B4 B8 B13 B21 C2 C6	Activities whose purpose is that the students enlarge the study of their topics presented in each theme and consolidate their acquired knowledge and capabilities. These activities should also help the students learn and improve their capabilities in literature survey.	60
Objective test	A1 A2 B2 B4 B8 B13 C2	Examination or objective test.	20

### Assessment comments

Students with an academic exemption: They will have to do the mixed test and present a previously agreed work with the professors of the subject.

The assessment will be 50% the objective test and 50% the supervised work.

The objective test may include questions related to the contents addressed in any of the sessions, whether theoretical, practical or during the debates that occur in the presentations of works.

To pass the subject, a minimum score of 4 (on a scale of 0 to 10) in the objective test is required.

The evaluation criteria of the 2nd opportunity are the same as those of the 1st opportunity. If the student did not carry out the laboratory practices, nor did he solve the problems raised, the mixed test will include questions related to these aspects, increasing the assessment of this methodology. The student must present a work previously agreed with the professors of the subject.

The evaluation criteria for the extraordinary call are the same as those for the 1st opportunity. If the student did not carry out the laboratory practices, nor did he solve the problems raised, the mixed test may include additional questions related to these aspects, increasing the assessment of this methodology. The student must present a work previously agreed with the professors of the subject.

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

<b>Basic</b>	O sistema de Biblioteca da UDC permite realizar búsquedas de literatura recomendada por profesor e material. Esta é unha lista ampliada das fontes recomendadas: Estudio reolóxico de betumes asfálticos [Recurso electrónico] / Jesús López Paz ; tutores Ramón Pedro Artiaga Díaz, Jorge José López Beceiro López Paz, Jesús Esc Politécnica Superior Depósito -- RP I 429 -- DISPONIBLE Understanding polymer processing : processes and governing equations Osswald, Tim A. Esc Politécnica Superior Depósito -- CM P 155 -- VENGE 05-06-15 Understanding rheology Morrison, Faith A. Esc Politécnica Superior Depósito -- CM 357 -- DISPONIBLE Thermal analysis. Fundamentals and applications to material characterization: proceedings of the international seminar: Thermal analysis and rheology. Ferrol, Spain, 30 Juny-4 July, 2003 / Ramón Artiaga Díaz (ed.), A Coruña: Universidade da Coruña, Servicio de Publicacions, 2005, ISBN 84-9749-100-9 Thermal analysis of polymers / edited by Joseph D. Menczel, R. Bruce Prime; Hoboken, N.J.: John Wiley, [2009], ISBN 978-0-471-76917-0 Menard, Kevin P., Dynamic mechanical analysis A practical introduction, Boca Raton : CRC Press, [1999], ISBN 0-8493-8688-8 Ward, Ian Macmillan. An introduction to the mechanical properties of solid polymers / I.M. Ward, and J. Sweeney, Chichester, England : John Wiley & Sons, [2004] 2nd ed. ISBN 0-471-49625-1 Relaxation phenomena in polymers / edited by Shiro Matsuoka. Munich ; New York : Hanser Publishers ; New York : Distributed in the U.S.A. and Canada by Oxford University Press, 1992. ISBN 3-446-17111-8 (Hanser), 0-19-520957-5 (Oxford University Press)
<b>Complementary</b>	

### 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 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.

(\*) 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.