Master's Academic Training Program in Civil Engineering - Structural Specialization
Faculty: Science and Technology
Field: Science and Technology
Specialization: Civil Engineering
Branch: Structures
Type of Training: Academic Master's Degree

1- Master's Program Overview

This program aims to teach students how to design and analyze structures made of reinforced concrete and steel while adhering to various construction standards and regulations.

2- Course Structure per Semester

Semester 1 (S1)

Course Unit	Subjects	Total Hours	Credits
Core Unit	Structural Mechanics, Structural Dynamics 1, Reinforced Concrete Structures 1, Steel Structures	450 hours	18
Methodological Unit	Programming Supplement, Experimental Methods, Innovative Materials	225 hours	9
Exploratory Unit	Building, Building Thermal Properties	50 hours	2
Transversal Unit	Ethics, Technical English and Terminology	25 hours	1

Semester 2 (S2)

Course Unit	Subjects	Total Hours	Credits
Core Unit	Elasticity, Structural Dynamics 2, Reinforced Concrete Structures 2, Foundations and Retaining Structures	450 hours	18
Methodological Unit	Finite Element Method, Steel Construction Project	225 hours	9
Exploratory Unit	Building Pathology, English 2	50 hours	2
Transversal Unit	Ethics, Professional Conduct, and Intellectual Property	25 hours	1

Semester 3 (S3)

Course Unit	Subjects	Total Hours	Credits
Core Unit	Prestressed Concrete, Plasticity and Damage, Earthquake Engineering, Special Structures	450 hours	18
Methodological Unit	Reinforced Concrete Structure Project, Structural Modeling	225 hours	9
Exploratory Unit	High-Performance Concrete, Soil-Structure Interaction	50 hours	2
Transversal Unit	Documentary Research and Thesis Preparation	25 hours	1

Semester 4 (S4)

Personal Work	Internship in a Company	Seminars	Supervision
750 hours	30 hours	---	---

3- Detailed Course Content

Structural Mechanics

- Introduction to Structural Analysis
- Differential Relations, Deflection and Rotation Calculations, Internal Potential Theory, Castigliano's Theorem, Menabrea's Statement

- Force Method (Concept of Internally Redundant Support, Calculation Simplification Methods: Elastic Center Method, Cases of Generalized Displacement Load, Temperature Variation Cases)
- Displacement Method
- Iterative Methods
- Continuous Beams on Elastic Supports
- Analysis of Arch Structures

Structural Dynamics 1

- Introduction and General Concepts
- Single-Degree-of-Freedom Systems
- Multi-Degree-of-Freedom Systems

Reinforced Concrete Structures 1

- Calculation of Slabs and Flat Slabs
- Calculation of Reinforced Concrete Frames under Vertical Loads
- Calculation of Frames under Horizontal Loads
- Regulatory Provisions for Columns and Beams
- Shallow Foundations

Steel Structures

- Design and Calculation of Beam-Column Joints
- Design and Calculation of Column Bases
- Design and Calculation of Crane Runways
- Composite Floors
- Various Steel Structures
- Methods of Analyzing Steel Structures

Programming Supplement

- Review of Programming Techniques and Program Structuring
- Use of Procedures and Functions
- Modular Programming
- Application Examples

Experimental Methods

- Fresh Self-Compacting Concrete Testing
- Concrete Durability Testing
- Mechanical Testing on Mortars and Concretes and Valorization of Portland Cement and Alternative Materials

Innovative Materials

- Eco-Materials
- Alternative Binders and Substitutes
- New Materials
- Construction Materials

Technical English and Terminology

Elasticity

- Introduction to Elasticity Theory
- Stress State Theory
- Strain State Theory
- Relationship Between Stresses and Deformations and Behavior Laws
- General Equations of Linear Elasticity
- Solution of Plane Elasticity Problems
- Beam Bending
- Study of Thin Plates

Structural Dynamics II

- Free Vibrations of Single-Degree-of-Freedom Systems
- Forced Vibrations of Single-Degree-of-Freedom Systems
- Progressive Push-Over Method

Reinforced Concrete Structures 2

- Calculation of Secondary Elements
- Bracing Systems
- Shear Walls
- Deep Foundations

Foundations and Retaining Structures

- Shear Strength of Soils
- Calculation of Shallow Foundations
- Calculation of Deep Foundations
- Retaining Structures and Reinforcement

Finite Element Methods

- Introduction and Objectives
- One-Dimensional Finite Elements
- Two- and Three-Dimensional Finite Elements
- Finite Elements in Dynamics

Steel Construction Project

- Data Collection and Preliminary Formulation
- Structural Framework Design for a Hall Building
- Evaluation of Snow and Wind Actions on the Building
- Sizing of Load-Bearing Steel Elements for Roof and Facades
- Static Analysis of Transverse Frames and Main Element Sizing
- Design and Sizing of Specific Joints
- Preparation of Technical Drawings for Execution

Ethics, Professional Conduct, and Intellectual Property

Final Project

- Presentation and Description of the Project
- Preliminary Structural Element Design and Load Evaluation
- Analysis and Design of Floors
- Seismic and Wind Load Analysis
- Calculation and Reinforcement of Stairs

- Calculation and Reinforcement of the Load-Bearing Structure
- Foundation Design
- Preparation of Execution Plans (Formwork and Reinforcement Plans)
- Conclusions and Recommendations