

Academic Year/course: 2021/22

## 28745 - Extension of Structures

### Syllabus Information

**Academic Year:** 2021/22

**Subject:** 28745 - Extension of Structures

**Faculty / School:** 175 - Escuela Universitaria Politécnica de La Almunia

**Degree:** 423 - Bachelor's Degree in Civil Engineering

**ECTS:** 6.0

**Year:** 4

**Semester:** First semester

**Subject Type:** Compulsory

**Module:**

## 1. General information

### 1.1. Aims of the course

The course and its expected results respond to the following approaches and objectives:

At the end of the course, the student will know the structural behavior of different types of bridges and will be able to define calculation models for a bridge, which can be solved with structural calculation software. You will also know how to solve other elements of the bridge such as the pillars.

Another transport infrastructure of great importance in the training of Civil Engineers is tunnels. In this course it is intended that the student knows the basic aspects of tunnel design and construction.

It is also intended that the student know how to design mixed structural sections (concrete - steel), know the Finite Element Method and know when it is necessary to carry out a dynamic analysis of structures.

### 1.2. Context and importance of this course in the degree

The course of Extension of Structures is a fourth-year subject located in the first semester and is compulsory, with a teaching load of 6 ECTS credits.

The course applies prior knowledge to the design and construction of bridges and tunnels. We cannot understand a civil engineer without a foundation in these basic subjects of the profession.

The need for the course within the degree program is more than justified.

### 1.3. Recommendations to take this course

The student must have previous knowledge of Structures and Geotechnics.

## 2. Learning goals

### 2.1. Competences

**Upon passing the course, the student will be more qualified to ...**

#### **Generic capacities**

G01. Organization and planning.

G02. Solve problems.

G03. Take decisions.

G04. Oral and written communication.

G05. Analysis and synthesis.

G06. Information management.

G07. Teamwork.

- G08. Critical thinking.
- G09. Multidisciplinary teamwork.
- G10. Work in an international context.
- G11. Adapt to new situations.
- G12. Leadership aptitude.
- G13. Adapt to social and technological innovations.
- G14. Reason and present their own ideas.
- G15. Communicate with words and pictures.
- G16. Search, analyze and select information.
- G17. Self-learning.
- G23. Respect fundamental rights, gender equality, accessibility for disabled people and respect the values of democracy and peace
- G24. Promote entrepreneurship.
- G25. Knowledge in information and communication technologies.

### **Specific competences**

- C04. Analyze and understand how the characteristics of structures influence their behavior. Apply knowledge of structures for design according to codes and using analytical and numerical calculation methods.
- C06. Know the behavior of reinforced concrete structures and metal structures and project, build and maintain this type of structures.

## **2.2. Learning goals**

### **The student, to pass this course, must achieve the following goals ...**

- Have an overview of the historical evolution of bridge construction and its typologies.
- Know basic design parameters and structural response of different types of straight concrete bridges and substructure elements.
- Define a frame model for the structural calculation of bridges.
- Know the actions that must be considered in the calculation of road bridges.
- Know the behavior of mixed structural sections (concrete - steel).
- Know the parameters and geomechanical classifications used in the design and construction of rock tunnels, being able to define a type of support table.
- Know the different methods of building tunnels in rock and in soils.
- Know the basic concepts of the calculation of structures using the Finite Element Method.
- Have a general understanding of when it is necessary to consider dynamic actions in the calculation of structures.

## **2.3. Importance of learning goals**

This course is practical, that is, it offers training with content that can be applied and developed immediately in professional life. Through the achievement of learning goals, the necessary capacity is obtained for the design of basic transport infrastructures such as bridges and tunnels.

# **3. Assessment (1st and 2nd call)**

## **3.1. Assessment tasks (description of tasks, marking system and assessment criteria)**

**The student must demonstrate that they have achieved the expected learning outcomes through the following assessment activities:**

### **Continuous assessment**

The course is divided into two parts:

- Part 1:                Bridges.  
                          Mixed structures (concrete ? Steel).
- Part 2:                Tunnels.  
                          Finite element method.  
                          Dynamic analysis of structures.

Each of the parts has a value equal to 50% of the subject and will be evaluated as follows:

Throughout each part there will be several mandatory exercises. Its value is 30% of the part. The teacher will propose the practical exercises, which the students must do during the determined time. Students will deliver the practice on the date scheduled for their evaluation. Once delivered, the practice will be resolved in class.

The continuous assessment of each part will be completed with a theoretical-practical test whose value is 70% of the total of the part.

Students whose average mark is equal to or greater than 5.0 points will pass each part in continuous assessment.

It will be necessary to pass each part independently.

It will also be necessary to have attended 80% of the face-to-face activities.

#### **Final assessment**

Students who do not pass the course in continuous assessment will have to take a theoretical-practical final test in each of the parts, which will be scored from 0 to 10 and it will be necessary to obtain a minimum score of 5 points to pass each of the parts.

The final score will be the average of the scores of the two parts passed.

Those students who have previously passed one of the parts, will have the option to examine only the part not passed.

## **4. Methodology, learning tasks, syllabus and resources**

### **4.1. Methodological overview**

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures, practice sessions, tutorials, and autonomous work and study.

A strong interaction between the teacher/student is promoted. This interaction is brought into being through a division of work and responsibilities between the students and the teacher. Nevertheless, it must be taken into account that, to a certain degree, students can set their learning pace based on their own needs and availability, following the guidelines set by the teacher.

If due to health reasons the in-person teaching-learning process is not possible, it shall be carried out telematically.

### **4.2. Learning tasks**

This course is organized as follows:

- **Lectures:** Theoretical activities carried out mainly through exposition by the teacher, where the theoretical supports of the course are displayed, highlighting the fundamentals, structuring them in topics and or sections, interrelating them.
- **Practice sessions:** The teacher resolves practical problems or cases for demonstrative purposes. This type of teaching complements the theory shown in the lectures with practical aspects.
- **Tutorials:** Carried out giving individual, personalized attention with a teacher from the department. These tutorials may be on-site or online.
- **Autonomous work and study**
  - Study and understanding of the theory taught in the lectures.
  - Understanding and assimilation of the problems and practical cases solved in the practice sessions.
  - Preparation of seminars, solutions to proposed problems, etc.
  - Preparation of the written tests for continuous assessment and final exams.

The course has 6 ECTS credits, which represents 150 hours of student work in the course during the trimester, in other words, 10 hours per week for 15 weeks of class.

A summary of a weekly timetable guide can be seen below. These figures are obtained from the course file in the Accreditation Report of the degree, taking into account the level of experimentation considered for this course is moderate.

#### **Activity / Weekly hours**

Lectures / 4

Other Activities / 6

### **4.3. Syllabus**

This course will address the following topics:

- Topic 1. Bridges
- Topic 2. Composite construction in steel and concrete
- Topic 3. Tunnels
- Topic 4. Finite Element Methods
- Topic 5. Dynamic analysis of structures

#### **4.4. Course planning and calendar**

Further information concerning the timetable, classroom, office hours, assessment dates (<http://www.eupla.unizar.es/asuntos-academicos/examenes>) and other details regarding this course will be provided on the first day of class or please refer to the Faculty of EUPLA website and Moodle.

#### **4.5. Bibliography and recommended resources**

<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=28745>