

## Course guide

### 205052 - 205052 - Design and Behaviour of Special Structures

**Last modified:** 11/04/2025

**Unit in charge:** Terrassa School of Industrial, Aerospace and Audiovisual Engineering  
**Teaching unit:** 737 - RMEE - Department of Strength of Materials and Structural Engineering.

**Degree:** MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2013). (Optional subject).  
MASTER'S DEGREE IN AERONAUTICAL ENGINEERING (Syllabus 2014). (Optional subject).  
MASTER'S DEGREE IN SPACE AND AERONAUTICAL ENGINEERING (Syllabus 2016). (Optional subject).  
MASTER'S DEGREE IN RESEARCH IN MECHANICAL ENGINEERING (Syllabus 2021). (Optional subject).  
MASTER'S DEGREE IN MECHANICAL ENGINEERING RESEARCH (Syllabus 2024). (Optional subject).  
MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2025). (Optional subject).

**Academic year:** 2025    **ECTS Credits:** 3.0    **Languages:** English

#### LECTURER

**Coordinating lecturer:** Weyler Perez, Rafael

**Others:** Guanchez Reyes, Edinson  
Hernández Rojas, Suilio Eliud

#### TEACHING METHODOLOGY

The instructor introduces the theoretical concepts associated with the behavior of special structures with examples and practical sessions for a better understanding. The analysis and design methods are explained using practical cases combined with last generation software?

The practical sessions are focused on solving numerical examples and propose solutions for real cases associated with design and construction of special structures for engineering applications.

#### LEARNING OBJECTIVES OF THE SUBJECT

#### STUDY LOAD

Type	Hours	Percentage
Self study	48,0	64.00
Hours large group	27,0	36.00

**Total learning time:** 75 h

## CONTENTS

### Module 1: Introduction

**Description:**

Definitions and terminology, behavior of special structures, design philosophy, design requirements, engineering applications, state of art on design processes for non-conventional structures, introduction to software capabilities, suggested readings.

**Related activities:**

Theoretical and practical sessions.

**Full-or-part-time:** 4h

Theory classes: 2h

Self study : 2h

### Module 2: Analysis and design of long span structures (Reinforced and Prestressed Concrete)

**Description:**

Basic concepts, typical construction procedures, structural behavior, elastic properties of materials. Flexural, shear and combined stresses analysis. Design process for practical purposes. Advantages and limitations regarding the using of concrete for long span structures. Introduction to analysis and design of bridges for industrial purposes. Analysis of real cases using last generation software.

**Related activities:**

Theoretical and practical sessions

**Full-or-part-time:** 17h 30m

Theory classes: 6h 30m

Self study : 11h

### Module 3: Analysis and design of long span structures (Steel and Composite Structures)

**Description:**

Basic concepts, elastic properties of materials. Flexural, shear and combined stresses analysis. Structural behavior of long span trusses and non-prismatic elements. Typical construction process. Advantages and limitations. Introduction to hangars design and industrial facilities such as: pipe-racks, platforms and conveyors supports. Analysis of real cases using last generation software.

**Related activities:**

Theoretical and practical sessions

**Full-or-part-time:** 17h 30m

Theory classes: 6h 30m

Self study : 11h

### Module 4: Analysis and design of slender structures (Steel, concrete and composite materials)

**Description:**

Basic concepts, behavior of slender structures, stability considerations. Wind loads analysis. Engineering applications (electrical towers, chimneys, monopoles for lighting, antennas, mast structures). Analysis of real cases using last generation software.

**Related activities:**

Theoretical and practical sessions

**Full-or-part-time:** 12h

Theory classes: 4h

Self study : 8h



#### Module 5: Analysis and design of laminar structures.

**Description:**

Basic concepts related to shell and plate theories, mechanical behavior of shells, structural analysis, physical modelling, recent advances in computation and structural design, analysis of membrane structures. Structural behavior of shells and grid structures. Introduction to Finite Element Analysis (FEM). Engineering applications (silos, bins, tanks, vessels, vaults and domes). Analysis of real cases using last generation software.

**Related activities:**

Theoretical and practical sessions

**Full-or-part-time:** 18h

Theory classes: 6h

Self study : 12h

#### Module 6: Foundations

**Description:**

Typical behavior of shallow and deep foundations. Loads considered on analysis process. Sizing considerations of foundations for special structures. Design and construction recommendations. Typical foundations for engineering applications (long span structures, slender structures, silos, bins, tanks, vaults and domes). Analysis of real cases using last generation software

**Related activities:**

Theoretical and practical sessions

**Full-or-part-time:** 6h

Theory classes: 2h

Self study : 4h

### GRADING SYSTEM

Final Exam 40%

Task Assignments 20%

Proposed activity 40%