1. BASIC INFORMATION

Course	Structural Mechanics
Degree program	Bachelor's in the Fundamentals of Architecture
School	Architecture, Engineering and Design
Year	Second
ECTS	6 ECTS
Credit type	Basic
Language(s)	English
Delivery mode	Classroom
Semester	First semester
Academic year	2024/2025
Coordinating professor	José Agulló de Rueda

2. PRESENTATION

This course is the first in the area of structures and where most of the concepts and nomenclatures that will be used in the following courses are addressed.

From the point of view of knowledge, the three basic requirements that a structure must fulfil are introduced: stability, resistance and rigidity. The previous data are studied in order to analyse a structure: loads, materials, geometric model, codes and safety coefficients, although the codes have yet to be studied or used in this course. The concepts of supports, joints and isostatism of structures will be addressed.

Subsequently, the agenda will focus on equilibrium and stability of structures in the architectural plan, and the mathematical verifications necessary to ensure that there is no sliding, overturning or subsidence. The concepts of soil mechanics will be introduced in order to solve the above.

In the middle part of the course, which is the most important, we will study the internal forces endured by the elements of a structure in building plans, in the process of transferring the loads from their point of application to the ground. The diagrams of axial, shear and bending moment of isostatic structures in a plan will be studied, and torsional stresses will be covered without going in depth.

The final part of the course will introduce the concepts of stresses and deflections, and about dimensioning sections of structural elements subjected to axial, shear or bending forces. We will work with steel, reinforced concrete and wood in a conceptual way and without the specific use of codes that are covered in subsequent courses.

From a practical point of view, exercises and workshops will be carried out with two different objectives: on one hand, for students to understand and practice mathematical concepts absolutely essential to the course; and on the other hand, for them to understand the processes of work in the design, analysis, dimensioning and documenting of building structures.

3. COMPETENCIES AND LEARNING OUTCOMES

Core competencies:

- CB1: That students have demonstrated knowledge and understanding in a field of study that is based on general secondary education, at a level which, although supported by advanced textbooks, imply some knowledge of the latest advances in their field of study.
- CB2: That students know how to apply their knowledge to their work or vocation in a professional manner and possess the skills that are usually demonstrated through the elaboration and defence of arguments and the resolution of problems within their field of study.
- CB3: That students have the ability to gather and interpret relevant data (usually within their field of study) to make judgements that include reflection on relevant social, scientific or ethical issues.
- CB5: That students have developed the necessary learning skills to undertake further studies with a high level of autonomy.

Cross-curricular competencies:

- CT1: Self-confidence.
- CT4: Communication skills in the native language (both oral and written) and in the English language, in accordance with the principles of the *Universidad Europea de Madrid*, any concept or specification for the development of the regulated profession of architect. This includes learning the specific vocabulary of the degree as well as the ability to manage information.
- CT9: Planning and time management: Ability to plan work in order to comply with delivery times and to respect the limits imposed by budgets and building codes.

Specific competencies:

- CE7: Knowledge of the principles of general mechanics, statics, mass geometry, vector and tensor fields, all adapted and applied to architecture and urbanism.
- CE24: Knowledge of solid, continuum and soil mechanics, as well as plastic and elastic qualities and strength of materials in heavy construction.

Learning outcomes:

- LO1: Elaborates a structural model of a building. Breakdown of steel members, solids, nodes and supports. Makes an assessment of loads. Understands the typology employed.
- LO2: Understands the basic concepts of mechanics and resistance of materials.
- LO3: Analyses the reactions, efforts and tensions in any of the sections of a given structure.
- LO4: Presents and explains a project in public.

The following table shows the relationship between the competencies developed during the course and the learning outcomes pursued:

Competencies	Learning outcomes
CB1, CB2 CG1, CG4 CT2, CT9	LO1: Elaborates a structural model of a building. Breakdown of steel members, solids, nodes and supports. Makes an assessment of loads. Understands the typology employed.
CG1 CE7, CE24	LO2: Understands of the basic concepts of mechanics and resistance of materials.
CB1 CT9 CE7, CE24	LO3: Analyses the reactions, efforts and tensions in any of the sections of a given structure.
CB3, CB3, CB5 CT2, CT4	LO4: Presents and explains a project in public.

4. CONTENT

Course is arranged in THREE learning units (UA), each one is divided in topics (depending on UA).

UA1- Structural concept

Topic B00: What is structures and structural requirements.

TopicB01: Forces and moments. Centroids. Resultant-Reaction.

UA2- Equilibrium and stability

TopicB02: Equilibrium of rigid solid. Reactions. Supports. Stability: overturning, subsidence, sliding and lifting.

TopicB03: Structure composed by bars. Joints. Determinancy.

TopicB04: Archs and cables. Funiculars and force poligons.

UA3- Internal forces

TopicB05: Truss, Triangulated structures. Internal forces.

TopicB06: Internal forces on beams, uneven beams and frames.

UA4- Dimensioning/Design of sections

TopicB07: Introduction to transversal section behaviour. Materials. Stresses.

UA5- Structure models

TopicB08: Geometric and analytical model.

TopicB09: Loads and loads distribution.

5. TEACHING-LEARNING METHODOLOGIES

The types of teaching-learning methodologies used are indicated below:

- Magistral class.
- Case method.
- Cooperative learning.
- Problems-base learning.
- Project-base learning.

6. LEARNING ACTIVITIES

Listed below are the types of learning activities and the number of hours the student will spend on each one:

Campus-based mode:

Learning activity	Number of hours
Lectures	25 h
Guided studies, practical exercises, problem-solving	50 h
Presentation of projects	0 h
Team work	0h
Independent study/work	50 h
Tutorials, academic monitoring and assessment	25 h
Lab work	0
Internships	0
TOTAL	**150 h**

7. ASSESSMENT

Listed below are the assessment systems used and the weight each one carries towards the final course grade:

Campus-based mode:

Assessment system	Weight
Exams and exercise about reading and laboratory	45 %
Exercises	35 %
Laboratory	10 %

Course work	10 %

When you access the course on the *Campus Virtual*, you'll find a description of the assessment activities you have to complete, as well as the delivery deadline and assessment procedure for each one.

7.1. First exam period

To pass the course in the first exam period, you must obtain a grade higher than or equal to 5.0 out of 10.0 in the final grade (weighted average). In the previous table of "Assessment of activities" and in table "8. Schedule" you can find the minimum grade required in some activities and the minimum number of exercises required to make the different exams.

7.2. Second exam period

To pass the course in the second exam period, you must obtain a grade higher than or equal to 5.0 out of 10.0 in the final grade (weighted average). The minimum grades required in different activities are the same as in the first period. On second period grades will be replaced, ONLY if they are greater than in first period. If not, first period grades will be keep.

Students are free to make up one, several or all of the parts at their own discretion. It is reasonable to make up those parts needed to pass the course.

Written **exam** replaces grade of many activities of first period. Independently for each one.

Exercises that have not been completed or those that you wish to improve/complete will be handed in again.

Course Work may be completed ore done again, according with professor choice. Can be made by same group, different group or individual.

Laboratory exercises cannot be made up and their grade must be made up with the exam.

8. SCHEDULE

A table in Virtual Campus shows the delivery deadline for each assessable activity in the course:
This schedule may be subject to changes for logistical reasons relating to the activities. The student will be notified of any change as and when appropriate.

9. BIBLIOGRAFÍA

The following bibliography is recommended:

- ENGEL, Heino. **Structure System**. Gustavo Gili, 2006.
- CHING, Francis DK. **Building Construction Illustrated**. Wiley, 2020.
- MILLAIS, Malcom. **Building Structures**. Routledge, 2017.
- VAZQUEZ, Manuel and Eloisa LOPEZ. **MecánicaparaIngenieros**. Noela, 2008.
- BLASCO LAFFÓN, Begoña and Emilia. **Fundamentos Físicos de la Edificación**. Delta, 2006.
- BLASCO LAFFÓN, Begoña and Emilia. **Fundamentos Físicos de la Edificación: Ejercicios resueltos**. Delta, 2006.

In the *Campus Virtual* you will find more bibliography available in the libraries of the UEM, as well as references to websites.

10. DIVERSITY MANAGEMENT UNIT

From the Educational Guidance and Diversity Unit we offer support to our students throughout their university life to help them reach their academic achievements. Other main actions are the students inclusions with specific educational needs, universal accessibility on the different campuses of the university and equal opportunities.

From this unit we offer to our students:

1. Accompaniment and follow-up by means of counselling and personalized plans for students who need to improve their academic performance.
2. In terms of attention to diversity, non-significant curricular adjustments are made in terms of methodology and assessment for those students with specific educational needs, pursuing an equal opportunities for all students.
3. We offer students different extracurricular resources to develop different competences that will encourage their personal and professional development.
4. Vocational guidance through the provision of tools and counselling to students with vocational doubts or who believe they have made a mistake in their choice of degree.

Students in need of educational support can write to us at:
orientacioneducativa@universidadeuropea.es

11. ONLINE SURVEYS

Your opinion matters!

The Universidad Europea encourages you to participate in several surveys which help identify the strengths and areas we need to improve regarding professors, degree programs and the teaching-learning process.

The surveys will be made available in the “surveys” section in virtual campus or via e-mail.

Your assessment is necessary for us to improve.

Thank you very much for your participation.