UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: DYNAMIC MATERIALS AND STRUCTURES
Code: 310812
Type: ELECTIVE
ECTS credits: 4.5
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: 2
Duration: First semester
Main language: English
Second language: Spanish
Use of additional languages:
English Friendly: N
Web site:
Bilingual: N

Lecturer: **ELISA POVEDA BAUTISTA** - Group(s): **20**

Building/Office	Department	Phone number	Email	Office hours
Politécnico/2-D56	MECÁNICA ADA. E ING. PROYECTOS	6322	elisa.poveda@uclm.es	

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 Wednesday: 16:00-19:00

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 & Thursday: 17:00-19:00

Lecturer: **XIAOXIN ZHANG ---** - Group(s): **20**

Building/Office	Department	Phone number	Email	Office hours
Politécnico/2-A54	MECÁNICA ADA. E ING. PROYECTOS	926052870	Xiaoxin.Zhang@uclm.es	Thursday: 10:00-14:00, 17:00-19:00

2. Pre-Requisites

It is recommended that the students have knowledge of the following subjects:

Continuum Mechanics and Materials Science, Rigid Body Mechanics, Solid Mechanics, Science and Tecnology 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
AFC1	Ability to address and solve advanced mathematical engineering problems, from problem solving to formulation development and implementation in a computer program. In particular, the ability to formulate, program and apply advanced analytical and numerical models for calculation, design, planning and management, as well as the ability to interpret the results obtained, in the context of civil engineering.
G27	Ability to communicate in a second language.
G29	Management capacity and teamwork.
ICET1	Theoretical and practical knowledge of the behaviour of materials, structural elements and structures through constitutive models. Ability to apply these models to specific cases and use them to predict mechanical phenomena.
ICET2	Theoretical and practical knowledge of the dynamic behaviour of materials, structural elements and structures. Ability to apply these models to specific cases and use them to predict mechanical phenomena.
ICET4	Capacity for dynamic analysis of structures and determination of the main characteristics that define their dynamic response. Knowledge of the actions that generate a dynamic response in structures and the ability to carry out an effective structural design in the face of dynamic actions.
TE02	Knowledge and capacity for structural analysis through the application of methods and programmes for the design and advanced calculation of structures, based on the knowledge and understanding of loads and their application to structural typologies in civil engineering. Ability to perform structural integrity assessments.
TE03	Knowledge of all types of structures and their materials, and ability to design, project, execute and maintain civil engineering structures and buildings.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Students can identify and solve structural problems.

Students can calculate and design technologically each of the elements of the structure according to the materials and typology chosen to solve the structural problem.

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

Students can numerically model the dynamic behavior of structures, determining the main characteristics that define their dynamic response.

Students know the actions that generate a dynamic response in the structure and can perform an effective structural design in response to dynamic actions.
Students use computer programs that simulate the mechanical behavior of materials and structures in static and dynamic regimes.

6. Units / Contents

Unit 1: Dynamic behavior of materials in Civil Engineering

- **Unit 1.1** Material behavior in dynamic regime
- **Unit 1.2** Constitutive models in dynamic regime
- **Unit 1.3** Linera elastic fracture mechanics in dynamic regime
- **Unit 1.4** Cohesive fracture in dynamic regime

Unit 2: Digital signal processing

- **Unit 2.1** Analog and digital signals. Linear systems
- **Unit 2.2** Time response: convolution; discrete Fouriour Transformation; FFT

Unit 3: Diginal signal processing applied to structural dynamics

- **Unit 3.1** Dynamic load decomposition
- **Unit 3.2** Mode and spectral analysis
- **Unit 3.3** Harmonic analysis
- **Unit 3.4** Transitory analysis

Unit 4: Fatigue of structures under cyclic loading

Unit 5: Lab practice

- **Unit 5.1** Fracture of concrete under impact loading through a drop weight device
- **Unit 5.2** Modelling of the fatigue of a structural element under cyclic loading

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	AFC1 G27 ICET1 ICET2 ICET4 TE02 TE03	0.95	23.75	N	-	
Class Attendance (practical) [ON-SITE]	Project/Problem Based Learning (PBL)	AFC1 TE02 TE03	0.15	3.75	N	-	
Practicum and practical activities report writing or preparation [OFF-SITE]	Cooperative / Collaborative Learning	G29 TE02 TE03	0.25	6.25	Y	Y	The report consists of two parts, experimental and numerical, a minimum note of 4 is required. It is recoverable with a new submission.
Laboratory practice or sessions [ON-SITE]	Combination of methods	AFC1 G29 TE02 TE03	0.25	6.25	Y	N	Can be recovered in the final exam. The class performance in the case of continuous evaluation forms 10% of the global note.
Study and Exam Preparation [OFF-SITE]	Combination of methods	AFC1 G29 TE02 TE03	2.9	72.5	N	-	
		Total:	**4.5**	**112.5**			
		Total credits of in-class work: 1.35					**Total class time hours: 33.75**
		Total credits of out of class work: 3.15					**Total hours of out of class work: 78.75**

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
Final test	50.00%	60.00%	In order to pass, the final test (TE) needs to have a minimum note of 4.
Practicum and practical activities reports assessment	15.00%	15.00%	Lab practice and lab report (EP) consist of both numerical and experimental parts. A minimum note of 4 is needed to pass.
Assessment of active participation	10.00%	0.00%	Class performance (AC).
Assessment of problem solving and/or case studies	25.00%	25.00%	Problem solving and case studies with finite element software (TC).
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:

1) Minimum requirements: ET, EP >=4.
2) Global evaluation: 0.50*ET+0.15*EP+0.10*AC+0.25*TC
3) No notes will be kept for the next academic year.

Non-continuous evaluation:

By default, all students will be under continuous assessment. Whoever chooses for the non-continuous evaluation should inform the instructor before the class period ends and can only do so if his or her participation in the evaluable activities (according to the continuous assessment) will not reach 50% of the subject.

1) Minimum requirements: ET, EP >=4.
2) Global evaluation: 0.60*ET+0.15*EP+0.25*TC
3) No notes will be kept for the next academic year.

Specifications for the resit/retake exam:
In the retake exam, each student will be evaluated in the same (continuous or non-continuous) manner as in the normal exam. The same weights and minimum note requirements will be applied. No evaluation will be carried to the next academic year.

Specifications for the second resit / retake exam:
The same criterion as that of the non-continuous evaluation applies.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	**hours**

Unit 1 (de 5): Dynamic behavior of materials in Civil Engineering

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	5.75
Study and Exam Preparation [AUTÓNOMA][Combination of methods]	18
Teaching period: two weeks	
Group 20:	
Initial date: 14-09-2023	**End date:** 28-09-2023

Unit 2 (de 5): Digital signal processing

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	6
Study and Exam Preparation [AUTÓNOMA][Combination of methods]	18
Teaching period: two weeks	
Group 20:	
Initial date: 27-09-2023	**End date:** 06-10-2023

Unit 3 (de 5): Diginal signal processing applied to structural dynamics

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	6
Study and Exam Preparation [AUTÓNOMA][Combination of methods]	18
Teaching period: two and a half weeks	
Group 20:	
Initial date: 12-10-2023	**End date:** 27-10-2023

Unit 4 (de 5): Fatigue of structures under cyclic loading

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	6
Study and Exam Preparation [AUTÓNOMA][Combination of methods]	18.5
Teaching period: two weeks	
Group 20:	
Initial date: 02-11-2023	**End date:** 10-11-2023

Unit 5 (de 5): Lab practice

Activities	**Hours**
Class Attendance (practical) [PRESENCIAL][Project/Problem Based Learning (PBL)]	3.75
Practicum and practical activities report writing or preparation [AUTÓNOMA][Cooperative / Collaborative Learning]	6.25
Laboratory practice or sessions [PRESENCIAL][Combination of methods]	6.25
Teaching period: two weeks	
Group 20:	
Initial date: 18-11-2023	**End date:** 01-12-2023

Global activity

Activities	**hours**
Practicum and practical activities report writing or preparation [AUTÓNOMA][Cooperative / Collaborative Learning]	6.25
Laboratory practice or sessions [PRESENCIAL][Combination of methods]	6.25
Class Attendance (theory) [PRESENCIAL][Lectures]	23.75
Class Attendance (practical) [PRESENCIAL][Project/Problem Based Learning (PBL)]	3.75
Study and Exam Preparation [AUTÓNOMA][Combination of methods]	72.5
Total horas:	112.5

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Sidney Mindess, J. Francis Young and David Darwin	Concrete	Prentice Hall		0130646326	2002	
Steven W Smith	Scientist and Engineer's Guide to Digital Signal Processing http://www.dspguide.com	Betrams		0966017633	1997	
X.X. Zhang, G. Ruiz & R.C. Yu	A New Drop-weight Impact Machine for Studing Fracture Process in Structural Concrete http://onlinelibrary.wiley.com/doi/10.1111/j.1475-1305.2008.00574.x/abstract?systemMessage=Wiley+Online+Library+disruption+has+been+delayed+to+the+12th+July+2015.+We+will+provide+a+further+update+as+soon+as+possible.	Blackwell Publishing Ltd.	Londres	1475-1305	2010	Se trata de una torre caída de deseño propio en la ETSI de Caminos, Canales y Puertos en la UCLM, Ciudad Real
	Concrete Structures under Impact and Impulsive Loading -Synthesis Report	CEB Bulletins			1988	

Anil K. Chopra	Dynamics of Structures	Prentice Hall International Series in Civil Engineering and Engineering Mechanics	0132858037 2011 4th Edition, ISBN-13: 978-0132858038
CEB-FIB Model Code 1990	Fatigue of Concrete Structures - State-of-the-art Report	CEB Bullitins	1988
	http://www.fib-international.org/fatigue-of-concrete-structures-pdf		