Master's Degree
Chemical Engineering

tech global university

global university

Master's Degree
Chemical Engineering

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

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

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01

Introduction

Artificial Intelligence, Blockchain and the Green Chemistry approach within the Industry have revolutionized projects in the sector. In this sense, both professionals and the scientific community seek to contribute innovation as well as sustainability, in order to use renewable materials, prevent pollution, and increase safety in the Chemical Industry. In view of this revolution, TECH has developed this 100% online program. It is an advanced program that will lead the professional to obtain a specialization in this field, to design processes that minimize the negative impact on the environment or to assume a leadership position in large companies. All this, thanks to a 12-month program of education and with the best multimedia tools.

This Master's Degree will lead you to specialize in Chemical Engineering oriented to sustainability and innovation in this sector"

The increased awareness of environmental protection has led chemical industry professionals to focus their efforts on "Green Chemistry", seeking efficiency in production, the use of renewable raw materials, pollution prevention, and the design of much safer products. In addition to this reality, the incorporation of new emerging technologies, favor process management with their tools, automation, the integration of robotization, or the exploration of nanotechnology.

In this sense, the Engineering professional is facing a promising landscape, which requires specialists who are up to date with the advances in this field. For this reason, TECH has designed this program of 1,500 teaching hours, developed by a multidisciplinary educational team.

In this way, the graduates enter a program that will lead them to obtain a very useful learning experience for their performance in large companies in the sector. All this, thanks to a deep knowledge of biomass utilization technology, L+O+I in Chemical Engineering, industrial safety, or the organization and management of companies in this field, among other aspects.

To this end, this educational institution provides high-quality teaching tools such as multimedia pills, detailed videos, case study simulations, and specialized readings. In addition, thanks to the Relearning method, which is based on the content reiteration, the graduate will be able to advance in a natural way through the syllabus and consolidate their learning in a simple way.

Undoubtedly, a unique opportunity to achieve an important progression in this sector, thanks to a university program that is distinguished by its flexible educational methodology. The student only needs an electronic device with an Internet connection to view the content at any time of the day.

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

- The development of practical cases presented by experts in Chemistry 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
- 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 Relearning method will allow you to obtain advanced learning in a natural way and without great effort. Enroll now"

You will be familiar with the main software for simulation and optimization of chemical processes"

Access high-quality multimedia teaching resources for this program, whenever and wherever you want.

You are in front of a program that dynamically addresses the impact of the 4.0 chemical industry, Blockchain, and Artificial Intelligence.

The program includes in its teaching staff professionals from the sector who bring to this program the experience of their work, as well as recognized specialists from leading societies 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 immersive education programmed to learn in real situations.

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

02

Objectives

At the end of the 12 months of this educational program, the student will have achieved advanced learning about the processes and tools most commonly used in the Chemical Industry. In this sense, the student will be up-to-date on innovation, the important role of bio-refinery, compliance with the SDGs, optimization of material resources, the responsible use of materials, and the analysis of the life cycle of products and the impact of new technologies on the development of the sector.

Delve from the comfort of your home into the most recent scientific studies on the various biomass conversion pathways and valorization routes"

General Objectives

- Analyze the principles and methods for the separation of substances in multicomponent systems
- Master advanced techniques and tools for the configuration of heat exchange networks
- Apply fundamental concepts in the design of chemical products and processes
- Integrate environmental considerations in the design of chemical processes
- Analyze optimization techniques and simulation of chemical processes
- Apply simulation techniques to common unit operations in the chemical industry
- Examine the multi-product industry and strategies for its optimization
- Raise awareness of the importance of sustainability in terms of economy, environment, and society
- Promote environmental management in the chemical industry
- Compile technological advances in Chemical Engineering
- Evaluate the applicability and potential advantages of new technologies
- Develop a comprehensive view of modern chemical engineering
- Contextualize the importance of biomass in the current framework of sustainable development
- Determine the importance of biomass as an energy resource
- Examine the current situation of L+O+I in Chemical Engineering in order to highlight its importance in the current sustainability framework
- Encourage innovation and creativity in the research processes in Chemical Engineering
- Analyze the ways of protection, exploitation, and communication of L+O+I results
- Explore job opportunities in L+O+I in Chemical Engineering
- Explore innovative applications of chemical reactors
- Promote the integration of theoretical and practical aspects of chemical reactor design

Specific Objectives

Module 1. Advanced Transfer Operations Design

- Analyze the fundamentals of ideal solutions and their deviations from ideality as applied to transfer operations
- Evaluate the effectiveness of supercritical fluids as solvents in transfer operations
- Delve into extraction techniques for the separation of multiphase systems
- Examine the mechanisms involved in the separation of substances by adsorption
- Develop a comprehensive approach to the design of membrane separation processes
- Substantiate the principles related to heat transfer in exchangers
- Propose configurational classifications of heat exchangers
- Determine the design of heat exchanger networks

Module 2. Advanced Chemical Reactor Design

- Apply mathematical models for the design of fixed-bed reactors with different technical specifications
- Analyze the effect of fluidization and the models that define it in fluidized bed reactors
- Design specific columns for fluid-fluid specifications
- Evaluate the influence of configuration on the design of electrochemical reactors
- Explore innovative applications in membrane reactors and photo-reactors
- Examine the different configurations for gasification reactors
- Optimize bioreactor design based on the mode of operation
- Selecting appropriate reactors for different polymerization processes

Module 3. Processes and Chemical Products Design
- Determine the importance of the steps involved in the design of chemical products
- Elaborate chemical process design diagrams
- Implement environmental remediation practices
- Explore the intensification of chemical processes
- Manage inventories and procurement

Module 4. Chemical Process Simulation and Optimization
- Establish the basis for the optimization of chemical processes
- Establish the Pinch method as a key tool for energy management
- Use optimization methods under uncertainty
- Examine chemical process simulation and optimization software
- Simulate essential separation operations in the chemical industry
- Perform simulations of heat exchange networks
- Expose the fundamental aspects of multi-product plants

Module 5. Sustainability and Quality Management in the Chemical Industry
- Examine international regulations and environmental management tools in the chemical industry
- Develop specialized knowledge on corporate carbon and environmental foot printing
- Assess the importance of the chemical life cycle
- Specify the quality guarantees for chemical products and processes
- Present integrated management systems

Module 6. Technological Advances in Chemical Engineering
- Analyze the relevant technologies in the treatment of industrial effluents
- Compile catalytic technologies applied to environmental processes of interest
- Explore those involved in the treatment of solid particulate materials
- Develop innovative chemical synthesis strategies
- Compile the latest advances in Biotechnology and Nanotechnology
- Analyze the importance of digitalization in the chemical industry
- Evaluate the impact of Blockchain and artificial intelligence on the chemical industry

Module 7. Biomass Utilization Technologies
- Examine the role of biomass in achieving sustainable development goals
- Detail the types of biomass and their composition
- Analyze the advantages of using biomass as an energy resource
- Inspect the different pathways of mechanical, biological, chemical, and thermochemical conversion of biomass
- Determine the importance of bio-refinery in the current framework of sustainability
- Examine biofuel generations and assess their feasibility
- Explore routes for biomass valorization
- Evaluate the integral valorization of waste biomass and its impact on the circular economy

Module 8. L+O+I Chemical Engineering

- Apply a rigorous scientific methodology in Chemical Engineering research
- Determine the importance of the creative process in L+O+I
- Compile strategies and types of innovation
- Review international financing options for L+O+I in Chemical Engineering
- Examine the protection of L+O+I results
- Effectively evaluate scientific communication and dissemination tools
- Analyze the potential of a research career in Chemical Engineering

Module 9. Industrial Safety in the Chemical Sector

- Provide a comprehensive understanding of industrial safety in the chemical sector
- Prepare emergency plans and accident investigations in the chemical industry
- Substantiate environmental protection measures based on the environmental risks of the chemical industry
- Determine the importance of industrial safety based on its historical evolution
- Promote safety culture in the industrial environment
- Use qualitative methods for risk analysis in the chemical industry
- Risk assessment in the chemical industry using quantitative methods of analysis
- Compile methods and equipment for worker protection
- Specify the classification of chemical products and their storage

Module 10. Organization and Management of Companies in the Chemical Sector

- Explore and analyze the different tools for the development of managerial and entrepreneurial skills
- Examine the main international agreements of the Chemical Industry
- Analyze strategies for motivating and training personnel in the Chemical Industry
- Assess efficient work organization methods
- Concrete effective teamwork techniques in the Chemical Industry
- Determine corporate social responsibility in the Chemical Industry
- Promote entrepreneurship in the chemical sector

The case studies will allow you to delve into the most effective accident investigation methodologies and integrate them into your professional performance"

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Competencies

The multidisciplinary nature of this university program will lead students to increase their leadership and entrepreneurial skills, work organization, and corporate responsibility within the Chemical Industry. For this purpose, TECH provides pedagogical tools that present a theoretical-practical approach such as case studies, in addition to a syllabus based on the professional experience of the teaching team that conforms it. In this way, the graduates will boost their professional aspirations within the sector.

Increase your skills to find solutions in the Chemical Industry from renewable resources such as biomass"

General Skills

- Develop competencies in modeling and design of chemical reactors
- Present economic analyses that support the feasibility of chemical projects
- Design and optimize multi-product plants
- Promote the adoption of innovative technologies
- Apply quality principles in the Chemical Industry
- Analyze biomass conversion pathways and the application of biomass-derived products
- Project the design of a bio-refinery
- Analyze environmental risks and protective measures
- Develop skills in business organization in the Chemical Industry
- Explore financial decisions and their impact on the industry

Acquire the skills you need to lead companies in the chemical sector"

Specific Skills

- Design and optimize transfer operations in Chemical Engineering
- Evaluate the economic feasibility of chemical projects
- Identify strategies useful in the design and manufacture of chemical products
- Apply quality strategies in the chemical industry
- Promote integrated waste management in the chemical industry
- Implement strategies for transferring results and technology
- Manage specific tools for the search and promotion of L+O+I results
- Apply qualitative and quantitative methods for risk analysis in the Chemical Industry
- Develop emergency plans and accident investigations in the Chemical Industry
- Present relevant international agreements in the chemical sector

04

Course Management

Students who access this university program will have at their disposal a program planned and developed by an excellent management and faculty made up of chemical engineers with experience in the sector and professionals in the legal field. Their experience in companies in the industry, as well as in the education and research fields are a great support for the graduate who seeks to obtain the most rigorous and accurate information from the hand of real experts on the novelties surrounding the current Chemical Engineering.

Enroll now in a university program in which engineers with extensive experience in chemical engineering companies and educational research participate"

Management

Dr. Barroso Martín, Isabel

- Expert in Inorganic Chemistry, Crystallography and Mineralogy
- Postdoctoral researcher of the I Own Research and Transfer Plan of the University of Málaga
- Research Staff at the University of Málaga
- ORACLE Programmer in CMV Consultants Accenture
- PhD in Sciences from the University of Málaga
- Master's Degree in Applied Chemistry - specialization in materials characterization - from the University of Málaga
- Master's Degree in SE, High School, Vocational Training, and Language Teaching - specializing in Physics and Chemistry University of Malaga

Professors

Dr. Torres Liñán, Javier

- Expert in Chemical Engineering and Associated technologies
- Specialist in Environmental Chemical Technology
- Collaborator of the the Chemical Engineering Department of the University of Málaga
- PhD from the University of Málaga in the PhD program of Chemistry and Chemical Technologies, Materials, and Nanotechnology
- Master's Degree in ESO, High School, Form. Prof. and Language Teaching. Esp. Physics and Chemistry from the University of Málaga
- Master's Degree in Chemical Engineering from the University of Málaga

D. Barroso Martín, Santiago

- Legal Advisor in Paralegal at Vicox Legal
- Legal Content Editor at Engineering and Advanced Integration S.A. / BABEL
- Administrative Lawyer at the Illustrious College of Lawyers of Málaga
- Paralegal Advisor at Garcia de la Vega Attorneys
- Law Degree from the University of Málaga
- Master's Degree in Corporate Legal Consultancy (MAJE) from the University of Málaga
- Expert Master's Degree in Labor, Tax and Accounting Consulting by Help T Pyme

Dr. Jiménez Gómez, Carmen Pilar

- Technical support staff at the Central Research Services of the University of Málaga
- Laboratory technician assistant at Acerinox
- Laboratory technician in Axaragua
- Predoctoral fellow at the Department of Inorganic Chemistry, Crystallography, and Mineralogy of the University of Málaga
- PhD in Chemical Sciences from the University of Málaga
- Chemical Engineer from the University of Málaga
- Direction of Final Degree Project in Chemical Engineering (2016)
- Teaching collaborator in different degrees: Chemical Engineering, Energy Engineering, and Industrial Organization Engineering at the University of Málaga

Dr. Montaña, Maia

- Postdoctoral Researcher at the Department of Chemical, Energetic, and Mechanical Technology of the Rey Juan Carlos University
- Interim Assistant at the Department of Chemical Engineering, School of Engineering, La Plata National University
- Collaborating teacher in the course "Introduction to Chemical Engineering"
- Teaching tutor at the La Plata National University
- PhD in Chemistry from the La Plata National University
- Graduate in Chemical Engineering from the La Plata National University

05
Structure and Content

The syllabus of this Master's Degree is structured into 10 modules that will allow the engineering professional to obtain complete learning about Chemical Engineering. To this end, it will delve into the advanced design of Transfer Operations and chemical reactors and their simulation and optimization, industrial safety, emerging technologies, sustainability, and the design of projects in this sector with all the guarantees of success. For this purpose, it has a syllabus created by leading experts and a large amount of didactic material, housed in an extensive Virtual Library.

A syllabus with a theoretical-practical perspective that will lead you to specialize in innovation and emerging technologies in the Chemical Industry"

Module 1. Advanced Transfer Operations Design

1.1. Vapor-Liquid Equilibrium in Multicomponent Systems
- 1.1.1. Ideal Solutions
- 1.1.2. Vapor-liquid Diagrams
- 1.1.3. Deviations from Ideality: Activity Coefficients
- 1.1.4. Azeotropes

1.2. Rectification of Multicomponent Mixtures
- 1.2.1. Differential or Flash Distillation
- 1.2.2. Rectification Columns
- 1.2.3. Energy Balances in Condensers and Boilers
- 1.2.4. Calculation of the Number of Plates
- 1.2.5. Plate Efficiency and Overall Efficiency
- 1.2.6. Discontinuous Rectification

1.3. Supercritical Fluids
- 1.3.1. Use of Supercritical Fluids as Solvents
- 1.3.2. Elements of Supercritical Fluid Systems
- 1.3.3. Applications of Supercritical Fluids

1.4. Extraction
- 1.4.1. Liquid-Liquid Extraction
- 1.4.2. Extraction in Plate Columns
- 1.4.3. Leaching
- 1.4.4. Drying
- 1.4.5. Crystallization

1.5. Solid Phase Extraction
- 1.5.1. The PSE Process
- 1.5.2. Addition of Modifiers
- 1.5.3. Applications in the Extraction of High Value-Added Compounds

1.6. Adsorption
- 1.6.1. Adsorbate-Adsorbent Interaction
- 1.6.2. Adsorption Separation Mechanisms
- 1.6.3. Adsorption Equilibrium
- 1.6.4. Contact Methods
- 1.6.5. Commercial Adsorbents and Applications

1.7. Membrane Separation Processes
- 1.7.1. Membrane Types
- 1.7.2. Membrane Regeneration
- 1.7.3. Ion Exchange

1.8. Heat Transfer in Complex Systems
- 1.8.1. Molecular Energy Transport in Multicomponent Mixtures
- 1.8.2. Equation of Conservation of Energy Thermal
- 1.8.3. Turbulent Energy Transport
- 1.8.4. Temperature-Enthalpy Diagrams

1.9. Heat Exchangers
- 1.9.1. Classification of Heat Exchangers According to Flow Direction
- 1.9.2. Classification of Heat Exchangers According to Structure
- 1.9.3. Exchanger Applications in Industry

1.10. Heat Exchanger Networks
- 1.10.1. Sequential Synthesis of an Exchanger Network
- 1.10.2. Simultaneous Synthesis of an Exchanger Network
- 1.10.3. Application of the Pinch Method to Heat Exchanger Networks

Module 2. Advanced Chemical Reactor Design

2.1. Reactor Design
- 2.1.1. Kinetics of Chemical Reactions
- 2.1.2. Reactor Design
- 2.1.3. Simple Reaction Design
- 2.1.4. Multiple Reaction Design

2.2. Fixed Bed Catalytic Reactors
- 2.2.1. Mathematical Models for Fixed-Bed Reactors
- 2.2.2. Fixed Bed Catalytic Reactor
- 2.2.3. Adiabatic Reactor with and without Recirculation
- 2.2.4. Non Adiabatic Reactors

2.3. Fluidized-Bed Catalytic Reactors
- 2.3.1. Gas-Solid Systems
- 2.3.2. Fluidization Regions
- 2.3.3. Fluidized Bed Bubble Models
- 2.3.4. Reactor Models for Fine and Large Particles

2.4. Fluid-Fluid Reactors and Multiphase Reactors
- 2.4.1. Design of Infill Columns
- 2.4.2. Design of Gushing Columns
- 2.4.3. Multiphase Reactor Applications

2.5. Electrochemical Reactors
- 2.5.1. Over-potential and Electrochemical Reaction Rate
- 2.5.2. Influence on the Geometry of Electrodes
- 2.5.3. Modular Reactors
- 2.5.4. Model of Electrochemical Reactor Piston Flow
- 2.5.5. Model of Electrochemical Reactor Perfect Mixing

2.6. Membrane Reactors
- 2.6.1. Membrane Reactors
  - 2.6.1.1. According to Membrane Position and Reactor Configuration
- 2.6.2. Membrane Reactors Applications
- 2.6.3. Design of Membrane Reactors for the Production of Hydrogen
- 2.6.4. Membrane Bioreactors

2.7. Photo-reactors
- 2.7.1. The Photo-reactors
- 2.7.2. Photo-reactor Applications
- 2.7.3. Photo-reactor Design for Pollutant Removal

2.8. Gasification and Combustion Reactors
- 2.8.1. Design of Fixed Bed Gasifiers
- 2.8.2. Design of Fluidized Bed Gasifiers
- 2.8.3. Drag-Flow Gasifiers

2.9. Bioreactors
- 2.9.1. Bioreactors by Mode of Operation
- 2.9.2. Design of a Batch Bioreactor
- 2.9.3. Design of a Continuous Bioreactor
- 2.9.4. Design of a Semi-continuous Bioreactor

2.10. Polymerization Reactors
- 2.10.1. Polymerization Process
- 2.10.2. Anionic Polymerization Reactors
- 2.10.3. Staged Polymerization Reactors
- 2.10.4. Free Radical Polymerization Reactors

Module 3. Processes and Chemical Products Design

3.1. Chemical Products Design
- 3.1.1. Chemical Products Design
- 3.1.2. Stages in Product Design
- 3.1.3. Chemical Products Categories

3.2. Strategies in Chemical Products Design
- 3.2.1. Detection of Market Needs
- 3.2.2. Conversion of Requirements into Product Specifications
- 3.2.3. Sources of Idea Production
- 3.2.4. Strategies for the Idea Screening
- 3.2.5. Variables Influencing Idea Selection

3.3. Strategies in Chemical Products Manufacturing
- 3.3.1. Prototypes in Chemical Products Manufacturing
- 3.3.2. Chemical Products Manufacture
- 3.3.3. Specific Design of Basic Chemicals
- 3.3.4. Scaling

3.4. Process Design
- 3.4.1. Flowsheeting for Process Design
- 3.4.2. Process Understanding Diagrams
- 3.4.3. Heuristic Rules in the Design of Chemical Processes
- 3.4.4. Flexibility of Chemical Processes
- 3.4.5. Problem Solving Associated with Process Design

3.5. Integrated Environmental Remediation in Chemical Processes
- 3.5.1. Integration of the Environmental Variable in Process Engineering
- 3.5.2. Recirculation Flows in the Process Plant
- 3.5.3. Treatment of Effluents Produced in the Process
- 3.5.4. Minimization of Discharges from Process Plant Activities

3.6. Process Intensification
- 3.6.1. Intensification Applied to Chemical Processes
- 3.6.2. Intensification Methodologies
- 3.6.3. Intensification in Reaction and Separation Systems
- 3.6.4. Process Intensification Applications: Highly Efficient Equipment

3.7. Stock Management
- 3.7.1. Inventory Management
- 3.7.2. Selection Criteria
- 3.7.3. Inventory Sheets
- 3.7.4. Procurement

3.8. Processes and Chemical Products Economic Analysis
- 3.8.1. Fixed and Working Capital
- 3.8.2. Capital and Manufacturing Cost Estimation
- 3.8.3. Equipment Cost Estimate
- 3.8.4. Estimation of Labor and Raw Material Costs

3.9. Profitability Estimation
- 3.9.1. Global Investment Estimation Methods
- 3.9.2. Detailed Investment Estimation Methods
- 3.9.3. Chemical Investment Selection Criteria
- 3.9.4. The Time Factor in Cost Estimation

3.10. Application in the Chemistry Industry
- 3.10.1. Glass Industry
- 3.10.2. Cement Industry
- 3.10.3. Ceramic Industry

Module 4. Chemical Process Simulation and Optimization

4.1. Optimization of Chemical Processes
- 4.1.1. Heuristic Rules in Optimization of Processes
- 4.1.2. Determination of Degrees of Freedom
- 4.1.3. Selection of Design Variables

4.2. Energy Optimization
- 4.2.1. Pinch Method Advantages
- 4.2.2. Thermodynamic Effects Influencing Optimization
- 4.2.3. Cascade Diagrams
- 4.2.4. Enthalpy-Temperature Diagrams
- 4.2.5. Corollaries of the Pinch Method

4.3. Optimization Under Uncertainty
- 4.3.1. Lineal Programming (LP)
- 4.3.2. Graphical Methods and Simplex Algorithm in LP
- 4.3.3. Non-Lineal Programming
- 4.3.4. Numerical Methods for the Optimization of Nonlinear Problems

4.4. Simulation of Chemical Processes
- 4.4.1. Simulated Process Design
- 4.4.2. Property Estimation
- 4.4.3. Thermodynamic Packages

4.5. Software for Chemical Process Simulation and Optimization
- 4.5.1. Aspen plus and Aspen hysys
- 4.5.2. Unisim
- 4.5.3. Matlab
- 4.5.4. COMSOL

4.6. Simulation of Separation Operations
- 4.6.1. Marginal Steam Flow Rate Method for Rectification Columns
- 4.6.2. Rectifying Columns with Thermal Coupling
- 4.6.3. Empirical Method for the Design of Multicomponent Columns
- 4.6.4. Calculation of the Number Minimally of Plates

4.7. Heat Exchanger Simulation
- 4.7.1. Simulation of a Shell and Tube Heat Exchanger
- 4.7.2. Heads on Heat Exchangers
- 4.7.3. Configurations and Variables to be Defined in Heat Exchanger Design

4.8. Reactor Simulation
- 4.8.1. Ideal Reactor Simulation
- 4.8.2. Multiple Reactor Systems Simulation
- 4.8.3. Reacting or Equilibrium Reactor Simulation

4.9. Multi-Product Plants Design
- 4.9.1. Multi-Product Plant
- 4.9.2. Multi-Product Plants Advantages
- 4.9.3. Multi-Product Plants Design

4.10. Multi-Product Plants Optimization
  4.10.1. Factors Affecting Optimization Efficiency
  4.10.2. Factorial Design Applied to Multiproduct Plants
  4.10.3. Optimization of Equipment Size
  4.10.4. Remodeling of Existing Plants

Module 5. Sustainability and Quality Management in the Chemical Industry

5.1. Environmental Management Systems
  5.1.1. Environmental Management
  5.1.2. Environmental Impact Assessment
  5.1.3. ISO 14001 Standard and Continuous Improvement
  5.1.4. Environmental Auditing
5.2. Carbon and Environmental Footprint
  5.2.1. Corporate Sustainability
  5.2.2. Corporate Carbon and Environmental Footprint
  5.2.3. Carbon Footprint Calculation of an Organization
  5.2.4. Application of the Corporate Environmental Footprint
5.3. Sustainable Water Management in Industry
  5.3.1. Planning the Sustainable Use of Water Resources through Hydrological Modeling
  5.3.2. Responsible Use of Water in Industrial Chemical Processes
  5.3.3. Use of Nature-Based Solutions in Industry
5.4. Life Cycle Analysis
  5.4.1. Sustainable Industrial Production
  5.4.2. Product Life Cycle Components
  5.4.3. Phases of the Life Cycle Analysis Methodology
  5.4.4. ISO 14040 Standard for Product Life Cycle Assessment
5.5. Quality Management Systems
  5.5.1. Quality Principles and Evolution
  5.5.2. Quality Control and Assurance
  5.5.3. ISO 9001
5.6. Process Quality Assurance
  5.6.1. Quality Management Systems and Its Processes
  5.6.2. Steps in the Quality Assurance Process
  5.6.3. Standardized Processes
5.7. Quality Assurance of the Final Product
  5.7.1. Standardization
  5.7.2. Equipment Calibration and Maintenance
  5.7.3. Product Approvals and Certifications
5.8. Implantation of Integrated Management System
  5.8.1. Integrated Management System
  5.8.2. Implantation of Integrated Management System
  5.8.3. GAP Analysis
5.9. Change Management in the Chemical Industry
  5.9.1. Change Management in the Industry
  5.9.2. Industry of Chemical Processes
  5.9.3. Change Planning
5.10. Sustainability and Minimization: Integrated Waste Management
  5.10.1. Minimization of Industrial Waste
  5.10.2. Stages in the Minimization of Industrial Waste
  5.10.3. Recycling and Treatment of Industrial Waste

Module 6. Technological Advances in Chemical Engineering

6.1. Green Technologies and Processes in the Chemical Industry
  6.1.1. Green Chemistry
  6.1.2. Industrial Liquid Effluent Treatment Technologies
  6.1.3. Industrial Gaseous Effluent Treatment Technologies
  6.1.4. Contaminated Soil Rehabilitation
6.2. Catalytic Technology for Environmental Processes
  6.2.1. Emerging Technologies in Automotive Catalysts
  6.2.2. Water Remediation Using Photo-catalysts
  6.2.3. Technologies of Production and Purification of Hydrogen

6.3. Particle Technology
- 6.3.1. Particle Characterization
- 6.3.2. Solids Disintegration
- 6.3.3. Solids Storage
- 6.3.4. Solids Transportation
- 6.3.5. Solids Drying Technology

6.4. Innovative Chemical Synthesis Technologies
- 6.4.1. Microwave-Assisted Synthesis
- 6.4.2. Photo-response-Assisted Synthesis
- 6.4.3. Synthesis by Electrochemical Technology
- 6.4.4. Bio-catalytic Technology for Ester Synthesis

6.5. Advances in Biotechnology
- 6.5.1. Microbial Biotechnology
- 6.5.2. Obtaining Bio-products
- 6.5.3. Biosensors
- 6.5.4. Biomaterials
- 6.5.5. Biotechnology and Food Safety

6.6. Advances in Nanotechnology
- 6.6.1. Types and Nanoparticles Properties
- 6.6.2. Inorganic Nanomaterials
- 6.6.3. Carbon-Based Nanomaterials
- 6.6.4. Nanocompounds
- 6.6.5. Applications of Nanotechnology in the Chemical Industry

6.7. Digitization Technologies in the Chemical Industry
- 6.7.1. Chemical Industry 4.0
- 6.7.2. Impact of Chemical Industry 4.0 on Processes and Systems
- 6.7.3. Agile and Scrum Methodologies in the Chemical Industry

6.8. Process Robotization
- 6.8.1. Automation in the Chemical Industry
- 6.8.2. Collaborative Robots and Technical Specifications
- 6.8.3. Industrial Applications
- 6.8.4. Use of Industrial Robots
- 6.8.5. Integration of Industrial Robots

6.9. Blockchain in Chemical Engineering
- 6.9.1. Blockchain for Sustainable Management of Chemical Processes
- 6.9.2. Blockchain in Supply Chain Transparency
- 6.9.3. Improving Security with Blockchain
- 6.9.4. Chemical Traceability with Blockchain

6.10. Artificial Intelligence in Chemical Engineering
- 6.10.1. Application of Artificial Intelligence in the Industry 4.0
- 6.10.2. Modeling of Chemical Processes with Artificial Intelligence
- 6.10.3. Artificial Chemical Technology

Module 7. Biomass Utilization Technologies

7.1. 2030 Agenda for Sustainable Development
- 7.1.1. International Energy Agency's Sustainable Development Scenario
- 7.1.2. Sustainable Development Goals of the 2030 Agenda
- 7.1.3. Contribution of the Biomass Sector to the Achievement of the SDGs

7.2. Biomass Uses for Energy Purposes
- 7.2.1. Biomass Manipulation
- 7.2.2. Biomass Storage
- 7.2.3. Use of Biomass for Energy Purposes

7.3. Mechanical Conversion of Biomass
- 7.3.1. Pelletized
- 7.3.2. Extrusion
- 7.3.3. Extraction and Pressing
- 7.3.4. Composites

7.4. Biological Conversion of Biomass
- 7.4.1. Biomass Composting
- 7.4.2. Anaerobic Digestion of Biomass
- 7.4.3. Biomass Hydrolysis

7.5. Chemical Conversion of Biomass
- 7.5.1. Transesterification
- 7.5.2. Solvolysis
- 7.5.3. Application of Chemical Conversion of Biomass: the Paper Industry

7.6. Thermo-chemicals Conversion of Biomass
- 7.6.1. Combustion
- 7.6.2. Pyrolysis
- 7.6.3. Gasification

7.7. The Bio-refinery Conceptual Design
- 7.7.1. The Bio-refinery
- 7.7.2. Conceptual Design of a Bio-refinery
- 7.7.3. Current Bio-refinery Challenges

7.8. Biofuels
- 7.8.1. Biofuel Generations
- 7.8.2. Liquid Biofuels
- 7.8.3. Bio-carburants

7.9. Valorization Routes: Obtainment of Platform Molecules
- 7.9.1. Routes for Biomass Valorization
- 7.9.2. Furfural as a Platform Molecule
- 7.9.3. Lignin Derivatives as Precursors of Resins
- 7.9.4. Biopolymers

7.10. Integral Valorization of Residual Biomass
- 7.10.1. Valorization of Animal Residual Biomass
- 7.10.2. Fractionation of Algal Biomass
- 7.10.3. Valorization of By-Products from the Food Industry

Module 8. L+O+I Chemical Engineering

8.1. L+O+I Chemical Engineering
- 8.1.1. Scientific Methodology Applied to Investigation
- 8.1.2. Factorial Design of Experiments
- 8.1.3. Empirical Modeling
- 8.1.4. Scientific Writing Strategies

8.2. Technological Innovation Strategies in the Chemical Industry: Innovation and Creativity
- 8.2.1. Innovation in the Chemical Industry
- 8.2.2. Creative Process
- 8.2.3. Creativity Facilitating Techniques

8.3. Innovation in Chemical Engineering
- 8.3.1. Taxonomy of Innovation
- 8.3.2. Types of Innovation
- 8.3.3. Dissemination of Innovation
- 8.3.4. ISO 56000 Standard / ISO 166000 Terminology

8.4. Marketing of Innovation
- 8.4.1. Differentiation and Positioning Strategies in Chemical Engineering
- 8.4.2. Communication Management in Innovative Chemical Engineering
- 8.4.3. Ethics in Chemical Engineering Innovation Marketing

8.5. Databases and Bibliographic Management Software
- 8.5.1. Scopus
- 8.5.2. Web of Science
- 8.5.3. Scholar Google
- 8.5.4. Bibliographic Management with Mendeley
- 8.5.5. Bibliographic Management with EndNote
- 8.5.6. Bibliographic Management with Zotero
- 8.5.7. Patent Search in Databases

8.6. International Research Funding Programs
- 8.6.1. Application for L+O+I projects
- 8.6.2. Marie-Curie Research Fellowship Program
- 8.6.3. International Research Funding Collaborations

8.7. Management of the Protection and Exploitation of L+O+I Results
- 8.7.1. Intellectual Property
- 8.7.2. Patents
- 8.7.3. Industrial Property

8.8. Tools for the Communication of L+O+I Results
- 8.8.1. Scientific Events
- 8.8.2. Scientific Articles and Reviews
- 8.8.3. Scientific Dissemination

8.9. Research Career in Chemical Engineering
- 8.9.1. The Researcher in Chemical Engineering Professional Background and Education
- 8.9.2. Chemical Engineering Advances
- 8.9.3. Responsibility and Ethic in a Research Career in Chemical Engineering

8.10. Transfer of Results and Technology between Research Centers and Companies
- 8.10.1. Interaction of Participants and Dynamics of Technology Transfer
- 8.10.2. Technology Monitoring
- 8.10.3. University-Business Projects
- 8.10.4. Spin-off Companies

Module 9. Industrial Safety in the Chemical Sector

9.1. Safety in the Chemical Industry
- 9.1.1. Safety in the Chemical Industry
- 9.1.2. Accidents in the Chemical Industry
- 9.1.3. International Safety Regulations in the Chemical Industry
- 9.1.4. Safety Culture in the Industry

9.2. Risk Prevention in Process Plants
- 9.2.1. Inherent Safety Design to Minimize Risk
- 9.2.2. Use of Safety Barriers and Control Systems
- 9.2.3. Maintenance of Safety Systems in the Life Cycle of the Chemical Plant

9.3. Structured Hazard Identification Methods
- 9.3.1. HAZOP Hazard and Operability Analysis
- 9.3.2. LOPA Risk and Operability Analysis with Layers of Protection
- 9.3.3. Comparison and Combination of Structured Methods

9.4. Quantitative Methods of Hazard Analysis
- 9.4.1. Diagrams of Events
- 9.4.2. Diagrams of Failures
- 9.4.3. Consequence Analysis and Risk Estimation

9.5. Workers Safety in the Chemical Industry
- 9.5.1. Safety in the Workplace
- 9.5.2. Protective Measures in the Handling of Chemical Products
- 9.5.3. Worker Safety Training and Coaching

9.6. Use of Chemical Products
- 9.6.1. Incompatibilities in Chemical Products Storage
- 9.6.2. Handling of Chemical Substances
- 9.6.3. Safety in the Use of Hazardous Chemicals

9.7. Emergency Strategies
- 9.7.1. Integral Emergency Planning in the Chemical Industry
- 9.7.2. Development of Emergency Scenarios
- 9.7.3. Development of Emergency Plan Simulations
- 9.7.4. Crisis Management and Continuity

9.8. Environmental Risks in Chemical Industry
- 9.8.1. Air Pollution Sources and Air Pollutant Dispersion Mechanisms
- 9.8.2. Sources of Soil Contamination and Their Impact on Biodiversity
- 9.8.3. Sources of Water Resources Contamination and Their Impact on Water Availability

9.9. Environmental Protection Measures
- 9.9.1. Air Pollution Control
- 9.9.2. Soil Contamination Control
- 9.9.3. Water Resources Contamination Control

9.10. Investigating Accidents
- 9.10.1. Accident Investigation Methodologies
- 9.10.2. Stages in Accidents Investigation
- 9.10.3. Human and Organizational Error Analysis
- 9.10.4. Communication and Continuous Improvement

Module 10. Organization and Management of Companies in the Chemical Sector

10.1. RRHH Management in the Chemical Sector
- 10.1.1. Human Resources
  - 10.1.1.1. Formation and Motivation of the Human Team in the Chemical Sector
- 10.1.2. Job Analysis: Group Organization
- 10.1.3. Payroll and Incentives

10.2. Organization of Work in the Chemical Sector
- 10.2.1. Work Planning: Taylor's Organizational Theory
- 10.2.2. Personal Recruitment in the Chemical Sector
- 10.2.3. Organization of the Work Team
- 10.2.4. Teamwork Techniques

10.3. Organization of the Company
- 10.3.1. Elements in the Organization of the Company
- 10.3.2. Organizational Structure in the Chemical Industry
- 10.3.3. Division of Labor

10.4. Chemical Production Management and Organization
- 10.4.1. Strategic Decisions in Chemical Production
- 10.4.2. Production Planning
- 10.4.3. Theory of the Limitations
- 10.4.4. Short-Term Programming

10.5. Financial Business Management
- 10.5.1. Financial Planning
- 10.5.2. Company Valuation Methods
- 10.5.3. The Investment: Static and Dynamic Inversion Methods

10.6. Development of Manager Skills
- 10.6.1. Creative Problem Solving
- 10.6.2. Corporate Conflict Management
- 10.6.3. Empowerment and Delegation: Pyramidal Structure
- 10.6.4. Formation of Efficient Teams

10.7. Business Plan
- 10.7.1. Legal-Fiscal Plan
- 10.7.2. Operational Plan
- 10.7.3. Marketing Plan
- 10.7.4. Economic-Financial Plan

10.8. Business and Corporate Social Responsibility
- 10.8.1. Governance in RSE and RSC
- 10.8.2. Criteria for the Analysis of RSC in the Chemical Industry
- 10.8.3. RSE and CSR Implications

10.9. International Agreements in the Chemical Sector
- 10.9.1. Rotterdam Convention on the Export and Import of Hazardous Chemicals
- 10.9.2. Chemical Weapons Convention
- 10.9.3. Stockholm Convention on Persistent Organic Pollutants
- 10.9.4. Strategic International Chemicals Management Agreement

10.10. Ethical Controversies in the Chemical Industry
- 10.10.1. Environmental Challenges
- 10.10.2. Distribution and Use of Natural Resources
- 10.10.3. Implications of Negative Ethics

"Thanks to this 100% online program you will be up-to-date with the most recent advances in Biotechnology or Nanotechnology"

05
Methodology

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

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

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

Case Study to contextualize all content

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

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

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

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

A learning method that is different and innovative

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

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

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

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

Relearning Methodology

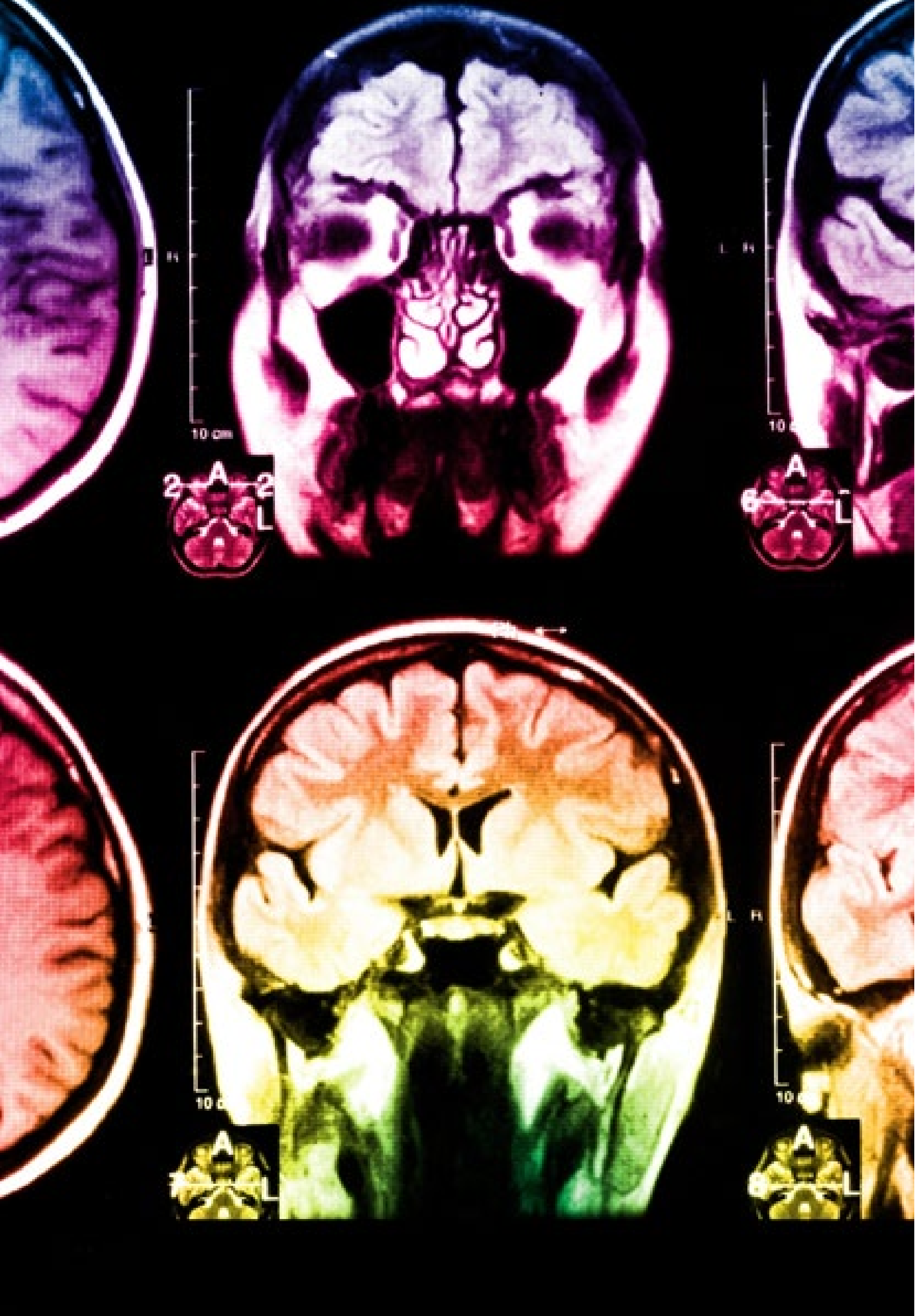
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

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

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

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

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



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

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

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

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

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

Study Material

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

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

Classes

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

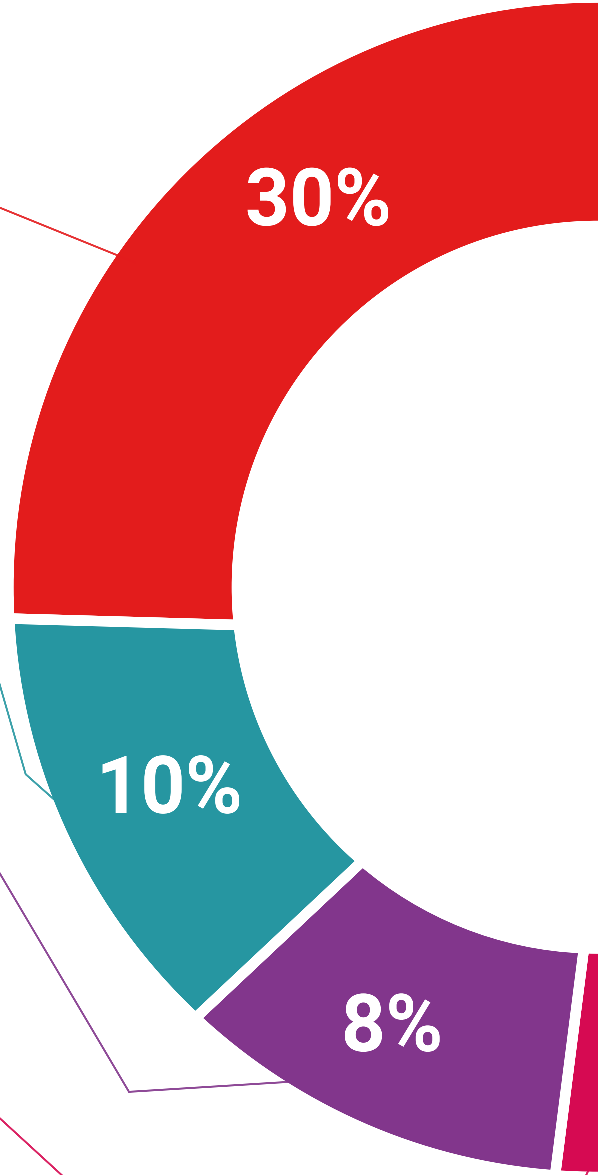
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

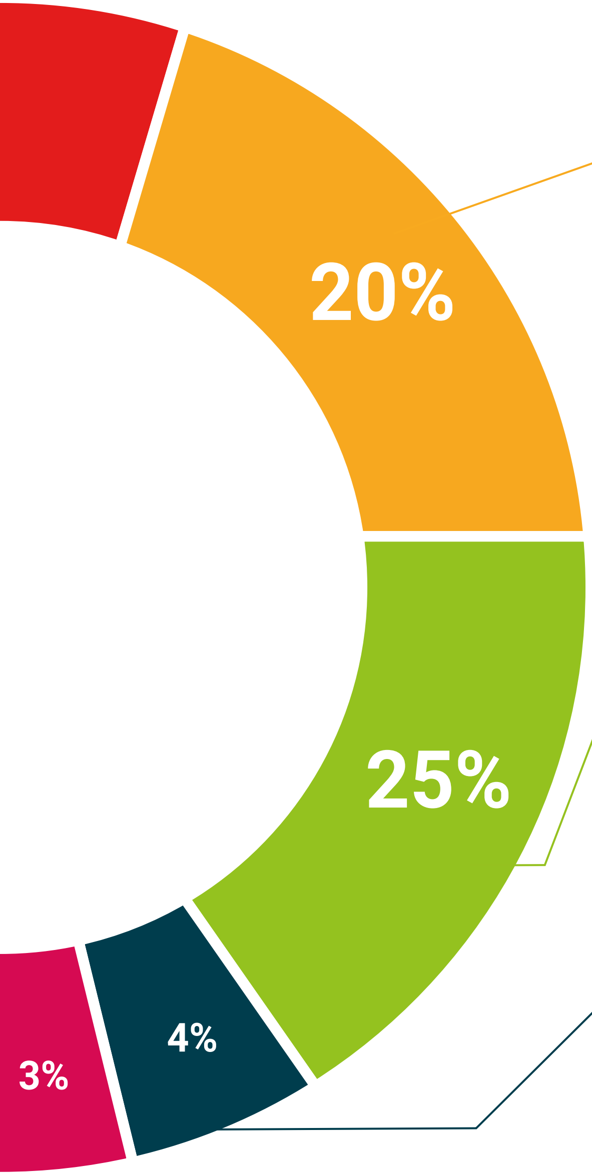
Practising Skills and Abilities

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

Additional Reading

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





Case Studies

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

Interactive Summaries

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

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

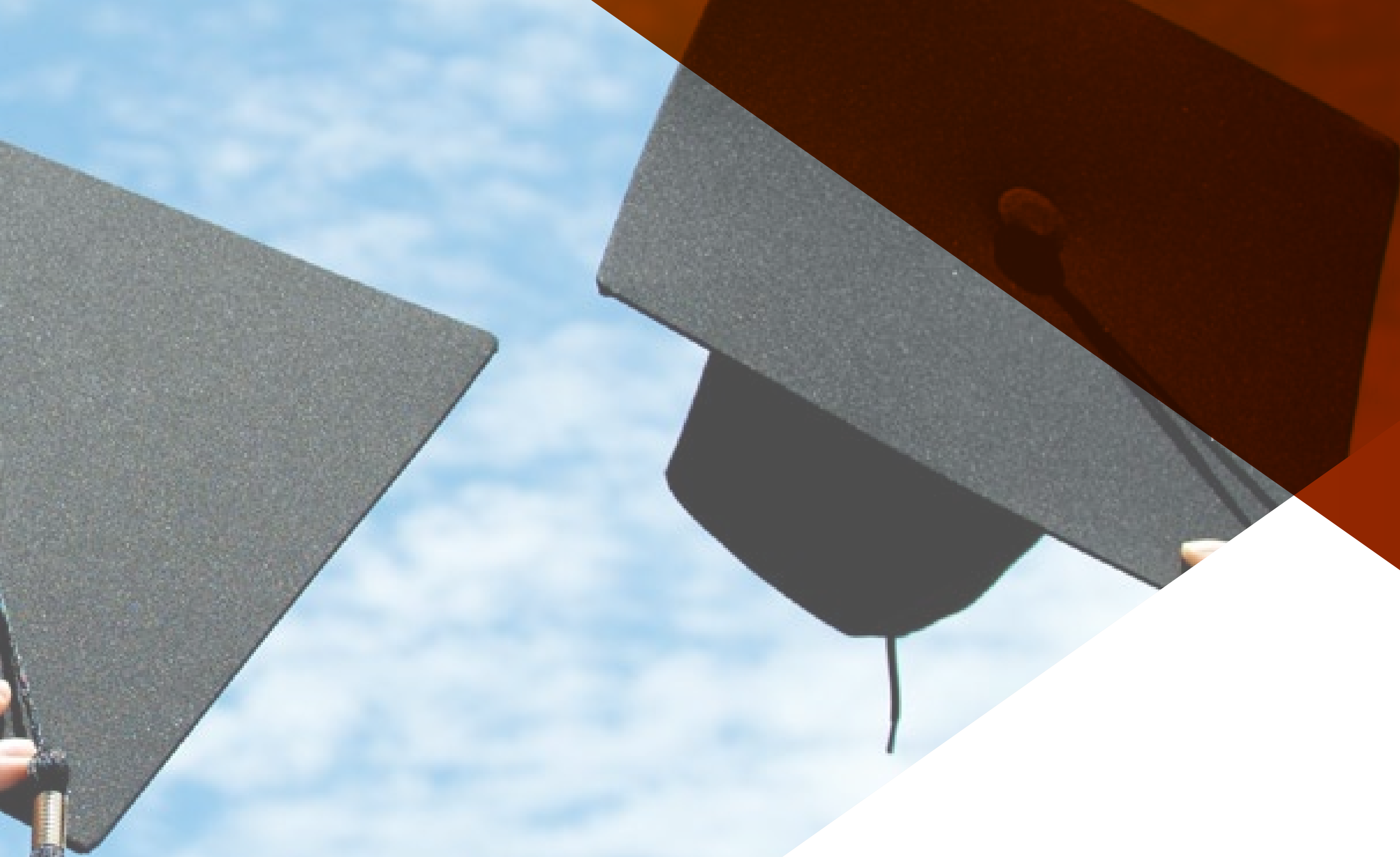
Testing & Retesting

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

07

Certificate

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



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

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

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

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

Title: **Master's Degree in Chemical Engineering**

Modality: **online**

Duration: **12 months**

Accreditation: **60 ECTS**


tech global university

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

Master's Degree in Chemical Engineering

This is a program of 1,620 hours of duration equivalent to 65 ECTS, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

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

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

Dr. Pedro Navarro Illana
Rector

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


Master's Degree in Chemical Engineering

General Structure of the Syllabus

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

General Structure of the Syllabus

Year	Subject	ECTS	Type
1º	Advanced Transfer Operations Design	6	CO
1º	Advanced Chemical Reactor Design	6	CO
1º	Processes and Chemical Products Design	6	CO
1º	Chemical Process Simulation and Optimization	6	CO
1º	Sustainability and Quality Management in the Chemical Industry	6	CO
1º	Technological Advances in Chemical Engineering	6	CO
1º	Biomass Utilization Technologies	6	CO
1º	L+0+I Chemical Engineering	6	CO
1º	Industrial Safety in the Chemical Sector	6	CO
1º	Organization and Management of Companies in the Chemical Sector	6	CO

Dr. Pedro Navarro Illana
Rector

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

tech global university

Master's Degree
Chemical Engineering

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

Master's Degree
Chemical Engineering