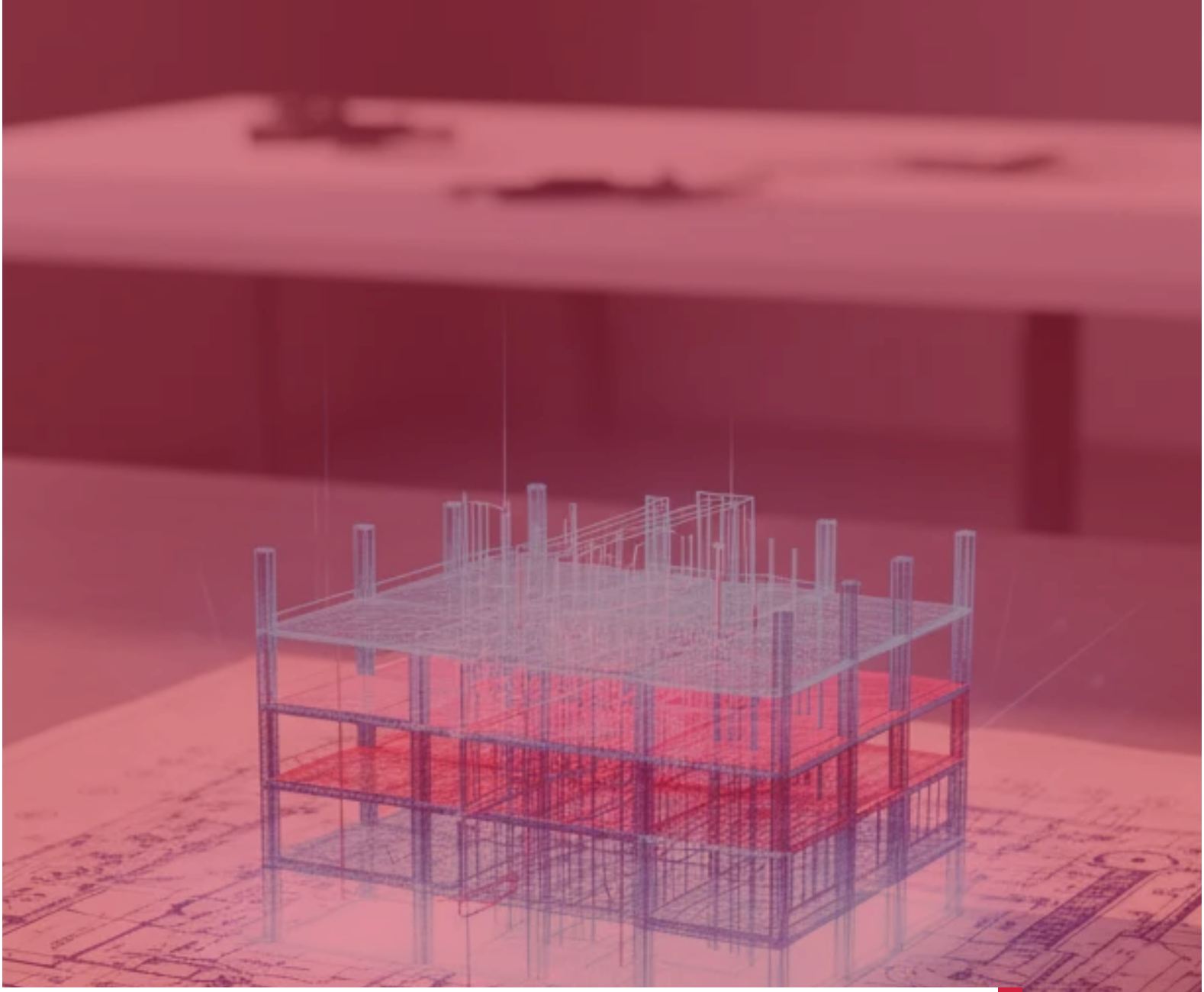


Máster online 100%

# Master in Analysis and Structural Calculation Software + 60 ECTS Credits

Structuralia

Máster online 100%

# Master in Analysis and Structural Calculation Software + 60 ECTS Credits

Modality
**Online**

Languages
**Español**

Duration
**1500 hours (60 ECTS)**

No Limit
**AI Assistant**

Does it include practices?
**NO**

Educational Institutions

Structuralia Engineering eLearning

UNIVERSIDAD NEBRIJA

## Summary

The Master in Analysis and Structural Calculation Software is a specialization for engineering and technical architecture professionals who seek to update their knowledge in calculation software and adapt to BIM methodologies, mastering advanced computational tools for the design and verification of structural elements. This program introduces you to the in-depth study of the types of structures and their connections, addressing tension analysis, the actions and efforts that affect them. You will delve into critical concepts such as bending, shear and buckling, applying these fundamentals to complex civil engineering and building scenarios. Through this master's degree, you will not only refresh and consolidate your knowledge of manual structural calculation, but you will also acquire advanced skills in the use of specific software, both matrix and finite element types. This duality will allow you to solve structural challenges with precision, optimizing projects and adapting to the demands of digitalization and BIM methodologies. You will explore surface foundations, understanding fluid dynamics in porous materials, the study of effective stresses and pore pressures. You will master the principles of soil mechanics, structural stability and the correct application of materials and load hypotheses. This comprehensive approach prepares you to lead

projects with a strategic and technical vision, enhancing your capacity in computational structural design.

# Agenda

## MODULE 1. CALCULATION OF STRUCTURES

### 1. DIDACTIC UNIT 1. TYPES OF STRUCTURES AND CONNECTIONS

1. Typology of structures
2. Typology of structures according to their behavior
3. Typology of structures according to their deformation
4. Types of support for structures: joints, embedments and sliders
5. Types of joints in the metal and concrete structure

### 2. DIDACTIC UNIT 2. STRESS ANALYSIS: ACTIONS AND EFFORTS

1. Actions in structures
2. Ultimate limit state and serviceability limit state
3. Calculation combinations
4. Stresses in the structures
5. Structural design methods

### 3. DIDACTIC UNIT 3. BENDING, SHEER, BUCKING

1. Calculation of flexion, shear and flexo-compression
2. Types of instabilities and their solution
3. Compression buckling
4. Lateral buckling
5. Dent, profiles that can be reinforced, criteria and solutions

### 4. DIDACTIC UNIT 4. APPLICATION OF FUNDAMENTAL CONCEPTS

1. Application of structural concepts
2. Deformation calculation
3. Calculation of a beam
4. Calculation of a pillar
5. Calculation of a porch

## MODULE 2. SURFACE FOUNDATIONS

### 1. DIDACTIC UNIT 1. FLUID DYNAMICS IN POROUS MATERIALS

1. The fundamental states of water
2. Darcy's Law. Soil permeability analysis
3. Definition of phreatic and capillary water
4. Introduction to total, effective and neutral pressures
5. Definition of hydraulic gradient
6. Liquefaction as an effect of overpressures
7. Analysis of the types of aquifers and catchment hydraulics
8. Development of the general flow equation
9. Groundwater

## 2. DIDACTIC UNIT 2. STUDY OF EFFECTIVE STRESS AND INTERSTITIAL PRESSURE

1. Analysis of the stress state in geotechnical media
2. Graphic representation of the state of stress: Mohr's circle and Mohr-Coulomb criterion
3. Characterization of mechanical behavior through shear and triaxial tests
4. Soil instability associated with groundwater flow
5. Design and application of filters for flow control in the field
6. Interaction of water with the matrix and the rock mass
7. Underground flow behavior

## 3. DIDACTIC UNIT 3. PRINCIPLES OF SOIL MECHANICS

1. Introduction to soil consolidation
2. Soil properties
3. Soil resistance: basic concepts
4. Loads and actions on the ground
5. The magnitude of the consolidation entry
6. The evolution of the consolidation entry
7. Theory of parabolic isochrones
8. Preload and radial and mixed consolidation
9. Identification and status tests
10. Resistance tests

## 4. DIDACTIC UNIT 4. STABILITY

1. Water collection systems
2. Design of individual wells. Analytical solutions
3. Well group design
4. Conception and construction of wellpoints
5. Well points design

## 5. DIDACTIC UNIT 5. MATERIALS AND LOADING HYPOTHESES

1. Introduction to materials
2. Stress calculation
3. Loading hypothesis

## 6. DIDACTIC UNIT 6. INTRODUCTION TO SURFACE FOUNDATIONS

1. Introduction to shallow foundations
2. Classification and calculation methods
3. Water in the foundations
4. Sinking: safety, load and allowable pressure
5. Safety against sliding, overturning and overall stability
6. The geotechnical study
7. Soil samples

## 7. DIDACTIC UNIT 7. TYPES AND COMPONENTS OF SURFACE FOUNDATIONS

1. Insulated shoes. Definition
2. Combined shoes. Definition
3. Foundation slabs. Definition

### 8. DIDACTIC UNIT 8. CALCULATION AND DESIGN OF SURFACE FOUNDATIONS

1. Stress distributions under rigid footings
2. Sinking and bearing capacity
3. Correction factors of the general formula
4. Some particular cases of bearing capacity
5. Sinking pressure from in situ tests
6. Considerations in particular soils
7. Bearing capacity in Rock
8. Definitions and concepts of Service Limit States
9. Stress distributions in the soil
10. Settlement estimation in granular soils
11. Settlement estimation in cohesive soils
12. Other methods and other deformations

### 9. DIDACTIC UNIT 9. CONSTRUCTION ASPECTS AND QUALITY IN SURFACE FOUNDATIONS

1. Construction processes of shallow foundations
2. Quality control of materials and execution

### 10. DIDACTIC UNIT 10. SLABS, WELLS, DYNAMIC ASPECTS AND OFFSHORE SCOPE

1. Slabs
2. Semi-deep foundations or foundation pits
3. Dynamic aspects
4. Surface foundations in the maritime and offshore fields

## MODULE 3. DEEP FOUNDATIONS. PILES

### 1. DIDACTIC UNIT 1. BASIC CONCEPTS AND COLUMN PILES IN SOILS

1. Typology of deep foundations
2. Definitions
3. Design bases for deep foundations
4. Basic formulation
5. Calculation of ground resistance against vertical actions in soils
6. Tip resistance in granular soils.
7. Analytical solutions Tip resistance in cohesive soils
8. Analytical solutions Tip resistance in soils through in situ tests

### 2. DIDACTIC UNIT 2. FLOATING PILES IN SOIL, PILES IN ROCK AND GROUPS OF PILES

1. Shaft resistance in granular soils
2. Analytical solutions Shaft resistance in cohesive soils
3. Analytical solutions Stem resistance in soils through in situ tests
4. Ground resistance against vertical actions in rocks Resistance of a group of piles

### 3. DIDACTIC UNIT 3. WORKLOADS AND SEATING ON PILES

1. Safety against sinking

2. Safety coefficient
3. Structural stop on piles Seats on piles
4. Pile pullout resistance Formulas for pile driving

### 4. DIDACTIC UNIT 4. CHOICE OF PILES AND UNCOMMON SITUATIONS

1. Piles subjected to lateral loads Negative friction in piles
2. Load tests on piles
3. Selecting the type of pile
4. Geotechnical calculation of micropiles

## MODULE 4. GROUND PUSHES AND EARTH CONTAINMENT STRUCTURES

### 1. DIDACTIC UNIT 1. SOIL MECHANICS

1. Previous works
2. Design and planning of research campaigns
3. The geotechnical study
4. Soil samples
5. Preliminary investigations and field surveys
6. Drilling and sampling techniques
7. In situ tests for soils and rock masses

### 2. DIDACTIC UNIT 2. MAIN FIELD TESTS

1. Concept of identification and state of resistance
2. Identification and status tests
3. Resistance tests
4. Introduction to triaxial testing. Previous concepts
5. Definition of the triaxial test
6. Interpretation of the triaxial test
7. Practical applications of triaxial testing

### 3. DIDACTIC UNIT 3. SOIL AND ROCK TESTS

1. Deformability test
2. Interpretation of the oedometric test
3. Compaction and reuse tests
4. Laboratory tests for rock characterization
5. In situ tests for rock characterization

### 4. DIDACTIC UNIT 4. DEFINITION OF SERVICE LIMIT STATES

1. Definitions and concepts
2. Stress distributions in the soil
3. Settlement estimation in granular soils
4. Settlement estimation in cohesive soils
5. Other methods and other deformations

### 5. DIDACTIC UNIT 5. THEORETICAL FOUNDATIONS OF EARTH THRESSES

1. Fundamental Coulomb Hypotheses
2. Soil mechanics according to Terzaghi and Rankine
3. Thrust coefficients at rest. Empirical relations of Jaky and Mayne

4. Winkler module
5. Numerical models (2D/3D FEM, LEM, DEM)
6. The earthquake and its mechanical influences on the ground

### 6. DIDACTIC UNIT 6. RIGID WALLS (NON-MOVABLE)

1. Introduction to rigid wall design
2. Design and calculation of gravity walls
3. Gravity Wall Geometry and Construction Procedures
4. Classification and stability of rigid walls
5. Masonry systems
6. Other rigid walls

### 7. DIDACTIC UNIT 7. FLEXIBLE WALLS (MOVABLE)

1. Principles of flexible behavior
2. Design and specifications of gabion and sieve walls
3. Continuous Reinforced Concrete Screens
4. Pile and micropile screens
5. Types of anchors on screens
6. Excavations in sheet piles and trenches

### 8. DIDACTIC UNIT 8. GENERAL DESIGN AND CONSTRUCTION CONSIDERATIONS

1. Wall construction procedures
2. Auscultation instrumentation for ground movements and monitoring
3. Main land problems (expansive, collapsible, liquefiable soils, anthropic fills, improvement treatments)
4. Selection of type sections and filtration design

## MODULE 5. SEISMICITY AND EARTHQUAKE-RESISTANT DESIGN

### 1. DIDACTIC UNIT 1. INTRODUCTION AND CHARACTERIZATION OF SEISMIC ACTION

1. What is an earthquake? Definition. Causes and effects. Regions of high seismicity in the world
2. Characterization of seismic action. PGA concept. Earthquake levels, return periods and seismic hazard curves.
3. Definition of response spectra. Local geology and amplification factors. Liquefaction
4. Importance coefficients
5. Consideration of seismic action in the project. Vertical action of the earthquake, associated mass, combination of seismic action

### 2. DIDACTIC UNIT 2. ANALYSIS METHODS

1. Introduction to modal analysis
2. Seismic-resistant design methodology. Guide to steps to follow
3. Static linear analyzes (i). Equivalent Lateral Force Method
4. Dynamic linear analyzes (ii). Spectral and modal-spectral analysis
5. Nonlinear analysis. Pushover analysis and time history method with accelerograms (time history)

### 3. DIDACTIC UNIT 3. EARTHQUAKE-RESISTANT DESIGN. METHODOLOGY AND REQUIREMENTS

1. Basic design criteria in seismic zone
2. Ductility. Behavioral factors
3. Ductile design requirements for reinforced concrete
4. Ductile design requirements for metallic structures
5. Travel evaluation. Seismic joints and separation of adjacent structures
6. Gravity and containment structures. Pseudostatic analysis: seismic design and thrust formulation
7. Seismic-resistant design strategy. Dissipate vs Isolate

### 4. DIDACTIC UNIT 4. APP. PRACTICAL CASES

1. Application example. Structural design of an earth retaining wall
2. Application example. Design of a reinforced concrete building. Application of the spectral modal method
3. Bibliography, reference standards and guides

## MODULE 6. BASIC CALCULATION OF STRUCTURES WITH AUTODESK ROBOT V2020

### 1. DIDACTIC UNIT 1. INTRODUCTION TO AUTODESK ROBOT

1. Download and install the evaluation version
2. Introduction to Autodesk Robot
3. Project Preferences: Units
4. Materials
5. Structural design regulations

### 2. DIDACTIC UNIT 2. GEOMETRIC DEFINITION

1. 2D Structures: Defining structure geometry using construction lines
2. Definition of knots, bars and Shell type elements
3. Operations with bars: division, cut, intersection and extension
4. Structure editing: Movement, copy, rotation, symmetry and homothecy
5. Viewing options: Viewcube. attribute view

### 3. DIDACTIC UNIT 3. STRUCTURAL DEFINITION

1. Definition of materials. Definition and assignment of sections
2. Boundary conditions (assignment and type of supports) and internal links
3. Load cases: Dead, live, wind, snow, temperature, exceptional and seismic
4. Loads in knots: Forces and moments, imposed displacements. Assignment
5. Loads on bars: Uniform, trapezoidal, distributed moments, thermal loads. Assignment

### 4. DIDACTIC UNIT 4. SPECIAL ANALYSIS

1. Introduction to structural calculation
2. Static and linear analysis. Structure calculation
3. Analysis of results
4. Nonlinear static p-delta analysis
5. Global buckling analysis

## MODULE 7. BASIC CALCULATION OF METAL STRUCTURES WITH CYPE 3D V2020

### 1. DIDACTIC UNIT 1. INTRODUCTION TO THE SOFTWARE

1. Introduction: geometry and general data of the work
2. Climate data: wind and snow
3. Side walls
4. Strap selection
5. Export to Cype 3D

### 2. DIDACTIC UNIT 2. CYPE 3D MODELING

1. Selection of regulations and materials
2. Load assumptions and combinations, allowable ground stress
3. Geometry creation
4. Definition of supports
5. Bar grouping

### 3. DIDACTIC UNIT 3. CYPE 3D STRUCTURAL DEFINITION

1. Definition of profiles
2. Bar boundary conditions
3. Definition and assignment of loads
4. Bar buckling and lateral buckling. Arrow limitation
5. Calculation and results. Structure sizing

### 4. DIDACTIC UNIT 4. RIGID FOUNDATIONS IN CYPE 3D

1. Introduction
2. Anchor plates
3. Foundation footings and beams
4. Footing Optimization
5. Party wall shoes

## MODULE 8. MODELING OF METAL AND CONCRETE STRUCTURES WITH TEKLA STRUCTURES 2021

### 1. DIDACTIC UNIT 1. COORDINATION OF NAVISWORKS MODELS.

1. Creating and exploring a Navisworks scene.
2. Visualization tools: Autodesk Rendering Navisworks.
3. Model Review: Clash Detective Navisworks.
4. Animation and planning: Animator + TimeLiner Navisworks.
5. Model measurement: Quantification.

### 2. DIDACTIC UNIT 2. COST ESTIMATION

1. Introduction to Presto.
2. Cost-It: basic handling.
3. Cost-It: measurement criteria.
4. Cost-It: from measurement to budget.
5. Cost-It: from 5D to 4D and measurement of IFC's

## MODULE 9. BASIC CALCULATION OF METAL STRUCTURES AND CONCRETE WITH SAP2000 V20

### 1. DIDACTIC UNIT 1. INTRODUCTION TO THE SOFTWARE

1. Program interface
2. Grid lines
3. 2D editing commands
4. 3D editing commands
5. Structural plan

## 2. DIDACTIC UNIT 2. STRUCTURE MODELING

1. Display options and supports
2. Materials and sections
3. Property Mapping
4. Boundary conditions
5. Loads and combinations

## 3. DIDACTIC UNIT 3. CALCULATION OF STRUCTURES

1. Load allocation
2. Tributary areas (none)
3. Climate actions
4. Analysis of results
5. Introduction to sizing

## 4. DIDACTIC UNIT 4. STRUCTURAL SIZING

1. Sizing in metal structure
2. Sizing in concrete structure
3. finite elements
4. Discretization
5. BIM environment

## MODULE 10. TFM. MASTER IN ANALYSIS AND STRUCTURE CALCULATION SOFTWARE

## Qualification

University Degree in Master of Lifelong Training in Analysis and Structural Calculation Software issued by the Antonio de Nebrija University with 60 ECTS University Credits. Teachings not leading to obtaining an official qualification

## Objectives

- • Perfect the fundamentals of structural analysis for various typologies in building and civil works. • Implement calculation methodologies, both manual and computational, with finite element and matrix software, to solve complex structural challenges. • Analyze actions and efforts in structures through a precise tension study, identifying critical design points. • Develop solutions for bending, shear and buckling phenomena, guaranteeing the integrity and stability of the elements. • Direct the design of shallow foundations, considering soil mechanics, effective stresses and pore pressures. • Incorporate principles of soil mechanics and stability in the design, optimizing materials and load hypotheses. • Base technical decisions on the analysis of structural data, applying key concepts to real projects. • Promote the implementation of advanced software tools for the verification and optimization of designs in BIM environments.

## What does it prepare you for?

This program prepares you to lead the design and verification of complex structures, integrating advanced calculation tools with BIM workflows. You will develop a strategic vision that will allow you to make informed decisions in civil engineering and building projects, optimizing resources and guaranteeing the safety and durability of constructions. You will master stress analysis and applied soil mechanics, applying these fundamental concepts with specific matrix or finite element software. You will manage surface foundations, understanding fluid dynamics in porous materials and the study of effective stresses, which will allow you to approach stability with technical rigor. With this master's degree, you will integrate advanced software for the optimization of structural projects.

## Who is it addressed to?

This master's degree is designed for engineering professionals, including Civil Engineers, Civil Engineers, Industrial Engineers, Mining Engineers, Public Works Engineers, and Technical Architects (surveyors), who seek a high-level specialization in the design and calculation of structures. If you work in the sector and need to update your knowledge in advanced calculation software and integrate BIM methodologies into your projects, this program is for you. It is ideal for profiles oriented towards innovation and efficiency in building and civil works, with a clear concern for mastering the most advanced tools and techniques in structural analysis.

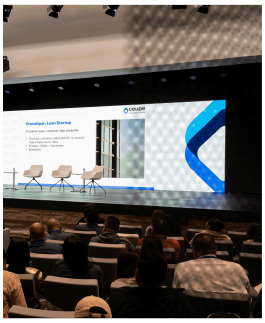
## Official Character

This training is not included within the scope of official regulated training (Early Childhood Education, Primary Education, Secondary Education, Official Vocational Training FP, Baccalaureate, University Degree, Master University Officer and Doctorate). It is therefore a complementary and/or specialization training, aimed at the acquisition of certain competencies, skills or aptitudes of a professional nature, which can be assessed as merit in job boards and/or competitive examinations, always within the section of Complementary Training and/or Continuous Training. It is always essential to review the specific grading requirements of the specific public job boards to which we wish to apply.

# Professional Outings

- Specialization in structural analysis and calculation software positions you strategically in the engineering and construction sector, opening doors to highly responsible roles. You will be able to lead as Structures Project Director in large construction or engineering companies, managing multidisciplinary teams and guaranteeing the technical feasibility of complex works. You will be able to work as Head of the BIM Technical Office, promoting digitalization and efficiency in the design and execution of building and civil works projects. You will also be able to develop as a Senior Consultant in Structural Engineering, advising companies on the optimization of solutions and the application of advanced regulations. Your mastery of structural calculation and BIM integration will consolidate you as an essential profile in any organization that seeks excellence in its projects.







Live Madrid

# Live the International Week

As an additional complement to your training, you can be part of the SIM: Week International in Madrid. A unique meeting that brings together students from all over the world. For seven days you can live an academic and cultural experience in the heart of Europe, culminating with the graduation ceremony in Madrid.

- Conferences and workshops with international experts
- Visits to companies and reference organizations
- Networking with students from different countries
- Cultural activities and discovery of Madrid
- graduation ceremony

# Structural

Structuralia is a leading educational institution in postgraduate and highly specialized online training, focused on the fields of engineering, architecture, construction, energy, technology and digital transformation.

Founded in 2001 with a strong industrial DNA, the result of collaboration between large companies in the sector and the Universitat Politècnica de Catalunya (UPC), for more than 25 years we have accompanied technical professionals in their academic and professional development through practical, flexible training aligned with the reality of the labor market.

Our training proposal connects advanced technical knowledge, real employability and international projection, acting as key support in the professional evolution of those seeking to specialize, grow professionally and generate impact in their sector, with a firm commitment to the democratization of access to technical excellence.



+350.000

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Experience in the training sector



5 stars

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You will have access to more than 400 key courses (soft skills, languages, competencies digital, etc.) and other surprises. Sign up and see how MyLXP improves your learning.

# Meet PHIA, your personalized learning assistant

## Use all the possibilities of artificial intelligence to get the most out of it match to your training

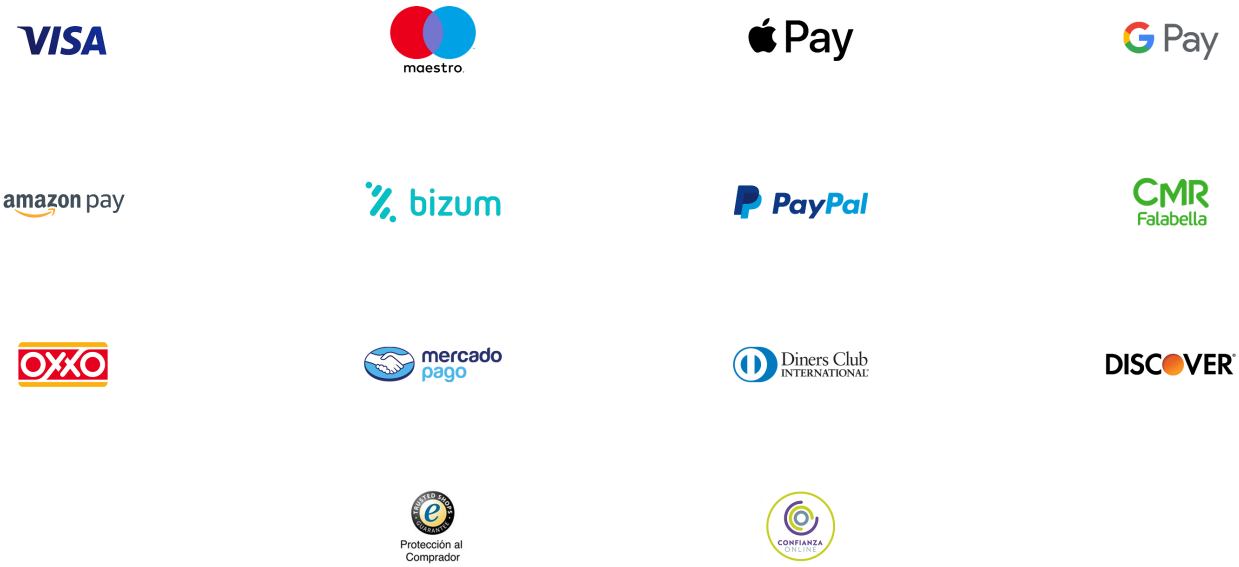
EDUCA EDTECH Group leads the digital revolution in education, promoting the continuous learning and technological transformation. The group is made up of recognized training institutions and its mission is to democratize access to education, promote the transfer of knowledge, technological development and research.

With the experience accumulated over more than 20 years, we have perfected our learning platform EDUCA LXP (Learning Experience Platform), the basis of our educational methodology, which provides students with online training practical and meaningful.



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