



## 1. General information

**Course:** DESIGN WORK: DESIGN AND SIZING OF A STRUCTURE**Type:** ELECTIVE**Degree:** 2343 - MASTERS DEGREE PROGRAMME IN ENGINEERING OF ROADS, CANALS AND PORTS**Center:** 603 - E.T.S. CIVIL ENGINEERS OF CR**Year:** 2**Main language:** Spanish**Use of additional languages:****Web site:****Code:** 310811**ECTS credits:** 6**Academic year:** 2020-21**Group(s):** 20**Duration:** First semester**Second language:** English**English Friendly:** Y**Bilingual:** N**Lecturer:** JOSE ANTONIO LOZANO GALANT - Group(s): 20

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Edificio Politécnica/A-41	INGENIERÍA CIVIL Y DE LA EDIFICACIÓN	+34 926 05 23 33	joseantonio.lozano@uclm.es	Office hours will be scheduled at the beginning of the course.

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## 2. Pre-Requisites

A basic knowledge of the following topics is advised: (1) Concrete and Steel structures, (2) Buildings and bridges, (3) Materials strength, (4) Calculation of structures, (5) Project management.

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

The aim of this subject is introducing students into the design of a structure (bridge or building) by Project Based Learning (PBL) methodology. To do so, their structural knowledge in Building Information Modelling (BIM), computer simulation and composite structures is strengthened. The students are also introduced into the design of bridges.

## 4. Degree competences achieved in this course

## Course competences

Code	Description
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
CB08	Be able to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of knowledge and judgments
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
G01	Scientific-technical and methodological capacity for the continuous recycling of knowledge and the exercise of the professional functions of consultancy, analysis, design, calculation, project, planning, leadership, management, construction, maintenance, conservation and exploitation in the fields of civil engineering.
G02	Understanding of the multiple technical, legal and property constraints that arise in the design of a public work, and the capacity to establish different valid alternatives, to choose the optimum one and to express it adequately, anticipating the problems of its construction, and using the most suitable methods and technologies, both traditional and innovative, with the aim of achieving the greatest efficiency and promoting the progress and development of a sustainable and respectful society with the environment.
G03	Knowledge, understanding and ability to apply the necessary legislation in the exercise of the profession of Civil Engineer.
G04	Knowledge of the history of civil engineering and ability to analyse and assess public works in particular and the construction industry in general.
G05	Knowledge of the Civil Engineering profession and the activities that can be carried out in the field of civil engineering.
G06	Ability to plan, design, inspect and manage land (roads, railways, bridges, tunnels and urban roads) or sea (port works and facilities) transport infrastructures.
G07	Knowledge to apply technical and managerial skills in R&D&I activities in the field of civil engineering.
G11	Capacity for the design, execution and inspection of structures (bridges, buildings, etc.), foundation works and underground civil works (tunnels, car parks), and the assessment of their integrity.
G12	Capacity to plan, design, manage, maintain and operate infrastructure.

G15	Capacity for environmental assessment and restoration of infrastructure works in projects, construction, rehabilitation and conservation.
G18	Ability to participate in research projects and scientific and technological collaborations within its thematic area, in interdisciplinary contexts and, where appropriate, with a high knowledge transfer component.
G20	Ability to choose between construction alternatives and public works management, anticipating the effects derived from the option assumed.
G27	Ability to communicate in a second language.
G28	Ability to work in an international context.
G29	Management capacity and teamwork.
ICET3	Ability to safely tackle the design of a bridge, based on the loads acting on it, understanding the behavior of its cross-section and knowing the main construction procedures for this type of structure.
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.
TE11	Ability to analyse the environmental factors involved in an engineering action
TE12	Ability to assess the impact an engineering work can have on the environment and to define appropriate corrective measures.

## 5. Objectives or Learning Outcomes

### Course learning outcomes

Description

Students can identify and solve structural problems.

Students can numerically model structural behavior both during the structure's construction process and once it is complete.

Students can evaluate the impact that an engineering work such as a building and/or viaduct can have on the environment and define the relevant corrective and/or compensatory measures.

Students can analyze the environmental factors involved in an engineering project, whether it is a building or a viaduct.

## 6. Units / Contents

**Unit 1: Computer simulation of structures**

**Unit 2: Bridge design**

**Unit 3: Project of concrete structures**

**Unit 4: Project of steel or composite structures**

**Unit 5: Building Information Modelling (BIM)**

## 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	CB06 CB07 CB10 G01 G02 G03 G04 G05 G15 G27 G28 TE02 TE03 TE11 TE12	0.56	14	Y	N	Theoretical concepts
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	CB06 CB07 CB10 G01 G02 G03 G04 G06 G07 G27 G28 TE02 TE03	0.56	14	Y	N	Classes oriented to solve problems
Writing of reports or projects [OFF-SITE]	Project/Problem Based Learning (PBL)	CB06 CB07 CB08 CB09 CB10 G01 G02 G03 G04 G06 G07 G11 G12 G18 G20 G29 TE02 TE03	2.8	70	Y	Y	Students will carry out a projectual work in teams (report and public exposition)
Writing of reports or projects [OFF-SITE]	Self-study	CB06 CB07 CB08 CB09 CB10 G01 G02 G03 G04 G29 TE02 TE03	0.8	20	Y	Y	Report showing how a the analysis of the assigned structure was performed.
Problem solving and/or case studies [ON-SITE]	project-based learning	CB10 G06 G27 G28 TE02	0.28	7	Y	Y	Use of advance structural software to simulate the behavior of different structures.
Workshops or seminars [ON-SITE]	Guided or supervised work	CB06 CB07 CB08 CB09 CB10 G15 ICET3 TE11 TE12	0.2	5	Y	N	Workshops or seminars will be planned to address students' motivation and detected gaps.
Group tutoring sessions [ON-SITE]	Group Work	CB09 CB10 G03 G06 G29	0.08	2	Y	N	Students will work in groups on the assigned task. Professors will be available to solve any question they might have.
Study and Exam Preparation [OFF-SITE]	Self-study	G27 G28 TE02 TE03	0.6	15	Y	N	Self study for the subject exam.
Final test [ON-SITE]	Assessment tests	G02 G12 G27 G28 TE02 TE03	0.12	3	Y	Y	Theoretical/practical exam of the subject
<b>Total:</b>			<b>6</b>	<b>150</b>			
<b>Total credits of in-class work: 1.8</b>			<b>Total class time hours: 45</b>				
<b>Total credits of out of class work: 4.2</b>			<b>Total hours of out of class work: 105</b>				

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%	50.00%	Theoretical / Practical exam of the subject
Practicum and practical activities reports assessment	15.00%	15.00%	Assignments
Theoretical papers assessment	35.00%	35.00%	Project
<b>Total:</b>	<b>100.00%</b>	<b>100.00%</b>	

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:

Grade: 50% Exam + 15% Assignments + 35% Project (minimal grade in each part 4.0)

The activities will preferably be done in person but if necessary virtual performance is also possible.

##### Non-continuous evaluation:

Grade: 50% Exam + 15% Assignments + 35% Project (minimal grade in each part 4.0)

The activities will preferably be done in person but if necessary virtual performance is also possible.

#### Specifications for the resit/retake exam:

Exam of the subject: This exam will preferably be done in person but if necessary virtual exams are also possible.

#### Specifications for the second resit / retake exam:

Exam of the subject: This exam will preferably be done in person but if necessary virtual exams are also possible.

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	hours
Unit 1 (de 5): Computer simulation of structures	
Activities	Hours
Problem solving and/or case studies [PRESENCIAL][project-based learning]	5
Unit 2 (de 5): Bridge design	
Activities	Hours
Writing of reports or projects [AUTÓNOMA][Project/Problem Based Learning (PBL)]	5
Writing of reports or projects [AUTÓNOMA][Self-study]	3
Workshops or seminars [PRESENCIAL][Guided or supervised work]	5
Group tutoring sessions [PRESENCIAL][Group Work]	3
Unit 3 (de 5): Project of concrete structures	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	7
Writing of reports or projects [AUTÓNOMA][Project/Problem Based Learning (PBL)]	10
Writing of reports or projects [AUTÓNOMA][Self-study]	3
Problem solving and/or case studies [PRESENCIAL][project-based learning]	1
Group tutoring sessions [PRESENCIAL][Group Work]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	5
Final test [PRESENCIAL][Assessment tests]	1.5
Unit 4 (de 5): Project of steel or composite structures	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	8
Writing of reports or projects [AUTÓNOMA][Project/Problem Based Learning (PBL)]	10
Writing of reports or projects [AUTÓNOMA][Self-study]	3
Problem solving and/or case studies [PRESENCIAL][project-based learning]	1
Group tutoring sessions [PRESENCIAL][Group Work]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	5
Final test [PRESENCIAL][Assessment tests]	1.5
Unit 5 (de 5): Building Information Modelling (BIM)	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Writing of reports or projects [AUTÓNOMA][Project/Problem Based Learning (PBL)]	40
Writing of reports or projects [AUTÓNOMA][Self-study]	6
Group tutoring sessions [PRESENCIAL][Group Work]	8
Global activity	
Activities	hours
Class Attendance (theory) [PRESENCIAL][Lectures]	15
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	15
Writing of reports or projects [AUTÓNOMA][Project/Problem Based Learning (PBL)]	65
Writing of reports or projects [AUTÓNOMA][Self-study]	15
Problem solving and/or case studies [PRESENCIAL][project-based learning]	7
Workshops or seminars [PRESENCIAL][Guided or supervised work]	5

Group tutoring sessions [PRESENCIAL][Group Work]	15
Final test [PRESENCIAL][Assessment tests]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	10
<b>Total horas: 150</b>	

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house	City	ISBN	Year	Description
C.H. Goodchild	Economic Concrete Frame Elements to Eurocode 2				2009	
Calavera, J.	Proyecto y cálculo de estructuras de hormigón. Tomos I y II	Intemac			1999	
Centro de Publicaciones Secretaría General Técnica Ministerio de Fomento	Guía de aplicación de la Instrucción de Hormigón Estructural (EHE 08): Edificación			978-8449809781	2014	
HAMBLY, E	Bridge Deck Behaviour			0-419-17260-2	1991	
MENN, C.	Prestressed concrete bridges			3-7643-241	1990	
	Eurocode 2: Design of concrete structures				1992	
	Eurocode 3: Design of steel structures				1993	
	Eurocode 4: Design of composite steel and concrete structures				1994	
	IAP11, Instrucción sobre las acciones a considerar en el proyecto de puentes de carretera	Ministerio de Fomento			2012	