UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: MECHANICS OF CONTINUOUS MEDIA AND MATERIALS SCIENCE
Code: 310801
Type: CORE COURSE
ECTS credits: 9
Degree: 2343 - MASTERS DEGREE PROGRAMME IN ENGINEERING OF ROADS, CANALS AND PORTS
Academic year: 2023-24
Center: 603 - E.T.S. CIVIL ENGINEERS OF CR
Group(s): 20
Year: 1
Duration: First semester
Main language: English
Second language: Spanish
Use of additional languages:
English Friendly: N
Web site:
Bilingual: N

Lecturer: **GONZALO FRANCISCO RUIZ LOPEZ** - Group(s): **20**

Building/Office	Department	Phone number	Email	Office hours
Politécnico/2-A61	MECÁNICA ADA. E ING. PROYECTOS	3257	gonzalo.ruiz@uclm.es	Monday: 16:00-19:00 Tuesday: 9:00-12:00

Lecturer: **EDUARDO WALTER VIEIRA CHAVES** - Group(s): **20**

Building/Office	Department	Phone number	Email	Office hours
D55	MECÁNICA ADA. E ING. PROYECTOS	6312	eduardo.vieira@uclm.es	Weekdays from 6:00 p.m.

Lecturer: **CHENGXIANG YU ---** - Group(s): **20**

Building/Office	Department	Phone number	Email	Office hours
A55	MECÁNICA ADA. E ING. PROYECTOS	6313	chengxiang.yu@uclm.es	Monday, Tuesday and Thursday 17:00-19:00

2. Pre-Requisites

Rigid Body Mechanics, Solid Mechanics, Science and Technology of Civil Engineering Materials, Strength of Materials

3. Justification in the curriculum, relation to other subjects and to the profession

Not established

4. Degree competences achieved in this course

Course competences

Code	Description
AFC2	Understanding and mastering the laws of thermomechanics of continuous media and the ability to apply them in engineering fields such as fluid mechanics, mechanics of materials, structural theory, etc.
CB06	Possess and understand knowledge that provides a basis or opportunity to be original in the development and / or application of ideas, often in a research context.
CB07	Apply the achieved knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to the area of study
CB09	Know how to communicate the conclusions and their supported knowledge and ultimate reasons to specialized and non-specialized audiences in a clear and unambiguous way
CB10	Have the learning skills which allow to continue studying in a self-directed or autonomous way
G05	Knowledge of the Civil Engineering profession and the activities that can be carried out in the field of civil engineering.
G07	Knowledge to apply technical and managerial skills in R&D&I activities in the field of civil engineering.
G25	Ability to identify, measure, enunciate, analyse, diagnose and scientifically and technically describe a civil engineering problem
G27	Ability to communicate in a second language.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Students understand the behavior of materials, structural elements and structures through constitutive models. They apply these models to specific cases and use them to predict mechanical phenomena.

Students use computer programs that simulate the mechanical behavior of materials and structures in static and dynamic regimes.

Additional outcomes

Measure the mechanical properties of construction materials in Civil engineering

6. Units / Contents

Unit 1: Termoelasticity, elasticity and linear viscoelasticity

Unit 1.1 termoelastic and linear elastic behavior

Unit 1.2 Viscoelastic behavior

Unit 2: Plasticity and viscoplasticity

Unit 2.1 Plastic behavior

Unit 2.2 Viscoplastic behavior

Unit 3: Fracture Mechanics

Unit 3.1 Failure criterion: the global perspective

Unit 3.2 Failure criterion: the local perspective

Unit 3.3 Subcritic fracture

Unit 4: Composites

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures	AFC2 CB06 CB07 CB09 CB10 G05 G07 G25 G27	1.9	47.5	N	-	Theory classes: The instructor explains the theoretical topics using the blackboard plus electronic presentations in case graphical - support is necessary; simple exercises highlighting basic theoretical concepts are given; attentive listening, taking notes, examples workout.
Class Attendance (practical) [ON-SITE]	Project/Problem Based Learning (PBL)	AFC2 CB06 CB07 CB09 CB10 G05 G07 G25 G27	0.3	7.5	N	-	Exercises classes: The instructor poses several series of problems so that students can solve as homework using the knowledge gained in - theory classes and in personal study; the methodology to solve the problems is explained in these classes; moreover, the most representative problems of each series are solved in detail.
Practicum and practical activities report writing or preparation [OFF-SITE]	Cooperative / Collaborative Learning	AFC2 CB06 CB07 CB09 CB10 G05 G07 G25 G27	0.5	12.5	Y	Y	Data analysis, writing the report: the instructor teaches how the data collected should be analyzed by applying the concepts exposed in the theory and problem classes; It also teaches how to prepare a report in a scientific format to present the measured data and the conclusions reached; the student learns by means of the application of the theoretical concepts to the data analysis; the writing of the report reinforces the understanding of the concepts and the conclusions reached. This activity can be made-up in non-continuous evaluation tests, in ordinary and extraordinary call, of the same academic year.
Laboratory practice or sessions [ON-SITE]	Combination of methods	AFC2 CB06 CB07 CB09 CB10 G05 G07 G25 G27	0.3	7.5	Y	Y	Students become familiar with experimental methods and with the interpretation of laboratory results. The evaluation will be done through the delivery and presentation of a report of practices, which must follow the guidelines that will be indicated at the beginning of the semester. This activity is recoverable in non-continuous assessment tests, in ordinary and extraordinary call, of the same academic year
Study and Exam Preparation [OFF-SITE]	Combination of methods	AFC2 CB06 CB07 CB09 CB10 G05 G07 G25 G27	5.8	145	N	-	This activity consists of the personal study of the topics explained in the theoretical classes with the help of the recommended bibliography, the notes that the student has taken and the copy of the graphic material that has been distributed. The student works on the exercises proposed by the instructor and tries to solve them with the competences that she/he is acquiring in the theoretical classes and with personal study; This activity is complemented by the practical classes since in them he/she confirms that she/he has solved the

							exercises correctly or, otherwise, he/she learns how to do what, for whatever reason, she/he has not been able to solve.
Progress test [ON-SITE]	Assessment tests	AFC2 CB06 CB07 CB09 CB10 G05 G07 G25 G27	0.2	5	Y	Y	Exams during continuous evaluation. This activity can be made-up in non-continuous evaluation tests, in ordinary and extraordinary call, of the same academic year.
Total:			**9**	**225**			
Total credits of in-class work: 2.7							**Total class time hours: 67.5**
Total credits of out of class work: 6.3							**Total hours of out of class work: 157.5**

As: Assessable training activity
Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Practicum and practical activities reports assessment	16.80%	0.00%	The grading is done by reviewing the report complemented with a presentation on the results. The report must follow the guidelines that will be given at the beginning of the semester. This activity can be made-up in non- continuous evaluation tests, in the ordinary and extraordinary call, of the same academic year.
Mid-term tests	50.00%	0.00%	Exams during continuous evaluation. This activity is recoverable in non-continuous evaluation tests, in the ordinary and extraordinary call, of the same academic year.
Assessment of active participation	16.60%	0.00%	Active participation of the student in the classes is considered in the continuous evaluation.
Assessment of problem solving and/or case studies	16.60%	0.00%	Problems proposed to reinforce the concepts explained in class and which are evaluated throughout the course.
Final test	0.00%	100.00%	Final exams cover the entire subject. In them, students can make up for the evaluable activities of continuous evaluation.
Total:	**100.00%**	**100.00%**	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject , an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

The continuous evaluation consists of four marks, all of them scored from 0 to 10 points. The first one corresponds to the average mark of three partial tests, being necessary to achieve a minimum of 4 in each of them. The second mark corresponds to the labwork, being necessary to obtain 4 or more points. The third and fourth marks correspond, respectively, to the proposed problems and the activity developed in class. The subject will be passed in continuous assessment when the weighted average of the four marks is equal to or greater than 5 points, provided the minimum grades indicated are met.

The partials, proposed problems and labwork are recoverable in the final exams. The marks of these parts equal to or greater than 4 points are kept until the end of the academic year, although students may also take the finals to improve their grades on these parts.

Non-continuous evaluation:

The final exams, ordinary and extraordinary, will consist of a single test that will cover the entire subject; They will be evaluated from 0 to 10 points, being necessary to reach a grade equal to or greater than 5 points to pass the subject.

In the final exams of the same academic year, students can choose to examine only those recoverable parts in which they have not passed the minimum mark. They can also take these recoverable parts in which they have exceeded the minimum grade to raise their grade. In both cases, the final grade will be the most favorable between (1) the final grade as a single exam; and (2) the continuous assessment grade considering the best grade obtained in each part at the end or throughout the course.

Specifications for the resit/retake exam:

Same as specified above.

Specifications for the second resit / retake exam:

The evaluation of this special call will consist of a single exam that will cover all the subject. It will be evaluated from 0 to 10 points, being necessary to reach a mark equal to or greater than 5 points to pass the subject.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours **hours**

Unit 1 (de 4): Termoelasticity, elasticity and linear viscoelasticity

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	15
Class Attendance (practical) [PRESENCIAL][Project/Problem Based Learning (PBL)]	2.5
Practicum and practical activities report writing or preparation [AUTÓNOMA][Cooperative / Collaborative Learning]	4
Laboratory practice or sessions [PRESENCIAL][Combination of methods]	2.5
Study and Exam Preparation [AUTÓNOMA][Combination of methods]	47.5
Progress test [PRESENCIAL][Assessment tests]	1.5

Teaching period: 4 weeks

Unit 2 (de 4): Plasticity and viscoplasticity	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	15
Class Attendance (practical) [PRESENCIAL][Project/Problem Based Learning (PBL)]	2.5
Practicum and practical activities report writing or preparation [AUTÓNOMA][Cooperative / Collaborative Learning]	4.5
Laboratory practice or sessions [PRESENCIAL][Combination of methods]	2.5
Study and Exam Preparation [AUTÓNOMA][Combination of methods]	47.5
Progress test [PRESENCIAL][Assessment tests]	2
Teaching period: 4 weeks	

Unit 3 (de 4): Fracture Mechanics	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	15
Class Attendance (practical) [PRESENCIAL][Project/Problem Based Learning (PBL)]	1.5
Practicum and practical activities report writing or preparation [AUTÓNOMA][Cooperative / Collaborative Learning]	3
Laboratory practice or sessions [PRESENCIAL][Combination of methods]	1
Study and Exam Preparation [AUTÓNOMA][Combination of methods]	40
Progress test [PRESENCIAL][Assessment tests]	1
Teaching period: three weeks	

Unit 4 (de 4): Composites	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2.5
Class Attendance (practical) [PRESENCIAL][Project/Problem Based Learning (PBL)]	1
Practicum and practical activities report writing or preparation [AUTÓNOMA][Cooperative / Collaborative Learning]	1
Laboratory practice or sessions [PRESENCIAL][Combination of methods]	1.5
Study and Exam Preparation [AUTÓNOMA][Combination of methods]	10
Progress test [PRESENCIAL][Assessment tests]	.5
Teaching period: one week	

Global activity	
Activities	**hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	47.5
Class Attendance (practical) [PRESENCIAL][Project/Problem Based Learning (PBL)]	7.5
Practicum and practical activities report writing or preparation [AUTÓNOMA][Cooperative / Collaborative Learning]	12.5
Laboratory practice or sessions [PRESENCIAL][Combination of methods]	7.5
Study and Exam Preparation [AUTÓNOMA][Combination of methods]	145
Progress test [PRESENCIAL][Assessment tests]	5
Total horas:	225

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house Citv	ISBN	Year	Description
Chadwick, Peter	Continuum mechanics: concise theory and problems	Dover	0-486-40180-4	1999	
Chandrasekharaiah, D. S.	Continuum mechanics	Academic Press	0-12-167880-6	0	
Chaves, E.W.V.	Mecánica del medio continuo: (conceptos básicos)	CIMNE	978-84-96736-38-2	2007	
Chaves, E.W.V.	Mécanica del medio continuo: modelos constitutivos / Eduardo	CIMNE	978-84-96736-68-9	2009	
Chaves, E.W.V.	Notes on Continuum Mechanics	Springer/CIMNE	978-94-007-5985-5	2013	
Chaves, E.W.V.	Solving Problems by means of Continuum Mechanics				
	https://previa.uclm.es/profesorado/evieira/ftp/apuntes/mmc_problems.pdf				
Christensen, R.M.	Theory of Viscoelasticity	Dover	0-486-42880-X	1982	
Chung, T. J.	General continuum mechanics	Cambridge University Press	978-0-521-87406-9	2007	
Gurtin, Morton E.	An introduction to continuum mechanics	Academic Press	0-12-309750-9	1981	
Haupt, Peter	Continuum mechanics and theory of materials	Springer	3-540-66114-X	2000	
Holzapfel, Gerhard A.	Nonlinear solid mechanics: a continuum approach for engineer	John Wiley & Sons	0-471-82319-8	2000	
J. Chakrabarty	Theory of Plasticity	Elsevier	978-0-7506-6638-2	2006	
Malvern, Lawrence E.	Introduction to the mechanics of a continuous medium	Prentice-Hall	0-13-487603-2	1969	
Mauel Elices	Mecanica de la fractura	ETSI de Caminos, UPM	9788474931976	1993	
Norman E. Dowling	Mechanical behavior of materials. Engineering Methods for deformation, fracture and fatigue	Prentice Hall	0-13-905720-X	1999	
Ogden, R.W.	non-linear elastic deformation	Dover		1984	
Oliver, X; Agelet de Saracíbar, C.	Mecánica de medios continuos para ingenieros	CIMNE	84-8301-412-2	2000	
Sanchez Galvez, Vicente	Curso de comportamiento plástico de materiales	Universidad Politécnica de Madrid,	84-7493-261-0	1999	

Basar, Yavuz	Nonlinear continuum mechanics of solids: fundamental mathema	Departamento de Springer	3-540-66601-X	2000