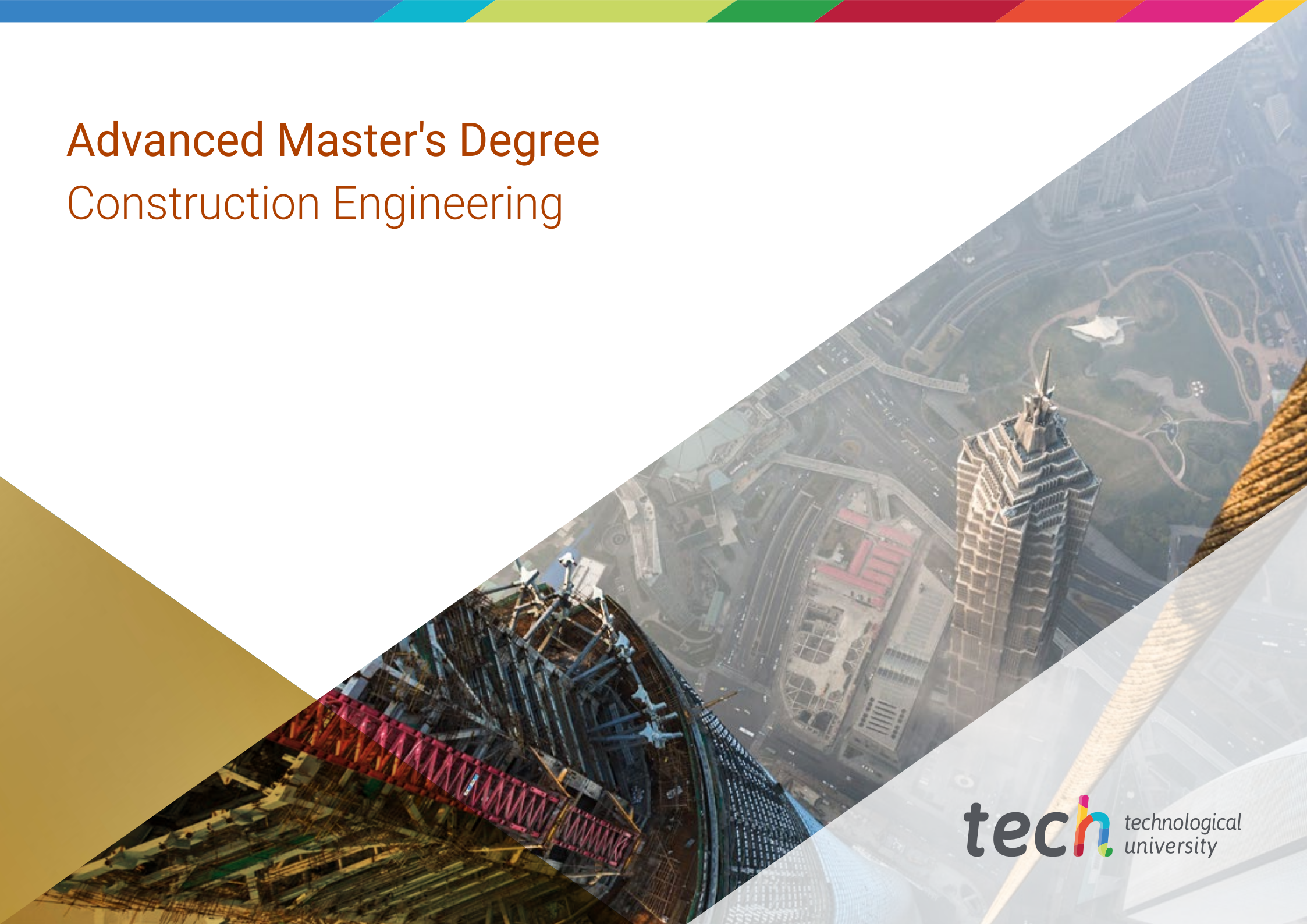
Advanced Master's Degree
Construction Engineering



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Advanced Master's Degree
Construction Engineering

- Modality: **online**
- Duration: **2 years**
- Certificate: **TECH Technological University**
- Dedication: **16h/week**
- Schedule: **at your own pace**
- Exams: **online**

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

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01

Introduction

The need to use cheaper and more efficient materials, to reduce environmental impact and to respond to urban infrastructure needs make 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. Thus, through this program, the engineer will be able to deepen in the latest procedures of Foundations and Geotechnics, in materials such as steel and structural concrete or in 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. both branches to obtain the best possible results.

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. Thus, 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

- Autonomous learning of new knowledge and techniques suitable for Civil Engineering
- 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, as well as the terminology of Civil Engineering
- Deepen knowledge in relation to the scientific and technical ways of the practice 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
- Correct waste recovery
- Manage from an engineering point of view the quality and production of materials for the site
- 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 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 dimension 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 dimension 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 dimension them according to existing standards and using analytical and numerical calculation methods

Module 10. Building

- 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

Module 11. Science and Technology of Cement-Based Materials

- 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
- Know in detail the nature, characteristics and performance of special concretes, which have been investigated in recent years
- Develop and manufacture special concretes according to their dosage specifications and technological properties
- 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 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
- Identify the main incompatibilities between construction materials
- 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)

- Achieve detailed knowledge of sustainable materials, carbon footprint, life cycle, etc
- Differentiate between the regulations and the importance of recycling CDW
- 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
- Identifying and using 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
- Identify basic production principles and specify new materials of the future
- Analyze 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 material characterization techniques, specifically optical 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

- 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
- Apply the acquired in-depth knowledge to the Management of Construction Works, through establishing formats that have been developed for the systematic monitoring of the different work units
- Compose and develop Quality Management Systems for the drafting, application, implementation and updating of Quality Manuals and Quality Plans

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. Thus, 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
- Perform an exhaustive analysis of the different types of construction materials
- Determine which of the new technologies are applied to the engineering of materials
- 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

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

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 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 of advanced materials characterization techniques, specifically optical 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

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 of the Advanced Building Science and Technology Group
- Dr. in Architectural Sciences from the Polytechnic University of Cartagena
- Master's Degree in Building with Specialization in Technology, Universidad Politécnica de Valencia
- Building Engineer from the Camilo José Cela University

Professors

Dr. Benito Saorín, Francisco Javier

- Technical Architect in Optional Direction and coordination of and Coordination Functions
- Municipal Technician in the Ricote. Town Hall Murcia
- Specialist in R+D+i in Construction Materials and Construction Works
- Contracted Doctor for the Advanced Construction from Science and Technology Group of the Polytechnic University of Cartagena
- Reviewer of journals indexed in JCR
- PhD in Architecture from the Polytechnic University of Valence
- Master's Degree in Construction Cone Major in Technology) from the Polytechnic University of Valencia

Mr. Martínez Pacheco, Víctor

- Architect at Martínez Pacheco Arquitectura
- Researcher at Cementos Cruz on Materials Development and Technological Innovation
- Head of 3D Additive Manufacturing Division
- Teacher of higher programs in the service of his specialty
- Dr. in Technology and Modeling in Civil, Mining and Environmental Engineering from the Polytechnic University of Cartagena
- Masters Degree in Business Administration from the European Business School of Barcelona
- Degree in Architecture, Polytechnic University of Cartagena

Mr. Rodríguez López, Carlos Luis

- Head of the Materials Department at the Construction Technology Center of the Region of Murcia
- Coordinator of the sustainable construction and climate change area in CTCON
- Technician in the projects department of PM Architecture & Management SL
- Construction Engineer from Polytechnic University of Cartagena
- PhD Dr. Engineering in Construction Materials and Sustainable Construction
- Doctor from the University of Alicante
- Specialist in the development of new materials, products for construction and in the analysis of pathologies in construction
- Professional Master's Degree in Materials, Water and Ground Engineering: Sustainable Construction from the University of Alicante
- Articles in international congresses and high-impact indexed journals on the different areas of construction materials

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
- Dr. in Materials, Structures and Terrain Engineering: Sustainable Construction from the University of Alicante
- Graduate in Civil Engineering with a double major in Hydrology and Civil Construction
- Professional Master's Degree in Civil Engineering with Specialization in Transportation 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 at the Spanish Ministry of Science and Innovation
- Technical Director of Bovis Lend Lease
- Production Manager at Dragados
- Civil Works Delegate for PACADAR
- Professional Master's Degree in Civil Engineering Research, University of Cantabria, Spain
- Diploma in Business Administration from the Universidad Nacional de Educación a Distancia (National University of Distance Education)
- Civil Engineer from the University of Cantabria

Dr. Parra Costa, Carlos José

- Principal Investigator of the Advanced Building Science and Technology Group
- Director of the Department of Architecture and Building Technology at the Polytechnic University of Cartagena
- Architect at CPC Architecture, their own studio
- Dr. in Architecture from the Polytechnic University of Valencia
- Postgraduate Diploma in the Finite Element Method
- Official Certification in Knowledge Transfer and Innovation from the National Commission for the Evaluation of Research Activity

Dr. Muñoz Sánchez, María Belén

- Construction Materials Innovation and Sustainability Consultant
- Researcher in polymers at POLYMAT
- Dr. in Materials and Sustainable Processes Engineering from the University of the Basque Country
- Chemical Engineer from the University of Extremadura
- Professional Master's Degree in Research with Specialization in Chemistry, University of Extremadura, Spain
- 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 AIMPLAS, Technological Institute of Plastic
- Quality Manager at AIDICO Technological Construction Institute
- Laboratory Technician at Cementos La Unión, S.A
- Degree in Chemistry from the University of Valencia
- Master's Degree in Food Safety and Quality from the University of Valencia
- Management Integration and Development Program at the Anant Foundation
- Program HACCP in Food Safety, Quality and Food Safety by the University of Salamanca

Dr. Navarro, Arsenio

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

Mr. Izquierdo Núñez, José Vicente

- AIMPLAS Characterization Laboratory Researcher
- Research Technician at the Institute of Water and Environmental Engineering (IIAMA)
- R+D+i Technician at Aguas de Valencia
- AIDICO Laboratory Technician
- 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 by the University of Valencia

05

Structure and Content

The Advanced Master's Degree in Construction Engineering 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. PreEngineering
- 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. 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 Study of the Solution
- 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 the Necessary Geotechnical Works
- 1.8.3. Subcontracting Topography and Geotechnical Works
- 1.8.4. Monitoring Topography and Geotechnical Works
- 1.8.5. Analysis of Results of Topography 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 Structural Calculation Solution
- 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
- 2.4.5. 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. Inertia products. Inertia matrix. Main axes
- 3.1.6. Balance and stability
- 3.1.7. Analytical Statics

3.2. Stocks
- 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 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, 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 the deformable solid

6.1. Basic Concepts
- 6.1.1. Structural engineering
- 6.1.2. Concept of continuous media
- 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 basic measurements
- 6.2.2. Field of displacements
- 6.2.3. The small displacement hypothesis
- 6.2.4. Kinematic equations. Deformation tensor

6.3. Kinematic relationships
- 6.3.1. Deformational state in the vicinity of a point
- 6.3.2. Physical interpretation of the components of the deformation tensor
- 6.3.3. Principal deformations and principal directions of deformation
- 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 relationships
- 6.4.1. Tension concept
- 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. 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. 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. Flexion 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 the tangential stresses due to bending

6.10. Theory of beams: torsion
- 6.10.1. Introduction
- 6.10.2. Coulimb 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. 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 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. 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 bases and structural analysis models
- 8.3.1. Basis of calculation
- 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. Limit state of instability
- 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 state III
- 8.6.1. Ultimate stiffness limit state
- 8.6.2. Longitudinally stiffened elements
- 8.6.3. Shear web buckling
- 8.6.4. Web resistance to concentrated transverse loads
- 8.6.5. Compressed wing induced web denting
- 8.6.6. Stiffeners

8.7. Serviceability Limit States
- 8.7.1. General Aspects
- 8.7.2. Deformation limit states
- 8.7.3. Vibration limit state
- 8.7.4. Limit state of transverse deformations in flat panels
- 8.7.5. Limit state of local plasticizations

8.8. Connecting means: screws
- 8.8.1. Means of attachment: Generalities 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 means: 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 column connections
- 8.9.5. Supporting devices and pillar bases

8.10. Steel structures against fire
- 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. Checking the strength of joints
- 8.10.6. Calculation of steel temperatures

Module 9. Structural concrete

9.1. Introduction
- 9.1.1. Introduction to the subject
- 9.1.2. Historical notes on 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. Stocks
- 9.2.2. Characteristics of concrete and steel materials
- 9.2.3. Durability-oriented calculation bases

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. Effects of prestressing
- 9.3.5. Calculation of sections in service
- 9.3.6. Shrinkage and creep

9.4. Service Life And Maintenance Of Reinforced Concrete
- 9.4.1. Concrete durability
- 9.4.2. Deterioration of the concrete mass
- 9.4.3. Steel corrosion
- 9.4.4. Identification of factors of aggressiveness on concrete
- 9.4.5. Protective Measures
- 9.4.6. Maintenance of concrete structures

9.5. Serviceability Limit State Calculations
- 9.5.1. Boundary states
- 9.5.2. Concept and method
- 9.5.3. Verification of cracking requirements
- 9.5.4. Verification of deformation requirements

9.6. Calculations Relating to the Latest Limit Statements
- 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. Cutting
- 9.6.5. Rasante
- 9.6.6. Torsion
- 9.6.7. Regions D

9.7. Sizing Criteria
- 9.7.1. Typical application cases
- 9.7.2. The knot
- 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 pillar
- 9.8.3. The slab
- 9.8.4. Foundation elements
- 9.8.5. Introduction to prestressed concrete

9.9. Constructive Provisions
- 9.9.1. General and nomenclature
- 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. Processes prior to 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. Prefabricated 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. Streamlined 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 installations I
- 10.5.1. Plumbing
- 10.5.2. Water supply
- 10.5.3. Sanitation
- 10.5.4. Water evacuation

10.6. Building 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. Maintenance and equipment usage costs
- 10.10.5. Advantages of Building Maintenance

Module 11. Science and Technology of Cement-Based Materials

11.1. Cement
- 11.1.1. Cement and Hydration Reactions: Cement Composition and Manufacturing Process. Majority Compounds, Minority Compounds
- 11.1.2. Process of Hydration. Characteristics of Hydrated Products. Alternative Materials to Cement
- 11.1.3. Innovation and New Products

11.2. Mortar
- 11.2.1. Properties
- 11.2.2. Manufacturing, Types and Uses
- 11.2.3. New Materials

11.3. High Resistance Concrete
- 11.3.1. Composition
- 11.3.2. Properties and Characteristics
- 11.3.3. New Designs

11.4. Self-Compacting Concrete
- 11.4.1. Nature and Characteristics of its Components
- 11.4.2. Dosage, Manufacturing, Transport and Commissioning
- 11.4.3. Characteristics of the Concrete

11.5. Light Concrete
- 11.5.1. Composition
- 11.5.2. Properties and Characteristics
- 11.5.3. New Designs

11.6. Fiber and Multifunctional Concretes
- 11.6.1. Materials Used in the Manufacturing
- 11.6.2. Properties
- 11.6.3. Designs

11.7. Self-Repairing and Self-Cleaning Concretes
- 11.7.1. Composition
- 11.7.2. Properties and Characteristics
- 11.7.3. New Designs

11.8. Other Cement-Based Materials (Fluid, Antibacterial, Biological, etc.)
- 11.8.1. Composition
- 11.8.2. Properties and Characteristics
- 11.8.3. New Designs

11.9. Destructive and Non-Destructive Characteristics Trials
- 11.9.1. Characterization of Materials
- 11.9.2. Destructive Techniques. Fresh and Hardened State
- 11.9.3. Non-Destructive Techniques and Procedures Applied to Materials and Construction Structures

11.10. Additive blends
- 11.10.1. Additive blends
- 11.10.2. Advantages and Disadvantages
- 11.10.3. Sustainability

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

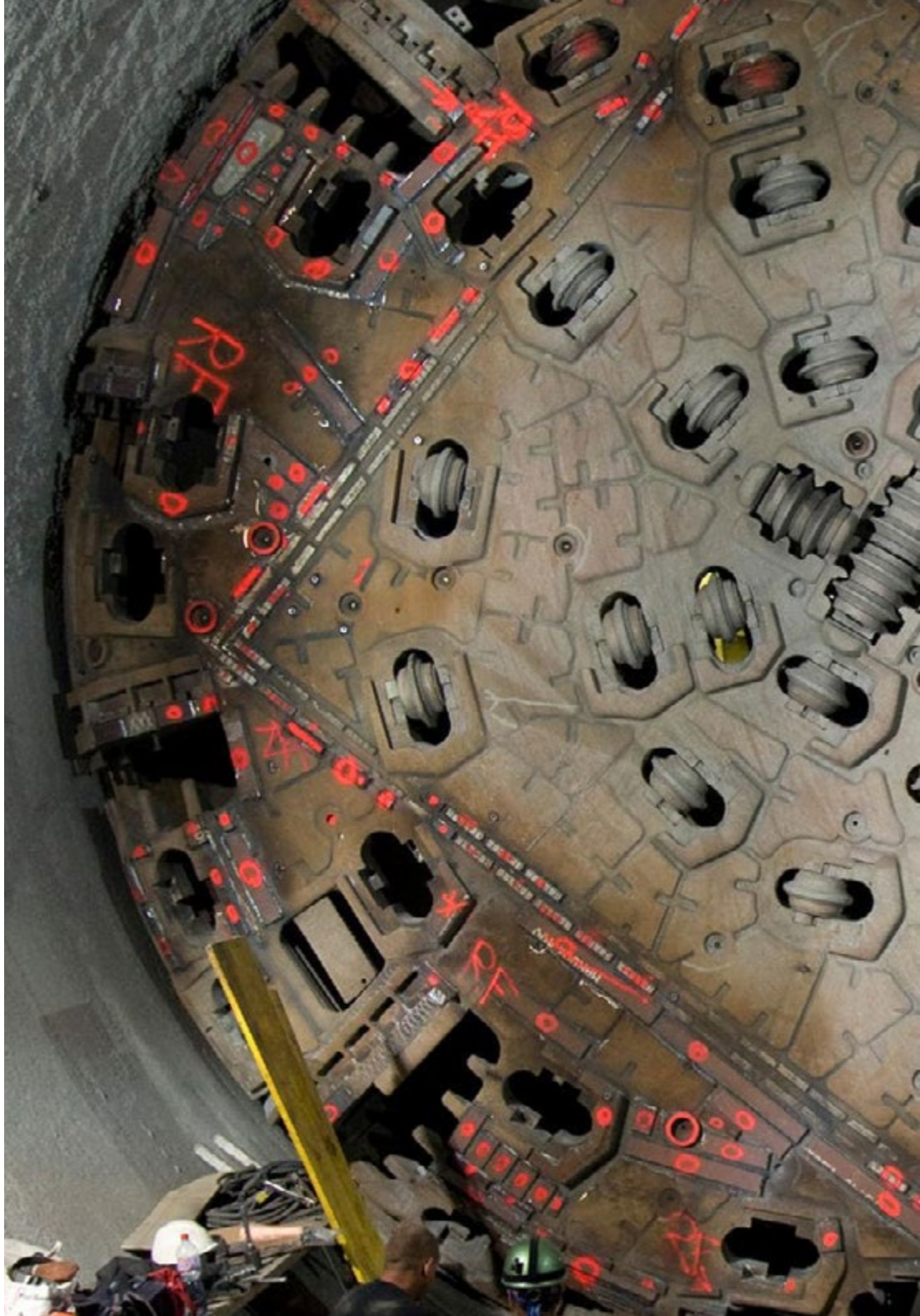
13.9. Maritime Works
- 13.9.1. New Materials and Shapes in Seawalls
- 13.9.2. Natural Alternative to Artificial Works
- 13.9.3. Prediction of Ocean Weather

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
- 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
- 15.5.4. Administrative Management of CDW

15.6. Legal Framework in CDW Material. Environmental Poilicy
- 15.6.1. Environment
- 15.6.2. Regulations
- 15.6.3. Obligations

15.7. Properties of CDW
- 15.7.1. Classification
- 15.7.3. Properties
- 15.7.4. Applications and Innovation with CDW

15.8. Innovation. Optimization of the Use of Resources. From Other Industrial, Agricultural and Urban Wastes
- 15.8.1. Supplementary material. ternary and binary mixtures
- 15.8.3. Geopolymers
- 15.8.4. Concrete and Asphalt Mixtures
- 15.8.5. Other Uses

15.9. Environmental Impact
- 15.9.1. Analysis
- 15.9.2. Impacts of CDW
- 15.9.3. Measures Adopted, Identification and Valorization

15.10. Degraded Spaces
- 15.10.1. Landfill
- 15.10.2. Use of Land
- 15.10.3. 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 Subbases
- 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. Aggregates 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. Education
- 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: Prefabricated Construction
- 18.1.1. The Beginnings of Industrialization in Construction
- 18.1.2. Prefabricated Structural Systems
- 18.1.3. Prefabricated Constructive Systems

18.2. Prestressed Concrete
- 18.2.1. Voltage Losses
- 18.2.2. Serviceability Limit States
- 18.2.3. Ultimate Limit States
- 18.2.4. Precast Systems: Prestressed Slabs and Beams with Prestressed 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. Automization 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 (EIE)
- 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 Erros

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. National Accreditation Entity (ENAC)
- 20.6.3. CE Marking
- 20.6.4. 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

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

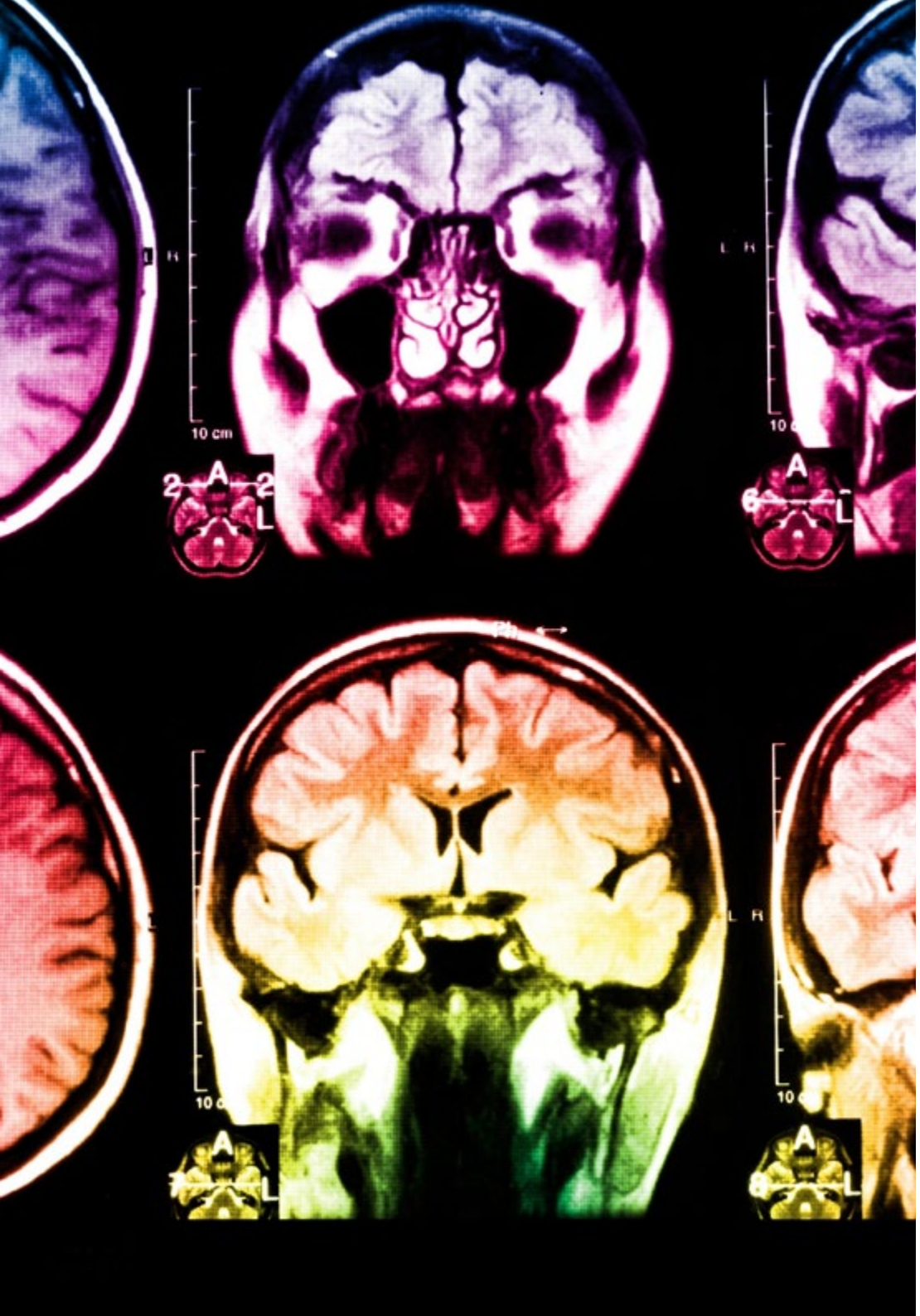
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

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.

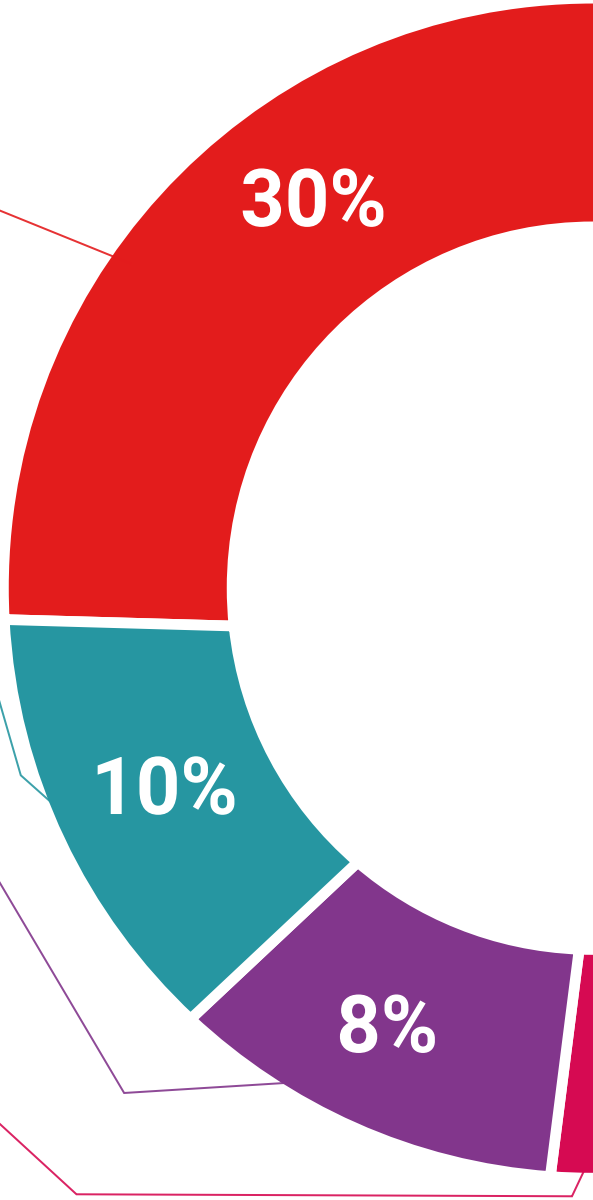
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

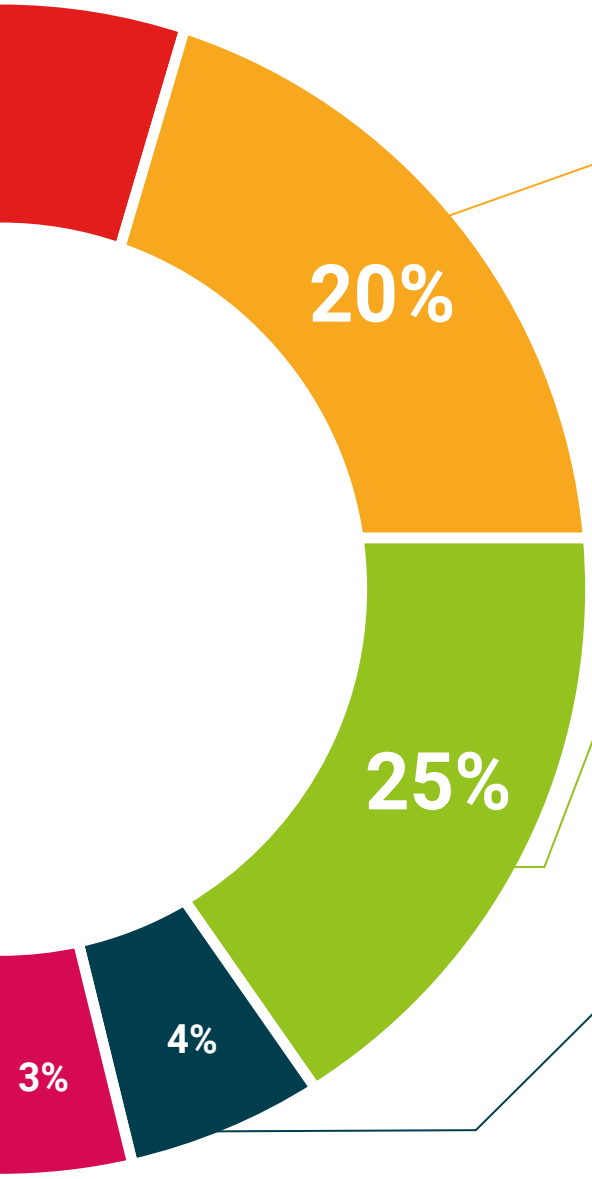
Practising Skills and Abilities

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.

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 a Postgraduate Certificate issued by TECH Technological University.

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

This **Advanced Master's Degree in Construction Engineering** contains the most complete and up-to-date program on the market.

After the student has passed the assessments, they will receive their corresponding **Advanced Master's Degree** issued by **TECH Technological University** via tracked delivery*.

The certificate issued by **TECH Technological University** will reflect the qualification obtained in the **Advanced Master's Degree**, and meets the requirements commonly demanded by labor exchanges, competitive examinations, and professional career evaluation committees.

Title: **Advanced Master's Degree in Construction Engineering**

Official N° of Hours: **3,000 h.**


tech technological university

Awards the following

CERTIFICATE

to

Mr./Ms. _____, with identification number _____.

For having successfully passed and accredited the following program

ADVANCED MASTER'S DEGREE

in

Construction Engineering

This is a qualification awarded by this University, equivalent to 3,000 hours, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

TECH is a Private Institution of Higher Education recognized by the Ministry of Public Education as of June 28, 2018.

June 17, 2020

Tere Guevara Navarro
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	Hours	Type
1º	Projects	300	CO
1º	Fluid mechanics and hydraulics	300	CO
1º	Structural analysis	300	CO
1º	Geotechnics and foundations	300	CO
1º	Construction materials and their applications	300	CO
1º	Mechanics of the deformable solid	300	CO
1º	Construction procedures I	300	CO
1º	Structural steel	300	CO
1º	Structural concrete	300	CO
1º	Building	300	CO

Year	Subject	Hours	Type
2º	Science and Technology of Cement-Based Materials	300	CO
2º	Durability, Protection and Service Life of Materials	300	CO
2º	New Materials and Innovations in Engineering and Construction	300	CO
2º	Metallic Materials	300	CO
2º	Valuation of Construction and Demolition Waste (CDW)	300	CO
2º	Road Surfaces, Pavements and Asphalt Mixes	300	CO
2º	Other Construction Materials	300	CO
2º	Industrialization and Earthquake-Resistant Construction	300	CO
2º	Microstructural Characterization of Materials	300	CO
2º	Quality Management: Focus and Tools	300	CO

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Dean

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*Apostille Convention. In the event that the student wishes to have their paper certificate issued with an apostille, TECH EDUCATION 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 Technological University**
- Dedication: **16h/week**
- Schedule: **at your own pace**
- Exams: **online**

Advanced Master's Degree
Construction Engineering

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