

# Postgraduate Certificate Multiphase Flow Simulation



## Postgraduate Certificate Multiphase Flow Simulation

- » Modality: online
- » Duration: 6 weeks
- » Certificate: TECH Technological University
- » Schedule: at your own pace
- » Exams: online

Website: [www.techtute.com/us/engineering/postgraduate-certificate/multiphase-flow-simulation](http://www.techtute.com/us/engineering/postgraduate-certificate/multiphase-flow-simulation)

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# 01

# Introduction

Today, fluid engineering faces constant challenges, such as process optimization in the petrochemical industry, the development of sustainable technologies for energy extraction and production, and the management of liquid waste and residues. Therefore, the Multiphase Flow Simulation Diploma offers engineers the opportunity to acquire skills and knowledge to meet these challenges. In this regard, it emphasizes cutting-edge tools and technologies, such as numerical simulation and Machine Learning. In addition, the 100% online format of the program allows students to access it from anywhere and at any time, without rigid schedules or inconvenient travel. In this way, students will gain a competitive advantage by developing competencies in a highly valued area of the labor market.





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*With this complete Postgraduate Certificate you will be able to acquire skills in multiphase flow simulation, which will not only allow you to highlight your profile as a key player in Industry 4.0, but also broaden your horizons in research and technological development”*

Multiphase Flow Simulation is a discipline in constant evolution. The numerical models and algorithms used in this branch of engineering allow understanding the behavior of fluids in various situations. For example, it is of fundamental importance in many industrial areas, such as food, pharmaceuticals, protocols or oil and gas. Its proper implementation translates into greater efficiency and safety in production processes. In addition, the incorporation of advanced technologies, such as Machine Learning, offers more opportunities to optimize existing models and obtain accurate results, improving decision making and reducing manufacturing costs.

Due to the high demand for specialized profiles in this area, the Multiphase Flow Simulation Diploma is an essential training for engineers seeking to keep up to date, and to be able to implement the correct techniques to meet the challenges of today's market. Its contents offer a practical and updated approach, and are developed in a 100% online format, which allows students to access it from anywhere in the world. In addition, the curriculum uses the innovative Relearning methodology, which fosters effective learning and autonomous problem solving.

In short, this Postgraduate Certificate will help students to acquire cutting-edge competencies, with the aim of broadening their knowledge, in addition to providing a competitive advantage to their profile. In this way, the engineering professional who performs it will achieve skills that will streamline industrial logistics, representing a key piece for business growth.

This **Postgraduate Certificate in Multiphase Flow Simulation** 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 Textile Engineering
- ◆ The graphic, schematic, and practical contents with which they are created, provide practical information on the disciplines that are essential for professional practice
- ◆ Practical exercises where self-assessment can be used to improve learning
- ◆ Its special emphasis on innovative methodologies
- ◆ Theoretical lessons, questions to the expert, debate forums on controversial topics, and individual reflection assignments
- ◆ Content that is accessible from any fixed or portable device with an Internet connection



*The demand for engineers with skills in multiphase flow simulation is increasing. According to the U.S. Department of Labor, employment of petroleum and chemical engineers is expected to continue to expand"*

“

*Get trained in multiphase flow simulation and help minimize greenhouse gas emissions in industry. With the knowledge you will acquire in this Diploma, you will propel your career towards change"*

*Expand your knowledge in complex fluid transport simulation and help reduce project design costs by up to 30%.*

*Specialize in optimizing industrial processes of various kinds, from food, pharmaceutical, or petrochemical, and open your job opportunities to the best companies in the sector.*

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

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

The design of this program focuses on Problem-Based Learning, by means of which the professional must try to solve the different practical situations that arise throughout the academic program. This will be done with the help of an innovative system of interactive videos made by renowned experts.



# 02

# Objectives

Fluid engineering has undergone numerous advances that have enabled the development of increasingly efficient and customized strategies to meet the needs of industry. Therefore, the main objective of this program is to provide fluid engineers with the most up-to-date and detailed information related to problem-based learning, so that they can master and use the latest simulation technologies and tools. This will allow them to implement the most effective tools in their work in just six weeks of fully online training.





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*Delve into multiphase flow simulation and master state-of-the-art technologies used to lower costs associated with drilling or producing oil wells”*



## General Objectives

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- ◆ Establish the basis for the study of turbulence
- ◆ Develop CFD statistical concepts
- ◆ Determine the main computational techniques in turbulence research
- ◆ Generate specialized knowledge in the method of Finite Volumes
- ◆ Acquire specialized knowledge in fluid mechanics calculation techniques
- ◆ Examine the wall units and the different regions of a turbulent wall flow
- ◆ Determine the characteristics of compressible flows
- ◆ Examine multiple models and multiphase methods
- ◆ Develop expertise on multiple models and methods in multiphysics and thermal analysis
- ◆ Interpret the results obtained by correct post-processing





## Specific Objectives

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- ◆ Distinguish what type of multiphase flow is to be simulated: continuous phases, such as simulating a ship at sea, a continuous medium; discrete phases, such as simulating specific droplet trajectories; or use statistical populations when the number of particles, droplets or bubbles is too large to be simulated
- ◆ Establish the difference between Lagrangian, Eulerian and mixed methods
- ◆ Determine the tools best suited to the type of flow to be simulated
- ◆ Modeling the effects of surface tension and phase changes such as evaporation, condensation or Cavitation
- ◆ Develop boundary conditions for wave simulation, learn about the different wave models and apply the so-called numerical beach, a region of the domain located at the exit whose objective is to avoid wave reflection

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*Get the most advanced tools in fluid engineering to innovate and develop new Industry 4.0 products or processes”*



03

# Course Management

Students who access this Postgraduate Certificate will have at their disposal a syllabus prepared by distinguished professionals within the fluid engineering sector. Their excellent knowledge of this industry is a guarantee for the graduate who seeks to obtain the most current information on simulation tools from the best experts. Thus, the engineering professional who attends this program will be faced with a highly qualified management and teaching staff with a long professional trajectory. An extraordinary background that will be reflected in the exhaustive syllabus to which the students will have access.





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*Update your profile with advances in multiphase flow simulation and apply this knowledge in different areas of engineering to expand your career opportunities”*

## Management



### Dr. José Pedro García Galache

- ♦ XFlow Development Engineer at Dassault Systèmes
- ♦ PhD in Aeronautical Engineering from the Polytechnic University of Valencia
- ♦ Degree in Aeronautical Engineering from the Polytechnic University of Valencia
- ♦ Master's Degree in Research in Fluid Mechanics from the Von Kármán Institute for Fluid Dynamics
- ♦ Short Training Programme en el Von Kármán Institute for Fluid Dynamics





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0.10	1300	0.10
0.10	980	0.10
0.15	980	0.20
0.15	745	0.20
0.15	745	0.20
0.20	545	0.30
0.20	415	0.30
0.20	240	0.30
0.30	135	0.40
0.30	100	0.40

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# 04

# Structure and Content

A team of experts in fluid engineering has designed the curriculum for this program, which covers 150 hours of theoretical, practical and complementary content presented in various audiovisual formats. In addition, thanks to TECH's innovative Relearning methodology, students will be able to enter Multiphase Flow Simulation in a natural and gradual way. This program is presented in a fully online and flexible format, which allows students to access the most advanced tools from any device with an internet connection and have access to the virtual campus 24 hours a day.



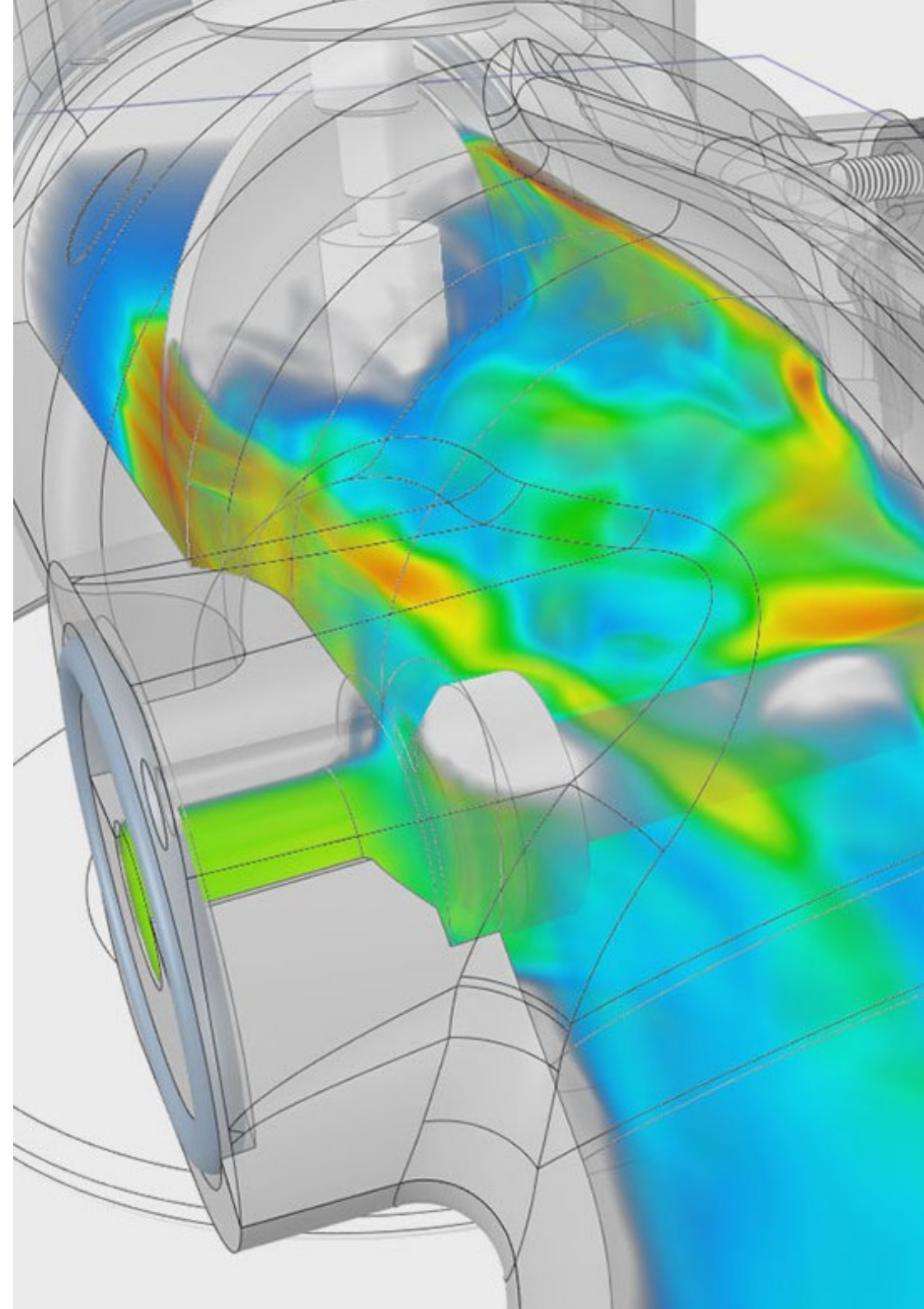


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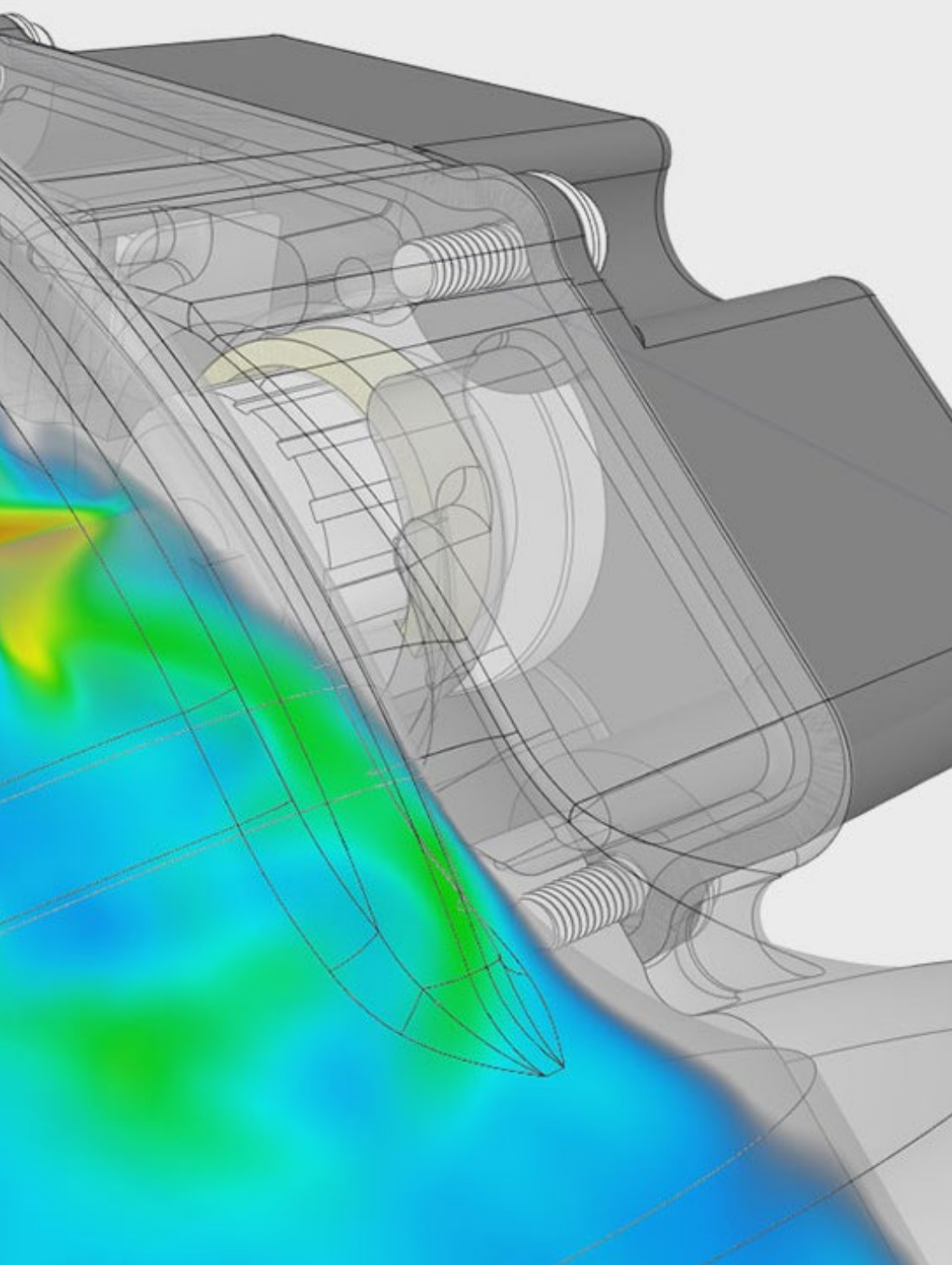
*Learn to identify potential risks and design contingency plans to prevent accidents and minimize environmental impact”*

## Module 1. Multiphase flow

- 1.1. Flow regimes
  - 1.1.1. Continuous phase
  - 1.1.2. Discrete phase
  - 1.1.3. Discrete phase populations
- 1.2. Continuous phases
  - 1.2.1. Properties of the liquid-gas interface
  - 1.2.2. Each phase a domain
  - 1.2.3. Phase resolution independently.
  - 1.2.4. Coupled solution
  - 1.2.5. Fluid fraction as a descriptive phase scalar
  - 1.2.6. Reconstruction of the gas-liquid interface
- 1.3. Marine simulation
  - 1.3.1. Wave regimes. Wave height vs. depth
  - 1.3.2. Input boundary condition. Wave simulation
  - 1.3.3. Non-reflective output boundary condition. Numerical beach
  - 1.3.4. Lateral boundary conditions. Lateral wind and drift
- 1.4. Surface Tension
  - 1.4.1. Physical Phenomenon of the Surface Tension
  - 1.4.2. Modeling
  - 1.4.3. Interaction with surfaces. Angle of wetting
- 1.5. Phase shift
  - 1.5.1. Source and sink terms associated with phase change
  - 1.5.2. Evaporation models
  - 1.5.3. Condensation and precipitation models. Nucleation of droplets
  - 1.5.4. Cavitation
- 1.6. Discrete phase: particles, droplets and bubbles
  - 1.6.1. Resistance strength
  - 1.6.2. The buoyancy force
  - 1.6.3. Inertia
  - 1.6.4. Brownian motion and turbulence effects
  - 1.6.5. Other forces







- 1.7. Interaction with the surrounding fluid
  - 1.7.1. Generation from continuous phase
  - 1.7.2. Aerodynamic drag
  - 1.7.3. Interaction with other entities, coalescence and rupture.
  - 1.7.4. Boundary Conditions
- 1.8. Statistical description of particle populations. Packages
  - 1.8.1. Transportation of stocks
  - 1.8.2. Stock boundary conditions
  - 1.8.3. Stock interactions
  - 1.8.4. Extending the discrete phase to populations
- 1.9. Water film
  - 1.9.1. Water Sheet Hypothesis
  - 1.9.2. Equations and modeling
  - 1.9.3. Source term from particles
- 1.10. Example of an application with OpenFOAM
  - 1.10.1. Description of an industrial problem
  - 1.10.2. Setup and simulation
  - 1.10.3. Visualization and interpretation of results

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*Thanks to this Postgraduate Certificate, you will become a valuable expert in this sought-after branch of engineering and will be able to help predict the behavior of complex fluids in different scenarios or operating conditions"*

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.





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*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.

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



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



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

### A learning method that is different and innovative

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

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

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

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

## Relearning Methodology

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

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

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

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

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





In our program, learning is not a linear process, but rather a spiral (learn, unlearn, forget, and re-learn). Therefore, we combine each of these elements concentrically.

This methodology has trained more than 650,000 university graduates with unprecedented success in fields as diverse as biochemistry, genetics, surgery, international law, management skills, sports science, philosophy, law, engineering, journalism, history, and financial markets and instruments. All this in a highly demanding environment, where the students have a strong socio-economic profile and an average age of 43.5 years.

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

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

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



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



### Study Material

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

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



### Classes

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

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



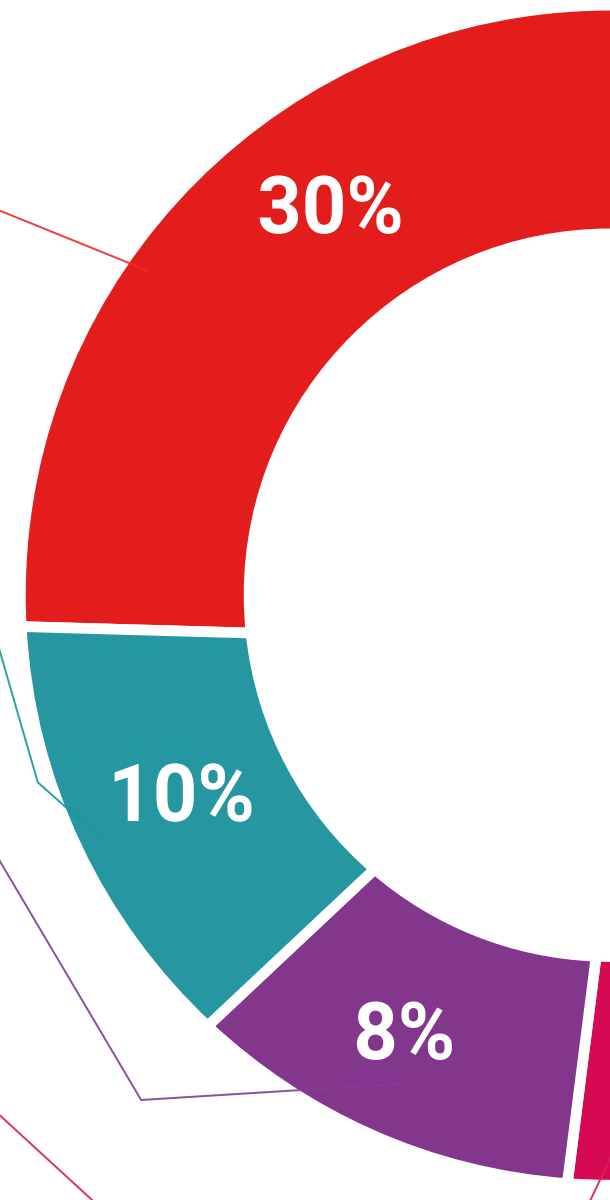
### Practising Skills and Abilities

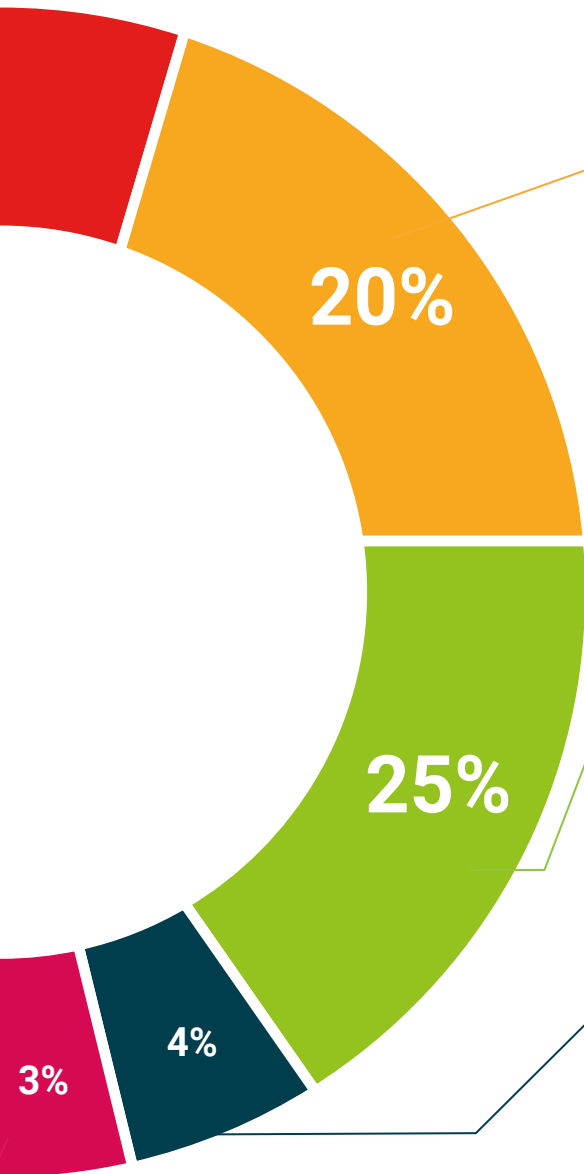
They will carry out activities to develop specific skills and abilities in each subject area. Exercises and activities to acquire and develop the skills and abilities that a specialist needs to develop in the context of the globalization that we are experiencing.



### Additional Reading

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





**Case Studies**

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



**Interactive Summaries**

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

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



**Testing & Retesting**

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





06

# Certificate

The Postgraduate Certificate in Multiphase Flow Simulation guarantees students, in addition to the most rigorous and up-to-date education, access to a Postgraduate Certificate issued by TECH Technological University.



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

This **Postgraduate Certificate in Multiphase Flow Simulation** contains the most complete and up-to-date program on the market.

After the student has passed the assessments, they will receive their corresponding **Postgraduate Certificate** issued by **TECH Technological University** via tracked delivery\*.

The diploma issued by **TECH Technological University** will reflect the qualification obtained in the Postgraduate Certificate, and meets the requirements commonly demanded by labor exchanges, competitive examinations, and professional career evaluation committees.

Title: **Postgraduate Certificate in Multiphase Flow Simulation**

Official N° of Hours: **150 h.**



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

future  
health confidence people  
education information tutors  
guarantee accreditation teaching  
institutions technology learning  
community commitment  
personalized service innovation  
knowledge present quality  
development languages  
virtual classroom



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