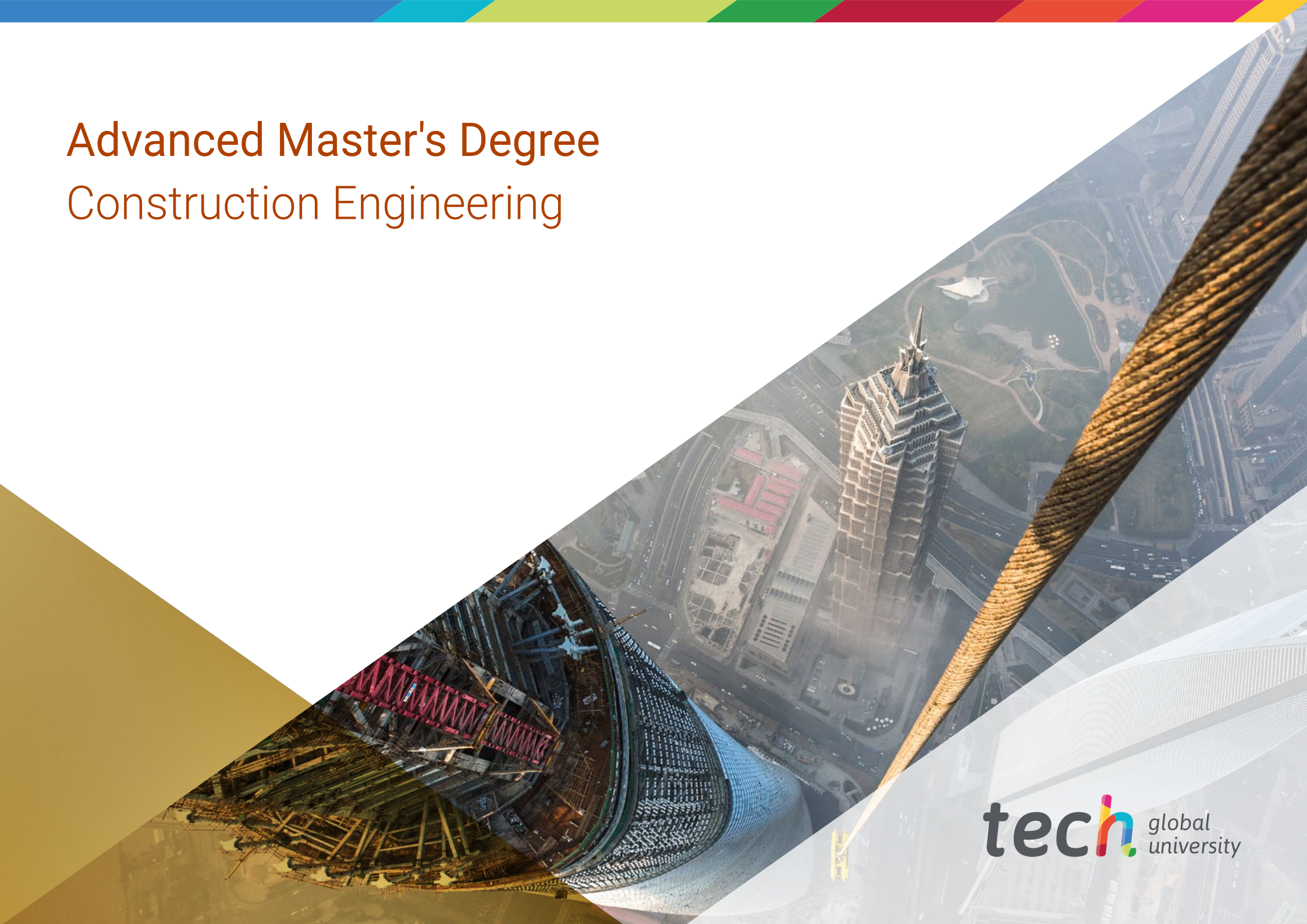
Advanced Master's Degree
Construction Engineering



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Advanced Master's Degree
Construction Engineering

- Modality: **online**
- Duration: **2 years**
- Certificate: **TECH Global University**
- Accreditation: **120 ECTS**
- Schedule: **at your own pace**
- Exams: **online**

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

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01

Introduction

The need to use cheaper and more efficient materials, reduce environmental impact and respond to urban infrastructure needs makes construction engineering a constantly evolving discipline. To address these challenges, it is necessary to master the most advanced techniques in this area, which is why this program is a great opportunity for the professional. Therefore, through this program, the engineer will be able to delve into the latest procedures of Foundations and Geotechnics, materials such as steel and structural concrete, or sustainable construction. In addition, it is taught in a 100% online format, which allows students to adapt their learning to their schedules and daily activities.

Acquire, thanks to this Advanced Master's Degree, the most advanced tools in fluid mechanics and hydraulics and apply them in your daily work in the field of Construction Engineering"

The construction industry is facing a number of increasingly complex challenges, such as the need to reduce environmental impact, efficient use of resources and improved workplace safety. To address these challenges, the Advanced Master's Degree in Construction Engineering offers students the opportunity to delve into the most advanced techniques and tools of Construction Engineering.

Aspects covered in the program include construction project management, structural engineering and sustainable construction. In the field of project management, techniques such as strategic planning, risk management and supervision of complex projects are studied. As for structural engineering, the focus is on the design of steel and concrete structures, as well as the analysis and calculation of seismic loads. In relation to sustainable construction, techniques and procedures are explored to reduce the environmental impact of buildings, such as the selection of materials and energy saving techniques.

In addition, the Advanced Master's Degree is delivered in a 100% online format, allowing students to participate in the program from anywhere in the world and adapt their learning to their schedule and pace of life. In short, the Advanced Master's Degree in Construction Engineering provides construction engineers with advanced and specialized training that will enable them to meet today's industry challenges successfully and efficiently.

This **Advanced Master's Degree in 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 construction engineering
- The graphic, schematic, and practical contents with which they are created, provide scientific and practical information on the disciplines that are essential for professional practice
- Practical exercises where self-assessment can be used to improve learning
- His special emphasis on innovative methodologies in Construction Engineering
- 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

The 100% online methodology of this program will allow you to study at your own pace, without interrupting your daily work”

Case studies, interactive summaries, technical videos... You will have at your disposal the most advanced multimedia resources in the educational market"

The Relearning methodology with which this program is developed will allow you to take advantage of every minute of study invested, since it has been designed to maximize efficiency in the learning process.

This program will mark a before and after in your professional career: don't wait any longer and enroll.

Its teaching staff includes professionals from the field of engineering, who contribute their work experience to this program, as well as renowned specialists from leading companies and prestigious universities.

The 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 learning experience designed to prepare for real-life situations.

This program is designed around Problem-Based Learning, whereby the student must try to solve the different professional practice situations that arise throughout the program. For this purpose, the professional will be assisted by an innovative interactive video system created by renowned and experienced experts.

02

Objectives

The main objective of the Advanced Master's Degree in Construction Engineering is to provide engineers with the most advanced techniques to meet the current challenges of the industry. Therefore, through this program, students will learn specialized tools for construction project management, structural engineering and sustainable construction. In addition, the program is delivered online, allowing students to tailor their learning to their needs and schedules.

The main objective of this program is to enable you to master the newest and most advanced construction techniques, capable of responding to all current engineering challenges"

General Objectives

- Learn in an autonomous way new knowledge and techniques suitable for Civil Engineering
- Know in detail the nature, characteristics and performance of new construction materials that have been investigated in recent years
- Understand and use the language of engineering, as well as the terminology of Civil Engineering
- Delve in a scientific and technical way in the exercise of the profession of Technical Engineer of Public Works with knowledge of the functions of consultancy, analysis, design, calculation, project, construction, maintenance, conservation and operation
- Perform an exhaustive analysis of the different types of construction materials
- Gain in-depth knowledge of the features of different construction materials
- Identify new technologies applied to materials engineering
- Carry out correct waste recovery
- Manage from an engineering point of view the quality and production of materials for construction
- Apply new techniques in making construction materials that are more environmentally friendly
- Raise awareness of new trends and materials applied to construction

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 dimension them according to existing standards and using analytical and numerical calculation methods

- Definition of basic stresses in structural sections: Axial and shear forces, bending moments and torsional moments
- Determine 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 concrete: fresh and hardened state Characteristics in the fresh state, mechanical properties in the hardened state, stress-strain behavior, modulus of deformation and Poisson's ratio, creep, fracture Dimensional stability, shrinkage
- Analyze the most important characteristics of special concretes, of the different existing typologies, whether with fibers, light, self-compacting, etc
- Gain in-depth knowledge of the different techniques for producing blended mixtures
- Perform typical tests on construction materials and be able to perform the required procedures

Module 6. Mechanics of Deformable Solids

- Understand the fundamentals of structural engineering and solid deformation, including basic concepts and laws of motion
- Master the relationships between stresses and external forces, as well as tools such as Mohr's circle for their analysis
- Understand material properties and how they behave under different loading conditions, focusing on elasticity and constitutive relationships
- Apply the concepts learned to practical problems of bending and torsion in structures, understanding both the static and dynamic analysis

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 pre-loading (pre-consolidation), 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

- Understand the characteristics of steel as a structural material and its historical and modern applications
- Master the basic principles of design and construction of steel structures, including the interpretation of specifications and building codes
- Acquire skills in structural design and analysis, including the determination of areas and cross-sections
- Analyze the strength limits of steel structures, addressing axial forces, bending moments, shear and torsional stresses
- Evaluate the serviceability limits of steel structures, considering deformations, vibrations and yield stresses
- Understand the methods of joining steel structures, both by bolting and welding, including considerations for situations such as fire

Module 9. Structural Concrete

- Understand the behavior of concrete and its combination with steel to create strong and durable structures
- Know the design bases, including actions, material characteristics and design criteria to ensure the durability of structures
- Master the structural analysis of reinforced concrete structures, considering analysis models, pre-stressing effects and in-service section calculations
- Learn to calculate and verify the strength and stability of reinforced concrete structures to ensure their safety

Module 10. Construction

- Train 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
- Understand the basic concepts of building and their importance, as well as the pertinent technical regulations
- Know the different stages and elements involved in the construction of buildings, from site preparation to subsequent maintenance

Module 11. Hydraulic Infrastructures

- Train in the wide range of hydraulic works in the field of Civil Engineering
- Know the appropriate machinery and construction processes for gravity and pressure piping works
- Access to the special parts available on the market for application in pipeline works
- Train in 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

Module 12. Durability, Protection and Service Life of Materials

- Analyze the concept of durability of the construction materials and their relationship with the concept of sustainability

- Identify the main causes of the alteration of construction materials
- Analyze the interaction of materials with the environment in which they are immersed and its influence on their durability
- Establish the most appropriate characterization techniques for the study of the durability of each material
- Master different options to ensure the durability of structures
- Present mathematical models for the estimation of service life of materials

Module 13. New Materials and Innovations in Engineering and Construction

- Analyze the different materials that are involved in the construction and conservation of roads
- Delve into the different parts that make up roads, drainage, roadbeds, base layers and pavement layers, as well as surface treatments
- Perform an in-depth breakdown of asphalt mix manufacturing and laying procedures

Module 14. Metallic Materials

- Study the different metallic materials and their typologies
- Analyze the bending performance of steel and its regulations
- Know in detail the most important properties and behavior of steel as a construction material

Module 15. Valuation of Construction and Demolition Waste (CDW)

- Gain in-depth knowledge of sustainable material, carbon footprint and life cycle, etc
- Address issues related to circular economy and waste reduction at source, as well as content related to the need for increased application of sustainable materials in construction works
- Identify and use sustainable materials in projects

Module 16. Road Surfaces, Pavements and Asphalt Mixes

- Establish the classification of soils and their bearing capacity when using them in esplanades
- Know the different layers and the process of preparation and installation on site
- Perform a breakdown of binders and conglomerates to make bituminous emulsions
- Gain knowledge of surface treatments, as well as their risks of priming, adhesion and curing
- Delve into the process of manufacturing and laying asphalt mixes

Module 17. Other Construction Materials

- Define and characterize the different insulating building materials
- Know the main advantages of using innovative building materials from the point of view of energy saving and efficiency
- Analyze the fundamentals of advanced and intelligent materials for sectors such as automotive, construction, aerospace, etc
- Establish new developments in nanotechnology

Module 18. Industrialization and Earthquake-Resistant Construction

- Analyze and evaluate advanced techniques for the characterization of building systems
- Analyze and understand how the characteristics of structures influence their behavior
- Gain in-depth knowledge of the fundamentals of the behavior of reinforced concrete structures and the ability to conceive, design, build and maintain this type of structures

Module 19. Microstructural Characterization of Materials

- Give an in-depth breakdown of the various techniques and equipment used to chemically, mineralogically and petrophysically characterize a construction material
- Establish the basis for advanced materials characterization techniques, specifically optical scanning electron microscopy, scanning electron microscopy, transmission electron microscopy, x-ray diffraction, x-ray fluorescence, etc
- Master the evaluation and interpretation of data obtained with scientific techniques and procedures

Module 20. Quality Management: Focus and Tools

- Understand the principles of Quality Management Systems and their benefits in building
- Identify and understand errors in building, from technical to organizational and human aspects, as well as their consequences
- Analyze the causes of errors in building, addressing organizational, technical and human factors in order to implement preventive and corrective measures
- Become familiar with quality tools and their application in the building industry, including quality planning and management in building companies

Reach your professional goals with TECH, which will provide you with everything you need to advance your career immediately"

03

Skills

The Advanced Master's Degree in Construction Engineering is designed to equip construction engineers with specialized skills and advanced knowledge to meet today's industry challenges. Therefore, through this program, students will be able to master aspects such as Quality Management in construction or the mechanics of the deformable solid, in addition to developing leadership and strategic decision-making skills for complex construction projects.

Enroll now and start applying the most advanced construction project evaluation methods in your daily work"

General Skills

- Maintain, conserve and operate infrastructures, within its scope
- Design, plan, build and maintain reinforced concrete and steel structures based on knowledge of the fundamentals of the behavior of these structures
- Comprehensively apply the analysis of the different types of construction materials
- Determine which are the new technologies applied to materials engineering
- Be able to globally manage different materials from a quality and production point of view
- Identify new techniques in making construction materials that are more environmentally friendly

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
- Draft 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 infrastructures
- Be able to delve into the basic aspects of concrete, knowing in detail its nature, characterization and presentations
- Develop and manufacture special concretes to suit the particular needs of the job site
- Gain knowledge about the different metallic materials and their properties
- Understand the concept of durability of construction materials and its relation to sustainability, identifying the main causes of alteration

- Acquire the necessary skills to identify the main incompatibilities between construction materials
- Master different options to ensure the durability of structures
- Address issues related to circular economy and waste reduction, as well as content related to the need for increased use of sustainable materials in construction works
- Learn the uses of sustainable material waster and how to use them in future jobs in a safe way
- Deepen understanding in the innovation of new materials, as well as the competitive advantages it brings, its protection and its financing
- Fully understand the main innovations in materials and construction procedures in the different sectors of innovation, including those that have be brought from other production sectors
- Optimal training to identify basic production principles and detail new materials of the future
- Gain an in-depth understanding of the fundamentals of the behavior of reinforced concrete structures and possess the ability to conceive, design, build and maintain this type of structures
- Establish the basis for advanced materials characterization techniques, specifically optical scanning electron microscopy, scanning electron microscopy, transmission electron microscopy, x-ray diffraction, x-ray fluorescence, etc.
- Identify the concepts related to Quality, ways of working that try to minimize the occurrence of failures, as well as internationally recognized quality management systems

With this Advanced Master's Degree you will acquire the necessary tools to lead and manage sustainable and efficient construction projects"

04

Course Management

The teaching staff of the Advanced Master's Degree in Construction Engineering is composed of experts with extensive experience in construction projects at national and international level. The professors are civil engineers, architects and other experts in the construction industry with a strong background in the management of large-scale projects, the design and engineering of complex structures, and the implementation of innovative techniques in sustainable construction.

Get up to speed with a faculty made up of renowned experts in the construction industry"

Management

Dr. Miñano Belmonte, Isabel de la Paz

- Researcher in the Advanced Building Science and Technology Group
  Doctorate in Architectural Sciences from the Polytechnic University of Cartagena
- Master's Degree in Construction with Specialization in Technology from the Polytechnic University of Valencia
- Construction Engineer by the Camilo José Cela University

Professors

Dr. Benito Saorín, Francisco Javier

- Technical Architect in charge of Project Management and Health and Safety Coordinator. Municipal technician in the Ricote City Council. Murcia
- Specialist in R+D+i in Construction Materials and Works
- Researcher and member of the Advanced Construction Science and Technology Group at the Polytechnic University of Cartagena
- Reviewer of journals indexed in JCR
- Doctorate in Architecture, Building, Urban Planning and Landscape from the Polytechnic University of Valencia
- Master's Degree in Building with Technological Specialty from the Polytechnic University of Valencia

Dr. Hernández Pérez, Miriam

- Civil Engineer at the Construction Technology Center. Murcia
- R+D+i Technician in the Materials Area at the Construction Technology Center. Murcia
- Technical Engineer in the company Servicios Comunitarios de Molina, SA
- Engineer at the Construction Technology Center. Murcia
- Researcher in Sustainable Construction and Sustainable Urban Drainage Systems
- Doctorate in Materials, Structures and Terrain Engineering: Sustainable Construction from the University of Alicante Sustainable Construction from the University of Alicante
- Degree in Civil Engineering with double major in Hydrology and Civil Construction
- Master's Degree in Civil Engineering with a specialization in Transport Engineering, Urban Planning and Land Use Planning

Mr. Del Pozo Martín, Jorge

- Civil Engineer dedicated to the evaluation and monitoring of R&D projects Technical evaluator and project auditor for the Spanish Ministry of Science and Innovation
- Technical Director of Bovis Lend Lease
- Production Manager at Dragados
- Civil Works Delegate for PACADAR
- Master's Degree in Civil Engineering Research from the University of Cantabria
- Diploma in Business Administration from the National University of Distance Education
- Civil Engineer by the University of Cantabria

Dr. Muñoz Sánchez, María Belén

- Construction Materials Innovation and Sustainability Consultant
- Reseracher in polymers at POLYMAT
- Doctorate in Materials Engineering and Sustainable Processes from the University of the Basque Country
- Chemical Engineer by the University of Extremadura
- Master's Degree in Research with specialization in Chemistry from the University of Extremadura
- Extensive experience in R&D&I in materials and waste valorization to create innovative construction materials
- Co-author of scientific article published in international journals
- Speaker at international congresses related to Renewable Energies and the Environmental Sector

Ms. López, Livia

- Quality and Certification Specialist
- Physical-Mechanical Laboratory Technician at AIMPLAS Technological Institute of Plastics
  Quality Manager at AIDICO Construction Technology Institute
- Laboratory Technician at Cementos La Unión, SA
- Degree in Chemistry from the University of Valencia
- Master's Degree in Food Quality and Safety from the University of Valencia
- Integration and Management Development Program at the Anant Foundation
- HACCP Course on Food Safety, Quality and Food Safety from the University of Salamanca

Mr. Izquierdo Núñez, José Vicente

- Researcher at AIMPLAS Characterization Laboratory
  Research Technician at the Institute of Water and Environmental Engineering (IIAMA)
- Technician in R+D+i at Aguas de Valencia
- Technician at AIDICO Laboratory
- Secondary School Teacher
- Degree in Chemical Sciences from the University of Valencia
- Master's Degree in Environmental Engineering from the Polytechnic University of Valencia
- Diploma of Advanced Studies in Instrumental and Applied Analysis from the University of Valencia

Dr. Navarro, Arsenio

- Head of the Construction and Renewable Energies Group at AIMPLAS
  PhD Senior Researcher at AIMPLAS
- Technician in the Physical-Mechanical Department at AIMPLAS
- Assembly Technician at Prefabricados Lufort SL
- Project Manager at MAT Service SL
- Associate Professor at the Polytechnic University of Valencia
- Doctorate in Industrial Production from the Polytechnic University of Valencia
- Technical Architect by the Polytechnic University of Valencia
- Construction Engineer and Materials Engineer by the Polytechnic University of Valencia
- Master's Degree in Mechanical and Materials Engineering from the Polytechnic University of Valencia

Mr. Martínez Pacheco, Víctor

- Architect at Martínez Pacheco Architecture
- Researcher at Cementos Cruz on Materials Development and Technological Innovation
- Head of 3D Additive Manufacturing Division
- Professor in higher programs in his field of expertise
- Doctorate in Technology and Modeling in Civil, Mining and Environmental Engineering from the Polytechnic University of Cartagena
- Master's Degree in Business Administration from the European Business School of Barcelona
- Degree in Architecture from the Polytechnic University of Cartagena

Dr. Rodríguez López, Carlos Luis

- Head of the Materials Area at the Construction Technology Center of the Region of Murcia Coordinator of the Sustainable Construction and Climate Change Area at CTCON
- Technician in the Projects Department of PM Arquitectura y Gestión SL
- Construction Engineer by the Polytechnic University of Cartagena
- Doctorate in Building Engineering, specializing in Materials, Structures and Terrain Engineering: Sustainable Construction from the University of Alicante
- Specialized in the Development of New Materials, Products for Construction and in the Analysis of Construction Pathologies
- Master's Degree in Materials, Water and Soil Engineering: Sustainable Construction from the University of Alicante
- Articles in international congresses and high impact indexed journals on different areas of construction material

Make the most of this opportunity to learn about the latest advances in this field in order to apply it to your daily practice"

05

Structure and Content

The Advanced Master's Degree in Construction Engineering curriculum focuses on the most relevant and advanced aspects of today's construction industry. Students will learn about the current challenges facing the industry, including the management of complex projects and the implementation of innovative techniques in sustainable construction, as well as the design of concrete and steel structures.

Enroll now and update your professional profile through the most complete and advanced syllabus in the area of Construction Engineering"

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 Feasibility Study of the Project
- 1.4.3. Environmental Feasibility Analysis of the Project

1.5. Pre-Startup Engineering
- 1.5.1. Site or Layout Study
- 1.5.2. Study of Typologies to be Used
- 1.5.3. Pre-Packaging Study of the Solution
- 1.5.4. Realization of the Project Model
- 1.5.5. Adjusted Economic Analysis of the Project

1.6. Analysis of the Tools to Be Used
- 1.6.1. Team Personnel in Charge of the Work
- 1.6.2. Equipment Materials Necessary
- 1.6.3. Software Required for the Drafting of the Project
- 1.6.4. Subcontracting Necessary for the Drafting of the Project

1.7. Field Work. Topography and Geotechnics
- 1.7.1. Determination of the Necessary Topography Works
- 1.7.2. Determination of the Necessary Geotechnical Works
- 1.7.3. Subcontracting Topography and Geotechnical Works
- 1.7.4. Monitoring Topography and Geotechnical Works
- 1.7.5. Analysis of Results of Topography and Geotechnical Works

1.8. Drafting the Project
- 1.8.1. DIA Drafting
- 1.8.2. Writing and Calculation of the Solution in Geometric Definition
- 1.8.3. Drafting and Calculation of the Structural Calculation Solution
- 1.8.4. Drafting and Calculation of the Solution in the Adjustment Phase
- 1.8.5. Drafting Annexes
- 1.8.6. Drawing Up Plans
- 1.8.7. Drafting Specifications
- 1.8.8. Budget Preparation

1.9. BIM Model Implementation in Projects
- 1.9.1. BIM Model Concept
- 1.9.2. BIM Model Phases
- 1.9.3. Importance of the BIM Model
- 1.9.4. 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

2.6. 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 Generalized Viscoelastic Fluid Model
- 2.10.6. Advanced Constitutive Equations and Rheometry

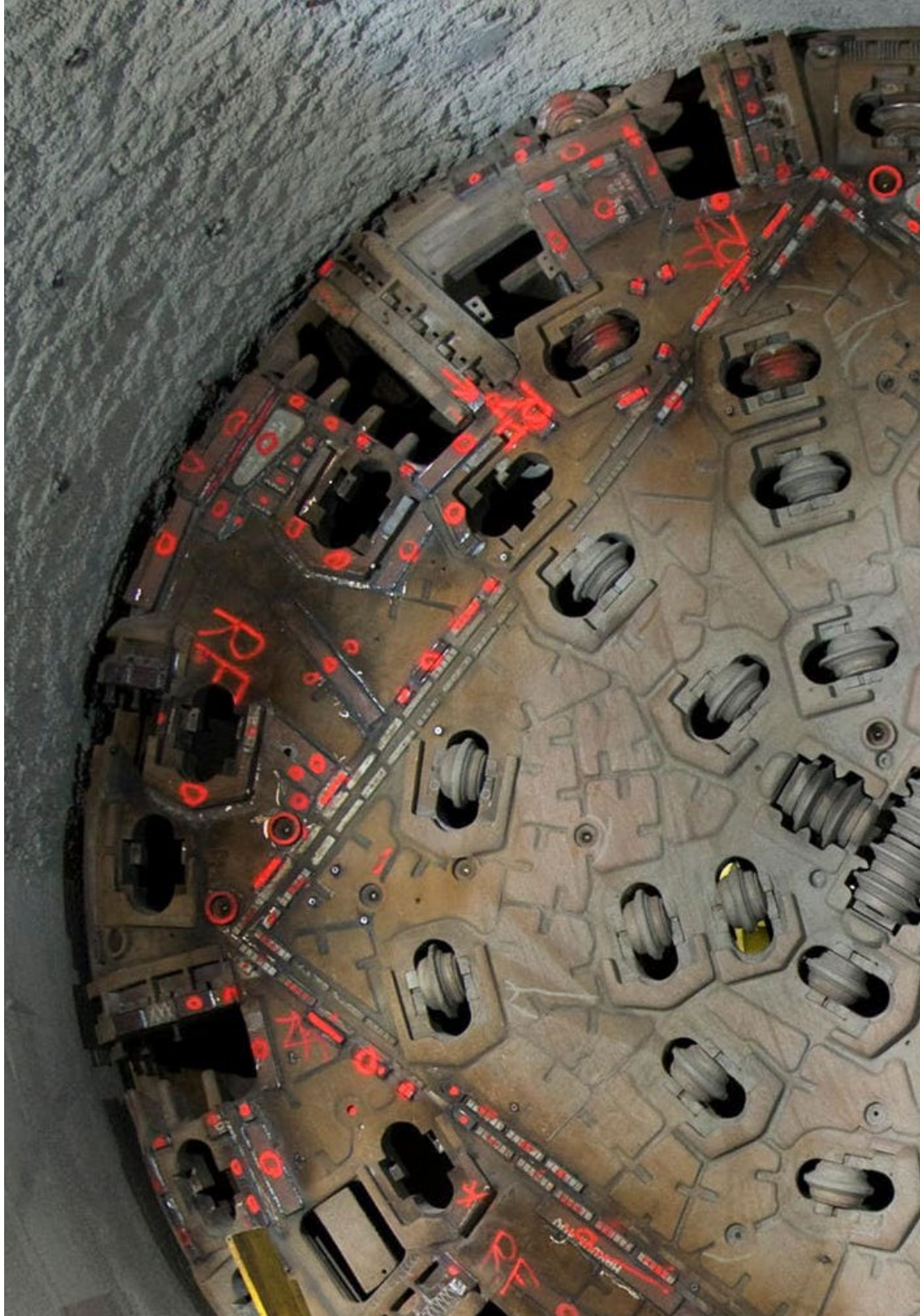
Module 3. Structural Analysis

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 Force Systems.
- 3.1.4. Center of Gravity. Distributed Loads.
- 3.1.5. Moment of Inertia. Products of Inertia. Matrix od Inertia. Main Axes.
- 3.1.6. Balance and Stability
- 3.1.7. Analytical Statics

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

3.3. Tension, Compression and Shear
- 3.3.1. Normal Stress 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 Stress 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. Pure Shear Stresses and Strains
- 3.6.4. Relationship 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. Relationships between Loads, Bending Moments and Shear Forces
- 3.7.4. Bending Moment and Shear Diagrams

3.8. Analysis of Structures in Flexibility (Force Method)
- 3.8.1. Static 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 Insecurity. Probability of Collapse
- 3.9.3. Latest 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 Matrices
- 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 and 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, 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 Cement-Based Materials (Fluid, Antibacterial, Biological...)
- 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 Constructive Structures

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

Module 6. Mechanics of Deformable Solids

6.1. Basic Concepts
- 6.1.1. Structural Engineering
- 6.1.2. Concept of Continuous Medium
- 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. Deformations
- 6.2.1. Deformation: Concept and Elementary Measurements
- 6.2.2. Displacement Field
- 6.2.3. The Hypothesis of Small Displacements
- 6.2.4. Kinematic Equations. Deformation Tensor

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

6.4. Stresses and Static Relationships
- 6.4.1. Concept of Stress
- 6.4.2. Relationships between Stresses and External Forces
- 6.4.3. Local Stress Analysis
- 6.4.4. Mohr's Circle

6.5. Constitutive Relationships
- 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. The 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. General Results

6.7. Theory of Beams: Fundamental Assumptions and Results I
- 6.7.1. Derived Theories
- 6.7.2. The Beam: Definitions and Classifications
- 6.7.3. Additional Hypotheses
- 6.7.4. Kinematic Analysis

6.8. Theory of Beams: 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 Elongation
- 6.9.1. Interpretation of the Results
- 6.9.2. Estimation of Off-Directional Displacements
- 6.9.3. Estimation of Normal Stresses
- 6.9.4. Estimation of Shear Stresses due to Bending

6.10. Theory of Beams: Torsion
- 6.10.1. Introduction
- 6.10.2. Coulomb's Torsion Balance
- 6.10.3. Saint-Venant Torsion Theory
- 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 Behaviors

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

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. Thermal 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. Early Uses of Iron and Steel

8.1.4. Steel Profiles
8.1.5. Stress-Strain Relationships of Structural Steel
8.1.6. Modern Structural Steels
8.1.7. Use of High-Strength Steels
8.2. General Principles of Design and Construction of Steel Structures
8.2.1. General Principles of Design 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 Stress
8.4.7. Torsion
8.5. Ultimate Limit States II
8.5.1. Instability Limit States
8.5.2. Elements Subjected to Compression
8.5.3. Elements Subjected to Flexion
8.5.4. Elements Subjected to Compression and Bending
8.6. Ultimate Limit State III
8.6.1. Ultimate Stiffness Limit State
8.6.2. Longitudinally Stiffened Elements
8.6.3. Web Shear Buckling
8.6.4. Resistance of Web to Transverse Concentrated Loads
8.6.5. Compressed Flange Induced Web Buckling
8.6.6. Stiffeners
8.7. Serviceability Limit States
8.7.1. Overview
8.7.2. Limit State of Deformations
8.7.3. Limit States of Vibrations
8.7.4. Limit State of Transverse Deformations in Flat Panels
8.7.5. Limit State of Local Plasticizations
8.8. Connecting Means: Bolts
8.8.1. Means of Attachment: General Aspects and Classifications
8.8.2. Bolted Joints - Part 1: General Aspects. Bolt Types and and Constructive Arrangements
8.8.3. Bolted Joints - Part 2: Calculation
8.9. Means of Attachment: Welding
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 Column Connections
8.9.5. Supporting Devices and Column Bases
8.10. Fire Resistance of Steel Structures
8.10.1. General Considerations
8.10.2. Mechanical and Indirect Actions
8.10.3. Properties of Materials Subjected to the Action of Fire
8.10.4. Strength Testing of Prismatic Elements Subjected to Fire Action
8.10.5. Testing the Resistance of Joints
8.10.6. Calculation of Temperatures in Steel

Module 9. Structural Concrete

9.1. Introduction
9.1.1. Introduction to the Subject
9.1.2. Historical Features of Concrete
9.1.3. Mechanical Behavior of Concrete
9.1.4. Joint 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. Characteristics of Concrete and Steel Materials
- 9.2.3. Durability-Oriented Basis of Calculation

9.3. Structural Analysis
- 9.3.1. Structural Analysis Models
- 9.3.2. Data Required for Linear, Plastic or Non-Linear Modeling
- 9.3.3. Materials and Geometry
- 9.3.4. Pre-Stressing Effects
- 9.3.5. Calculation of Cross-Sections in Service
- 9.3.6. Shrinkage and Creep

9.4. Service Life and Maintenance of Reinforced Concrete
- 9.4.1. Durability of Concrete
- 9.4.2. Deterioration of the Concrete Mass
- 9.4.3. Corrosion of Steel
- 9.4.4. Identification of the Factors of Aggressiveness on Concrete
- 9.4.5. Protective Measures
- 9.4.6. Maintenance of Concrete Structures

9.5. Calculations Related to Serviceability Limit States
- 9.5.1. Limit States
- 9.5.2. Concept and Method
- 9.5.3. Verification of Cracking Requirements
- 9.5.4. Verification of Deformation Requirements

9.6. Ultimate Limit State Calculations
- 9.6.1. Strength Behavior of Linear Concrete Elements
- 9.6.2. Bending and Axial Forces
- 9.6.3. Calculation of Second Order Effects with Axial Loading
- 9.6.4. Shear
- 9.6.5. Gradient
- 9.6.6. Torsion
- 9.6.7. D-Regions

9.7. Sizing Criteria
- 9.7.1. Typical Application Cases
- 9.7.2. The Node
- 9.7.3. The Bracket
- 9.7.4. The Large-Edged Beam
- 9.7.5. Concentrated Load
- 9.7.6. Dimensional Changes in Beams and Columns

9.8. Typical Structural Elements
- 9.8.1. The Beam
- 9.8.2. The Column
- 9.8.3. The Slab
- 9.8.4. Foundation Elements
- 9.8.5. Introduction to Pre-Stressed Concrete

9.9. Constructive Arrangements
- 9.9.1. General Aspects and Nomenclature
- 9.9.2. Coatings
- 9.9.3. Hooks
- 9.9.4. Minimum Diameters

9.10. Concreting Execution
- 9.10.1. General Criteria
- 9.10.2. Processes Prior to Concreting
- 9.10.3. Elaboration, Reinforcement and Assembly of Reinforcements
- 9.10.4. Preparation and Placement of Concrete
- 9.10.5. Processes Subsequent to Concreting
- 9.10.6. Pre-Fabricated Elements
- 9.10.7. Environmental Aspects

Module 10. Construction

10.1. Introduction
- 10.1.1. Introduction to Construction
- 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. Masonry
- 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. One-Way Slabs
- 10.4.4. Waffle Slabs

10.5. Construction Installations I
- 10.5.1. Plumbing
- 10.5.2. Water Supply
- 10.5.3. Sanitation
- 10.5.4. Drainage

10.6. Construction Installations II
- 10.6.1. Electrical Installations
- 10.6.2. Heating

10.7. Enclosures and Finishes 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 Finishes 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 Fendering
- 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. Equipment Maintenance and Usage Costs
- 10.10.5. Advantages of Building Maintenance

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

Module 12. Durability, Protection and Service Life of Materials

12.1. Durability of Reinforced Concrete
- 12.1.1. Types of Damage
- 12.1.2. Factors
- 12.1.3. Most Common Damage

12.2. Durability of Cement-Based Materials 1. Concrete Degradation Processes
- 12.2.1. Cold Weather
- 12.2.2. Sea Water
- 12.2.3. Sulphate Attack

12.3. Durability of Cement-Based Materials 2. Concrete Degradation Processes
- 12.3.1. Alkali–Silica Reaction
- 12.3.2. Acid Attacks and Aggressive Ions
- 12.3.3. Hard Waters

12.4. Corrosion of Reinforcement I
- 12.4.1. Process of Corrosion in Metals
- 12.4.2. Forms of Corrosion
- 12.4.3. Passivity
- 12.4.4. Importance of the Problem
- 12.4.5. Behavior of Steel in Concrete
- 12.4.6. Corrosion Effects of Steel Embedded in Concrete

12.5. Corrosion of Reinforcement II
- 12.5.1. Carbonation Corrosion of Concrete
- 12.5.2. Corrosion by Penetration of Chlorides
- 12.5.3. Stress Corrosion
- 12.5.4. Factors Affecting the Speed of Corrosion

12.6. Models of Service Life
- 12.6.1. Service Life
- 12.6.2. Carbonation
- 12.6.3. Chlorides

12.7. Durability in the Regulations
- 12.7.1. EHE-08
- 12.7.2. Europe
- 12.7.3. Structural Code

12.8. Estimation of Service Life in New Projects and Existing Structures
- 12.8.1. New Project
- 12.8.2. Residual Service Life
- 12.8.3. Applications

12.9. Design and Execution of Durable Structures
- 12.9.1. Material Selection
- 12.9.2. Dosage Criteria
- 12.9.3. Protection of Reinforcement Against Corrosion

12.10. Tests, Quality Controls on Site and Reparation
- 12.10.1. Control Tests on Site
- 12.10.2. Execution Control
- 12.10.3. Tests on Structures with Corrosion
- 12.10.4. Fundamentals for Reparation

Module 13. New Materials and Innovations in Engineering and Construction

13.1. Innovation
- 13.1.1. Innovation. Incentives. New Products and Diffusion
- 13.1.2. Innovation Protection
- 13.1.3. Innovation Financing

13.2. Roads II
- 13.2.1. Circular Economy with New Materials
- 13.2.2. Self-Repairing Road
- 13.2.3. Decontaminating Roads

13.3. Roads I
- 13.3.1. Energy Production on Roads
- 13.3.2. Wildlife Passes. Ecosystemic Fragmentation
- 13.3.3. IoT and Digitalization in Roads

13.4. Roads III
- 13.4.1. Safe Roads
- 13.4.2. Anti-Noise Roads and "Noisy" Roads
- 13.4.3. Anti-Heat Island Roads in Cities

13.5. Railroads
- 13.5.1. New Alternative Materials to Ballast
- 13.5.2. Ballast Flight
- 13.5.3. Elimination of Catenaries on Tramways

13.6. Underground and Tunnel Works
- 13.6.1. Excavation and Gunning
- 13.6.2. RMR (Rock Mass Rating)
- 13.6.3. Tunnel Boring Machines

13.7. Renewable Energy I
- 13.7.1. Solar Photovoltaic
- 13.7.2. Solar Thermal
- 13.7.3. Wind

13.8. Renewable Energy II
- 13.8.1. Maritime
- 13.8.2. Hydroelectric
- 13.8.3. Geothermal Energy

13.9. Maritime Works
- 13.9.1. New Materials and Shapes in Seawalls
- 13.9.2. Natural Alternative to Artificial Works
- 13.9.3. Prediction of Ocean Weather

13.10. Incorporation of Innovation from Other Construction Sectors
- 13.10.1. LIDAR (Laser Imaging Detection and Ranging)
- 13.10.2. Drones
- 13.10.3. Internet of Things (IoT)

Module 14. Metallic Materials

14.1. Metallic Materials: Types and Alloys
- 14.1.1. Metals
- 14.1.2. Ferrous Alloys
- 14.1.3. Non-Ferrous Alloys

14.2. Ferrous Metal Alloys
- 14.2.1. Fabrication
- 14.2.2. Treatment
- 14.2.3. Conformation and Types

14.3. Ferrous Metal Alloys. Steel and Castings
- 14.3.1. Corten Steel
- 14.3.2. Stainless Steel
- 14.3.3. Carbon Steel
- 14.3.4. Castings

14.4. Ferrous Metal Alloys. Products of Steel
- 14.4.1. Hot Rolled Products
- 14.4.2. Foreign Profiles
- 14.4.3. Cold-Formed Profiles
- 14.4.4. Other Products Used in Metallic Construction

14.5. Ferrous Metallic Alloys Mechanical Characteristics of Steel
- 14.5.1. Stress-Strain Diagram
- 14.5.2. Simplified E-Diagrams
- 14.5.3. Loading and Unloading Process

14.6. Welded Joints
- 14.6.1. Cutting Methods
- 14.6.2. Types of Welded Joints
- 14.6.3. Electric Arc Welding
- 14.6.4. Fillet Welded Seams

14.7. Non-Ferrous Metal Alloys. Aluminium and its Alloys
- 14.7.1. Properties of Aluminium and its Alloys
- 14.7.2. Thermal Treatments and Hardening Mechanisms
- 14.7.3. Designation and Standardization of Aluminum Alloys
- 14.7.4. Aluminium Alloys for Forging and Casting

14.8. Non-Ferrous Metal Alloys. Copper and its Alloys
- 14.8.1. Pure Copper
- 14.8.2. Classification, Properties and Applications
- 14.8.3. Brasses, Bronzes, Cupro-Aluminums, Cupro-Silicides and Cupro-Nickels
- 14.8.4. Alpaca Silver

14.9. Non-Ferrous Metal Alloys. Titanium and its Alloys
- 14.9.1. Characteristics and Properties of Commercially Pure Titanium
- 14.9.2. Most Commonly Used Titanium Alloys
- 14.9.3. Thermal Treatments of Titanium and its Alloys

14.10. Non-Ferrous Metal Alloys, Light Alloys and Superalloys
- 14.10.1. Magnesium and its Alloys Superalloys
- 14.10.2. Properties and Applications
- 14.10.3. Nickel-, Cobalt- and Iron-Based Superalloys

Module 15. Valuation of Construction and Demolition Waste (CDW)

15.1. Decarbonization
- 15.1.1. Sustainability of Construction Materials
- 15.1.2. Circular Economy
- 15.1.3. Carbon Footprint
- 15.1.4. Life Cycle Analysis Methodology and Analysis

15.2. Construction and Demolition Waste (CDW)
- 15.2.1. CDW
- 15.2.2. Current Situation
- 15.2.3. Problems of CDW

15.3. Characterization of CDW
- 15.3.1. Dangerous Waste
- 15.3.2. Non-Dangerous Waste
- 15.3.3. Urban Waste
- 15.3.4. European List of Construction and Demolition Wastes

15.4. Management of CDW I
- 15.4.1. General Rules BORRAR
- 15.4.2. Dangerous Waste
- 15.4.3. Non-Dangerous Waste
- 15.4.4. Inert Waste, Soils and Stones

15.5. Management of CDW II
- 15.5.1. Reuse
- 15.5.2. Recycled
- 15.5.3. Energy Recovery. Disposal

15.6. Properties of CDW
- 15.6.1. Classification
- 15.6.3. Properties
- 15.6.4. Applications and Innovation with CDW

15.7. Innovation. Optimization of the Use of Resources. From Other Industrial, Agricultural and Urban Wastes
- 15.7.1. Supplementary Material. Ternary and Binary Mixtures
- 15.7.3. Geopolymers
- 15.7.4. Concrete and Asphalt Mixtures
- 15.7.5. Other Uses

15.8. Environmental Impact
- 15.8.1. Analysis
- 15.8.2. Impacts of CDW
- 15.8.3. Measures Adopted, Identification and Valorization

15.9. Degraded Spaces
- 15.9.1. Landfill
- 15.9.2. Use of Land
- 15.9.3. Control Plan, Maintenance and Restoration of the Zone

Module 16. Road Surfaces, Pavements and Asphalt Mixes

16.1. Drainage and Sewage Systems
- 16.1.1. Elements of Underground Drainage
- 16.1.2. Drainage of Road Surface
- 16.1.3. Drainage of Earthworks

16.2. Esplanades
- 16.2.1. Classification of Soils
- 16.2.2. Soil Compaction and Bearing Capacity
- 16.2.3. Formation of Esplanades

16.3. Base Layers
- 16.3.1. Granular Layers, Natural Aggregates, Artificial Aggregates and Drainage Aggregates
- 16.3.2. Behavior Models
- 16.3.3. Preparation and Commissioning Processes

16.4. Treated Layers for Bases and Sub-Bases
- 16.4.1. Layers Treated with Cement: Soil-Cement and Gravel-Cement
- 16.4.2. Layers Treated with Other Binders
- 16.4.3. Layers Treated with Bituminous Binding Agents. Gravel-Emulsion

16.5. Binders and Binding Agents
- 16.5.1. Asphalt Bitumens
- 16.5.2. Fluidized and Fluxed Bitumens. Modified Binders
- 16.5.3. Bituminous Emulsions

16.6. Aggregates for Pavement Layers
- 16.6.1. Aggregate Origins. Recycled Aggregates
- 16.6.2. Nature
- 16.6.3. Properties

16.7. Surface Treatments
- 16.7.1. Priming, Bonding and Curing Sprays
- 16.7.2. Gravel Irrigation
- 16.7.3. Bituminous Slurries and Cold Micro-Agglomerates

16.8. Bituminous Mixtures
- 16.8.1. Hot Mix Asphalt
- 16.8.2. Tempered Blends
- 16.8.3. Cold Asphalt Mixtures

16.9. Concrete Sidewalks
- 16.9.1. Types of Rigid Sidewalks
- 16.9.2. Concrete Slabs
- 16.9.3. Joints

16.10. Manufacturing and Laying of Asphalt Mixtures
- 16.10.1. Manufacturing, Commissioning and Quality Control
- 16.10.2. Conservation, Rehabilitation and Maintenance
- 16.10.3. Surface Characteristics of Pavements

Module 17. Other Construction Materials

17.1. Nanomaterials
- 17.1.1. Nanoscience
- 17.1.2. Applications in Construction Materials
- 17.1.3. Innovation and Applications

17.2. Foams
- 17.2.1. Types and Design
- 17.2.2. Properties
- 17.2.3. Uses and Innovation

17.3. Biomimetic Materials
- 17.3.1. Features
- 17.3.2. Properties
- 17.3.3. Applications

17.4. Metamaterials
- 17.4.1. Features
- 17.4.2. Properties
- 17.4.3. Applications

17.5. Biohydrometallurgy
- 17.5.1. Features
- 17.5.2. Technology of Recovery
- 17.5.3. Environmental Advantages

17.6. Self-Healing and Photoluminescent Materials
- 17.6.1. Types
- 17.6.2. Properties
- 17.6.3. Applications

17.7. Insulating and Thermoelectric Materials
- 17.7.1. Energy Efficiency and Sustainability
- 17.7.2. Typology
- 17.7.3. Innovation and New Design

17.8. Ceramics
- 17.8.1. Properties
- 17.8.2. Classification
- 17.8.3. Innovations in this Sector

17.9. Composite Materials and Aerogels
- 17.9.1. Description
- 17.9.2. Training
- 17.9.3. Applications

17.10. Other Materials
- 17.10.1. Stone Materials
- 17.10.2. Plaster
- 17.10.3. Others

Module 18. Industrialization and Earthquake-Resistant Construction

18.1. Industrialization: Pre-Fabricated Construction
- 18.1.1. The Beginnings of Industrialization in Construction
- 18.1.2. Pre-Fabricated Structural Systems
- 18.1.3. Pre-Fabricated Constructive Systems

18.2. Pre-Stressed Concrete
- 18.2.1. Voltage Losses
- 18.2.3. Serviceability Limit States
- 18.2.4. Ultimate Limit States
- 18.2.5. Pre-Cast Systems: Pre-Stressed Slabs and Beams with Pre-Stressed Reinforcement

18.3. Quality in Horizontal Building Structures
- 18.3.1. Unidirectional Joist Floor Slabs
- 18.3.2. Unidirectional Hollow-Core Slab Floors
- 18.3.3. Unidirectional Ribbed Sheet Metal Floor Slabs
- 18.3.4. Waffle Slabs
- 18.3.5. Solid Slabs

18.4. Structural Systems in Tall Buildings
- 18.4.1. Review of Skyscrapers
- 18.4.2. Wind in High-Rise Buildings
- 18.4.3. Materials
- 18.4.4. Structural Diagrams

18.5. Dynamic Behavior of Building Structures Exposed to Earthquakes
- 18.5.1. One Degree of Freedom Systems
- 18.5.2. Systems with Several Degrees of Freedom
- 18.5.3. Seismic Action
- 18.5.4. Heuristic Design of Earthquake-Resistant Structures

18.6. Complex Geometrics in Architecture
- 18.6.1. Hyperbolic Paraboloids
- 18.6.2. Tensile Structures
- 18.6.3. Pneumatic or Inflatable Structures

18.7. Reinforcement of Concrete Structures
- 18.7.1. Appraisals
- 18.7.2. Reinforcement of Pillars
- 18.7.3. Beam Reinforcement

18.8. Wooden Structures
- 18.8.1. Wood Grading
- 18.8.2. Dimension of Beams
- 18.8.3. Dimension of Pillars

18.9. Automatization in Structures. BIM as a Control Tool
- 18.9.1. BIM
- 18.9.2. Federated BIM File Exchange Models
- 18.9.3. New Structure Generation and Control Systems

18.10. Additive Manufacturing Through 3D Printing
- 18.10.1. Principles of 3D Printing
- 18.10.2. Structural Systems Printed in 3D
- 18.10.3. Other Systems

Module 19. Microstructural Characterization of Materials

19.1. Optical Microscope
- 19.1.2. Advanced Optic Microscope Techniques
- 19.1.3. Principles of the Technique
- 19.1.4. Topography and Application

19.2. Transmission Electron Microscopy (TEM)
- 19.2.1. TEM Structure
- 19.2.2. Electron Diffraction
- 19.2.3. TEM Images

19.3. Scanning Electron Microscope (SEM)
- 19.3.1. SEM Characteristics
- 19.3.2. Microanalysis of X Rays
- 19.3.3. Advantages and Disadvantages

19.4. Scanning Transmission Electron Microscopy (STEM)
- 19.4.1. STEM
- 19.4.2. Images and Tomography
- 19.4.3. EELS

19.5. Atomic Force Microscopy (AFM)
- 19.5.1. AFM
- 19.5.2. Topographic Modes
- 19.5.3. Electric and Magnetic Characterization of Samples

19.6. Mercury Intrusion Porosimetry Hg
- 19.6.1. Porosity and Porous System
- 19.6.2. Equipment and Properties
- 19.6.3. Analysis

19.7. Nitrogen Porosimetry
- 19.7.1. Description of the Equipment
- 19.7.2. Properties
- 19.7.3. Analysis

19.8. X-Ray Diffraction
- 19.8.1. Generation and Characteristics of XRD
- 19.8.2. Sample Preparation
- 19.8.3. Analysis

19.9. Electrical Impedance Spectroscopy (EIS)
- 19.9.1. Method
- 19.9.2. Procedure
- 19.9.3. Advantages and Disadvantages

19.10. Other Interesting Techniques
- 19.10.1. Thermogravimetry
- 19.10.2. Fluorescence
- 19.10.3. Absorption Isothermal Desorption of H2O Vapor

Module 20. Quality Management: Focus and Tools

20.1. Quality in Construction
- 20.1.1. Quality. Principles of Quality Management Systems (QMS)
- 20.1.2. Documentation of Quality Management Systems
- 20.1.3. Benefits of Quality Management Systems
- 20.1.4. Environmental Management Systems (EMS)
- 20.1.5. Integrated Management Systems (IMS)

20.2. Errors
- 20.2.1. Concept of Error, Failure, Defect or Non-Conformity
- 20.2.2. Errors in the Technical Processes
- 20.2.3. Errors in the Organization
- 20.2.4. Errors in Human Behavior
- 20.2.5. Consequence of the Errors

20.3. Causes
- 20.3.1. Organization
- 20.3.2. Techniques
- 20.3.3. Human

20.4. Quality Tools
- 20.4.1. Global
- 20.4.2. Partial
- 20.4.3. ISO 9000:2008

20.5. Quality and its Control in Construction
- 20.5.1. Quality Control Plan
- 20.5.2. Quality Plan of a Company
- 20.5.3. Quality Manual of a Company

20.6. Laboratory Testing, Calibration, Certification and Accreditation
- 20.6.1. Normalization, Accreditation, Certification
- 20.6.2. CE Marking
- 20.6.3. Advantages of Accreditation of Testing and Accreditation Laboratories

20.7. Quality Management Systems ISO 9001:2015 Standard
- 20.7.1. ISO 17025
- 20.7.2. Objective and Scope of the 17025 Regulation
- 20.7.3. Relationship Between ISO 17025 and LA 9001

20.8. Management Requirements and Laboratory Techniques of ISO 17025 I
- 20.8.1. Quality Management Systems
- 20.8.2. Document Control
- 20.8.3. Complaint Handling, Corrective and Preventive Actions

20.9. Management Requirements and Laboratory Techniques of ISO 17025 II
- 20.9.1. Internal Audits
- 20.9.2. Personal, Installation and Environmental Conditions
- 20.9.3. Testing Methods and Calibration and Validation of Methods

20.10. Phases to Follow to Achieve the ISO 17025 Accreditation
- 20.10.1. Accreditation in a Laboratory Test and Calibration I
- 20.10.2. Accreditation in a Laboratory Test and Calibration II
- 20.10.3. Process of Accreditation

Thanks to this Advanced Master's Degree, you will obtain innovative tools and techniques in Construction Engineering in a 100% online format"

06

Study Methodology

TECH is the world's first university to combine the **case study** methodology with **Relearning**, a 100% online learning system based on guided repetition.

This disruptive pedagogical strategy has been conceived to offer professionals the opportunity to update their knowledge and develop their skills in an intensive and rigorous way. A learning model that places students at the center of the educational process giving them the leading role, adapting to their needs and leaving aside more conventional methodologies.

TECH will prepare you to face new challenges in uncertain environments and achieve success in your career"

The student: the priority of all TECH programs

In TECH's study methodology, the student is the main protagonist.
The teaching tools of each program have been selected taking into account the demands of time, availability and academic rigor that, today, not only students demand but also the most competitive positions in the market.

With TECH's asynchronous educational model, it is students who choose the time they dedicate to study, how they decide to establish their routines, and all this from the comfort of the electronic device of their choice. The student will not have to participate in live classes, which in many cases they will not be able to attend. The learning activities will be done when it is convenient for them. They can always decide when and from where they want to study.

"At TECH you will NOT have live classes (which you might not be able to attend)"

The most comprehensive study plans at the international level

TECH is distinguished by offering the most complete academic itineraries on the university scene. This comprehensiveness is achieved through the creation of syllabi that not only cover the essential knowledge, but also the most recent innovations in each area.

By being constantly up to date, these programs allow students to keep up with market changes and acquire the skills most valued by employers. In this way, those who complete their studies at TECH receive a comprehensive education that provides them with a notable competitive advantage to further their careers.

And what's more, they will be able to do so from any device, pc, tablet or smartphone.

> *TECH's model is asynchronous, so it allows you to study with your pc, tablet or your smartphone wherever you want, whenever you want and for as long as you want"*

Case Studies and Case Method

The case method has been the learning system most used by the world's best business schools. Developed in 1912 so that law students would not only learn the law based on theoretical content, its function was also to present them with real complex situations. In this way, they could make informed decisions and value judgments about how to resolve them. In 1924, Harvard adopted it as a standard teaching method.

With this teaching model, it is students themselves who build their professional competence through strategies such as Learning by Doing or Design Thinking, used by other renowned institutions such as Yale or Stanford.

This action-oriented method will be applied throughout the entire academic itinerary that the student undertakes with TECH. Students will be confronted with multiple real-life situations and will have to integrate knowledge, research, discuss and defend their ideas and decisions. All this with the premise of answering the question of how they would act when facing specific events of complexity in their daily work.

Relearning Methodology

At TECH, case studies are enhanced with the best 100% online teaching method: Relearning.

This method breaks with traditional teaching techniques to put the student at the center of the equation, providing the best content in different formats. In this way, it manages to review and reiterate the key concepts of each subject and learn to apply them in a real context.

In the same line, and according to multiple scientific researches, reiteration is the best way to learn. For this reason, TECH offers between 8 and 16 repetitions of each key concept within the same lesson, presented in a different way, with the objective of ensuring that the knowledge is completely consolidated during the study process.

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

A 100% online Virtual Campus with the best teaching resources

In order to apply its methodology effectively, TECH focuses on providing graduates with teaching materials in different formats: texts, interactive videos, illustrations and knowledge maps, among others. All of them are designed by qualified teachers who focus their work on combining real cases with the resolution of complex situations through simulation, the study of contexts applied to each professional career and learning based on repetition, through audios, presentations, animations, images, etc.

The latest scientific evidence in the field of Neuroscience points to the importance of taking into account the place and context where the content is accessed before starting a new learning process. Being able to adjust these variables in a personalized way helps people to remember and store knowledge in the hippocampus to retain it in the long term. This is a model called Neurocognitive context-dependent e-learning that is consciously applied in this university qualification.

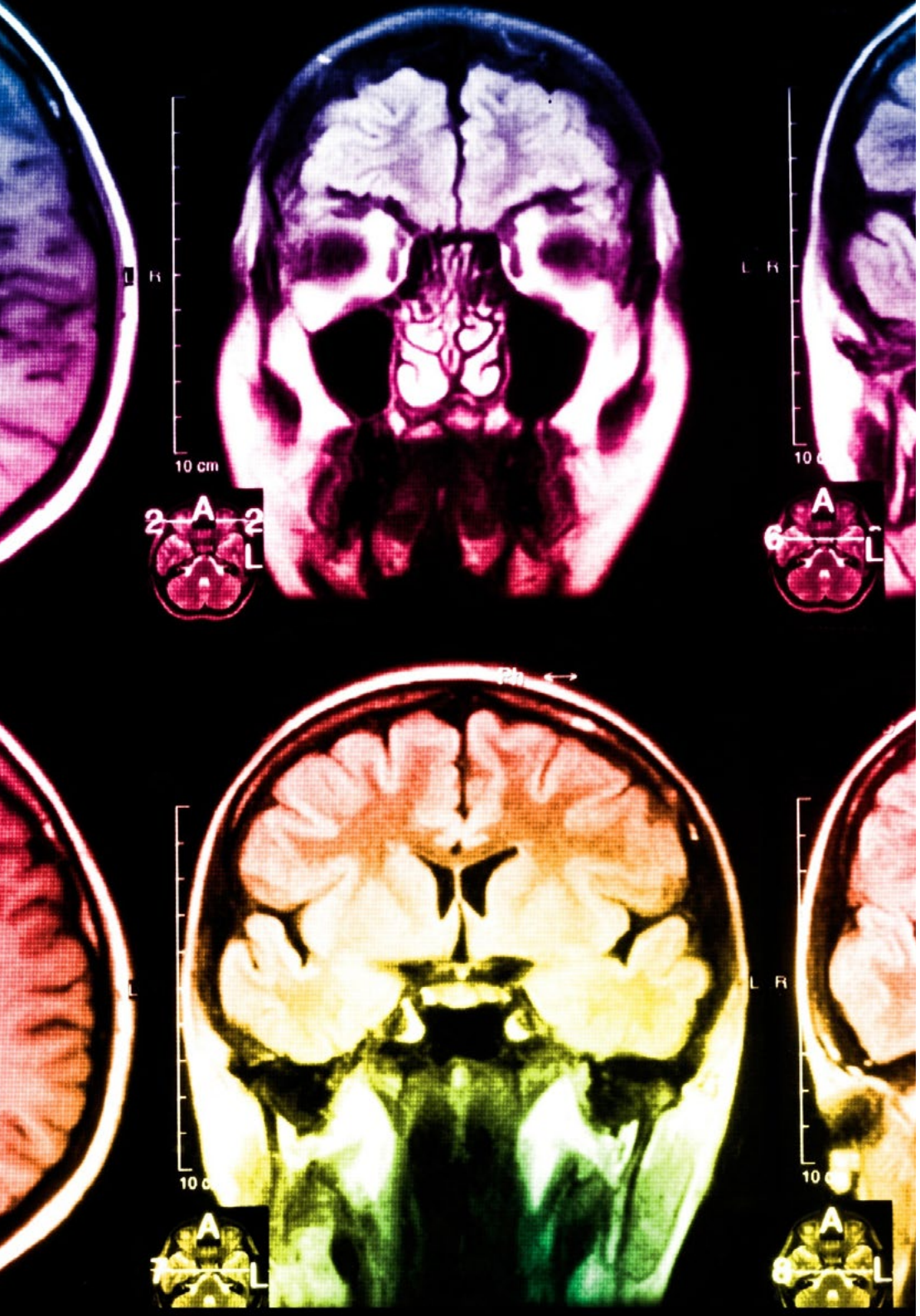
In order to facilitate tutor-student contact as much as possible, you will have a wide range of communication possibilities, both in real time and delayed (internal messaging, telephone answering service, email contact with the technical secretary, chat and videoconferences).

Likewise, this very complete Virtual Campus will allow TECH students to organize their study schedules according to their personal availability or work obligations. In this way, they will have global control of the academic content and teaching tools, based on their fast-paced professional update.

The online study mode of this program will allow you to organize your time and learning pace, adapting it to your schedule"

The effectiveness of the method is justified by four fundamental achievements:

1. Students who follow this method not only achieve the assimilation of concepts, but also a development of their mental capacity, through exercises that assess real situations and the application of knowledge.
2. Learning is solidly translated into practical skills that allow the student to better integrate into the real world.
3. Ideas and concepts are understood more efficiently, given that the example situations are based on real-life.
4. Students like to feel that the effort they put into their studies is worthwhile. This then translates into a greater interest in learning and more time dedicated to working on the course.



The university methodology top-rated by its students

The results of this innovative teaching model can be seen in the overall satisfaction levels of TECH graduates.

The students' assessment of the quality of teaching, quality of materials, course structure and objectives is excellent. Not surprisingly, the institution became the best rated university by its students on the Trustpilot review platform, obtaining a 4.9 out of 5.

Access the study contents from any device with an Internet connection (computer, tablet, smartphone) thanks to the fact that TECH is at the forefront of technology and teaching.

You will be able to learn with the advantages that come with having access to simulated learning environments and the learning by observation approach, that is, Learning from an expert.

As such, the best educational materials, thoroughly prepared, will be available in this program:

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.

This content is then adapted in an audiovisual format that will create our way of working online, with the latest techniques that allow us to offer you high quality in all of the material that we provide you with.

Practicing Skills and Abilities

You will carry out activities to develop specific competencies and skills in each thematic field. Exercises and activities to acquire and develop the skills and abilities that a specialist needs to develop within the framework of the globalization we live in.

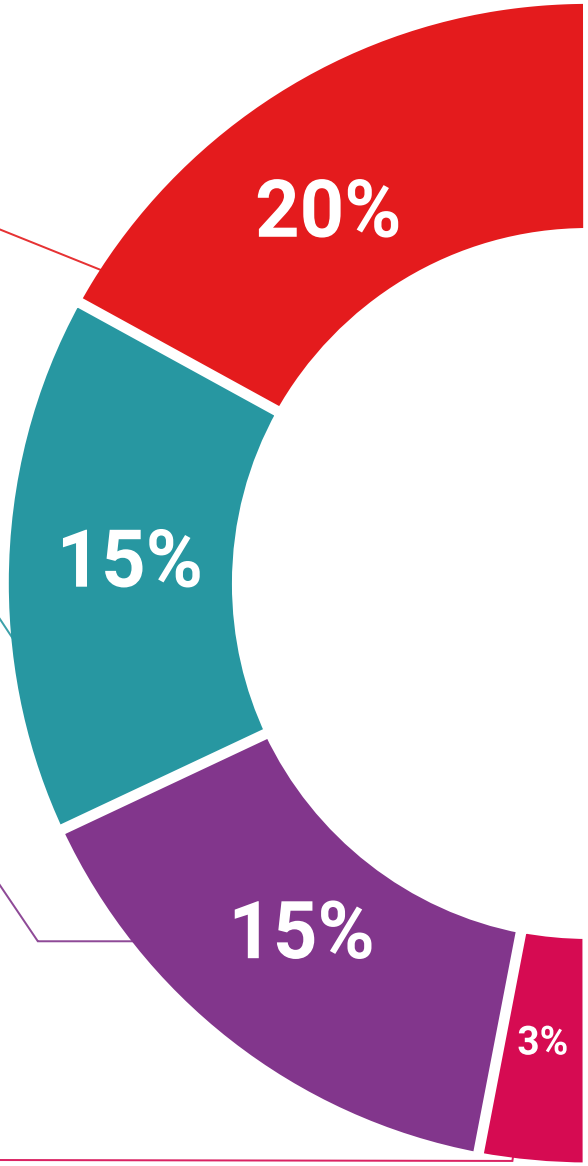
Interactive Summaries

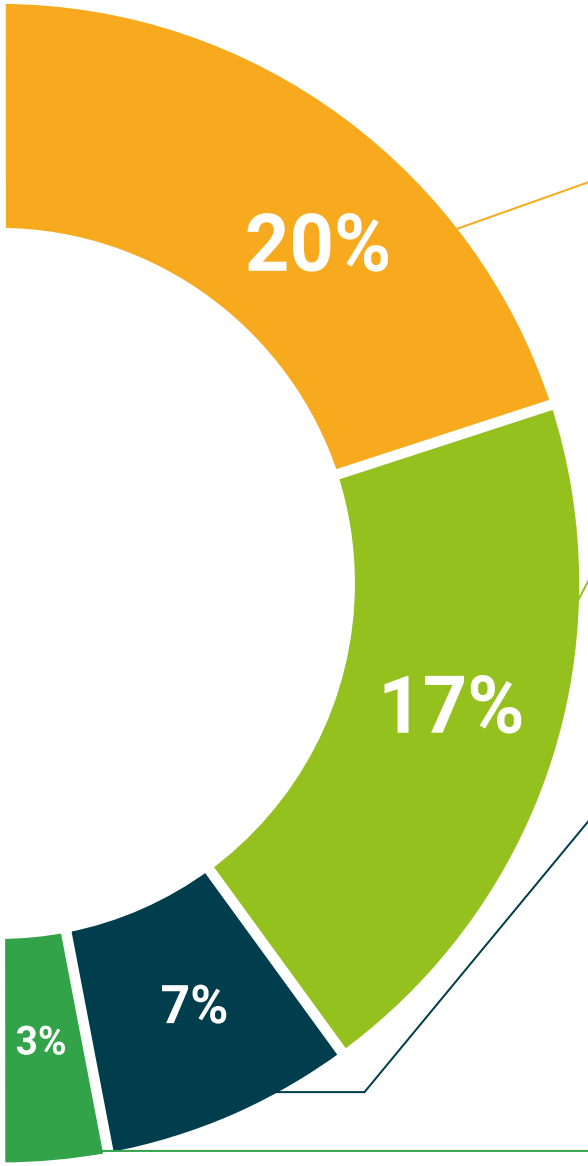
We present the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

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

Additional Reading

Recent articles, consensus documents, international guides... In our virtual library you will have access to everything you need to complete your education.





Case Studies

Students will complete a selection of the best case studies in the field. Cases that are presented, analyzed, and supervised by the best specialists in the world.

Testing & Retesting

We periodically assess and re-assess your knowledge throughout the program. We do this on 3 of the 4 levels of Miller's Pyramid.

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 for future difficult decisions.

Quick Action Guides

TECH offers the most relevant contents of the course in the form of worksheets or quick action guides. A synthetic, practical and effective way to help students progress in their learning.

07

Certificate

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

By successfully completing this program, you will receive your TECH qualification without the need for complicated paperwork"

This private qualification will allow you to obtain a **Advanced Master's Degree in 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** private qualification 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: **Advanced Master's Degree in Construction Engineering**

Modality: **online**

Duration: **2 years**

Accreditation: **120 ECTS**


tech global university

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

Advanced Master's Degree in Construction Engineering

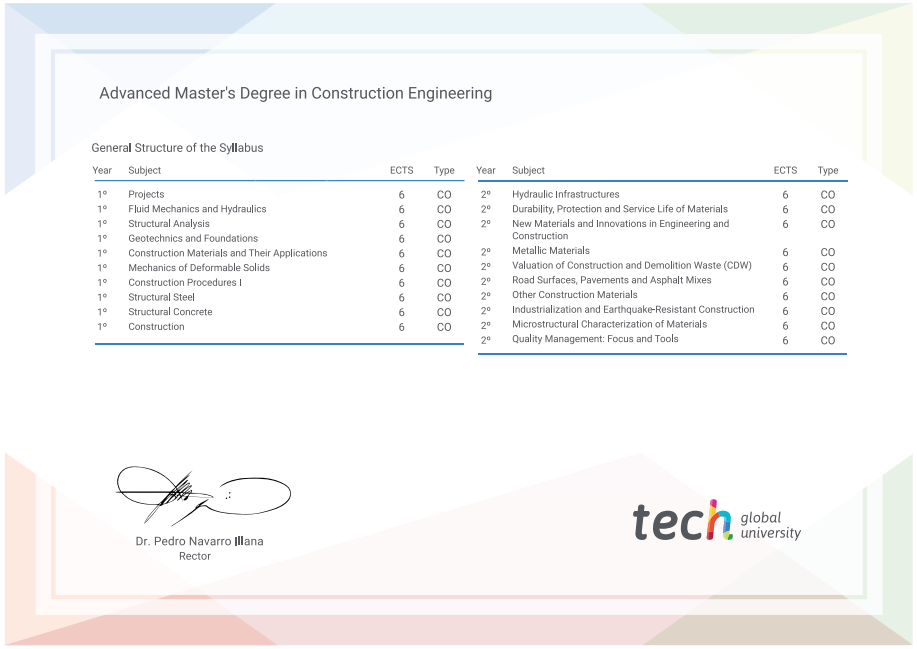
This is a private qualification of 3,600hours of duration equivalent to 120 ECTS, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

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
Dean

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


Advanced Master's Degree in Construction Engineering

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 Deformable Solids	6	CO
1º	Construction Procedures I	6	CO
1º	Structural Steel	6	CO
1º	Structural Concrete	6	CO
1º	Construction	6	CO

Year	Subject	ECTS	Type
2º	Hydraulic Infrastructures	6	CO
2º	Durability, Protection and Service Life of Materials	6	CO
2º	New Materials and Innovations in Engineering and Construction	6	CO
2º	Metallic Materials	6	CO
2º	Valuation of Construction and Demolition Waste (CDW)	6	CO
2º	Road Surfaces, Pavements and Asphalt Mixes	6	CO
2º	Other Construction Materials	6	CO
2º	Industrialization and Earthquake-Resistant Construction	6	CO
2º	Microstructural Characterization of Materials	6	CO
2º	Quality Management: Focus and Tools	6	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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Advanced Master's Degree

Construction Engineering

- Modality: **online**
- Duration: **2 years**
- Certificate: **TECH Global University**
- Acreditation: **120 ECTS**
- Schedule: **at your own pace**
- Exams: **online**

Advanced Master's Degree
Construction Engineering

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