

29740 - Structural Analysis of Industrial Facilities

Syllabus Information

Academic year: 2023/24

Subject: 29740 - Structural Analysis of Industrial Facilities

Faculty / School: 110 - Escuela de Ingeniería y Arquitectura

Degree: 434 - Bachelor's Degree in Mechanical Engineering

ECTS: 6.0

Year: 4

Semester: First semester

Subject type: Optional

Module:

1. General information

The objective of the subject is to enable the student to analyse and design industrial structures and installations. The following specific objectives are proposed for this purpose.

- To broaden the students' knowledge with the study of two structural typologies that had not been considered before, such as plate and sheet
- Application of this theoretical knowledge to the structural calculation of liquid tanks, gas tanks, silos for grain storage and chimneys. Study of the applicable regulations
- To extend the knowledge of structural analysis to the field of dynamic actions, of great importance in certain industrial facilities, and essential when an anti-seismic design is required.
- To know the different types of foundations, as well as their recommended use according to the results of the geotechnical study of the implementation area.

The different activities that are proposed during the development of this subject (practices, assignments and problem classes) do not only seek the assimilation of the different concepts exposed throughout the term, but also the enhancement of the reasoning, synthesis, resolution and further analysis of the results of different problems.

2. Learning results

1. Is capable of designing, calculating and projecting surface structural elements (tanks, silos, roofs).
2. Knows the technology of the construction of surface elements and the regulations that govern it.
3. Is capable of designing, calculating and projecting structures subjected to dynamic actions (vibrations induced by machinery and equipment, dynamic effects of wind, seismic actions)
4. Knows the current regulations regarding seismic design, both at national and European level.
5. Is capable of designing, calculating and projecting shallow and deep foundations.
6. Knows the technology of foundation construction and the regulations governing it.

3. Syllabus

Block I: Plastic calculation of structures

1. Limit theorems of structural analysis.
2. Plastic calculation of structures.

Block II: Surface structures

1. The plate model
2. The sheet model
3. Liquid storage tanks
4. Silos for grain storage
5. Gas storage tanks

Block II: Structural dynamics

1. Fundamentals of Structural Dynamics. Equations and calculation methods
2. Systems of 1 degree of freedom. Free and forced vibrations
3. Systems of N degrees of freedom
4. Calculation of frequencies and vibration modes
5. Methods for solving dynamic equations
6. Seismic calculation

4. Academic activities

Attendance to **all** learning activities is of special relevance to acquire the competencies of the subject.

The subject will be developed from the following learning activities:

- 1. Theoretical classes.** They constitute the central teaching nucleus. In them, the body of the content is developed in the program and examples of its application are presented.
- 2. Practical problem classes.** The problem classes complement the theoretical classes, allowing the student to apply the concepts to the resolution of engineering practice problems..
- 3. Computer Simulation Practices.** The aim is to familiarize students with the basic tools of calculation of surface structures, dynamic analysis and foundations.
- 4. Assignment work.** It intends to develop the project-based learning formula, to reinforce the rest of teaching activities, allowing the student to acquire teamwork skills.
- 5. Tutoring.** They allow the student to integrate the different contents and consolidate the object of their learning in a more individualized way.

5. Assessment system

In order to allow the **continuous evaluation** of the student, the following tests are proposed with their corresponding weighting in the final grade. A minimum grade of 45 out of 10 will be required in each of the parts.

Subject work (Weighting: 30%)

- The mechanical and resistant design of an industrial installation, its components and its subsidiary structures, including foundations, will be considered, allowing students to apply and reinforce the learning results discussed above through a real case study.
- Dates will be set for partial reviews and final delivery, prior to the official exam date.
- The evaluation will be based on the written report submitted and an oral presentation.

Practices (Weighting 30 %)

- A short practice report will be required at the end of each session.

Examination (Weighting: 40 %)

- Final exam in which the theoretical content of the subject will be evaluated.
- It will have an estimated duration of three hours.

For the **global evaluation** of the subject, the following tests are proposed to be taken during the official period of exams, with their weighting in the final grade. A minimum grade of 5 out of 10 will be required in each of the parts.

Examination (Weighting: 60 %)

- Final exam in which the complete content of the subject will be evaluated.
- It will consist of a theoretical part and another part of problems (exercises)
- It will have an estimated duration of three hours.

Practice exam (Weighting: 40 %)