1. SUBJECT DESCRIPTION

The course aims to familiarize students with the basic instruments for the design of building structures: structural types, design and analytical processes, methods, formulas, materials, optimization suggestions, constructive solutions, etc.

Making good architecture is, among other things, designing correct and useful structures that are integrated into the project, so that they are part of the project from the very beginning, for which we must seek the appropriate structural type, adapted to the needs of the project. The various stages of structural design must always be dominated by common sense in the same way as it is, for example, the organization of space.

The course is organized into three units. The units are not strictly sequential, but much of the content is repeated, being presented and developed in a deeper and more detailed manner each time. The first unit is the Introduction to structural design, the second is the Quantification of internal forces and the third is Structural Types.

In the first unit all the stages and processes involved in the design and testing of a structure are described. The student will learn, in general terms, the steps and skills required for the architectural design of the structure.

The second unit focuses on the study of the transmission of loads and their influence on the elements that supports them (internal forces, strain, stress). The use of internal forces diagrams is shown as an analysis tool.

The third unit shows a sample of structural types commonly used at present, showing their potential, differences, characteristics, cost, etc. For each type, the influence on the conception of architecture will be reviewed, and the load transmission to the main structural elements will be searched.

Theoretical classes are supplemented with exercises, workshops, master classes, and ongoing discussions during the class sessions.

2. OBJECTIVES AND SKILLS

2.1. Course objectives and acquired skills

The particular skills and learning outcomes that the student can expect to gain from attending this module are as follows:

Regarding competency 1: “Learn and acquire design and calculation skills: Structures applied to buildings (T)”. The aim is for the student to develop a good understanding and be able to demonstrate a capability to design and calculate building structures with ease.

Regarding competency 2: “Learn and acquire design and calculation skills: Foundations (T)”. The aim is for the student to develop a good structural understanding and be able to demonstrate a capability for the design and calculation of efficient foundations.

Regarding competency 3: “Conservation of building structures, foundation systems and civil works (T)”. The aim is for the student to apply their structural skills to make informed decisions regarding the conservation of building structures, foundation systems and civil works in the course of their professional work.
2.2. Objectives and specific skills

**Conceptual objectives:**

- Learning the different types of structures under different classification criteria
- Knowing the process of designing a structure
- Establishing and applying loads to the structure components
- Learning the Limit States method
- Knowing the characteristics of different types of connections that exist in the structures and their construction features
- Setting out and solving isostatic structures using the internal forces diagrams
- Dominating internal forces diagrams and the relations between them
- Understanding the stresses that occur for every internal force
- Knowing and understanding the use and the phases of stress-strain diagram of the most common building materials.
- Mastering the usual materials in structures and their main strength characteristics
- Determining the characteristics of the main structural types and their differences
- Identifying structural types in existing works, and understanding how they work
- Understanding the suitability of each type to specific cases

**Technical objectives**

- Applying the knowledge learnt in Physics, and taking it to the field of architecture
- Understanding the use of internal forces diagrams
- Learning to understand the structure as part of the design process
- Knowing the materializing of structural decisions

**Professional Skills**

- Understanding the logic of structures, and how to use the criteria acquired as part of the design process
- Knowing all phases of the design process of a structure, whose control is vital for a successful project to materialize

**Learning outcomes**

Once the student has achieved the objectives set out above, they will:

- Understand the structure as a part of the design process, incorporating structural decisions to the creative process
- Be able to make decisions for structural design and types: materials, types, construction processes, supports and connections
- Know the loads acting on the support elements of a structure.

3. CONTENTS

**UNIT 1: INTRODUCTION TO STRUCTURAL DESIGN**

INTRODUCTION TO BUILDING STRUCTURES. CONCEPTS: Structural members under axial loads, bending moments, shear and torsion loads. Types of supports. Internal and external connections. Loads.


UNIT 2: QUANTIFYING INTERNAL FORCES

ANALYSIS AND DESIGN CRITERIA. ANALYSIS AND DESIGN PROCESS: Characteristics of statically determinate and statically indeterminate structures. Design criteria: serviceability, efficiency, construction, costs. Design process: geometry definition, load assessment, modelling of the structure and boundary conditions, load modelling, determination of reactive forces, determination of internal forces and moments, determination of adequacy of member.


STRUCTURAL MATERIALS – PROPERTIES: Characteristics of common structural materials in use in terms of their material properties: Iron and Steel, Reinforced concrete, Timber, Masonry and Stone.

UNIT 3: STRUCTURAL TYPES

STRUCTURE AS ARCHITECTURE

ONE AND TWO-WAY SPANNING CONCRETE STRUCTURES

METALLIC STRUCTURES

4. METHODOLOGY AND ECTS WEIGHTING

In the lectured classes the theory will be presented with the help of visual aids to help explain structural concepts, and will be further illustrated by means of case studies, worked examples and graphical representation, and the professor will be responsible for the preparation and delivery of these sessions.

Students will be expected to prepare the exercises set in previous classes, search for relevant information to supplement lecture notes, prepare for workshops and take part in a group activity outside of lecture hours. The hours expected to be dedicated to these activities are set out in the table below, and all this time will be orientated towards achieving a good understanding of the material explained in part 2 of this paper.

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<th>Sessions</th>
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<th>Self-study hours</th>
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<td>Practical classes</td>
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<tr>
<td>Workshops</td>
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<tr>
<td>Exam</td>
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<td><strong>Total</strong></td>
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<td></td>
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This subject does not require the use of a laptop in class; nevertheless, if you want to bring your laptop, please contact your professor.
## 5: EVALUATION SYSTEM

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<th>Criteria</th>
<th>Means</th>
<th>Weight</th>
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<tr>
<td>Attendance and participation</td>
<td>Attendance and active participation in class activities</td>
<td>Observation and professors notes</td>
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</tr>
<tr>
<td>Completion of exercises, assignments and workshop</td>
<td>Submission of tutorials with problems addressed satisfactorily. Participation in group assignment and submission of acceptable work</td>
<td>Exercises completed and submitted on time Results of workshop submitted on time</td>
<td>20% 20%</td>
</tr>
<tr>
<td>Examination of lecture material</td>
<td>Demonstrate adequate understanding of the structural principles dealt with in classes</td>
<td>Written exams</td>
<td>50%</td>
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