Professional Master's Degree
Hydraulic Works Infrastructure

tech technological university

Professional Master's Degree
Hydraulic Works Infrastructure

- Modality: **online**
- Duration: **12 months**
- Certificate: **TECH Technological University**
- Dedication: **16h/week**
- Schedule: **at your own pace**
- Exams: **online**

Website: **www.techtitute.com/pk/engineering/professional-master-degree/master-hydraulic-works-infrastructure**

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01

Introduction

Currently, access to water and the preservation of the environment are some of the factors that depend on the realization of hydraulic works generating an impact on the regions for the care of natural resources. This is why water technologies are present to guarantee the care of the environment and the saving of the liquid. Thus, this is a field that requires the skills and knowledge of the Civil Engineer, who must be up to date with the innovative methods applied in surface hydrology and the most current knowledge regarding the particular elements that are part of a hydraulic infrastructure. All this with a pedagogical format 100% online and with a team of experienced teachers in Hydraulic Works

TECH offers you a teaching format 100% online and with a team of teachers experienced in Hydraulic Works"

Previously, the construction of hydraulic works generated high costs in their execution and maintenance, in addition to not contributing to the environment by not having the tools that were linked to techniques and materials designed for sustainable construction. That is why today this type of hydraulic infrastructure works are focused on helping to mitigate environmental problems by ensuring access to clean water for communities. In this sense, the professionals will apply the concepts of surface hydrology to natural environments to perform hydrological models of basins and urban hydrological models.

This is a field that day by day is being updated in aspects of materials, methods and techniques that contribute to natural preservation and the development of the execution of works that help to make a better water management. Therefore, this Professional Master's Degree from TECH will provide the graduates with in-depth and advanced knowledge in the typology of dams and the main water purification processes. The focus of its content is guided to the design and construction of hydraulic infrastructures that allow the supply of water resources to urban supply and purification systems.

In this way, the professionals will acquire knowledge and specific skills, such as in the approach of solutions to real civil engineering problems using advanced software, deepening in concepts such as methodology and BIM model. A program that integrates a specialized teaching team and at the same time, supported with quality multimedia content that offers dynamism and comfort with the online modality.

TECH provides an excellent opportunity for engineers who wish to combine their work and personal responsibilities with a quality university education. The professionals will only need an electronic device with Internet connection to access the virtual platform at any time. In this way, students will be able to distribute the teaching load according to their needs.

This **Professional Master's Degree in Hydraulic Works Infrastructure** contains the most complete and up-to-date program on the market. The most important features include:

- The development of case studies presented by experts in Civil Engineering focused on Hydraulic Works
- 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
- Its special emphasis on innovative methodologies
- Theoretical lessons, questions to the expert, debate forums on controversial topics, and individual reflection assignments
- Content that is accessible from any fixed or portable device with an Internet connection

The professionals will apply the concepts of surface hydrology to natural environments to carry out hydrological models of basins and urban hydrological models"

This Professional Master's Degree will provide you with advanced knowledge in the typology of dams and the main water purification processes"

Deepen your skills and become an expert engineer in hydraulic infrastructures.

In TECH you will only need a device with Internet connection and you will be able to access the virtual platform at any time.

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

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

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

02 Objectives

In this Proffesional Master's Degree, students aim to deepen in the development of specialized criteria in the application of new tools for the design and construction of infrastructure with BIM technology. This will allow them to increase their competitiveness in the international engineering market together with different tools of academic innovation, ensuring the successful development of the program. Upon completion, the graduates will have nurtured their knowledge in irrigation, reservoirs, canals and river channeling from the design concept and elements to be taken into account.

The Professional Master's Degree in Hydraulic Works Infrastructure will allow you to increase your competitiveness at an international level with the different tools of academic innovation"

General Objectives

- Specify the most relevant concepts of hydrology and hydraulics for their application in civil engineering
- Analyze the key elements that apply, in particular, to hydraulic infrastructures of the water cycle
- Develop specialized knowledge on the application of these concepts to the design of such infrastructures
- Present practical cases to apply the knowledge acquired
- Identify the main elements of a water collection, storage and purification system
- Evaluate different alternatives for the selection of collection and/or purification systems
- Develop the main criteria for the design of the elements that are part of the system
- Base the practical cases on the theoretical knowledge acquired
- Develop new knowledge on BIM methodology, the concept of information model, collaborative workflows and modeling tools
- Generate skills in dam modeling using advanced softwares
- Extrapolate theoretical concepts to the design and modeling of these types of structures
- Analyze the use and application of BIM methodology in the project, construction and dam operation
- Develop new knowledge in the hydraulics of free sheet pipelines
- Determine the particular elements that are part of a piping system
- Extrapolate this knowledge to real civil engineering problems, proposing solutions and establishing construction procedures
- Analyze canal and channel works with computer software, basing the results on canal hydraulics
- Develop new knowledge about drinking water storage, the construction of storage structures and their operation
- Analyze the main elements that make up tanks, their materials and uses
- Define the main criteria for reservoir design, installation of control and control equipment and asset management
- Determine the use and application of the BIM methodology in modeling and information management

> *You will achieve your objectives with the support of the most updated and innovative content that only TECH can provide"*

Specific Objectives

Module 1. Hydrology and Hydraulics for Civil Engineering

- Apply the concepts of surface hydrology to natural environments in order to carry out watershed hydrological models and urban hydrological models
- Compile the different methods applied in surface hydrology to assess their potentialities
- Develop specialized skills to carry out flood studies of fluvial areas
- Analyze the elements of general hydraulics in the design of hydraulic infrastructures
- Generate new knowledge on the particular elements that are part of a hydraulic infrastructure
- Define the hydraulic variables that must intervene in our design of channels and pipelines, identifying the hydrodynamics of the infrastructure

Module 2. Dams, catchments and water treatment. Elements and design

- Develop key knowledge of dam typology and its application
- Determine the fundamentals of dam design, according to their typology
- Analyze water catchment systems
- Establish the elements of a catchment
- Examine the main processes for water purification
- Identify the main parameters for the selection of treatment systems
- Apply theoretical knowledge for the presentation of solutions to practical cases

Module 3. Modeling of dams

- Examine the fundamentals of BIM methodology applied to Civil Engineering
- Determine the workflows in the development of a BIM model of dams
- Develop skills in modeling vertical and horizontal structures
- Analyze design solutions and alternatives in dam modeling
- Establish the main BIM objects that make up a dam model
- Propose solutions to real civil engineering problems using advanced software
- Apply the BIM methodology assuming the role of modeler and enriching models with the necessary information for their construction and exploitation

Module 4. Channels and river channelization. Elements and design

- Develop the general hydraulic concepts and fundamentals of free sheet pipelines
- Determine the elements that are part of hydraulic pipelines
- Examine the general aspects of pipeline routing
- Analyze in depth the concrete-lined channels, deepening in the considerations to take into account, as well as in the constructive procedures
- Establish the elements of flow regulation in canals in order to carry out an optimal management of the infrastructure
- Specify special elements that are part of the pipelines
- Apply the theoretical concepts to the simulation of pipelines in computer software

Module 5. Reservoirs, elements and design

- Specify the functions, uses and classifications of reservoirs
- Analyze the fundamentals of water supply reservoir design
- Develop the general aspects of reservoirs, auxiliary structures and installations
- Identify the main criteria for reservoir sizing
- Propose solutions to water storage problems and the management and maintenance of storage structures
- Apply the BIM methodology, proposing a modeling strategy for vertical structures and the incorporation of information for their management

Module 6. Irrigation. Elements and design

- Specify the factors involved in irrigation
- Address the fundamentals of irrigation network design
- Develop the general aspects that make up an irrigation network
- Determine the main criteria for sizing irrigation networks
- Analyze solutions using drip and sprinkler network techniques
- Apply BIM methodology in the design and analysis of irrigation networks
- Examine BIM deliverables of an irrigation network providing the student with knowledge applicable to any piping system

Module 7. Upstream supply systems. Water transport pipelines

- Specify the basic hydraulic fundamentals of large water conveyance pipelines
- Develop the fundamentals of water hammer phenomena
- Determine the general design aspects of an upstream water supply system
- Identify the main sizing criteria
- Analyze solutions for system protection elements using specialized water hammer software
- Propose solutions for the commissioning, maintenance and operation of upstream water supply systems
- Apply BIM methodology in the design and analysis of upstream distribution systems

Module 8. Urban drainage and design

- Specify the problems of sanitary engineering
- Examine the fundamentals of urban drainage network design
- Develop the general aspects that make up an urban drainage network
- Identify the main criteria for sizing a drainage network
- Analyze solutions through the simulation of sewerage networks
- Propose solutions to urban flooding problems based on rainwater retention basins
- Apply BIM methodology in the design and analysis of urban drainage networks

Module 9. Sustainable Urban Drainage System

- Specify the background and current problems in the drainage of current urban developments
- Define the types of SUDS according to their function
- Develop the fundamental pillars in the design of SUDS
- Analyze the SUDS for detention, retention, filtration, infiltration and treatment
- Identify the main design parameters of each typology
- Specify the use of each one of them
- Apply the design knowledge to the use of digital construction

Module 10. Debugging. Elements and design

- Analyze the main characteristics of wastewater
- Establish the appropriate processes for wastewater purification
- Present basic considerations on the implementation of wastewater treatment plants
- Generate the basic scheme of a WWTP
- Develop a simple design of a conventional WWTP
- Evaluate the waste generated, and its possibilities of utilization
- Apply the acquired knowledge to the digital construction of a WWTP

03
Skills

The focus of this Professional Master's Degree in Hydraulic Works Infrastructure addresses everything related to the design and construction of hydraulic works of the integral water cycle that are continuously renewed to improve their life cycle. In addition, due to the demanding demand for digital transformation of the design processes of the sector, the plan presents the technological innovations of greater implementation, so that students can implement and apply them in their current position, thus acquiring a differential value in their skills compared to other professionals in the sector, giving them very advanced knowledge in all aspects related to the management of the design of hydraulic infrastructures with BIM technology.

The graduates will be able to apply technological innovations, acquiring a differential value with respect to other professionals in the sector"

General Skills

- Develop new knowledge on irrigation, problems, solutions, infrastructure and new technologies
- Determine the main elements that make up an irrigation network according to the different typologies
- Establish the main design criteria of the elements that make up the network
- Analyze the use and application of the BIM methodology in the design, modeling and operation of networks of networks
- Develop new knowledge on large water supply pipelines
- Identify the main elements that compose the high head supply systems, and the main materials
- Deepen the concept of water hammer, and the protection elements necessary in upstream supply systems
- Develop the main design criteria of the elements that make up the system, as well as their application in the simulation with computer software
- Analyze the use and application of BIM methodology in the design, modeling and operation of large pipelines

Specific Skills

- Deepen in the integration of BIM methodology in all phases of a project and construction management in hydraulic engineering infrastructures
- Acquire knowledge of the most advanced BIM software applied to hydraulic infrastructures with GIS, Civil 3D and Revit, in order to reach a professional advanced user training
- Implement knowledge of interoperability workflows between different BIM tools
- Develop the knowledge of digital construction design and construction information management on construction sites, through the development of real projects with BIM technology
- Identify the main sustainable drainage systems and their use in urban development
- Define the fundamental pillars and main definitions related to SUDS
- Develop new knowledge on sanitary engineering, problems, solutions, infrastructure and new technologies
- Determine the main elements that make up an urban drainage network and the materials used in its construction
- Establish the main design criteria of the elements that make up the network, as well as their application in the simulation with computer software
- Analyze the use and application of BIM methodology in the design, modeling and operation of urban drainage networks

04

Course Management

TECH counts on renowned professionals so that the student acquires a solid knowledge in the specialty of Hydraulic Works Infrastructures. Therefore, this Professional Master's Degree has an experienced and fully qualified teaching team, which will offer the latest tools for the professional in the development of the academic program. In this way, students have the guarantees they need to specialise at an international level in a booming sector that will catapult them to professional success.

TECH has a highly experienced faculty, which offers innovative tools for the development of the academic program”

Management

D. González González, Blas

- Manager of the Technical Institute of Digital Construction Bimous
- Managing Director at Tolvas Verdes Malacitanas S.A
- CEO in Andaluza de Traviesas
- Director of Engineering and Development at GEA 21, S.A. Head of the Technical Services of the UTE Metro of Seville and co-director of the Construction Projects for Line 1 of the Metro of Seville
- CEO in Bética de Ingeniería S.A.L
- Teacher of several university master's degrees related to Civil Engineering, as well as subjects of the Degree in Architecture at the University of Seville
- Degree in Civil Engineering from the Polytechnic University of Madrid
- Master's Degree in New Materials Science and Nanotechnology from the University of Seville
- Master's Degree in BIM Management in Infrastructure and Civil Engineering by EADIC - Rey Juan Carlos University

Professors

Mr. Rubio González, Carlos

- Head of the Development Department at TEAMBIMCIVIL S.L
- Specialist at the Interuniversity Institute for Research on the Earth System in Andalusia at the University of Granada
- Civil Engineer at TEAMBIMCIVIL S.L
- Double Master in Civil Engineering and Environmental Hydraulics by the University of Granada
- Master's Degree in Technology and Management of the Integral Water Cycle from the University of Seville
- Degree in Civil Engineering from the University of Seville with mention in Hydrology
- Lecturer in specialization courses on BIM Modeling of Water Supply and Irrigation Networks

D. Pedraza Martínez, Horacio

- Pavement and layout specialist in the Drafting and Project Management Area of the Public Works Agency of the Andalusian Regional Government
- Layout, earth and pavement specialist for the construction project of the San Martín de Valdeiglesias Bypass, for the Ministry of Public Works
- Author and project manager of several road maintenance projects in the provinces of Granada and Jaén
- Specialist in earthworks, pavements and drainage for the bidding project: New Road M-410
- Co-author of the construction project for the extension of Line 2 of the Malaga Subway
- Author of the layout project for the A-318 Olivar Highway
- Graduate in Civil Engineering from the University of Granada
- Master's Degree BIM in Civil Engineering from the University of Seville

Ms. Pérez Vallecillos, Natalia

- Project manager for the Alcalá tramway infrastructure development
- Hydraulics specialist for the construction engineering project with OPWP (Oman Power and Water Procurement Company)
- Hydraulic specialist in the bidding phase of the potable water network of the urban development complex with ACWA Power
- Project manager for the preliminary design of the intake, pumping, pipelines and water treatment plant in Dhaka
- Collaborator in the elaboration of hydraulic works projects with URCI CONSULTORES, S.L
- Project coordinator for the production, transport and distribution of drinking water in La Concordia, Argentina
- Graduated in Civil Engineering at E.T.S.I.C.C.P. of Granada

Mr. García Romero, Francisco

- Technical Director at TEAMBIMCIVIL, S.L. - Seville
- Interim Civil Servant of the Senior Faculty of Civil Engineers A2003
- Interim Substitute Professor in the Projects Area, associated to the Department of Construction
- Engineering and Engineering Projects of the ETSI of Seville
- Graduate in Civil Engineering from the University of Seville, specializing in Civil Construction
- MSc in Civil Engineering from the University of Seville
- Specialist in BIM Modeling by the CA1 Department of the University of Seville

Ms. Provincial Gallardo, Olga

- Head of the Engineer Department at TEAMBIMCIVIL S.L
- Civil Engineer at TEAMBIMCIVIL S.L
- Graduate in Civil Engineering at the University of Seville
- Degree in Civil Engineering at the University of Valencia
- Specialist in BIM Modeling by the CA1 Department of the University of Seville
- Lecturer in the courses of specialization in BIM technology applied to Hydraulic Works of the BIOMOUS Digital Construction Technology Institute

Dr. Hernández Sánchez, Silvestre

- Manager of Infrastructure Management Actions of Andalusia
- Head of the Planning and Statistics Service of the General Directorate of Planning of the Regional Ministry of Public Works and Transport
- Head of the Office of the General Information System of the General Directorate of Planning of the Regional Ministry of Public Works and Transport
- Head of the Department of Technical Supervision in the Projects Service of the General Directorate of Roads of the Regional Ministry of Public Works and Transport
- PhD in the Department of Design Engineering at the School of Industrial Engineering of Seville
- Civil Engineer from the University of Granada
- Lecturer and speaker in several courses and congresses related to Cartography and Topography of Road Works

05

Structure and Content

This syllabus has been designed according to the recent and innovative construction techniques in hydraulic works infrastructures that have been developed within the sector. In this way, a syllabus has been created whose Modules offer a wide perspective of the designs and construction management involved in the hydraulic infrastructures of catchment and also of urban systems, from a vision of its application at international level, incorporating all the knowledge of the digital technologies involved in the development of the activities of a civil engineer. For this, the professionals will have the help of an innovative interactive video system made by recognized experts in engineering with great experience.

With this academic qualification you will be able to incorporate into your practice multiple knowledge of digital technologies involved in the development of the activities of a civil engineer"

Module 1. Hydrology and Hydraulics for Civil Engineering

1.1. Surface and urban hydrology
 1.1.1. Precipitation
 1.1.2. Infiltration
 1.1.3. Groundwater
 1.1.4. Flow rate. Duration and mass curves
 1.1.5. Probability distribution functions used in hydrology
 1.1.6. Analysis of drought frequencies
 1.1.7. Stochastic Processes Time series models
1.2. Rainfall. Precipitation - Runoff Ratio
 1.2.1. The design storm
 1.2.2. Historical analysis of maximum rainfall intensities
 1.2.3. Flood hydrographs
1.3. Hydrological parameters of catchment areas
 1.3.1. Typical hydrograph
 1.3.2. Unit Hydrograph
 1.3.3. Dimensionless Hydrographs
 1.3.4. Triangular Hydrographs
1.4. Determination of discharge flow rates
 1.4.1. Flood flow
 1.4.2. Transit of reservoirs
 1.4.3. Transit in natural watercourses
1.5. Hydrological Modeling
 1.5.1. Témez method
 1.5.2. Rational Method
 1.5.3. SCS Method
 1.5.4. Hydraulic Modeling
1.6. Hydraulic Modeling
 1.6.1. Hydromechanics
 1.6.2. Flows and currents
 1.6.3. Movements in hydraulic infrastructures
1.7. Free sheet pipelines. Hydraulic fundamentals
 1.7.1. Water flow in pipelines
 1.7.2. Classification of flows in channels
 1.7.3. Flow states
1.8. Properties of flow in open channels
 1.8.1. Types of open channels
 1.8.2. Geometry of an artificial channel
 1.8.3. Elements of a channel section
 1.8.4. Velocity and pressure distribution in channels
 1.8.5. Flow energy in open channels
 1.8.6. Critical flow status
 1.8.7. Local phenomena. Hydraulic Highlighting
1.9. Uniform motion in channels
 1.9.1. Uniform flow characteristics
 1.9.2. Uniform flow equations
 1.9.3. Common formulas for uniform motion in channels
1.10. Varied motions
 1.10.1. Gradually varied motion in rivers and streams
 1.10.2. Wave propagation
 1.10.3. Pressures and dynamic forces
 1.10.4. Waves and Water hammer
 1.10.5. Valve closure. Gradual, rapid and instantaneous

Module 2. Dams, catchments and water treatment. Elements and design

2.1. Water Storage System
 2.1.1. Water Storage Systems
 2.1.2. Surface and subway storage
 2.1.3. Water Pollution Problems
2.2. Surface water catchment
 2.2.1. Rainwater catchment
 2.2.2. Catchments in river courses
 2.2.3. Catchments in lakes and reservoirs

2.3. Groundwater abstraction
- 2.3.1. Groundwater
- 2.3.2. Protection of aquifers
- 2.3.3. Calculation of wells

2.4. Dams
- 2.4.1. Types of dams
- 2.4.2. Main elements of dams
- 2.4.3. Previous studies

2.5. Spillways and drains
- 2.5.1. Typology
- 2.5.2. Avenues study
- 2.5.3. Main Components

2.6. Construction of dams
- 2.6.1. River diversion
- 2.6.2. Construction of cofferdams and closure of the river bed
- 2.6.3. Constructive considerations on dams of different typology

2.7. Water purification
- 2.7.1. Water Treatment
- 2.7.2. Treatment Processes
- 2.7.3. Treatment equipment

2.8. Drinking water treatment processes
- 2.8.1. Treatment of Other Pollutants
- 2.8.2. Additives in drinking water treatment
- 2.8.3. Disinfection

2.9. By-products of water treatment
- 2.9.1. Nature of Sludge
- 2.9.2. Treatment Processes
- 2.9.3. Final destination of sludge

2.10. Dams as a renewable energy generation system
- 2.10.1. Renewable energy generation
- 2.10.2. Reservoirs and pumping stations as a source of clean energy generation
- 2.10.3. International energy regulation

Module 3. Modeling of dams

3.1. Digital construction
- 3.1.1. Digital construction
- 3.1.2. Building Information Models
- 3.1.3. BIM Technology

3.2. Dam modeler. Civil 3D
- 3.2.1. Civil 3D interface
- 3.2.2. Workspaces
- 3.2.3. Template configuration

3.3. Site survey
- 3.3.1. Preliminary site analysis
- 3.3.2. Civil 3D model preparation
- 3.3.3. Study of Alternatives

3.4. Civil 3D modeling strategy
- 3.4.1. Workflow
- 3.4.2. Model of linear works in Civil 3D
- 3.4.3. Modeling strategy for loose material dams
- 3.4.4. Modeling strategy for gravity dams

3.5. Creation of assemblies for weir bodies
- 3.5.1. Methods for the creation of subassemblies
- 3.5.2. Choice of the type profile
- 3.5.3. Creation of subassemblies from the profile type

3.6. Generation of the gravity dam linear structure
- 3.6.1. Design slope
- 3.6.2. Creation of the Linear Work
- 3.6.3. Parameters and surface of the linear work
- 3.6.4. Checking the proper functioning of the assemblies

3.7. Complementary works
- 3.7.1. Dam spillway
- 3.7.2. Dam crest roads
- 3.7.3. Interior galleries

3.8. Parameterization in Civil 3D
- 3.8.1. Types of properties according to their origin
- 3.8.2. Property types by data format
- 3.8.3. Creation of user-defined parameters

3.9. Generation of the dam body model in Revit
- 3.9.1. Model preparation in Revit
- 3.9.2. Dynamo routine for the creation of solids from Civil 3D to Revit
- 3.9.3. Execution of the Dynamo routine

3.10. Model of a gravity dam in Revit
- 3.10.1. Dam body
- 3.10.2. Construction divisions
- 3.10. 3 Control and maneuvering installations

Module 4. Channels and river channelization. Elements and design

4.1. Properties of flow in open channels. Hydraulic fundamentals
- 4.1.1. Classification of flows in channels
- 4.1.2. Types of open channels
- 4.1.3. Geometry of an artificial channel
- 4.1.4. Elements of a channel section
- 4.1.5. Velocity and pressure distribution in channels
- 4.1.6. Flow energy in open channels
- 4.1.7. Critical flow status
- 4.1.8. Local phenomena. Hydraulic Highlighting

4.2. Formulation of channel flows
- 4.2.1. Uniform motion in channels
- 4.2.2. Gradually varying flow in channels
- 4.2.3. Characteristics of gradually varied motion in channels
- 4.2.4. General formula for draft variation
- 4.2.5. Cases of gradually varied motion

4.3. Geometric definition of the standard section
- 4.3.1. Initial Aspects
- 4.3.2. Design Criteria
- 4.3.3. Channel lining
- 4.3.4. Guards in canals
- 4.3.5. Types of drainage

4.4. Concrete-lined channels
- 4.4.1. Concrete-lined channels
- 4.4.2. Construction Aspects
- 4.4.3. Types of joints in Concrete Channels
- 4.4.4. Construction phases of a canal

4.5. Canal layout
- 4.5.1. The layout of a canal
- 4.5.2. Aqueducts
- 4.5.3. Tunnels
- 4.5.4. Siphons
- 4.5.5. Channeling of rivers

4.6. Special elements in canals
- 4.6.1. Transitions between different sections
- 4.6.2. Desanders
- 4.6.3. Gauging

4.7. Regulation in canals
- 4.7.1. Manual gates
- 4.7.2. Hydraulically operated by-pass dampers
- 4.7.3. Hydraulically operated automatic control dampers
- 4.7.4. Duckbill weirs

4.8. Spillways
- 4.8.1. Design
- 4.8.2. Fixed lip spillways
- 4.8.3. Siphon spillways

4.9. HEC-RAS for simulation in free sheeting
- 4.9.1. HEC-RAS. Features
- 4.9.2. Limitations in channel modeling
- 4.9.3. Data required for modeling
- 4.9.4. Results Obtained

4.10. Modeling Strategy
- 4.10.1. Civil 3D design of the civil works in plan
- 4.10.2. Longitudinal Profiles in Civil 3D
- 4.10.3. Cross Sections in Civil 3D

Module 5. Reservoirs, elements and design

5.1. Tanks
- 5.1.1. Deposit
- 5.1.2. Functionality of a Header Reservoir
- 5.1.3. Other Uses

5.2. Classification of Deposit
- 5.2.1. According to their Arrangement on the Terrain
- 5.2.2. According to its Constructive Process
- 5.2.3. According to its Material
- 5.2.4. According to their Relative Position in the Network

5.3. Reservoir Design
- 5.3.1. Types of Demand and Utilization
- 5.3.2. Design Requirements
- 5.3.3. Topography
- 5.3.4. Financial Elements
- 5.3.5. Others

5.4. Sizing of a Reservoir
- 5.4.1. Reservoir Dimensions
- 5.4.2. Height of the Sheet of Water
- 5.4.3. Capacity

5.5. Components of the Reservoirs
- 5.5.1. Enclosure Walls
- 5.5.2. Dividing Walls
- 5.5.3. Sills
- 5.5.4. Guide Partitions
- 5.5.5. Roof
- 5.5.6. Joints
- 5.5.7. Key Chamber

5.6. Equipment of the Reservoirs
- 5.6.1. Schematic Diagram of Basic Installations
- 5.6.2. Valves
- 5.6.3. Drainage
- 5.6.4. Control Elements

5.7. Maintenance and Conservation of Reservoirs
- 5.7.1. Applicable Regulations
- 5.7.2. Tank Cleaning
- 5.7.3. Maintenance of Reservoirs

5.8. Revit Reservoir Modeling Strategy
- 5.8.1. Revit Modeler Environment
- 5.8.2. Levels and Reference Planes
- 5.8.3. Revit Families

5.9. Operational Information. Set of reservoir parameters
- 5.9.1. Property Sets
- 5.9.2. Application of PSET to BIM objects
- 5.9.3. Export of Properties. Attributes to Databases

5.10. Management with Visualization Tools
- 5.10.1. Software to Visualize the Models
- 5.10.2. Information Requirements
- 5.10.3. BIMDATA IO Viewer

Module 6. Irrigation. Elements and design

- 6.1. Irrigation networks
  - 6.1.1. Irrigation network
  - 6.1.2. Physical characteristics of the soil
  - 6.1.3. Factors influencing irrigation
  - 6.1.4. Soil water storage
  - 6.1.5. Irrigation dosage
  - 6.1.6. Crop water requirements
- 6.2. Types of irrigation
  - 6.2.1. Gravity irrigation
  - 6.2.2. Sprinkler irrigation
  - 6.2.3. Drip irrigation
- 6.3. Pressure networks Hydraulic fundamentals
  - 6.3.1. Flow energy
  - 6.3.2. Bernoulli's Equation
  - 6.3.3. Energy losses in pipelines
- 6.4. Sprinkler irrigation networks Features
  - 6.4.1. Sprinklers
  - 6.4.2. System Types
  - 6.4.3. Hydraulic characteristics of sprinklers
  - 6.4.4. Distribution of sprinklers in conventional systems
  - 6.4.5. Uniformity and efficiency
- 6.5. Sizing of sprinkler irrigation networks
  - 6.5.1. Design Criteria
  - 6.5.2. Side branches
  - 6.5.3. Distribution Networks
- 6.6. Drip irrigation networks
  - 6.6.1. System Components
  - 6.6.2. Uniformity and efficiency
  - 6.6.3. Installation diagram
  - 6.6.4. Micro-sprinkler
- 6.7. Dimensioning of drip irrigation systems
  - 6.7.1. Design Criteria
  - 6.7.2. Side branches
  - 6.7.3. Bypass piping
  - 6.7.4. Distribution piping
- 6.8. Modeling of irrigation networks in Civil 3D
  - 6.8.1. Elements catalog
  - 6.8.2. Network modeling
  - 6.8.3. Irrigation network profile
- 6.9. Modeling of retention basins in Civil 3D
  - 6.9.1. Flattening element
  - 6.9.2. Footprint design
  - 6.9.3. Volume measurements
- 6.10. Deliverables of an irrigation network
  - 6.10.1. Plan alignment drawings
  - 6.10.2. Plan and profile drawings
  - 6.10.3. Transversal Sections and Measurements

Module 7. Upstream supply systems. Water transport pipelines

- 7.1. Types of Upstream supply systems
  - 7.1.1. Gravity conveyance systems
  - 7.1.2. Pressure transport systems
  - 7.1.3. Components
- 7.2. Design of upstream supply systems
  - 7.2.1. Plan Layout
  - 7.2.2. The pipeline profile
  - 7.2.3. Buried pipelines
  - 7.2.4. Headworks, midstream and tailrace reservoirs
  - 7.2.5. Components

7.3. System Dimensioning
- 7.3.1. Magnitude and time distribution of demand
- 7.3.2. Design Flow Rate
- 7.3.3. Design Criteria
- 7.3.4. Mechanical calculation of pipelines

7.4. Head losses in pipelines
- 7.4.1. Linear losses
- 7.4.2. Localized losses
- 7.4.3. Economic diameter

7.5. Tunnel pipelines
- 7.5.1. State of rock mass loadings
- 7.5.2. Excavation distortion
- 7.5.3. Bearing
- 7.5.4. Free sheet tunnels
- 7.5.5. Pressurized galleries

7.6. Singular elements
- 7.6.1. Lift stations
- 7.6.2. Hydraulic study of the elevator
- 7.6.3. Siphons operation
- 7.6.4. Siphon calculation and design

7.7. Structural protection of the pipeline
- 7.7.1. Water Hammer
- 7.7.2. Calculation of water hammer in pipelines
- 7.7.3. Elements of protection against the water hammer

7.8. Other protections
- 7.8.1. Cathodic protections
- 7.8.2. Coatings
- 7.8.3. Types of Coatings for pipelines
- 7.8.4. Valves and suction cups

7.9. Materials in high pressure supply systems
- 7.9.1. Regulations and selection criteria
- 7.9.2. Ductile iron pipes
- 7.9.3. Helical welded steel pipes
- 7.9.4. Reinforced and prestressed concrete pipelines
- 7.9.5. Pipes made of plastic materials
- 7.9.6. Other Materials
- 7.9.7. Quality control of materials

7.10. Connecting, operating and control elements
- 7.10.1. Types of joints and elements
- 7.10.2. Valves
- 7.10.3. Aeration valves or suction cups
- 7.10.4. Complementary elements

Module 8. Urban drainage and design

8.1. Sanitation Networks
- 8.1.1. Sanitation Network
- 8.1.2. Typologies of sewerage networks
- 8.1.3. Network layout

8.2. Network Elements
- 8.2.1. Pipelines
- 8.2.2. Manholes
- 8.2.3. Connections
- 8.2.4. Surface catchment elements
- 8.2.5. Spillways

8.3. Materials in sewerage networks
- 8.3.1. Selection Criteria
- 8.3.2. Concrete pipes
- 8.3.3. Pipes
- 8.3.4. Fiberglass reinforced polyester pipes

8.4. Geotechnics in the hydraulic works of sanitation
- 8.4.1. Phases of a reconnaissance campaign
- 8.4.2. Most common tests
- 8.4.3. Calculation and stability parameters in trenches for sewerage collectors

8.5. Sizing criteria
- 8.5.1. Design Criteria
- 8.5.2. Main factors in the design
- 8.5.3. Design parameters and variables

8.6. Dimensioning of sewerage networks
- 8.6.1. Urban hydrology
- 8.6.2. Fundamental Equations
- 8.6.3. Performance criteria

8.7. Simulation of sewage networks in SWWM
- 8.7.1. Network Elements
- 8.7.2. Contribution basin
- 8.7.3. Design rainfall
- 8.7.4. Hydraulic profile of conduits
- 8.7.5. Results

8.8. Retention tanks
- 8.8.1. Planning and location
- 8.8.2. Cleaning systems
- 8.8.3. Auxiliary Elements

8.9. Modeling of sewage networks in Civil 3D
- 8.9.1. Workflow in Civil 3D
- 8.9.2. Networks Creation Tools
- 8.9.3. Network creation

8.10. Network Analysis with Storm and Sanitary Analysis (SSA)
- 8.10.1. Network export from Civil 3D to SSA
- 8.10.2. Hydraulic-hydrologic modeling of the network
- 8.10.3. Hydraulic calculations
- 8.10.4. Results Obtained

Module 9. Sustainable Urban Drainage System Design

9.1. Sustainable Urban Drainage System Design
- 9.1.1. Floor Sealing
- 9.1.2. Climate Change
- 9.1.3. Sustainable Drainage System

9.2. Sustainable Urban Drainage System Types(SUDS)
- 9.2.1. Transport
- 9.2.2. Filtration and Infiltration
- 9.2.3. Retention and Reuse

9.3. Intervention Conditions and Levels
- 9.3.1. Factors Intrinsic to the Receiving Environment
- 9.3.2. Physical Factors
- 9.3.3. Factors Related to Land Use
- 9.3.4. Socio-environmental Factors
- 9.3.5. Capacity to Manage Urban Runoff Waters
- 9.3.6. Sustainable Urban Drainage System Choice(SUDS)

9.4. Pillars in the design of SUDS
- 9.4.1. Water Quantity
- 9.4.2. Water Quality
- 9.4.3. Others
- 9.4.4. Typologies in Relation to their Main Functions

9.5. Sustainable Urban Drainage Systems (SUDS) of detention and retention
- 9.5.1. Detention and Infiltration basins
- 9.5.2. Vegetable Covers
- 9.5.3. Cisterns or Rainwater Reservoirs

9.6. Sustainable Urban Drainage Systems (SUDS) of Filtration
- 9.6.1. Filter Strips
- 9.6.2. Drainage Ditches
- 9.6.3. Sand Filters
- 9.6.4. Permeable Pavements

9.7. Sustainable Urban Drainage Systems (SUDS) of Infiltration
 9.7.1. Structural Cork Oaks
 9.7.2. Gardens Rain meadows
 9.7.3. Wells and Infiltration Ditches
 9.7.4. Reticulated Reservoirs
9.8. Sustainable Urban Drainage Systems (SUDS) of Treatment
 9.8.1. Floodable Flowerbeds
 9.8.2. Vegetated Swales
 9.8.3. Artificial Wetlands and Ponds
9.9. Civil 3D Model of Parametric Infiltration Sections
 9.9.1. Catalog of Parametric Sections
 9.9.2. Bioretention
 9.9.3. Rain Garden
 9.9.4. Permeable Sidewalk
 9.9.5. Permeable Pavements
 9.9.6. Others
9.10. Sustainable Urban Drainage System Modeling(SUDS) in Civil 3D
 9.10.1. BIM modeling of SUDS in Civil 3D
 9.10.2. Assembly Creation
 9.10.3. Creation of the Linear Work

Module 10. Debugging. Elements and design

10.1. Wastewater
 10.1.1. Domestic Water
 10.1.2. Industrial Water
 10.1.3. Specific Pollutants
10.2. Purification Processes
 10.2.1. Physical Processes
 10.2.2. Physicochemical Processes
 10.2.3. Biological Processes
10.3. Selection Criteria According to the Quality of the Discharge
 10.3.1. Water Uses
 10.3.2. Performance of the Purification Processes
 10.3.3. Implementation Considerations
10.4. Pre-treatment
 10.4.1. Components
 10.4.2. Design Parameters
 10.4.3. Performance
10.5. Primary Treatment
 10.5.1. Components
 10.5.2. Design Parameters
 10.5.3. Performance
10.6. Secondary Treatment
 10.6.1. Biological Purification
 10.6.2. Components
 10.6.3. Design Parameters
 10.6.4. Performance
10.7. Tertiary Treatment
 10.7.1. Components
 10.7.2. Design Parameters
 10.7.3. Performance
10.8. Sludge: Production, Treatment and Uses
 10.8.1. Sludge Production and Treatment Systems
 10.8.2. Design Parameters
 10.8.3. Performance
10.9. Auxiliary Systems and Current Trends
 10.9.1. Instrumentation and Control in a WWTP
 10.9.2. Deodorization
 10.9.3. Cogeneration
10.10. Modeling of a WWTP
 10.10.1. BIM modeling of a WWTP
 10.10.2. Uses of Biogas from Biological Processes in WWTPs
 10.10.3. Uses of Sludge

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

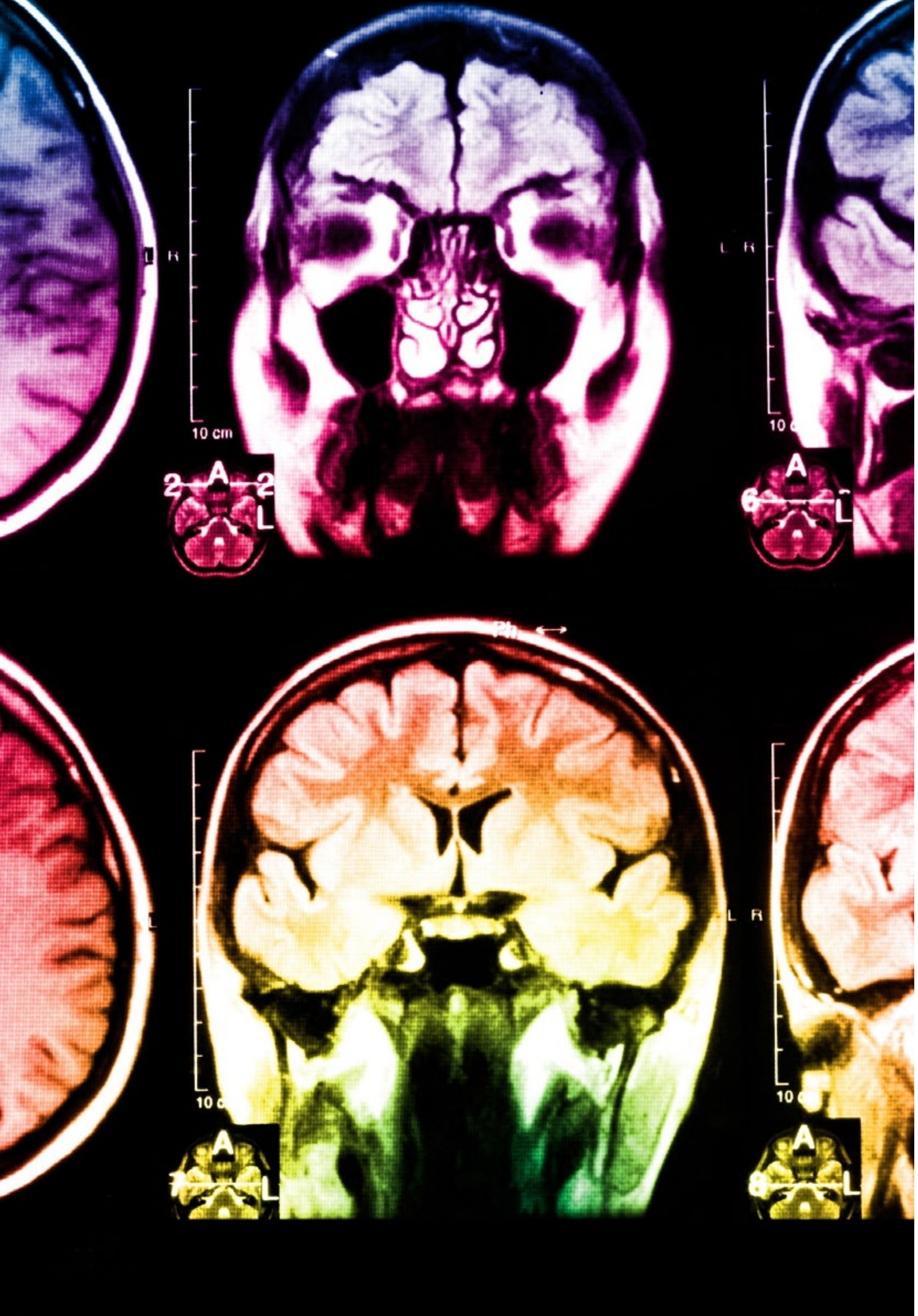
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

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.

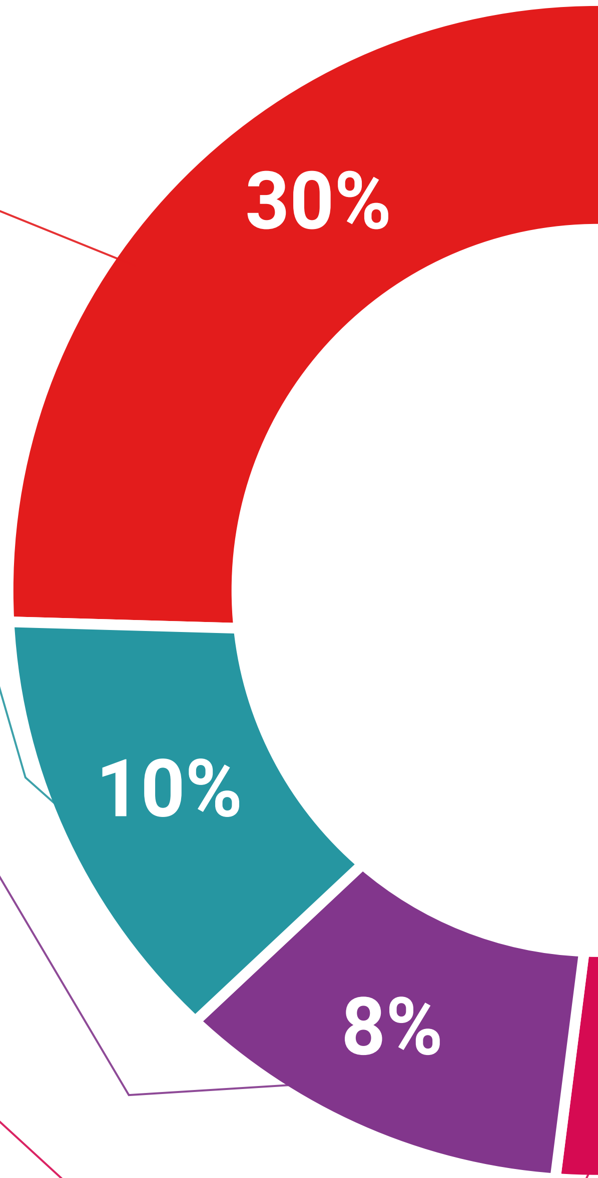
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

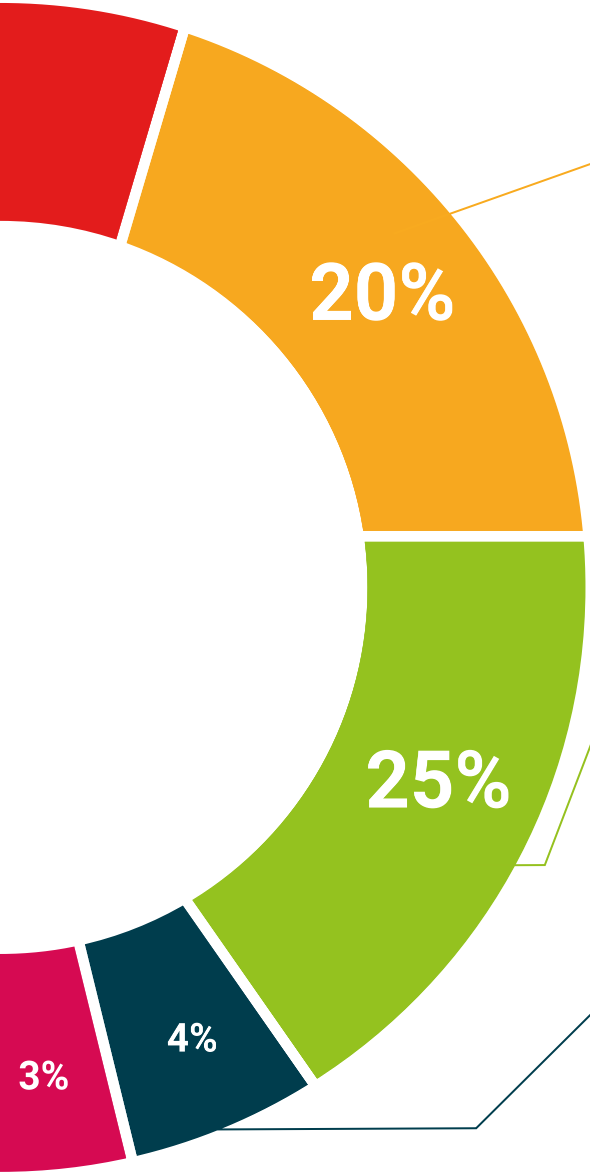
Practising Skills and Abilities

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 Professional Master’s Degree in Hydraulic Works Infrastructure guarantees students, in addition to the most rigorous and up-to-date education, access to a Professional Master's Degree diploma issued by TECH Technological University.

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

This **Professional Master's Degree in Hydraulic Works Infrastructure** contains the most complete and up-to-date program on the market.

After the student has passed the assessments, they will receive their corresponding **Professional 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 Professional Master's Degree, and meets the requirements commonly demanded by labor exchanges, competitive examinations, and professional career evaluation committees.

Title: **Professional Master's Degree in Hydraulic Works Infrastructure**

Official Nº of hours: **1,500 h.**


tech technological university

Awards the following

CERTIFICATE

to

Mr./Ms. _________________, with identification number _____________.

For having successfully passed and accredited the following program

PROFESSIONAL MASTER'S DEGREE

in

Hydraulic Works Infrastructure

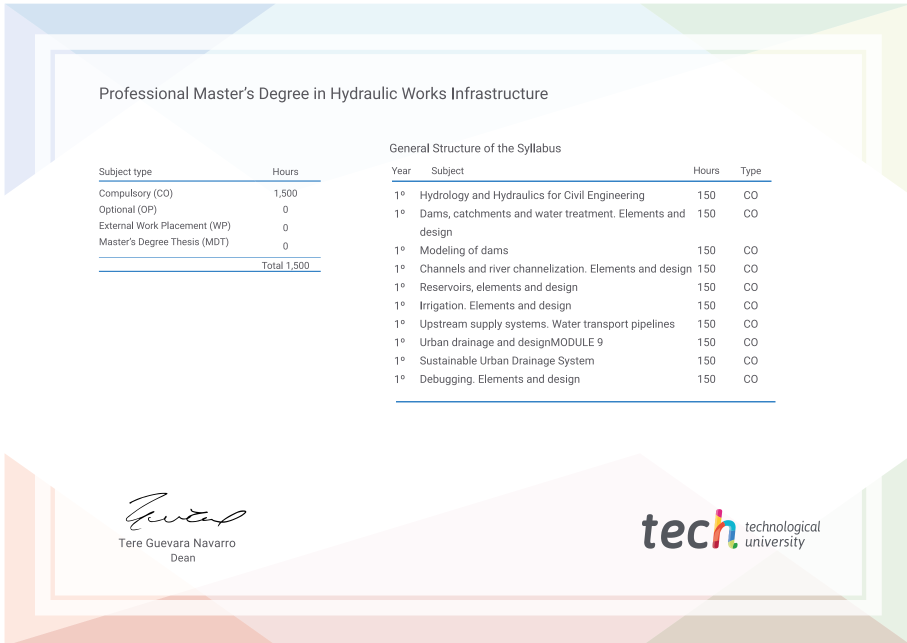
This is a qualification awarded by this University, equivalent to 1,500 hours, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

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


Professional Master's Degree in Hydraulic Works Infrastructure

Subject type	Hours
Compulsory (CO)	1,500
Optional (OP)	0
External Work Placement (WP)	0
Master's Degree Thesis (MDT)	0
	Total 1,500

General Structure of the Syllabus

Year	Subject	Hours	Type
1º	Hydrology and Hydraulics for Civil Engineering	150	CO
1º	Dams, catchments and water treatment. Elements and design	150	CO
1º	Modeling of dams	150	CO
1º	Channels and river channelization. Elements and design	150	CO
1º	Reservoirs, elements and design	150	CO
1º	Irrigation. Elements and design	150	CO
1º	Upstream supply systems. Water transport pipelines	150	CO
1º	Urban drainage and designMODULE 9	150	CO
1º	Sustainable Urban Drainage System	150	CO
1º	Debugging. Elements and design	150	CO

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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.

technological university

Professional Master's Degree
Hydraulic Works Infrastructure

- Modality: **online**
- Duration: **12 months**
- Certificate: **TECH Technological University**
- Dedication: **16h/week**
- Schedule: **at your own pace**
- Exams: **online**

Professional Master's Degree
Hydraulic Works Infrastructure

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