Universidad Zaragoza

Academic Year/course: 2022/23

28612 - Structures I: Introduction to Structures

Syllabus Information

Academic Year: 2022/23
Subject: 28612 - Structures I: Introduction to Structures
Faculty / School: 175 - Escuela Universitaria Politécnica de La Almunia
Degree: 422 - Bachelor's Degree in Building Engineering
ECTS: 6.0
Year: 2
Semester: First semester
Subject Type: Compulsory
Module:

1. General information

1.1. Aims of the course

The subject has the following aims and scopes:

- At the end of this subject, the student will understand the physical phenomenon of solids deformation, as well as the resistant schemes related with each structural typology.
- The student will understand the two principles that all deformable solid must fulfill:
  - a) The equilibrium between external and internal forces
  - b) The compatibility of solid deflections with the external and internal constraints / restraints, forces and other strain effects.

The student will be able to solve structural systems by using the two aboved meantioned principles.

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/es/), in such a way that the acquisition of the course learning outcomes provides training and competence to contribute to their achievement to some degree.

Goal 4: Quality Education
Goal 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation

1.2. Context and importance of this course in the degree

The subject of Structures I, is part of the Building Engineering degree (Grado en Arquitectura Técnica) taught by EUPLA, framed within the group of specific subtject. It is a subject of the second course, in the first semester and compulsory (OB), it has 6 ECTS.

This subject is one of the student's first contacts with structural analysis field, which is very important to the future of the students. This subject has two main parts, a first one focus on the strength of materials and a second one on structures analsys.

Although this is one of the first students' contact with the structural analysis, the sizing of steel members is already cover in the subject.

The students who take this course they need to have a good level of maths, physics, mechanic concepts, learned in previous degree courses.

1.3. Recommendations to take this course

It is recommeded that students have passed the previous bacherlor's degree subjects of Mathematics, Physics and Mechanics of the first academic course. The student, before starting this subject, should be able to:

- To understand how to work with polynomials and trigonometric functions.
- To solve a linear system with different numbers of variables.
- To solve a polynomial equation of "n" degrees.
- To know how to work with vectors and matrixes.
- To derive and integrate polynomial functions and trigonometric funtions
- To change of physical units.

- To knowledge of vector algebra
- To apply the equations of the statics to obtain one or more unknown forces.
- To calculate statically determined articulated trusses.
- To calculate internal forces of simply supported beams.

2. Learning goals

2.1. Competences

Upon passing the subject, the student will be more competent to ...

General competences

- G01. Organizational and planning skills.
- G02. Capacity to solve problems.
- G03. Ability to make decisions.
- G04. Aptitude for oral and written communication in the native language.
- G05. Capacity for analysis and synthesis.
- G06. Ability to manage information.
- G07. Capacity for teamwork.
- G08. Capacity for critical reasoning.
- G09. Ability to work in an interdisciplinary team.
- G10. Ability to work in an international context.
- G11. Improvisation and adaptation capacity to face new situations.
- G12. Leadership aptitude.
- G13. Positive social attitude towards social and technological innovations.
- G14. Ability to reason, discuss and present your own ideas.
- G15. Ability to communicate through words and images.
- G16. Ability to search, analyze and select information.
- G17. Capacity for independent learning.
- G18. Possess and understand knowledge in a study area that starts from the general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that involve knowledge from the avant-garde. from your field of study.
- G19. Apply their knowledge to their job or vocation in a professional way and possess the competencies that are usually demonstrated through the elaboration and defense of arguments and problem solving within their area of ? ? s t u d y .
  G20. Ability to collect and interpret relevant data (usually within their area of ??study) to make judgments that include reflection on relevant issues of a social, scientific or ethical nature.
- G21. Transmit information, ideas, problems and solutions to a specialized and non-specialized audience.
- G22. Develop those learning skills necessary to undertake further studies with a high degree of autonomy.

Specific competences

- CE9 Ability to rule on the causes and manifestations of building injuries, propose solutions to avoid or correct pathologies, and analyze the life cycle of construction elements and systems.
- CE15 Ability to pre-dimension, design, calculate and check structures and to direct their material execution

2.2. Learning goals

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

Explain the theory of deformable bodies. Capturing the physical phenomenon of the deformation of the solids, as well as the resistant diagrams attached to the different structural typologies.

Correctly determine the two basic principles that every deformable solid must meet:

Balance of both external forces and internal efforts.

- Solid deformation compatibility with external and internal constraints.
- Being able to pose for simple structural elements, the equations in which both principles are reflected.

Explain how sectional characteristics affect behavior and overall structural analysis.

Explain the structural resistant operation for subsequent sizing.

Organize, plan and solve a problem of resistance of materials and / or structures.

Determine stresses and strains in pure, compound and simple bending.

Solve isostatic and hyperstatic structures.

Know how to use general methodology and software tools at the appropriate level to work with structural systems.

Being able to pre-dimension structures in steel and concrete.

2.3. Importance of learning goals

This subject has a marked theoretical character in which the fundamental concepts of structural calculation are established. Through the achievement of the relevant learning results, the necessary capacity is obtained to understand the structural functioning, which will be absolutely essential for the student's training, and essential to overcome the rest of the degree subjects related to structures.

A structural project comprises three phases: design, analysis and dimensioning. In the specific case of this subject it is intended that the student obtain a good level of the first and second phase, design and analysis. Later it will be expanded in the subject of Structures II.

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

Assessment is a basic element in the entire teaching-learning process, since it is the mechanism that allows, at any time during an educational period, to detect the degree of achievement of the proposed learning results and, if appropriate, apply the necessary corrections. .

The evaluation must be understood as a continuous and individualized process throughout the entire teaching-learning period, prioritizing the capacities and abilities of each student, as well as their performance.

The evaluation process will include two types of action:

1. A continuous assessment system, which will be carried out throughout the entire learning period.
2. A global assessment system, reflecting the achievement of learning results, at the end of the teaching period. These evaluative processes will be carried out by:

-Direct observation of the student to know their attitude towards the subject and the work that it requires (attention in class, completion of assigned tasks, resolution of questions and problems, active participation in the classroom, etc.).

-Direct observation of skills and abilities in daily work.

-Checking their progress in the conceptual field (questions in class, comments in the classroom, taking tests, etc.).

CONTINUOUS ASSESSMENT SYSTEM

The qualification of the subject through the Continuous Assessment System has been established to facilitate the use of the subject regardless of the personal circumstances of the student. For this, a calendar of partial tests and practices has been proposed that cover the entire subject in a segmented way.

In such a way that two or three non-exclusive midterm exams will be carried out, which will consist of written exams that will include theoretical, theoretical-practical questions and problems related to the teaching units taught prior to the dates of the respective tests.

In addition, during the course there will be a series of assignments, which will be compulsory and correct for those interested in this evaluation modality. Failure to carry them out or delivery after the deadline will mean not being able to continue in this evaluation system.

The mark of the continuous assessment will be obtained according to the following: Partial Tests (80%) and Practices (20%).

The course is divided into two parts. Part I of the course will be evaluated by 1 or 2 tests and Part II will be evaluated by 1 test. Part I will represent 60% of the percentage of the Partial Tests and Part II the remaining 40%.

To pass the subject, it will be necessary to obtain a minimum score of 4.0 in each of the parts (I and II) and that the average obtained in each of the two parts of the subject is higher than 5.0.

It will be an essential condition to pass the subject by continuous assessment to attend / perform 100% of the face-to-face activities: classroom exercises, technical visits, problems, seminars, structural software courses, etc.

In the case of not passing in the continuous evaluation modality, the global final evaluation test described in the following section must be taken.

Parts of one academic year will not be saved to another.

Final exam dates and times are subject to change. The official dates published at https://eupla.unizar.es/ will prevail.

GLOBAL ASSESSMENT SYSTEM (FINAL EXAMINATION ONLY)

The student must opt ??for this modality when, due to their personal situation, they cannot adapt to the rhythm of work required in the continuous evaluation system, or have not passed the subject in continuous evaluation.

As in the previous evaluation methodology, the global final evaluation test must be aimed at verifying if the learning results have been achieved, as well as contributing to the acquisition of the various skills described above.

The global assessment test will consist of a written exam in which there will be theoretical, theoretical-practical questions and problems. It is understood that, by the type of subject, the learning is cumulative throughout the course and that this final test must faithfully collect the knowledge that the student must acquire after completing this subject. The percentage of the final evaluation test will be 100% of the grade for the course as the student. This examination of the final evaluation test may be the same as that carried out for students who have followed the continuous evaluation system without success.

The subject is passed by passing the final global test.

The global test will have two or three parts that can be saved from one call to another. However, parts of one academic year will be saved to another.

Final exam dates and times are subject to change. The official dates published at https://eupla.unizar.es/ will prevail.

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 theory sessions, practice sessions, laboratory sessions, tutorials, and autonomous work and study.

A strong interaction between the teacher and student is encouraged. 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, up to a certain degree, students can set their learning pace based on their own needs and availability, following the guidelines set by the teacher.

The approach, methodology and assessment of this guide are intended to be the same for any teaching scenarios. They will be adapted to the social-health situation at any particular time, as well as to the instructions given by the authorities concerned.

4.2. Learning tasks

This course is organized as follows:

- **Theory sessions**: The theoretical concepts of the course are explained and illustrative examples are developed as support to the theory when necessary.
- **Practical Classes**: Problems and practical cases are carried out, complementary to the theoretical concepts studied.
- **Tutorials**: Individual tutorials that can be online or face-to-face
- **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 practical classes.
    - Preparation of seminars, solutions to proposed problems, etc.
    - Preparation of the written tests for continuous assessment and final exams.

4.3. Syllabus

This course will address the following topics:

- Topic 1: Introduction. Fundamental concepts
- Topic 2: Statically Determinate Structures: calculation of forces and reactions
- Topic 3: Mechanical properties of the materials
- Topic 4: Tension-only and compression-only structures. Bar and cable systems (Only axial forces structures).
- Topic 5: Pure Bending
- Topic 6: Combined Bending and Axial Forces
- Topic 7: Simple Bending & Shear Force
- Topic 8: Torsional Moment
- Topic 9: Beams deflection calculation (displacement and angle of rotation)
- Topic 10: Energy Methods
- Topic 11: Introduction to Statically Indeterminate Structures resolution
- Topic 12: Statically Indeterminate Structures: Analysis by Force Method

- Topic 13: Statically Indeterminate Structures: Analysis by Displacement Method
- Topic 14: Buckling Analysis
- Topic 15: Articulated Structures

4.4. Course planning and calendar

The course has 6 ECTS credits, which represents 150 hours of student work in the course during the four-month period, this is, 10 hours per week for 15 weeks of class. This includes 4 hours of lectures a week and 6 hours of autonomous work and study and other activities.

Further information concerning the timetable, classroom, office hours, assessment dates (http://eupla.unizar.es/) 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=28612