Universidad Zaragoza

Academic Year/course: 2024/25

28745 - Extension of Structures

Syllabus Information

Academic year: 2024/25
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

The objective of the course is that the student knows how to discern the structural behavior of different types of straight concrete bridge decks and other bridge infrastructure elements (piers and abutments) and to be able to define models of bridge deck members to be solved with structural calculation software.

It is also intended that the student acquires a global vision of tunnels, from the parameters for their design to the means used for their construction.

The course is completed with contents of mixed concrete-steel structures, the Finite Element Method to solve two-dimensional elasticity problems and dynamic analysis of structures.

2. Learning results

After passing the subject the student will have acquired the following knowledge:

- To have an overview of the historical evolution of bridge construction and its typologies.
- To know basic design parameters and structural response of decks of different types of straight concrete bridges and substructure elements (piers, abutments).
- Define an equivalent member model for the structural design of straight concrete bridges.
- To know the actions to be considered in the calculation of road bridges.
- To know the basic aspects of the operation of mixed structural sections (concrete - steel).
- Be familiar with the geomechanical parameters and classifications used in the design and construction of tunnels in rock, being able to define a typical support table.
- To know the different methods of construction of tunnels in rock and soils and their monitoring.
- To know the basic concepts of the calculation of linear and two-dimensional structures (plane stress and plane strain problems) by means of the Finite Element Method.
- Have a general knowledge of when it is necessary to consider dynamic actions in the design of structures.

3. Syllabus

TOPIC 1. BRIDGES

- Evolution of bridges.
- The beam deck.
- The slab bridge.
- Calculation of panels by the grid method.
- Batteries.
- Stirrups.
- Actions to consider.

TOPIC 2. MIXED STRUCTURES

- Basic fundamentals.
- Elastic analysis.
- The connection in mixed structures.

TOPIC 3. TUNNELS

- Introduction.
- Geomechanical design parameters.
- Geomechanical classifications.
- Estimation of support by empirical methods.
- Excavability criteria.
- Methods of excavation and support of rock tunnels.
- Methods of construction of tunnels in soils.
- Geological-geotechnical considerations during construction.

TOPIC 4. INTRODUCTION TO THE FINITE ELEMENT METHOD

- Basic concepts. Introduction to FEM.
- Two-dimensional elasticity.

TOPIC 5. DYNAMIC ANALYSIS OF STRUCTURES

- Presentation of the dynamic phenomenon.

4. Academic activities

Lectures: These are classes on theoretical arguments or on problem solving given by the professor in a fundamentally expository manner.

Seminars/workshops: Theoretical or preferably practical discussion activities carried out in the classroom or in other forums by visiting professors or speakers not belonging to the teachingstaff of the subject.

Visits: Didactic visits (guided by the teachers of the course) related to the topics developed throughout the subject.

Individual tutorials: they can be face-to-face or virtual through the virtual teaching portal (Moodle) or through the University of Zaragoza's e-mail.

Group tutoring: Activities focused on student learning developed by the teacher who meets with a group of students to solve group doubts or develop resolutions of exams or problems of commoninterest.

5. Assessment system

Continuous Assessment

The subject will be divided into two blocks:

Block 1: Bridges. Mixed structures.

Block 2. Tunnels. Finite Element Method. Dynamic analysis.

Each of the two blocks will have a weight of 50% and will be evaluated as follows:

Throughout each part there will be several exercises of application of the syllabus, of obligatory fulfillment, having a weight of 25% of the overall evaluation of each part.

At the end of the syllabus of each block there will be a theoretical-practical evaluation test, which will be scored from 0 to 10, being its weight in the total of the block 70%.

The remaining 5% corresponds to the attendance to the classroom activities. For visits and seminars, it will be necessary to pass a test related to that activity.

A minimum grade of 5 points is required to pass each of the blocks.

It is a necessary condition for continuous assessment to have attended 80% of the classroom activities.

Final assessment:

Students who have not passed the course may take a final exam, consisting of a theoretical test - practical content corresponding to Block 1 and another corresponding to Block 2. Each of the tests has a weight of 50% and is evaluated from 0 to 10. A minimum of 5 points must be obtained in each of the tests. The grade of the final assessment of each block will be the maximum value between the following two: 100% of the final exam grade; or, the result of adding 90% of the final exam grade + 5% of the continuous assessment practice + 5% of the attendance to face-to-face activities.

Those students who have previously passed one of the blocks will have the option of taking the exam for only the first block not passed.

6. Sustainable Development Goals

5 - Gender Equality
9 - Industry, Innovation and Infrastructure