Master's Degree

Structural and Construction Engineering

tech global university

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Master's Degree
Structural and Construction Engineering

- Modality: **online**
- Duration: **12 months**
- Certificate: **TECH Global University**
- Credits: **60 ECTS**
- Schedule: **at your own pace**
- Exams: **online**

Website: **www.techtitute.com/us/engineering/master-degree/master-structural-construction-engineering**

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01

Introduction

Problems in logistics chains, climate change itself, or the use of more environmentally friendly materials are just some of the challenges facing Structural and Construction Engineering today. Fortunately, technology is one of the great allies in this field, allowing decisive advances in construction procedures. This qualification provides an in-depth study of the most relevant developments in the planning, creation, maintenance, and operation of infrastructures, updating in areas such as structural steel, geotechnical engineering and construction procedures. All this in a 100% online program, providing maximum flexibility to the engineer and full access to the contents from any device with an Internet connection.

Stand out in the field of Structural and Construction Engineering by incorporating the most advanced analysis and project management tools into your work methodology"

Technological advances have enabled Structural and Construction Engineering to take giant steps forward. Smarter urbanization, increasing automation of machinery, or the use of *Big Data* in the analysis of structures are just some of the consequences that have resulted from the most innovative developments in recent years.

Engineers are facing a favorable performance scenario since they have tools, work methodologies, and construction techniques that allow much more agile, deep, and organized work. This also forces them to a process of continuous renewal, which is essential to keep up to date in order to continue advancing professionally and build stronger and, more importantly, working relationships.

For this reason, TECH has created this program, which presents the most outstanding advances in topics such as construction materials, building, structural analysis, and project management. The engineer will have access to a multitude of topics detailing the improvement of dynamic behavior, modular construction, alternative foundation methods, or the most modern software in project drafting.

In addition, the format of the qualification is completely online, as all the contents can be downloaded directly from the Virtual Campus. This means that it is the engineer who sets the pace of study, being able to adapt the teaching load to their own professional and personal responsibilities. The multitude of real cases analyzed, the audiovisual materials, and the meticulous and exhaustive detail with which each topic has been elaborated will be decisive in updating the engineer, giving a definitive boost to their professional career.

This **Master's Degree in Structural and Construction Engineering** contains the most complete and up-to-date program on the market. The most important features include:

- The development of case studies presented by experts in Civil Engineering
- The graphic, schematic, and practical contents with which they are created, provide practical information on the disciplines that are essential for professional practice
- Practical exercises where self-assessment can be used to improve learning
- Its special emphasis on innovative methodologies
- Theoretical lessons, questions to the expert, debate forums on controversial topics, and individual reflection assignments
- Content that is accessible from any fixed or portable device with an Internet connection

Delve into the latest developments in construction materials, including modules dedicated to building, deformable solid mechanics, and structural concrete"

Give a definitive boost to your professional career by incorporating this Master's Degree in your CV and stand out as an up-to-date and avant-garde structural engineer"

You decide your own course load, taking the exams and advancing through the syllabus according to your own interests.

You choose how, when, and where to study at your own pace without face-to-face classes or fixed schedules.

The program's teaching staff includes professionals from sector who contribute their work experience to this educational program, as well as renowned specialists from leading societies and prestigious universities.

Its multimedia content, developed with the latest educational technology, will provide the professional with situated and contextual learning, i.e., a simulated environment that will provide an immersive education programmed to learn in real situations.

The design of this program focuses on Problem-Based Learning, by means of which the professional must try to solve the different professional practice situations that are presented throughout the academic course. For this purpose, the student will be assisted by an innovative interactive video system created by renowned experts.

02

Objectives

The field of Civil Engineering is becoming increasingly competitive, and advances in Structural and Construction Engineering have cascaded in recent years. Therefore, the final objective of this Master's Degree is to provide the engineer with the most advanced technical and technological tools in the area, delving into the most relevant topics and knowledge through a dynamic, extensive, and effective syllabus.

Specialize in the most important developments in Structural and Construction Engineering, mastering in a scientific and technical way the practice of the profession"

General Objectives

- Autonomous learning of new knowledge and techniques suitable for Civil Engineering
- To know in detail the nature, characteristics, and performance of the new construction materials that have been investigated in recent years
- Understand and use the language of engineering and the terminology of Civil Engineering
- Delve in a scientific and technical way in the activity of the profession of the technical engineer of public works with knowledge of the functions of consultancy, analysis, design, calculation, projection, construction, maintenance, , conservation, and operation

Specific Objectives

Module 1. Projects

- Apply all the latest knowledge and techniques for the execution of contracts, following all relevant administrative processes
- Apply health and safety regulations at all stages of project design and construction
- Develop linear works following the current regulations and choosing the specific and most appropriate machinery for each case
- Apply all the necessary tools for the construction of hydraulic works
- Develop maritime works, taking into account the peculiarities of each construction and the latest trends in R+D+i
- Perform the necessary tasks for the completion of the project (settlement and closure of the work), as well as the follow-up of the project

Module 2. Fluid mechanics and hydraulics

- Understand the general concepts of Fluid Physics and solve related problems
- Know the basic characteristics of fluids and their behavior under various conditions
- Be able to explain these behaviors using the basic equations of fluid dynamics
- Know the constitutive equations
- Acquire confidence in the handling of the Navier-Stokes equations

Module 3. Structural Analysis

- Analyze and understand how the characteristics of structures influence their behavior
- Apply knowledge of the resistant performance of structures in order to evaluate them according to existing standards and using analytical and numerical calculation methods
- Define primary stresses in structural sections: axial and shear forces, bending and torsional moments
- Calculate stress diagrams

Module 4. Geotechnics and foundations

- In-depth knowledge of the conditioning factors that influence the design and behavior of shallow foundations
- Analyze the trends in the different international design standards, contemplating their differences in terms of criteria and the different safety coefficients used
- Establish a sensitivity analysis of the behavior of the foundations in the evolution of this type of loads
- Identify the different types of improvement of foundations already in use, classifying them according to the type of foundation the soil on which it is located and the age at which it was built
- Break down, in a comparative way, the costs of the use of this type of foundations and their influence on the rest of the structure
- Identify the most common types of surface foundation failures and their most effective corrective measures

Module 5. Construction Materials and their Applications

- Delve into the science of fresh and hardened concrete: fresh state characteristics, hardened mechanical properties, stress-strain behavior, modulus of deformation and Poisson's ratio, creep, fracture, dimensional stability, and shrinkage
- Analyze the most important characteristics of special concretes, and the different existing typologies, whether with fibers, light, self-compacting, etc
- Gain in-depth knowledge of the different techniques for producing additive mixtures
- Perform typical tests on construction materials and be able to perform the required procedures

Module 6. Mechanics of the deformable solid

- Analyze and understand how the characteristics of structures influence their behavior
- Apply knowledge of the resistant performance of structures in order to evaluate them according to existing standards and using analytical and numerical calculation methods

Module 7. Construction Procedures I

- Acquire a thorough knowledge of the different types of existing land treatments
- Analyze the range of existing typologies and their correspondence with the improvement
- of the different properties
- Know precisely the variables that are found in the processes of land improvement by injection Consumption, requirements, advantages and disadvantages
- Present, in an extensive way, gravel column treatments as elements of land treatment of relatively little use, but with remarkable technical applications
- In-depth presentation of soil treatments by chemical treatment and freezing, as little-known treatments but with very good spot applications
- Define the applications of preloading (preconsolidation), which was covered in a previous module as an element of soil treatment to accelerate the evolution of soil behavior
- Complete the knowledge of one of the most used ground treatments in subway works, such as micropile umbrellas, defining applications different from the usual ones and the characteristics of the process
- Deal in detail with soil decontamination as a land improvement process, defining the typologies that can be used

Module 8. Structural Steel

- Design, plan, build and maintain reinforced concrete and steel structures based on knowledge of the fundamentals of the behavior of these structures
- Analyze and understand how the characteristics of structures influence their behavior
- Apply knowledge of the resistant performance of structures in order to evaluate them according to existing standards and using analytical and numerical calculation methods

Module 9. Structural Concrete

- Analyze and understand how the characteristics of structures influence their behavior
- Apply knowledge of the resistant performance of structures in order to evaluate them according to existing standards and using analytical and numerical calculation methods

Module 10. Building

- Prepare for the application of the necessary legislation during the exercise of the profession of technical engineer of public works
- Understand the design, calculation, construction, and maintenance of building works in terms of structure, finishes, installations, and equipment

Module 11. Hydraulic Infrastructures

- Training on the wide range of hydraulic works in the field of Civil Engineering
- Know the appropriate machinery and constructive processes of gravity and pressure piping works
- Bring the students closer to the special parts available on the market for application in pipeline works
- Training on the particularities, appropriate machinery and construction processes of canals and dams
- Know the particularities, suitable machinery and construction processes of channeling works
- Know the particularities, appropriate machinery and construction processes of WWTP, DWTP and irrigation works

Stand out as an engineer adapted to the most recent challenges in the field of Civil Engineering, delving into the development and maintenance of different types of works"

03

Skills

The competencies to be developed by an engineer specialized in structures and constructions are multiple, so the syllabus has been developed from the most advanced professional experience. In this way, and through numerous practical examples and real analyses throughout the syllabus, the student will perfect the most useful skills in this field, which will be an unquestionable advance to stand out as a cutting-edge engineer.

Develop the most important and in-demand competencies in your sector, relying on the best didactic and academic content"

General Skills

- Maintain, preserve, and operate infrastructures in its area of operation
- Design, plan, build and maintain reinforced concrete and steel structures based on knowledge of the fundamentals of the behavior of these structures

Register now and do not miss a unique academic opportunity to delve into the main challenges and opportunities offered by Structural and Construction Engineering today"

Specific Skills

- Analyze stresses
- Develop and manufacture special concretes according to their dosage specifications and technological properties
- Recognize the different actions present in shallow foundations, both those that require and those that contribute to the stability of the element
- Drafting of construction projects with the use of the latest computer tools
- Perform budget, cost, purchasing, planning and certification control of a project
- Perform maintenance and preservation contracts
- Identify and repair possible damage to infrastructure

04

Structure and Content

The entire syllabus has been written following the Relearning methodology, in which TECH is a pioneer. This means that the most advanced concepts and knowledge in Structural and Construction Engineering are provided gradually and progressively, resulting in a much more natural and effective academic experience and learning. Students will have 24-hour access to the Virtual Campus, where they will find a multitude of multimedia resources to support them throughout the learning process.

Access detailed videos, interactive guides, and advanced summaries of all the modules covered, allowing you to delve deeper into the ones you are most interested in"

Module 1. Projects

1.1. Stages in the Design and Engineering of a Project
- 1.1.1. Problem Analysis
- 1.1.2. Solution Design
- 1.1.3. Analysis of the Regulatory Framework
- 1.1.4. Solution Engineering and Drafting

1.2. Knowledge of the Problem
- 1.2.1. Coordination With the Client
- 1.2.2. Study of the Physical Environment
- 1.2.3. Social Environment Analysis
- 1.2.4. Economic Environment Analysis
- 1.2.5. Analysis of the Environmental Setting (EIS)

1.3. Solution Design
- 1.3.1. Conceptual Design
- 1.3.2. Study of Alternatives
- 1.3.3. Pre-Engineering
- 1.3.4. Preliminary Economic Analysis
- 1.3.5. Coordination of the Design with the Client (cost-sales)

1.4. Client Coordination
- 1.4.1. Land Ownership Study
- 1.4.2. Economic from Feasibility Study of the Project
- 1.4.3. Environmental Feasibility Analysis of the Project

1.5. Regulatory Framework
- 1.5.1. General Regulations
- 1.5.2. Structural Design Regulations
- 1.5.3. Environmental Regulations
- 1.5.4. Water Regulations

1.6. Pre-Startup Engineering
- 1.6.1. Site or Layout Study
- 1.6.2. Study of Typologies to be Used
- 1.6.3. Pre-packaging solution study
- 1.6.4. Realization of the Project Model
- 1.6.5. Adjusted Economic Analysis of the Project

1.7. Analysis of the Tools to be Used
- 1.7.1. Team Personnel in Charge of the Work
- 1.7.2. Equipment Materials Necessary
- 1.7.3. Software Required for the Drafting of the Project
- 1.7.4. Subcontracting Necessary for the Drafting of the Project

1.8. Field work. Topography and geotechnics
- 1.8.1. Determination of the Necessary Topography Works
- 1.8.2. Determination of Geotechnical Works Required
- 1.8.3. Subcontracting of Surveying and Geotechnical Works
- 1.8.4. Follow-up of surveying and geotechnical works
- 1.8.5. Analysis of results of surveying and geotechnical works

1.9. Drafting of the Project
- 1.9.1. DIA Drafting
- 1.9.2. Writing and Calculation of the Solution in Geometric Definition
- 1.9.3. Drafting and calculation of the solution in structural calculation
- 1.9.4. Drafting and Calculation of the Solution in the Adjustment Phase
- 1.9.5. Drafting of Annexes
- 1.9.6. Drawing up of Plans
- 1.9.7. Drafting of Specifications
- 1.9.8. Budget Preparation

1.10. BIM Model Implementation in Projects
- 1.10.1. BIM Model Concept
- 1.10.2. BIM Model Phases
- 1.10.3. Importance of the BIM Model
- 1.10.4. The Need for BIM for the Internationalization of Projects

Module 2. Fluid mechanics and hydraulics

2.1. Introduction to Fluid Physics
- 2.1.1. No-Slip Condition
- 2.1.2. Classification of Flows
- 2.1.3. Control System and Volume
- 2.1.4. Fluid Properties
  - 2.1.4.1. Density
  - 2.1.4.2. Specific Gravity
  - 2.1.4.3. Vapor Pressure
  - 2.1.4.4. Cavitation
  - 2.1.4.5. Specific Heat
  - 2.1.4.6. Compressibility
  - 2.1.4.7. Speed of Sound
  - 2.1.4.8. Viscosity
  - 2.1.4.9. Surface Tension

2.2. Fluid Statics and Kinematics
- 2.2.1. Pressure
- 2.2.2. Pressure Measuring Devices
- 2.2.3. Hydrostatic Forces on Submerged Surfaces
- 2.2.4. Buoyancy, Stability and Motion of Rigid Solids
- 2.2.5. Lagrangian and Eulerian Description
- 2.2.6. Flow Patterns
- 2.2.7. Kinematic Tensors
- 2.2.8. Vorticity
- 2.2.9. Rotationality
- 2.2.10. Reynolds Transport Theorem

2.3. Bernoulli and Energy Equations
- 2.3.1. Conservation of Mass
- 2.3.2. Mechanical Energy and Efficiency
- 2.3.3. Bernoulli's Equation
- 2.3.4. General Energy Equation
- 2.3.5. Stationary Flow Energy Analysis

2.4. Fluid Analysis
- 2.4.1. Conservation of Linear Momentum Equations
- 2.4.2. Conservation of Angular Momentum Equations
- 2.4.3. Dimensional Homogeneity
- 2.4.4. Variable Repetition Method
- 2.5.5. Buckingham's Pi Theorem

2.5. Flow in Pipes
- 2.5.1. Laminar and Turbulent Flow
- 2.5.2. Inlet Region
- 2.5.3. Minor Losses
- 2.5.4. Networks
- 2.5.5. Buckingham's Pi Theorem

2.6. Differential Analysis and Navier-Stokes Equations
- 2.6.1. Conservation of Mass
- 2.6.2. Current Function
- 2.6.3. Cauchy Equation
- 2.6.4. Navier-Stokes Equation
- 2.6.5. Dimensionless Navier-Stokes Equations of Motion
- 2.6.6. Stokes Flow
- 2.6.7. Inviscid Flow
- 2.6.8. Irrotational Flow
- 2.6.9. Boundary Layer Theory. Blausius Equation

2.7. External Flow
- 2.7.1. Drag and Lift
- 2.7.2. Friction and Pressure
- 2.7.3. Coefficients
- 2.7.4. Cylinders and Spheres
- 2.7.5. Aerodynamic Profiles

2.8. Compressible Flow
- 2.8.1. Stagnation Properties
- 2.8.2. One-Dimensional Isentropic Flow
- 2.8.3. Nozzles
- 2.8.4. Shock Waves
- 2.8.5. Expansion Waves
- 2.8.6. Rayleigh Flow
- 2.8.7. Fanno Flow

2.9. Open Channel Flow
- 2.9.1. Classification
- 2.9.2. Froude Number
- 2.9.3. Wave Speed
- 2.9.4. Uniform Flow
- 2.9.5. Gradually Varying Flow
- 2.9.6. Rapidly Varying Flow
- 2.9.7. Hydraulic Jump

2.10. Non-Newtonian Fluids
- 2.10.1. Standard Flows
- 2.10.2. Material Functions
- 2.10.3. Experiments
- 2.10.4. Generalized Newtonian Fluid Model
- 2.10.5. Generalized Linear Viscoelastic Fluid Model
- 2.10.6. Advanced Constitutive Equations and Rheometry

Module 3. Structural Analysis

3.1. Introduction to Structures
- 3.1.1. Definition and Classification of Structures
- 3.1.2. Design process and practical and ideal structures
- 3.1.3. Equivalent systems of forces
- 3.1.4. Centers of Gravity. Distributed loads
- 3.1.5. Moments of inertia. Products of inertia. Inertia matrix. Main axes
- 3.1.6. Equilibrium and stability
- 3.1.7. Analytical Statics

3.2. Actions
- 3.2.1. Introduction
- 3.2.2. Permanent actions
- 3.2.3. Variable actions
- 3.2.4. Accidental actions

3.3. Tension, compression and shear
- 3.3.1. Normal strain and linear deformation
- 3.3.2. Mechanical Properties of Materials
- 3.3.3. Linear elasticity, Hooke's law, and Poisson's ratio
- 3.3.4. Tangential strain and angular deformation

3.4. Equilibrium equations and stress diagrams
- 3.4.1. Calculation of forces and reactions
- 3.4.2. Equilibrium equations
- 3.4.3. Compatibility equations
- 3.4.4. Stress diagram

3.5. Axially loaded elements
- 3.5.1. Length changes in axially loaded elements
- 3.5.2. Length changes in non-uniform bars
- 3.5.3. Hyperstatic elements
- 3.5.4. Thermal effects, misalignments and previous deformations

3.6. Torsion
- 3.6.1. Torsional deformations in circular bars
- 3.6.2. Non-uniform torsion
- 3.6.3. Strain and deformation in pure shear
- 3.6.4. Relation between the modulus of elasticity E and G
- 3.6.5. Hyperstatic torsion
- 3.6.6. Thin wall tubing

3.7. Bending moment and shear stress
- 3.7.1. Beam types, loads, and reactions
- 3.7.2. Bending moments and shear forces
- 3.7.3. Relations between loads, bending moments, and shear forces
- 3.7.4. Bending moment and shear forces diagrams

3.8. Analysis of structures in flexibility (force method)
- 3.8.1. Dynamic classification
- 3.8.2. Principle of superposition
- 3.8.3. Definition of flexibility
- 3.8.4. Compatibility equations
- 3.8.5. General solution procedure

3.9. Structural safety. Limit state method
- 3.9.1. Basic requirements
- 3.9.2. Causes of unsafety. Probability of collapse
- 3.9.3. Ultimate Limit States
- 3.9.4. Serviceability Limit States of deformation
- 3.9.5. Vibration and cracking serviceability limit states

3.10. Structural stiffness analysis (displacement method)
- 3.10.1. Fundamentals
- 3.10.2. Stiffness matrix
- 3.10.3. Nodal forces
- 3.10.4. Displacement calculation

Module 4. Geotechnics and foundations

4.1. Footings and Foundation Slabs
- 4.1.1. Most Common Types of Footings
- 4.1.2. Rigid and Flexible Footings
- 4.1.3. Large Shallow Foundations

4.2. Design Criteria and Regulations
- 4.2.1. Factors that Affect Footing Design
- 4.2.2. Elements Included in International Foundation Regulations
- 4.2.3. General Comparison Between Normative Criteria for Shallow Foundations

4.3. Actions Carried Out on Foundations
- 4.3.1. Most Common Types of Footings
- 4.3.2. Rigid and Flexible Footings
- 4.3.3. Large Shallow Foundations

4.4. Foundation Stability
- 4.4.1. Bearing Capacity of the Soil
- 4.4.2. Sliding Stability of the Footing
- 4.4.3. Tipping Stability

4.5. Ground Friction and Adhesion Enhancement
- 4.5.1. Soil Characteristics Influencing Soil-Structure Friction
- 4.5.2. Soil-Structure Friction According to the Foundation Material
- 4.5.3. Soil-Citation Friction Improvement Methodologies

4.6. Foundation Repairs Underlay
- 4.6.1. Need of Foundation Repair
- 4.6.2. Types of Repairs
- 4.6.3. Underlay Foundations

4.7. Displacement in Foundation Elements
- 4.7.1. Displacement Limitation in Shallow Foundations
- 4.7.2. Consideration of Displacement in the Calculation of Shallow Foundations
- 4.7.3. Estimated Calculations in the Short Term And in the Long Term

4.8. Comparative Relative Costs
- 4.8.1. Estimated Value of Foundation Costs
- 4.8.2. Comparison According to Superficial Foundations
- 4.8.3. Estimation of Repair Costs

4.9. Alternative Methods Foundation Pits
- 4.9.1. Semi-deep superficial foundations
- 4.9.2. Calculation and Use of Pit Foundations
- 4.9.3. Limitations and Uncertainties About the Methodology

4.10. Types of Faults in Superficial Foundations
- 4.10.1. Classic Breakages and Capacity Loss in Superficial Foundations
- 4.10.2. Ultimate Resistance in Superficial Foundations
- 4.10.3. Overall Capacities and Safety Coefficients

Module 5. Construction Materials and Their Applications

5.1. Cement
- 5.1.1. Cement and Hydration Reactions: Cement Composition and Manufacturing Process. Majority Compounds and Minority Compounds
- 5.1.2. Process of Hydration. Characteristics of Hydrated Products. Alternative Materials to Cement
- 5.1.3. Innovation and New Products

5.2. Mortar
- 5.2.1. Properties
- 5.2.2. Manufacturing, Types and Uses
- 5.2.3. New Materials

5.3. High Resistance Concrete
- 5.3.1. Composition
- 5.3.2. Properties and Characteristics
- 5.3.3. New Designs

5.4. Self-Compacting Concrete
- 5.4.1. Nature and Characteristics of its Components
- 5.4.2. Dosage, Manufacturing, Transport and Commissioning
- 5.4.3. Characteristics of the Concrete

5.5. Light Concrete
- 5.5.1. Composition
- 5.5.2. Properties and Characteristics
- 5.5.3. New Designs

5.6. Fiber and Multifunctional Concretes
- 5.6.1. Materials Used in the Manufacturing
- 5.6.2. Properties
- 5.6.3. Designs

5.7. Self-Repairing and Self-Cleaning Concretes
- 5.7.1. Composition
- 5.7.2. Properties and Characteristics
- 5.7.3. New Designs

5.8. Other from Cement-Based Materials (Fluid, Antibacterial, Biological, etc.)
- 5.8.1. Composition
- 5.8.2. Properties and Characteristics
- 5.8.3. New Designs

5.9. Destructive and Non-Destructive Characteristics Trials
- 5.9.1. Characterization of Materials
- 5.9.2. Destructive Techniques. Fresh and Hardened State
- 5.9.3. Non-Destructive Techniques and Procedures Applied to Materials and Construction Structures

5.10. Additive Mixtures
- 5.10.1. Additive Mixtures
- 5.10.2. Advantages and Disadvantages
- 5.10.3. Sustainability

Module 6. Mechanics of the deformable solid

6.1. Basic Concepts
- 6.1.1. Structural Engineering
- 6.1.2. Continuum Model Concept
- 6.1.3. Surface and Volume Forces
- 6.1.4. Lagrangian and Eulerian formulations
- 6.1.5. Euler's laws of motion
- 6.1.6. Integral Theorems

6.2. Deformities
- 6.2.1. Deformation: Concept and Elementary Measurements
- 6.2.2. Field of displacements
- 6.2.3. The Small Displacement Hypothesis
- 6.2.4. Kinematic equations. Deformation tensor

6.3. Kinematic Relations
- 6.3.1. Deformation State in the Environment of a Point
- 6.3.2. Physical Interpretation of the Strain Tensor Components
- 6.3.3. Principal Deformations and Main Deformation Directions
- 6.3.4. Cubic Deformation
- 6.3.5. Elongation of a Curve and Change in Body Volume
- 6.3.6. Compatibility equations

6.4. Stresses and Static Relations
- 6.4.1. Tension Concept
- 6.4.2. Relations Between Stresses and External Forces
- 6.4.3. Local Stress Analysis

6.4.4. Mohr's circle
6.5. Constitutive Relations
6.5.1. Concept of Ideal Behavioral Model
6.5.2. Uniaxial Responses and One-Dimensional Ideal Models
6.5.3. Classification of Behavioral Models
6.5.4. Generalized Hooke's Law
6.5.5. Elastic constants
6.5.6. Deformation Energy and Complementary Energy
6.5.7. Limits of the elastic model
6.6. Elastic Problem
6.6.1. Linear Elasticity and the Elastic Problem
6.6.2. Local Formulation of the Elastic Problem
6.6.3. Global Formulation of the Elastic Problem
6.6.4. Overall results
6.7. Beam Theory: Fundamental Assumptions and Results I
6.7.1. Derived Theories
6.7.2. Beam: Definitions and Classifications
6.7.3. Additional Hypotheses
6.7.4. Kinematic Analysis
6.8. Beam Theory: Fundamental Assumptions and Results II
6.8.1. Static Analysis
6.8.2. Constitutive Equations
6.8.3. Deformation Energy
6.8.4. Formulation of the Stiffness Problem
6.9. Bending and Stretching
6.9.1. Interpretation of the Results
6.9.2. Estimation of Displacements out of Guideline
6.9.3. Estimation of Normal Stresses
6.9.4. Estimation of the Tangential Stresses due to Bending
6.10. Theory of Beams: Torsion
6.10.1. Introduction
6.10.2. Coulomb Torsion
6.10.3. Saint-Venant Torsion

6.10.4. Introduction to Non-Uniform Torsion

Module 7. Construction Procedures I

7.1. Objectives. Movements and Property Enhancement
- 7.1.1. Internal and Global Property Enhancement
- 7.1.2. Practical Objectives
- 7.1.3. Improvement of Dynamic Behaviours

7.2. Improvement by High Pressure Mixing Injection
- 7.2.1. Typology of Soil Improvement by High-pressure Grouting
- 7.2.2. Characteristics of Jet-Grouting
- 7.2.3. Injection Pressures

7.3. Gravel Columns
- 7.3.1. Overall Use of Gravel Columns
- 7.3.2. Quantification of Land Property Improvements
- 7.3.3. Indications and Contraindications of Use

7.4. Improvement by Impregnation and Chemical Injection
- 7.4.1. Characteristics of Injections and Impregnation
- 7.4.2. Characteristics of Chemical Injections
- 7.4.3. Method Limitations

7.5. Freezing
- 7.5.1. Technical and Technological Aspects
- 7.5.2. Different Materials and Properties
- 7.5.3. Application and Limitation Fields

7.6. Preloading, Consolidations and Compactions
- 7.6.1. Preloading
- 7.6.2. Drained Preloading
- 7.6.3. Control During Ejection

7.7. Improvement by Drainage and Pumping
- 7.7.1. Temporary Drainage and Pumping
- 7.7.2. Utilities and Quantitative Improvement of Properties
- 7.7.3. Behavior After Restitution

7.8. Micropile Umbrellas
- 7.8.1. Ejection and Limitations
- 7.8.2. Resistant Capacity
- 7.8.3. Micropile Screens and Grouting

7.9. Comparison of Long-term Results
- 7.9.1. Comparative Analysis of Land Treatment Methodologies
- 7.9.2. Treatments According to Their Practical Application
- 7.9.3. Combination of Treatments

7.10. Soil Decontamination
- 7.10.1. Physicochemical Processes
- 7.10.2. Biological Processes
- 7.10.3. Termical Processes

Module 8. Structural Steel

8.1. Introduction to Structural Steel Design
- 8.1.1. Advantages of Steel as a Structural Material
- 8.1.2. Disadvantages of Steel as a Structural Material
- 8.1.3. First Uses of Iron and Steel
- 8.1.4. Steel Profiles
- 8.1.5. Stress-Strain Relationship of Structural Steel
- 8.1.6. Modern Structural Steels
- 8.1.7. Use of High-Strength Steels

8.2. General Principles for the Project and Construction of Steel Structures
- 8.2.1. General Principles for the Project and Construction of Steel Structures
- 8.2.2. Structural Design Work
- 8.2.3. Responsibilities
- 8.2.4. Specifications and Building Codes
- 8.2.5. Economical Design

8.3. Calculation Basis and Structural Analysis Models
- 8.3.1. Calculation Basis
- 8.3.2. Structural Analysis Models
- 8.3.3. Determination of Areas
- 8.3.4. Sections

8.4. Ultimate Limit States I
- 8.4.1. General Aspects. Strength Limit State of the Sections
- 8.4.2. Equilibrium Limit State
- 8.4.3. Strength Limit State of the Sections
- 8.4.4. Axial Force

8.4.5. Bending Moment
8.4.6. Shear Sress
8.4.7. Torsion
8.5. Ultimate Limit States II
8.5.1. Instability Limit State
8.5.2. Elements Subjected to Compression
8.5.3. Elements Subjected to Bending
8.5.4. Elements Subjected to Compression and Bending
8.6. Ultimate Limit States III
8.6.1. Ultimate Limit States of Stiffness
8.6.2. Longitudinally Stiffened Elements
8.6.3. Shear Web Buckling
8.6.4. Web Resistance to Transverse Loads
8.6.5. Web Buckling Induced by the Compressed Flange
8.6.6. Stiffeners
8.7. Serviceability Limit States
8.7.1. General Aspects
8.7.2. Deformation Limit States
8.7.3. Vibrations Limit States
8.7.4. Limit State of Transverse Deformations in Thin Panels
8.7.5. Local Plasticization Limit State
8.8. Joining Methods: Screws
8.8.1. Bonding Methods: General Aspects and Classifications
8.8.2. Bolted Joints Part 1: General Aspects, Screw Types and Constructive Arrangements
8.8.3. Bolted Joints Part 2: Calculation
8.9. Joining Methods: Welds
8.9.1. Welded Joints Part 1: General Aspects. Classifications and defects
8.9.2. Welded Joints Part 2: Constructive Arrangements and Residual Stresses
8.9.3. Welded Joints Part 3: Calculation
8.9.4. Design of Beam and Pillar Joints
8.9.5. Bearing Apparatus and Pillar Bases
8.10. Steel Structures Facing Fire
8.10.1. General Considerations
8.10.2. Mechanical and Indirect Actions
8.10.3. Properties of Materials Under Fire
8.10.4. Strength Testing of Prismatic Elements under Fire
8.10.5. Joint Strength Testing
8.10.6. Calculation of Temperatures in Steel

Module 9. Structural Concrete

9.1. Introduction
9.1.1. Subject Introduction
9.1.2. Historical Notes about Concrete
9.1.3. Mechanical Behavior of Concrete
9.1.4. Combined behavior of steel and concrete that has led to its success as a composite material
9.2. Project Basis
9.2.1. Actions
9.2.2. Concrete and Steel Characteristics
9.2.3. Durability-Oriented Calculation Basis
9.3. Structural Analysis
9.3.1. Structural Analysis Models
9.3.2. Data Required for Linear, Plastic, or Nonlinear Modeling
9.3.3. Materials and Geometry
9.3.4. Prestressing Effects
9.3.5. Calculation of In-Service Sections
9.3.6. Shrinkage and Creep
9.4. Service Life And Maintenance Of Reinforced Concrete
9.4.1. Concrete Durability
9.4.2. Concrete Mass Deterioration
9.4.3. Steel Corrosion
9.4.4. Identification of Factors of Aggressiveness on Concrete
9.4.5. Protective Measures
9.4.6. Concrete Structures Maintenance
9.5. Serviceability Limit State Calculations

9.5.1. The Limit States
9.5.2. Concept and Method
9.5.3. Verification of Cracking Requirements
9.5.4. Verification of Deformation Requirements
9.6. Relative Calculations for Ultimate Limit States
9.6.1. Resistance Behavior of Linear Concrete Elements
9.6.2. Bending and Axial
9.6.3. Calculation of Second-Order Effects with Axial Loading
9.6.4. Shear
9.6.5. Flush
9.6.6. Torsion
9.6.7. Regions D
9.7. Sizing Criteria
9.7.1. Common Application Cases
9.7.2. The knot
9.7.3. The Cantilever
9.7.4. The Large-Edge Beam
9.7.5. Concentrated Load
9.7.6. Dimension changes in Beams and Columns
9.8. Common Structural Elements
9.8.1. The Beam
9.8.2. The Pillar
9.8.3. The Slab
9.8.4. Foundation Elements
9.8.5. Introduction to Prestressed Concrete
9.9. Constructive Arrangements
9.9.1. General Aspects and Terminology
9.9.2. Coatings
9.9.3. Hooks
9.9.4. Minimum Diameters
9.10. The Execution of Concreting
9.10.1. General Criteria
9.10.2. Previous Processes to the Concreting
9.10.3. Elaboration, Assembly and Erection of Reinforcements
9.10.4. Preparation and Placement of Concrete
9.10.5. Post-Concreting Processes
9.10.6. Premade Elements
9.10.7. Environmental Aspects

Module 10. Building

10.1. Introduction
10.1.1. Introduction to Building
10.1.2. Concept and Importance
10.1.3. Functions and Parts of the Building
10.1.4. Technical Regulations
10.2. Previous Operations
10.2.1. Superficial Foundations
10.2.2. Deep foundations
10.2.3. Retaining Walls
10.2.4. Basement Walls
10.3. Load-Bearing Wall Solutions
10.3.1. From Factory
10.3.2. Concrete
10.3.3. Rationalized Solutions
10.3.4. Prefabricated Solutions
10.4. Structures
10.4.1. Slab Structures
10.4.2. Static Structural Systems
10.4.3. Unidirectional Slabs
10.4.4. Waffle Slabs
10.5. Building Facilities I
10.5.1. Plumbing
10.5.2. Water Supply
10.5.3. Sanitation
10.5.4. Water Drainage
10.6. Building Facilities II
10.6.1. Electrical Installations
10.6.2. Heating
10.7. Enclosures and Finishing I

10.7.1. Introduction
10.7.2. Physical Protection of the Building
10.7.3. Energy Efficiency
10.7.4. Noise Protection
10.7.5. Moisture Protection
10.8. Enclosures and Finishing II
10.8.1. Flat Roofs
10.8.2. Sloping Roofs
10.8.3. Vertical Enclosures
10.8.4. Interior Partitions
10.8.5. Partitions, Carpentry, Glazing and Fenders
10.8.6. Coatings
10.9. Facades
10.9.1. Ceramics
10.9.2. Concrete Blocks
10.9.3. Panels
10.9.4. Curtain Walls
10.9.5. Modular Construction
10.10. Building Maintenance
10.10.1. Building Maintenance Criteria and Concepts
10.10.2. Building Maintenance Classifications
10.10.3. Building Maintenance Costs
10.10.4. Maintenance and Equipment Usage Costs
10.10.5. Building Maintenance Advantages

Module 11. Hydraulic Infrastructures

11.1. Types of Hydraulic Works
11.1.1. Pressure Piping Works
11.1.2. Severity Pipeline Works
11.1.3. Canal Works
11.1.4. Dam Works
11.1.5. Works of Actions in Watercourses
11.1.6. WWTP and DWTP Works
11.2. Earthwork

11.2.1. Terrain Analysis
11.2.2. Dimensioning of the Necessary Machinery
11.2.3. Control and Monitoring Systems
11.2.4. Quality Control
11.2.5. Standards of Good Execution
11.3. Severity Pipeline Works
11.3.1. Survey Data Collection in the Field and Data Analysis in the Office
11.3.2. Re-Study of the Project Solution
11.3.3. Piping Assembly and Manhole Construction
11.3.4. Final Testing of Pipelines
11.4. Pressure Piping Works
11.4.1. Analysis of Piezometric Lines
11.4.2. Lifting Stations Execution
11.4.3. Piping and Valve Assembly
11.4.4. Final Testing of Pipelines
11.5. Special Valve and Pumping Elements
11.5.1. Types of Valves
11.5.2. Types of Pumps
11.5.3. Boilermaking Elements
11.5.4. Special Valves
11.6. Canal Works
11.6.1. Types of Channels
11.6.2. Execution of Channels of Excavated Sections in the Ground
11.6.3. Type of Rectangular Cross-Section
11.6.4. Desanders, Sluice Gates and Loading Chambers
11.6.5. Auxiliary Elements (Gaskets, Sealants and Treatments)
11.7. Dam Works
11.7.1. Types of Dams
11.7.2. Earth Dams
11.7.3. Concrete Dams
11.7.4. Special Valves for Dams
11.8. Actions in the Channels

11.8.1. Types of Works in Watercourses
11.8.2. Channeling
11.8.3. Works for Channel Defenses
11.8.4. River Parks
11.8.5. Environmental Measures in River Works
11.9. WWTP and DWTP Works
11.9.1. Elements of a WWTP
11.9.2. Elements of a DWTP
11.9.3. Water and Sludge Lines
11.9.4. Sludge Treatment
11.9.5. New Water Treatment Systems
11.10. Irrigation Works
11.10.1. Study of the Irrigation Network
11.10.2. Lifting Stations Execution
11.10.3. Piping and Valve Assembly
11.10.4. Final Testing of Pipelines

You will have a large number of complementary readings with which to expand your knowledge in the most relevant areas of Structural and Construction Engineering"

05

Methodology

This academic program offers students a different way of learning. Our methodology uses a cyclical learning approach: **Relearning.**

This teaching system is used, for example, in the most prestigious medical schools in the world, and major publications such as the **New England Journal of Medicine** have considered it to be one of the most effective.

Discover Relearning, a system that abandons conventional linear learning, to take you through cyclical teaching systems: a way of learning that has proven to be extremely effective, especially in subjects that require memorization"

Case Study to contextualize all content

Our program offers a revolutionary approach to developing skills and knowledge. Our goal is to strengthen skills in a changing, competitive, and highly demanding environment.

At TECH, you will experience a learning methodology that is shaking the foundations of traditional universities around the world"

You will have access to a learning system based on repetition, with natural and progressive teaching throughout the entire syllabus.

The student will learn to solve complex situations in real business environments through collaborative activities and real cases.

A learning method that is different and innovative

This TECH program is an intensive educational program, created from scratch, which presents the most demanding challenges and decisions in this field, both nationally and internationally. This methodology promotes personal and professional growth, representing a significant step towards success. The case method, a technique that lays the foundation for this content, ensures that the most current economic, social and professional reality is taken into account.

> *Our program prepares you to face new challenges in uncertain environments and achieve success in your career"*

The case method is the most widely used learning system in the best faculties in the world. The case method was developed in 1912 so that law students would not only learn the law based on theoretical content. It consisted of presenting students with real-life, complex situations for them to make informed decisions and value judgments on how to resolve them. In 1924, Harvard adopted it as a standard teaching method.

What should a professional do in a given situation? This is the question that you are presented with in the case method, an action-oriented learning method. Throughout the program, the studies will be presented with multiple real cases. They will have to combine all their knowledge and research, and argue and defend their ideas and decisions.

Relearning Methodology

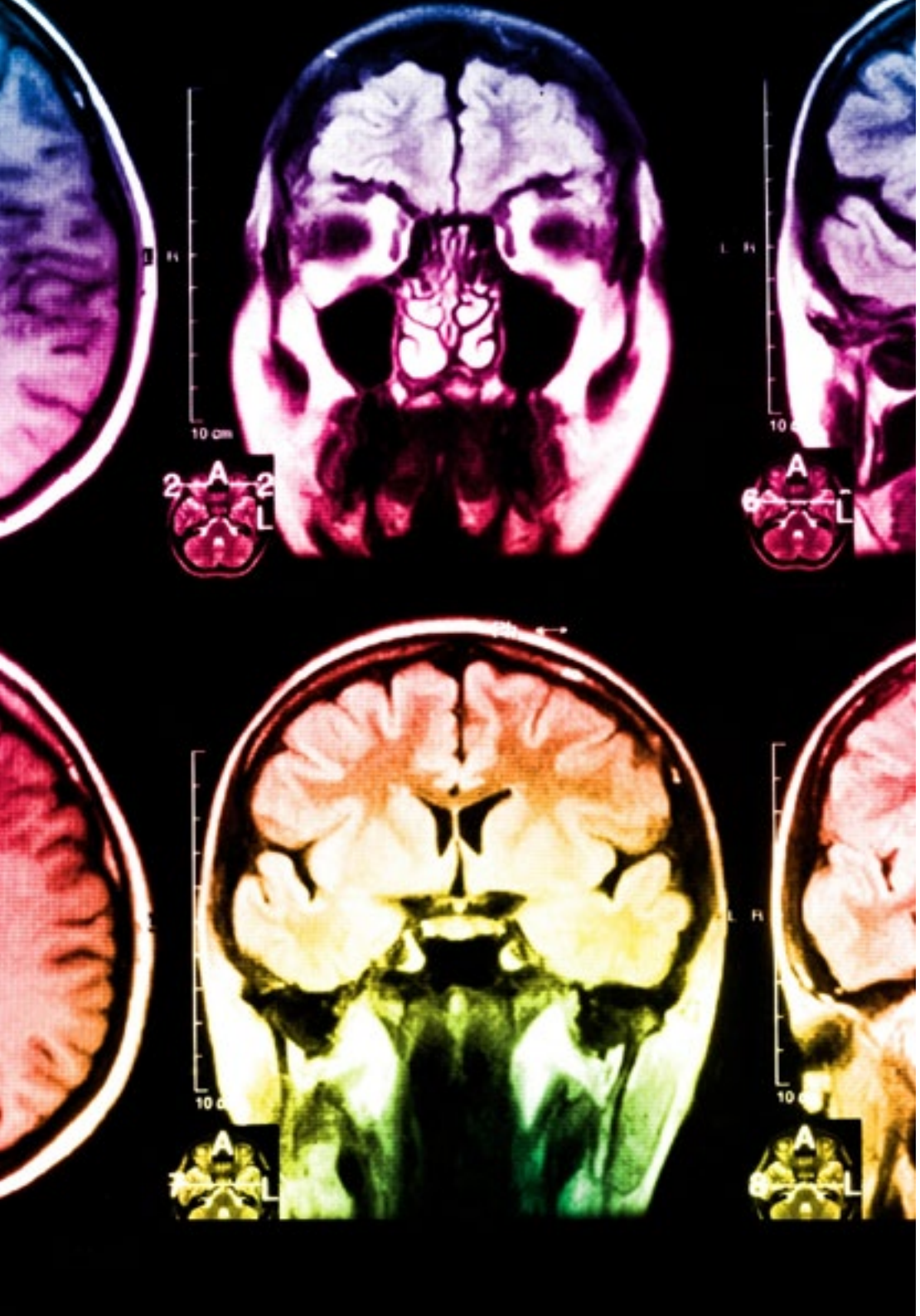
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

We enhance the Case Study with the best 100% online teaching method: Relearning.

In 2019, we obtained the best learning results of all online universities in the world.

At TECH, you will learn using a cutting-edge methodology designed to train the executives of the future. This method, at the forefront of international teaching, is called Relearning.

Our university is the only one in the world authorized to employ this successful method. In 2019, we managed to improve our students' overall satisfaction levels (teaching quality, quality of materials, course structure, objectives...) based on the best online university indicators.



In our program, learning is not a linear process, but rather a spiral (learn, unlearn, forget, and re-learn). Therefore, we combine each of these elements concentrically. This methodology has trained more than 650,000 university graduates with unprecedented success in fields as diverse as biochemistry, genetics, surgery, international law, management skills, sports science, philosophy, law, engineering, journalism, history, and financial markets and instruments. All this in a highly demanding environment, where the students have a strong socio-economic profile and an average age of 43.5 years.

Relearning will allow you to learn with less effort and better performance, involving you more in your training, developing a critical mindset, defending arguments, and contrasting opinions: a direct equation for success.

From the latest scientific evidence in the field of neuroscience, not only do we know how to organize information, ideas, images and memories, but we know that the place and context where we have learned something is fundamental for us to be able to remember it and store it in the hippocampus, to retain it in our long-term memory.

In this way, and in what is called neurocognitive context-dependent e-learning, the different elements in our program are connected to the context where the individual carries out their professional activity.

This program offers the best educational material, prepared with professionals in mind:

Study Material

All teaching material is produced by the specialists who teach the course, specifically for the course, so that the teaching content is highly specific and precise.

These contents are then applied to the audiovisual format, to create the TECH online working method. All this, with the latest techniques that offer high quality pieces in each and every one of the materials that are made available to the student.

Classes

There is scientific evidence suggesting that observing third-party experts can be useful.

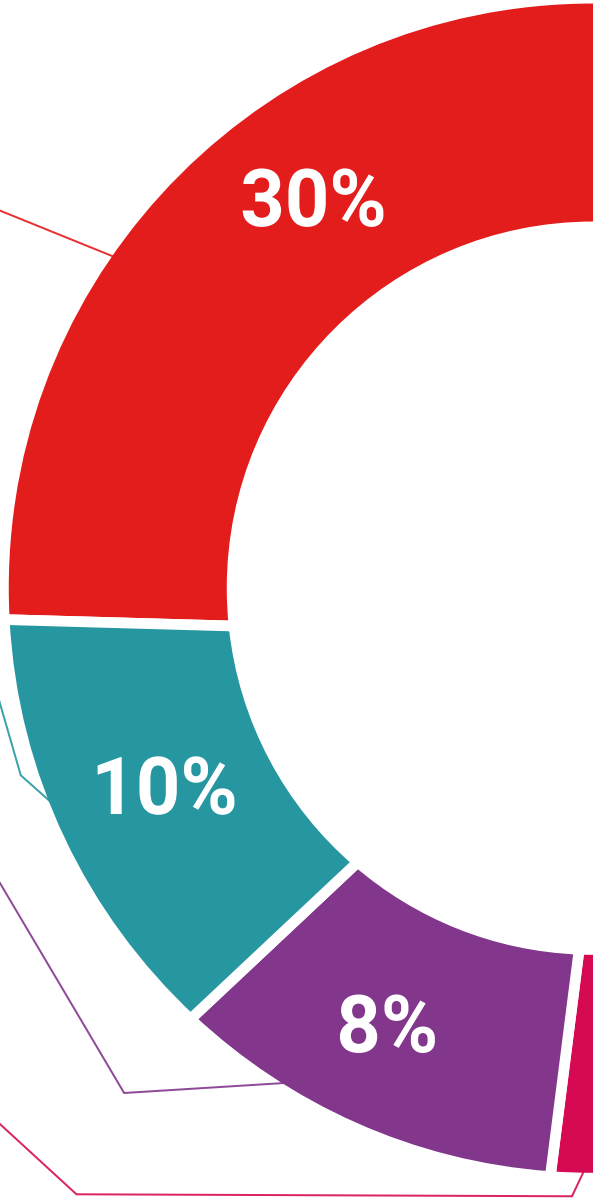
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

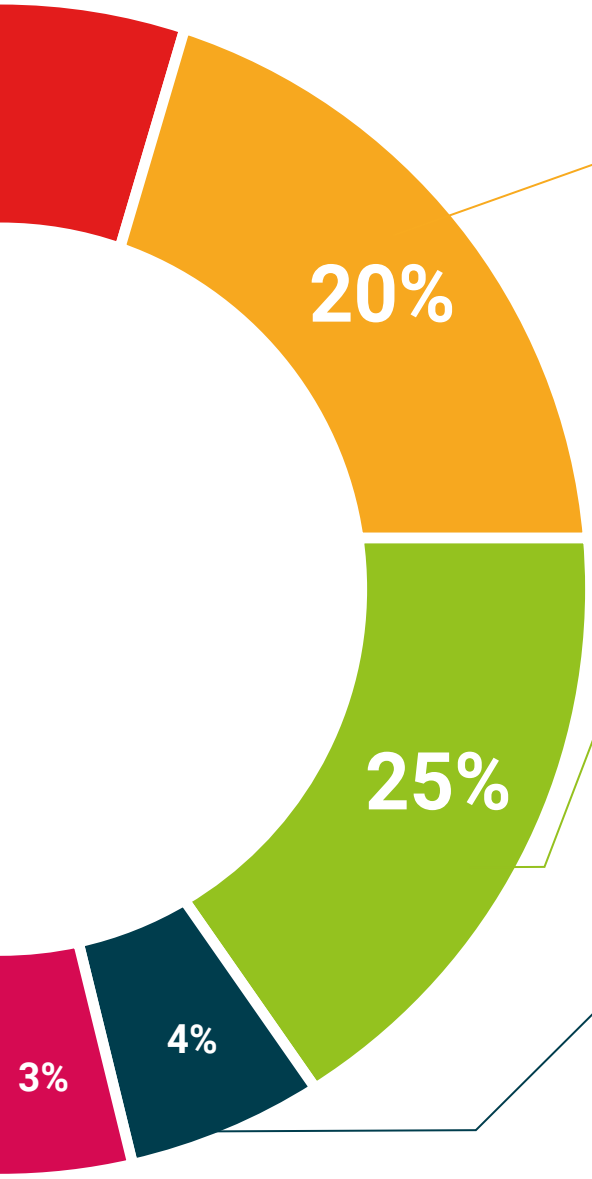
Practising Skills and Abilities

They will carry out activities to develop specific skills and abilities in each subject area. Exercises and activities to acquire and develop the skills and abilities that a specialist needs to develop in the context of the globalization that we are experiencing.

Additional Reading

Recent articles, consensus documents and international guidelines, among others. In TECH's virtual library, students will have access to everything they need to complete their course.





Case Studies

Students will complete a selection of the best case studies chosen specifically for this program. Cases that are presented, analyzed, and supervised by the best specialists in the world.

Interactive Summaries

The TECH team presents the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

This exclusive educational system for presenting multimedia content was awarded by Microsoft as a "European Success Story".

Testing & Retesting

We periodically evaluate and re-evaluate students' knowledge throughout the program, through assessment and self-assessment activities and exercises, so that they can see how they are achieving their goals.

06

Certificate

The Master's Degree in Structural and Construction Engineering guarantees students, in addition to the most rigorous and up-to-date education, access to a Master's Degree diploma issued by TECH Global University.

Successfully complete this program and receive your university qualification without having to travel or fill out laborious paperwork"

This program will allow you to obtain your **Master's Degree diploma in Structural and Construction Engineering** endorsed by **TECH Global University**, the world's largest online university.

TECH Global University is an official European University publicly recognized by the Government of Andorra (***official bulletin***). Andorra is part of the European Higher Education Area (EHEA) since 2003. The EHEA is an initiative promoted by the European Union that aims to organize the international training framework and harmonize the higher education systems of the member countries of this space. The project promotes common values, the implementation of collaborative tools and strengthening its quality assurance mechanisms to enhance collaboration and mobility among students, researchers and academics.

This **TECH Global University** title is a European program of continuing education and professional updating that guarantees the acquisition of competencies in its area of knowledge, providing a high curricular value to the student who completes the program.

Title: **Master's Degree in Structural and Construction Engineering**

Modality: **online**

Duration: **12 months**

Accreditation: **60 ECTS**


tech global university

Mr./Ms. _____, with identification document _____
has successfully passed and obtained the title of:

Master's Degree in Structural and Construction Engineering

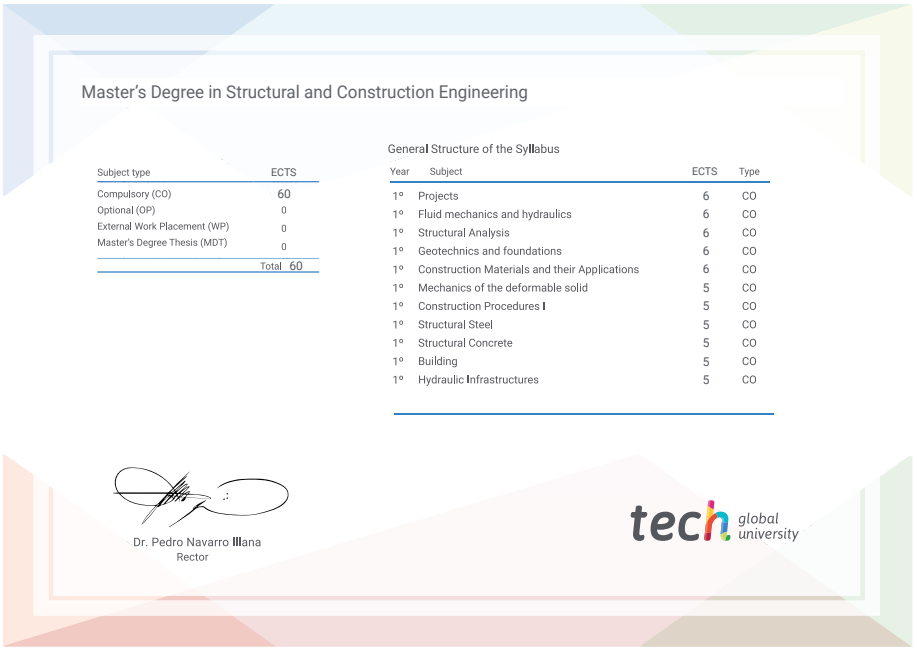
This is a program of 1,500 hours of duration equivalent to 60 ECTS, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

TECH Global University is a university officially recognized by the Government of Andorra on the 31st of January of 2024, which belongs to the European Higher Education Area (EHEA).

In Andorra la Vella, on the 28th of February of 2024

Dr. Pedro Navarro Illana
Rector

This qualification must always be accompanied by the university degree issued by the competent authority to practice professionally in each country. Unique TECH Code: AFWORD23S techtitute.com/certificates


Master's Degree in Structural and Construction Engineering

Subject type	ECTS
Compulsory (CO)	60
Optional (OP)	0
External Work Placement (WP)	0
Master's Degree Thesis (MDT)	0
Total	60

General Structure of the Syllabus

Year	Subject	ECTS	Type
1º	Projects	6	CO
1º	Fluid mechanics and hydraulics	6	CO
1º	Structural Analysis	6	CO
1º	Geotechnics and foundations	6	CO
1º	Construction Materials and their Applications	6	CO
1º	Mechanics of the deformable solid	5	CO
1º	Construction Procedures I	5	CO
1º	Structural Steel	5	CO
1º	Structural Concrete	5	CO
1º	Building	5	CO
1º	Hydraulic Infrastructures	5	CO

Dr. Pedro Navarro Illana
Rector

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*Apostille Convention. In the event that the student wishes to have their paper diploma issued with an apostille, TECH Global University will make the necessary arrangements to obtain it, at an additional cost.

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Master's Degree

Structural and Construction Engineering

- Modality: **online**
- Duration: **12 months**
- Certificate: **TECH Global University**
- Credits: **60 ECTS**
- Schedule: **at your own pace**
- Exams: **online**

Master's Degree

Structural and Construction Engineering

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