



## Teaching Guide

Identifying Data					2019/20
Subject (*)	Continuum mechanics		Code	614855205	
Study programme	Mestrado Universitario en Matemática Industrial (2013)				
Descriptors					
Cycle	Period	Year	Type	Credits	
Official Master's Degree	1st four-month period	First	Optional	6	
Language	Spanish				
Teaching method	Face-to-face				
Prerequisites					
Department	Matemáticas				
Coordinador	Arregui Alvarez, Iñigo	E-mail	inigo.arregui@udc.es		
Lecturers	Arregui Alvarez, Iñigo Rodríguez Seijo, Jose Manuel	E-mail	inigo.arregui@udc.es jose.rodriguez.seijo@udc.es		
Web	<a href="http://www.m2i.es/docs/modulos/MESimNumerica/MMContinuos/Mecanica%20de%20los%20medios%20continuos.pdf">http://www.m2i.es/docs/modulos/MESimNumerica/MMContinuos/Mecanica%20de%20los%20medios%20continuos.pdf</a>				
General description					

## Study programme competences / results

Code	Study programme competences / results
A1	Alcanzar un conocimiento básico en un área de Ingeniería/Ciencias Aplicadas, como punto de partida para un adecuado modelado matemático, tanto en contextos bien establecidos como en entornos nuevos o poco conocidos dentro de contextos más amplios y multidisciplinares.
A2	Modelar ingredientes específicos y realizar las simplificaciones adecuadas en el modelo que faciliten su tratamiento numérico, manteniendo el grado de precisión, de acuerdo con requisitos previamente establecidos.
A9	Conocer, saber seleccionar y saber manejar las herramientas de software profesional (tanto comercial como libre) más adecuadas para la simulación de procesos en el sector industrial y empresarial.
B3	Ser capaz de integrar conocimientos para enfrentarse a la formulación de juicios a partir de información que, aun siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos.

## Learning outcomes

Learning outcomes	Study programme competences / results		
Reaching a basic knowledge in mechanics, as a starting point for an adequate mathematical modelling	AC1		
	AC2		
	AC9		
Be able to integrate knowledges to proceed to the formulation of decisions.	AC1	BC2	
	AC2		

## Contents

Topic	Sub-topic
Introduction	Tensor algebra and analysis. Polar decomposition, divergence and Stokes theorems
Curvilinear coordinates	Vector bases and curvilinear coordinates. Vector fields. Differential operators in curvilinear coordinates
Kinematics	Material bodies. Motion and deformation, types of motions. Transport theorems. Isochoric motions, spin, circulation, vorticity
Conservation laws	Mass. Linear and angular moments. Force and stress. Moment equilibrium and its consequences. Piola-Kirchhoff tensor. Energy conservation, Clausius-Duhem inequality



Change of observer	Change of observer. Material indifference pinciple
Some simple models	Constitutive hypotheses. Ideal fluids. Navier-Stokes equations. Elastic bodies. Thermoelasticity

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Problem solving	A9 B3	13	45	58
Mixed objective/subjective test	A1 A2 B3	4	4	8
Guest lecture / keynote speech	A1 A2	41	42	83
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
Problem solving	Resolution, by the student, of some exercises of continuum mechanics
Mixed objective/subjective test	Theoretical-practical control
Guest lecture / keynote speech	Exposition, by the teacher, of the contents and resolution of some exercises

Personalized attention	
Methodologies	Description
Problem solving	The teacher will help the students, when necessary, in the resolution of the proposed exercises

Assessment			
Methodologies	Competencies / Results	Description	Qualification
Problem solving	A9 B3	Resolución de exercicios e cuestións teórico-prácticas por parte do alumno, con axuda de bibliografía	40
Mixed objective/subjective test	A1 A2 B3	Resolución de exercicios e cuestións teórico-prácticas nunha proba presencial	60

Assessment comments
To surpass the matter, the student will have to obtain at least a qualification of 4 in the mixed objective/subjective proof. Both methodologies of evaluation will be taken into account, with the indicated percentages, in all the opportunities employed by the student.

Sources of information	
<b>Basic</b>	- M. E. Gurtin (1981). An Introduction to Continuum Mechanics. Academic Press. Boston - O. López Pouso (2002). "An Introduction to Continuum Mechanics" de M. E. Gurtin. Ejercicios Resueltos (capítulos I-VI). Publicacións Docentes do Departamento de Matemática Aplicada. Univ. de Santiago de Compostela



<b>Complementary</b>	<ul style="list-style-type: none"><li>- Y. C. Fung (1994). A First Course in Continuum Mechanics. Prentice Hall</li><li>- K. Hutter, K. Jöhnk (2004). Continuum Methods of Physical Modeling. Springer</li><li>- A. Bermúdez de Castro (2004). Continuum Termomechanics. Birkhauser</li><li>- N. Bobillo Ares (2003). Introducción a la geometría y cinemática de medios continuos. Servicio de Publicaciones de la Unviersidad de Oviedo</li><li>- R. Temam, A. Miranville (2001). Mathematical Modeling in Continuum Mechanics. Cambridge University Press</li><li>- L. A. Segel (1987). Mathematics Applied to Continuum Mechanics. Dover, New York</li><li>- G. Duvaut (1990). Mécanique des Milieux Continus. Masson, París</li></ul>
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### Recommendations

Subjects that it is recommended to have taken before

Subjects that are recommended to be taken simultaneously

Partial differential equations/614855203

Subjects that continue the syllabus

Fluid mechanics/614855206

Solid mechanics/614855207

Other comments

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