

Academic Year/course: 2022/23

30154 - Metallic Structures

Syllabus Information

Academic Year: 2022/23

Subject: 30154 - Metallic Structures

Faculty / School: 179 - Centro Universitario de la Defensa - Zaragoza

Degree: 563 - Bachelor's Degree in Industrial Organisational Engineering

ECTS: 6.0

Year: 4

Semester: First semester

Subject Type: Optional

Module:

1. General information

1.1. Aims of the course

The expected results of the subject must be:

The student must:

- Ability to understand the mechanisms load transmission of structures.
- Knowledge of the types of steels and their alloys. Modes of behavior
- Be able to perform the design, sizing and testing of steel structures, according to the Spanish rule, with constructive solutions of sustainable architecture.
- Knowledge to execution of concrete structures.
- Ability to analyze and assess the social and environmental impact of solutions, acting with ethics, professional responsibility and social commitment.

Specialization in Defence: These approaches and objectives are in line with the following Sustainable Development Goals (SDGs) of the United Nations 2030 agenda (<https://www.un.org/sustainabledevelopment/>), in such a way that the acquisition of the course learning outcomes provides training and competence to contribute to their achievement to some degree.

- ODS7: Affordable and clean energy. Compliance with goal 7.3 is encouraged: "By 2030, double the global rate of improvement in energy efficiency", providing information on materials used for cement with lower energy consumption and CO2 emissions in its generation process. Will be provided information about the possible use of recycled materials and on the recycling process of the available materials.
- ODS 9: Industry, innovation and infrastructure. The fulfillment of two goals is encouraged:

9.1 "Develop reliable, sustainable, resilient and quality infrastructure..." Structural design parameters will be provided that allow structures to be built with the minimum amount of material. If we add this factor to the use of non-polluting, recycled and recyclable materials mentioned in goal 7.3, the student will be able to calculate and execute structures that are not only reliable and resilient, but also sustainable.

9.4. "By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities." Its fulfillment is strengthened with the objective indicated in goal 7.3, closely related.

- ODS 11: Sustainable cities and communities. Specifically, with the development of the subject, compliance with goal 11.6 is favored: "By 2030, reduce the negative environmental impact per capita of cities, including paying special attention to air quality and municipal waste management and of another type", taking into account recycling and designs, that promote the use of less polluting materials and therefore less waste.

1.2. Context and importance of this course in the degree

The subject is included in the Structures and Materials specialty of IOI, together with ?Steel Structures? and the ?Structural Calculation? subjects. It?s a fundamental subject in the in the training of Engineers Arm of the Earth Army. Previously, the student has studied the ?strength of materials? subject, which lays the bases for understand the equations to define

the behaviour of structures against external stresses. Also knowledge learned in the 'General Construction Procedures' subject is used.

This subject contributes to the training in values of the Army Officers, providing knowledge about the behavior of structural steel that will allow you to find and evaluate solutions to real problems related to metal structures, mainly used for the execution of bridges and mobility support structures. This knowledge is necessary for Army Officers to carry out their mission, and thereby contribute to reliable and sustainable construction and infrastructure.

1.3. Recommendations to take this course

To deal with the study of this subject, pupils must have previous knowledge of materials (properties and behavior of steel, relationship tension-strain etc.), mechanics (Static), resistance of materials (Efforts, relationship between stress and deformation). It is also necessary some domain of differential and integral calculus, resolution of equations systems and working with matrix . It would be desirable to have previously studied the subject "Calculation of Structures". It is important to attend classes, daily study and realization of the proposed exercises .

2. Learning goals

2.1. Competences

- C02 - Ability to plan, budget, organise, manage and monitor tasks, people and resources.
- C04 - Ability to solve problems and take decisions with initiative, creativity and critical reasoning.
- C06 – Ability to communicate knowledge and skills in Spanish.
- C09 – Ability to work in a multidisciplinary group and in a multilingual setting.
- C11 – Ability to continue learning and develop self-learning strategies.
- C60 –Gaining the necessary competence to calculate elementary architectural constructions.
- C66 –Knowledge of the basic theories and technologies to project and calculate metallic structures.

2.2. Learning goals

The student, to pass this subject, must demonstrate the following results ...

Define qualitatively the resistant response mechanisms in metal structure elements.

Design and execute metal structures according to Spanish regulations.

Describe in a basic way the behavior of metallic structures.

Describe in a general way the characteristics of other types of special alloys and their applications

Students will be able to apply all these learning goals within sustainability parameters in their professional future, promoting the reduction of the use of materials, as well as the use of less polluting materials, in line with compliance with the SDG of the subject

2.3. Importance of learning goals

The learning results are part of the competences that the student must acquire as part of their training in the They provide a knowledge of the behavior of metallic structures, present as a resistant element supporting ar They will help the future officer of Engineers branch solve problems in their professional future through the u

3. Assessment (1st and 2nd call)

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

FIRST CALL

Continuous assessment: The students will be able to pass the total of the subject by the continuous assessment procedure. To do this, they must demonstrate that they have achieved the expected learning outcomes by passing the assessment instruments indicated below, which will be carried out throughout the semester:

- Two Midterm exams about theoretical and practical aspects, based on problem solving. Its weight in the final grade is 50%.
- Presentation in class of the analysis of an existing structure, in which the transmission mechanisms and load distribution are indicated. Its weight in the final grade is 10%.
- Coursework: in pairs, a metallic industrial warehouse will be designed. Its weight in the final grade is 10%.
- Course dissertation: in pairs, calculate the industrial warehouse designed above, with Cype Ingenieros program, according to the requirements of the Building Technical Code. Its weight in the final grade is 25%.
- Presentation and defense of the results of the practices in English and brief report of the work. its weight in the final grade is 5%.

The final continuous evaluation grade (100%) will be calculated according to the specific weight of each continuous evaluation test. The minimum mark of the evaluation of each of the midterm exam, works, presentations and practices must be 3.5 to mediate in the continuous evaluation. To pass the subject, the student must obtain a final grade greater than or equal to 5.

The evolution of the acquisition of knowledge throughout the course will be taken into consideration, as well as the active participation in class and the quality of the works.

The value of each section and the way to correct it will be indicated in each exam and work.

Final exam: The students who do not pass the subject by continuous assessment or who would like to improve their grades, will have the right to take the Final Exam set in the academic calendar, prevailing, in any case, the best of both grades. This global test will have a weight of 100% in the final grade. It will consist of the calculation of a column, a beam and a joint of a metallic structure. To pass the subject, the student's final grade must be equal to or greater than 5.

SECOND CALL:

Final Exam: The students who do not pass the subject in the first call may take the Final Exam set in the academic calendar for the second call. This Final Exam will consist of the calculation It will consist of the calculation of a column, a beam and a joint of a metallic structure. To pass the subject, the student's final grade must be equal to or greater than 5.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The approach, methodology and assessment of this course is prepared to be equivalent in any teaching scenario. It will be adjusted to the socio-sanitary conditions of each moment, as well as to the indications given by the competent authorities.

It is a continuous learning process where the student plays an important participatory role.

Different methodologies are alternated along the course and complement each other: Participatory theory classes, problem solving classes, cooperative problem solving with invert classroom, computer practices based on project-based learning, and oral presentations. Student participation in their own training is encouraged.

4.2. Learning tasks

The learning activities will be:

1. Participatory lectures. Consisting in exhibition of concepts and theoretical developments of the subject, always

accompanied by real examples that help understanding thereof. The student will participate in the reasoning and deduction of the concepts, to reinforce learning a theoretical and practical way. Photographs of various works will be shown to the student to visualize the whole construction process.

2. Learning based on problem solving: Problems of different resistant elements with different sections and reinforcements will be solved. The calculation process and the reasoning followed in the decisions made will be explained. The student will learn to solve from start to finish the main structural typologies that he will find in his professional activity.
3. Cooperative problem solving and inverted classroom: the classroom will be divided into groups of students and by groups they will solve a problem in parts, with the support of the teacher. Each group will go out to explain the resolution of one of the parties, as progress is made.
4. Computer practices. Project-based learning: The student will be taught one of the most common structural calculation programs in the field of engineering: CYPE structures, also used in Army engineering units. Throughout various practical computer sessions, he will introduce a previously designed industrial warehouse, and learn to calculate and optimize the structure. He will be able to get the plans, budget and memory of the project.
5. Oral presentations: The students will make an oral presentation of 10 minutes about the results of his final works in English
6. Moodle interactive platform: the student will be encouraged to put up videos, photographs and interesting facts about the topics covered in class, to share thereof with the other students. Discussion forums to resolve doubts are created by the professor or among them.
7. Tutorials in which the student is helped to resolve the doubts raised during learning.

4.3. Syllabus

The program that the student is offered to help achieve the expected results is

- Main structural response mechanisms of metallic structures. Active section, active form and active vector. Design parameters
- Construction process of metallic structures.
- Calculation bases.
- Structural safety.
- The resistance of the sections.
- The resistance of the bars.
- Welded joints.
- Joints.
- Life cycle of structures

4.4. Course planning and calendar

The calendar of the theory classes and problems, as well as the computer practice sessions, will have the schedule established on their website. The deliveries of work and midterm exams will be shown to the student at the beginning of the course in the presentation of the subject, so that they can plan their study hours. The calendar will be available in moodle throughout the course. Class schedules and exams can be found on the official website. Within the hours assigned to the subject are the practice schedules, which will be related in detail during the course of the subject.

4.5. Bibliography and recommended resources

<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=30154>