INTRODUCTION

The structure is an integral part of the building. An adequate understanding of the resistance mechanisms present in any structure is, therefore, basic. Only then the structure will no longer be an addition but integral to the architectural design. In this course, the student will understand how a structure behaves, and the basic principles of structural design.

- **Degree**: Studies in Architecture
- **Module in the Degree Program**: Technical design. Structures
- **Year**: Second
- **Semester**: Spring
- **Lecture schedule:**
- **Number of credits**: 3 ECTS
- **Type of course**: Required
- **Language**: English
- **Instructors**:
  - Jose Manuel Cabrero, course director (jcabrero@unav.edu)
  - Rufino Goñi
- **Department**: Building Construction, Services and Structures
- **Office**: A1112
- **Office Hours**: You may make an appointment as required, here https://meet.boomerangapp.com/jcabrero.unav.es/tutorial

COMPETENCIES

BASIC COMPETENCES

- BC02 Students must know how to apply their knowledge professionally to their job or career and have the skills that usually demonstrated by writing and supporting their arguments, and problem-solving within their area of study.
- BC04 Students are able to convey information, ideas, problems and solutions to specialist and non-specialist audiences.
- BC05 Students have developed the learning skills necessary to undertake further studies with a high degree of autonomy.

GENERAL COMPETENCES

- GC01 Understand the history and theories of architecture and related arts, technologies and human sciences.
- GC04 Understand the structural, construction and engineering design problems associated with building design as well as the techniques for solving them.
- GC06 Understand the industries, organisations, regulations and procedures involved in translating design concepts into buildings and integrating plans into overall planning.

SPECIFIC COMPETENCES

- SC12 Ability to conceive, calculate, design, integrate into buildings and urban complexes, and execute foundation solutions (T).
- SC13 Ability to apply technical and construction standards.
• SC14 Ability to preserve building structures, foundations and civil engineering works. SC15 Ability to preserve finished works.
• SC17 Ability to conceive, calculate, design, integrate into buildings and urban complexes, and execute building structures (T).
• SC67 Use of English, level B2, to a sufficient level for the scientific and academic terminology typically used in architecture.

PROGRAM

Below you can find the different subjects, described in brief. For a more detailed enumeration, please refer to the Schedule Section.

• Introduction to the concept of stress
  • Stress
  • Type of loads and corresponding stress
• Introduction to structural modelling
• Introduction to structural design
  • Actions, loads
  • Structural requirements (deformation, resistance, stability)
• Structural systems:
  • Behaviour
  • Size estimation
  • Functional footprint

EDUCATIONAL ACTIVITIES

Classroom activities

Most of the course will follow a typical classroom methodology, in which, after the lecture, you work by yourself on the material. Each week, after the lecture, you will be given reference material to read and watch. You must prove your understanding by realising a comprehension test on the given topics, and a weekly assignment.

All the weekly material will be made available in the corresponding section.

Seminar (Required)

The seminars involve related knowledge, which is interesting for the student but which, due to the nature of the activity, is better performed in a different environment. This year, there will be a single seminar, with a duration of 3 hours. The topic will be seismic design, and we will count on a guest professor. Seminar date: January, 2024.

One-to-one tutorials

Each student may have personal interviews with the professor to help him/her with personal study and learning. You may appoint a one-to-one tutorial (online or face-to-face) through the dedicated link: https://meet.boomerangapp.com/jcabrero.unav.es/tutorial

Personal work

Students must understand themes covered early in the course to be able to comprehend information presented later in the course, and will have to be able to integrate material learned throughout the course. Weekly activities have been devised to help you with this.
Therefore, they mustn’t fall behind and try to set aside regular times outside of class to work on the course material regularly, as described above.

Credits/hours distribution of the activities.

<table>
<thead>
<tr>
<th>Educational activities</th>
<th>Total hours</th>
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<tbody>
<tr>
<td>AF1</td>
<td>Attendance and participation in theoretical face-to-face &amp; online classes</td>
</tr>
<tr>
<td>AF2</td>
<td>Attendance and participation in practical face-to-face &amp; online classes</td>
</tr>
<tr>
<td>AF3</td>
<td>Carrying out directed work (individual and group)</td>
</tr>
<tr>
<td>AF5</td>
<td>Participation in tutorials</td>
</tr>
<tr>
<td>AF6</td>
<td>Study and personal work</td>
</tr>
</tbody>
</table>

ASSESSMENT

EVALUATION IN THE ORDINARY CALL

To calculate the final grade, course performance and grading will be determined as follows:

- Attendance: 1 pt.
- Projects: 6 pts. (+ 1 additional point)
- Final exam: 3 pts.

There’s an extra additional point, which will be based on your participation in the additional weekly activity.

There’s a common graded activity with Taller de Proyectos 2. If you are not enrolled at Taller de Proyectos 2, you will develop an alternative assignment.

All students, independently of their actual examination period, are expected to attend the lectures as a regular student. There are no alternative paths to pass the course during the examination period.

Attendance: 1 pt.
Each week, during the lecture you will be given a woodlap test to promote your active participation and improve your understanding of the explained material. Your grade in this part will be based on the number of answered questions to these tests, whether right or wrong.

Assignments: 6 (+1) pts.

The projects introduce you to the role of structural design in architecture. Altogether encompassed in collaboration with other subjects from the second year of the degree. If you are not enrolled

The main aim of this part is allowing you to test your knowledge with a reduced risk. Therefore, in most of them you’re given intermediate assignments before the final submission. If you succeed on submitting the different parts, you will be given the opportunity to revise your work before the final submission based on the professors’ comments.

Moreover, if you submit your work at every intermediate stage, your grade will be multiplied by 1.1. If you submit just the final assignment (with no intermediate ones), your maximum possible grade will be 8, since it will be multiplied by 0.8.

This part comprises three different activities:

- **Weekly comprehension tests (20% of this part, 1.2 pts. of the total grade).**
  - These weekly tests help you to study the material of the course. They will be done by means of gimkit games. The final grade will be based on your points on the totality of the games, in relation to the points obtained by your classmates.
  - **Due date: before the following lecture.**

- **Load assessment (20% of this part, 1.2 (+0.5) pts. of the total grade).**
  - It consists of four weekly partial assignments. Each partial assignment will count as an additional 0.1 factor on the final grade in this assignment, summing up to x1.4 (and 1.7 pts possible, meaning a possible extra 0.5 pts.).
  - **Due date: February, 2024**

- **Spaghetti structure (20% of this part, 1.2 (+0.5) pts. of the total grade).**
  - Within this assignment, you will build your first structure ever with spaghetti, and you will submit it to an earthquake. This activity will allow you to take part in a national competition of spaghetti structures.
  - It consists of three weekly partial assignments. Each partial assignment will count as an additional 0.13 factor on the final grade in this assignment, summing up to x1.4 (and 1.7 pts possible, meaning a possible extra 0.5 pts.).
  - **Due date: March, 2024**

- **Design the structure. Structural concept and architectural integration (40% of this part, 2.4 pts. of the total grade).**
  - There’s no building without structure. You are asked to design a building, in which the structural design will play a key role in the architectural concept. This last project will correspond to the last design made in Taller de Proyectos II.
  - This is a common graded activity with Taller de Proyectos II.
  - If you are not enrolled at Taller de Proyectos II, you will develop an alternative assignment, accounting for the same value.
  - **Due date: May, 2024.**

Final exam: 3 pts.
The final exam will be held in May, 2024. You will be asked about structural terms in English, and your understanding of structural systems applied to buildings. All the questions will be related to the material covered in lectures, class discussions, and projects.

To pass the course, it is compulsory to answer the exam and obtain a minimum grade of 4 over 10. If you do not, you will fail in May and will have to attend the exam in June.

The exam will consist of a test, comprised of 100 questions, on the following topics:

- structural terms (and their translation into Spanish);
- application of concepts of structural design;
- load assessment;
- structural system of a building, namely:
  - the type of structural system,
  - loads to be considered in the structural design,
  - load path of the vertical loads,
  - lateral stability,
  - design issues.

Additional activity (+1 pt.)

Additionally, you will be requested to propose new questions for the question roster. After approval by the professor, these self-proposed questions will be included in the set. Those contributing students may obtain up to an additional extra point in the final grade of the course.

Criteria to pass the course

The course will be graded based on student performance in comparison to the class (curve graded).

The course will be graded over 10 points.

Students whose final grade is 5 points or more will pass the course.

Students whose final grade is below 5 points will not pass the course and will be graded as Suspenso.

Students who do not take the final exam will not pass the course and will be graded as No presentado.

EVALUATION IN THE EXTRAORDINARY CALL

For those students who do not pass the course in May (grades Suspenso or No presentado) there will be an additional re-sit exam in June which will account for 100% of the final grade. Be aware that only the exam grade will be taken into consideration.

As stated in the General Evaluation Regulations of the University of Navarrra approved in May 2019, “Students who request it may be evaluated in the re-sit examination call, even if they have passed the course. To do this they must request to be included at least five days before the start of the exam period of that call. The final grade of the subject will be that of the extraordinary call, even if it is lower than the one obtained previously”. Therefore, the grade obtained in the extraordinary call will be the valid one, regardless of that obtained in the ordinary call, even the student may not pass the subject if he or she fails to attend.
Students with special learning needs

Accommodation will be provided for students with special learning needs, either regarding the methodology and/or evaluation of the course, but they will be expected to fulfil all course objectives.

Students not enrolled at Taller de Proyectos 2

You will be given an alternative assignment instead of the common activity with Taller de Proyectos 2.

Summary

<table>
<thead>
<tr>
<th>ASSESSMENT SYSTEMS</th>
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<tbody>
<tr>
<td>Attendance and participation in lectures, practices,</td>
<td>10%</td>
</tr>
<tr>
<td>and lectures</td>
<td></td>
</tr>
<tr>
<td>Individual and team practical assignments</td>
<td>60%</td>
</tr>
<tr>
<td>Exams (partial and final)</td>
<td>30%</td>
</tr>
</tbody>
</table>

OFFICE HOURS

Prof. Jose M. Cabrero (jcabrero@unav.edu)

- Office A1112. School of Architecture.
- You may appoint a one-to-one tutorial (online or face-to-face) through the dedicated link below. [https://meet.boomerangapp.com/jcabrero.unav.es/tutorial](https://meet.boomerangapp.com/jcabrero.unav.es/tutorial)

BIBLIOGRAPHY AND RESOURCES

Compulsory textbook

- **Structures (Daniel L. Schodek)** It is one of the most classical and considered textbooks on the subject. It is the course textbook. There will be compulsory readings each week from it (see the course's schedule).
  - [Localízalo en la Biblioteca](Localízalo en la Biblioteca)
  - [Localízalo en la Biblioteca](Localízalo en la Biblioteca)

Additional readings
• Allen and Zalewski. *Form and forces: designing efficient, expressive structures.* John Wiley and Sons, 2010. [Localízalo en la Biblioteca](#)


• Millais. *Building structures. From concepts to design.* Spon Press, 2 edition, 2004 [Localízalo en la Biblioteca](#)


• Torroja. *Razón y Ser de los Tipos Estructurales.* C.S.I.C., 1991 [Localízalo en la Biblioteca](#)

**Software**

[https://structural-analyser.com/](https://structural-analyser.com/)

@X@buscar_unika.obtener@X@