



1. General information

Course: DESIGN WORK: DESIGN AND SIZING OF A STRUCTURE**Code:** 310811**Type:** ELECTIVE**ECTS credits:** 6**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:** Spanish**Second language:** English**Use of additional languages:****English Friendly:** Y**Web site:****Bilingual:** N**Lecturer:** JOSE ANTONIO LOZANO GALANT - Group(s): 20

| Building/Office | Department | Phone number | Email | Office hours |
|---------------------------|--------------------------------------|------------------|----------------------------|--|
| Edificio Politécnica/A-41 | INGENIERÍA CIVIL Y DE LA EDIFICACIÓN | +34 926 05 23 33 | joseantonio.lozano@uclm.es | Tentative. Tuesdays and Thursdays from 15:00 to 18:00 h. |

Lecturer: RAMON ALFONSO SANCHEZ DE LEON - Group(s): 20

| Building/Office | Department | Phone number | Email | Office hours |
|---------------------------|--------------------------------------|--------------|-------------------------------|---|
| Edificio Politécnica/A-59 | INGENIERÍA CIVIL Y DE LA EDIFICACIÓN | | rsanchezdeleon@estudioaia.com | Tentative. Tuesday from 12:00 to 18:00 h. |

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

Students can identify and solve structural problems.

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

6. Units / Contents

Unit 1: Recognition of the area and evaluation of technical solutions

Unit 1.1 Preliminary recognition and problems

Unit 1.2 Study of alternatives

Unit 1.3 Construction processes and environmental impact

Unit 2: Design of a structure

Unit 2.1 Structural codes and modeling

Unit 2.2 Structural typologies and analysis

Unit 2.3 Dimensioning of the structural elements

Unit 3: Calculation of a structure

Unit 3.1 Structural analysis and construction processes

Unit 3.2 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 | 1 | 25 | N | - | |
| 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 | Y | Recoverable with exam. |
| 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 | 2.4 | 60 | Y | Y | Recoverable with an assignment. |
| Project or Topic Presentations [ON-SITE] | Debates | CB09 CB10 | 0.12 | 3 | Y | Y | |
| Study and Exam Preparation [OFF-SITE] | Self-study | G27 G28 TE02 TE03 | 1.8 | 45 | N | - | |
| Final test [ON-SITE] | Assessment tests | G02 G12 G27 G28 TE02 TE03 | 0.12 | 3 | Y | Y | Recoverable with exam. |
| Total: | | | 6 | 150 | | | |
| Total credits of in-class work: 1.8 | | | Total class time hours: 45 | | | | |
| Total credits of out of class work: 4.2 | | | Total hours of out of class work: 105 | | | | |

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 | 60.00% | 100.00% | Recoverable in extraordinary exam, Minimal grade 4.0 |

| | | | |
|---|----------------|----------------|---|
| Projects | 20.00% | 0.00% | 15% technical content and 5% oral presentation. Non recoverable. Minimal grade 4.0. |
| Assessment of problem solving and/or case studies | 20.00% | 0.00% | Non recoverable. Minimal grade 4.0 |
| 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:

Grade:60% Exam + 20% projects + 20% case studies. The details on content, extension and requirements of the works or practices that have to be delivered in writing will be indicated on the virtual campus at the beginning of the semester.

The minimal grade for the exam, project and the case study is 4.0.

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

Non-continuous evaluation:

Unless stated otherwise, continuous evaluation criteria will be applied to all students.

Anyone choosing non-continuous assessment must notify it to the lecturer within the class period of the subject. The option is only available if the student's participation in evaluation activities (from the continuous assessment) has not reached 50% of the total evaluation for the subject.

For the retake exam, the assessment type used for the final exam will remain valid.

Exam 100% grade.

Specifications for the resit/retake exam:

Grade:60% Exam + 20% projects + 20% case studies. The details on content, extension and requirements of the works or practices that have to be delivered in writing will be indicated on the virtual campus at the beginning of the semester.

The minimal grade for the exam, project and the case study is 4.0.

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

The passed projects and works will be considered for the following academic course.

Specifications for the second resit / retake exam:

The same criteria of the non-continuous evaluation is applied.

| 9. Assignments, course calendar and important dates | |
|---|--------------|
| Not related to the syllabus/contents | |
| Hours | hours |
| Final test [PRESENCIAL][Assessment tests] | 3 |
| Unit 1 (de 3): Recognition of the area and evaluation of technical solutions | |
| Activities | Hours |
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] | 4 |
| Writing of reports or projects [AUTÓNOMA][Project/Problem Based Learning (PBL)] | 25 |
| Project or Topic Presentations [PRESENCIAL][Debates] | 3 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 7 |
| Unit 2 (de 3): Design of a structure | |
| Activities | Hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 26 |
| Writing of reports or projects [AUTÓNOMA][Project/Problem Based Learning (PBL)] | 20 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 30 |
| Unit 3 (de 3): Calculation of a structure | |
| Activities | Hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 2 |
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] | 10 |
| Writing of reports or projects [AUTÓNOMA][Project/Problem Based Learning (PBL)] | 15 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 5 |
| Global activity | |
| Activities | hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 28 |
| Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] | 14 |
| Writing of reports or projects [AUTÓNOMA][Project/Problem Based Learning (PBL)] | 60 |
| Final test [PRESENCIAL][Assessment tests] | 3 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 42 |
| Project or Topic Presentations [PRESENCIAL][Debates] | 3 |
| Total horas: 150 | |

| 10. Bibliography and Sources | | | | | | |
|--------------------------------|--|------------------|------|------------|------|-------------|
| Author(s) | Title/Link | Publishing house | Citv | ISBN | Year | Description |
| Toniolo, G. | Reinforced Concrete Design to Eurocode 2 | Springer | | 3319520326 | 2017 | |
| H. M. G. M. Steenbergen, H. H. | Steel Design 1: Structural Basics | | | | 2020 | |

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|--|---|--------------------------|------------------------|
| Snijder 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 |
| Romo, J. | DISEÑO EN PUENTES | | 9788438005422 2020 |
| Reis, J. Oliveira, J.J. | BRIDGE DESIGN: CONCEPTS AND ANALYSIS | | 9780470843635 2019 |
| Strasky, J. | DESIGNING AND CONSTRUCTING PRESTRESSED BRIDGES | | 9780727763853 2021 |
| Ioannis Vayas, Aristidis Iliopoulos | DESIGN OF STEEL-CONCRETE COMPOSITE BRIDGES TO EUROCODES | | 9781138076952 2017 |
| | Reinforced Concrete Design Workflow to Eurocode 2 | Yfilios Solution | 2021 |
| Dongzhou Huang, Bo Hu | CONCRETE SEGMENTAL BRIDGES: THEORY, DESIGN, AND CONSTRUCTION TO AASHTO LRFD SPECIFICATIONS | | 9781498799003 2020 |