

Postgraduate Certificate Course on Finite Volumes applied to CFD





Postgraduate Certificate Course on Finite Volumes applied to CFD

- » Modality: online
- » Duration: **6 weeks**
- » Certificate: **TECH Technological University**
- » Accreditation: **6 ECTS**
- » Dedicated **16h/week**
- » Schedule: **at your own pace**
- » Exams: **online**

Website: www.techtute.com/in/information-technology/postgraduate-certificate/course-finite-volumes-applied-cdf

Index

01

Introduction

p. 4

02

Objectives

p. 8

03

Course Management

p. 12

04

Structure and Content

p. 16

05

Methodology

p. 20

06

Certificate

p. 28

01

Introduction

Studying finite volumes applied to CFD is important because this technique is widely used in industry and research to solve flow problems in different systems, from internal combustion engines to the design of chemical reactors and the simulation of geophysical phenomena. For this reason, TECH Technological University has designed a degree that allows students to maximize their knowledge on aspects such as the Scalar Source Term, the Symmetry Condition, Wall Models, Historical Background or Re-meshing Techniques, among others. All this, thanks to a 100% online modality and with the most dynamic and practical multimedia materials available in the academic market.





Maximize your skills and acquire new competences on Finite Volumes Applied to CFD, thanks to TECH Technological University"

The study of finite volumes applied to CFD is important for computer scientists, engineers and scientists who seek to solve flow problems efficiently, understand the strengths and limitations of this technique or develop more advanced technologies through numerical simulation.

For this reason, TECH Technological University has designed a University Course on Finite Volumes applied to CFD to provide students with the necessary skills to be able to perform their work as specialists with the highest possible efficiency and quality. Thus, throughout this program, aspects such as Loops in Transient Regime, Moving Contours, High Order Schemes, Numerical Errors or Wall Models will be addressed.

All this, through a convenient 100% online modality that allows students to organize their schedules and studies, combining them with their other work and interests. In addition, this degree has the most Complete theoretical and practical materials on the market, which facilitates the student's study process and allows them to achieve their objectives quickly and effectively.

This **Postgraduate Certificate in Course on Finite Volumes applied to CFD** 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 Finite Volumes applied to CFD
- ◆ The graphic, schematic and practical contents of the program provide Rehabilitation and practical information on those 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



Reach your full potential expert in DSMC Method Applicability in only 6 weeks and with total freedom of organization"

“

Enhance your professional profile in one of the most promising areas of the IT sector, thanks to TECH Technological University and the most innovative materials”

Access all content on Input and Physical Model Uncertainties from your tablet, mobile or computer.

Delve into CFD in Application Environments from the comfort of your home or work office at any time of the day.

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 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 professional practice situations that are presented throughout the academic course. For this purpose, the student will be assisted by an innovative interactive video system created by renowned experts.



02 Objectives

The final objective of this Postgraduate Course in Finite Volumes applied to CFD is to provide the student with advanced and updated knowledge in this area. An update that will allow the student to work with the highest possible quality. All this, thanks to TECH Technological University and a 100% online modality that gives total freedom of organization and schedules to the student.



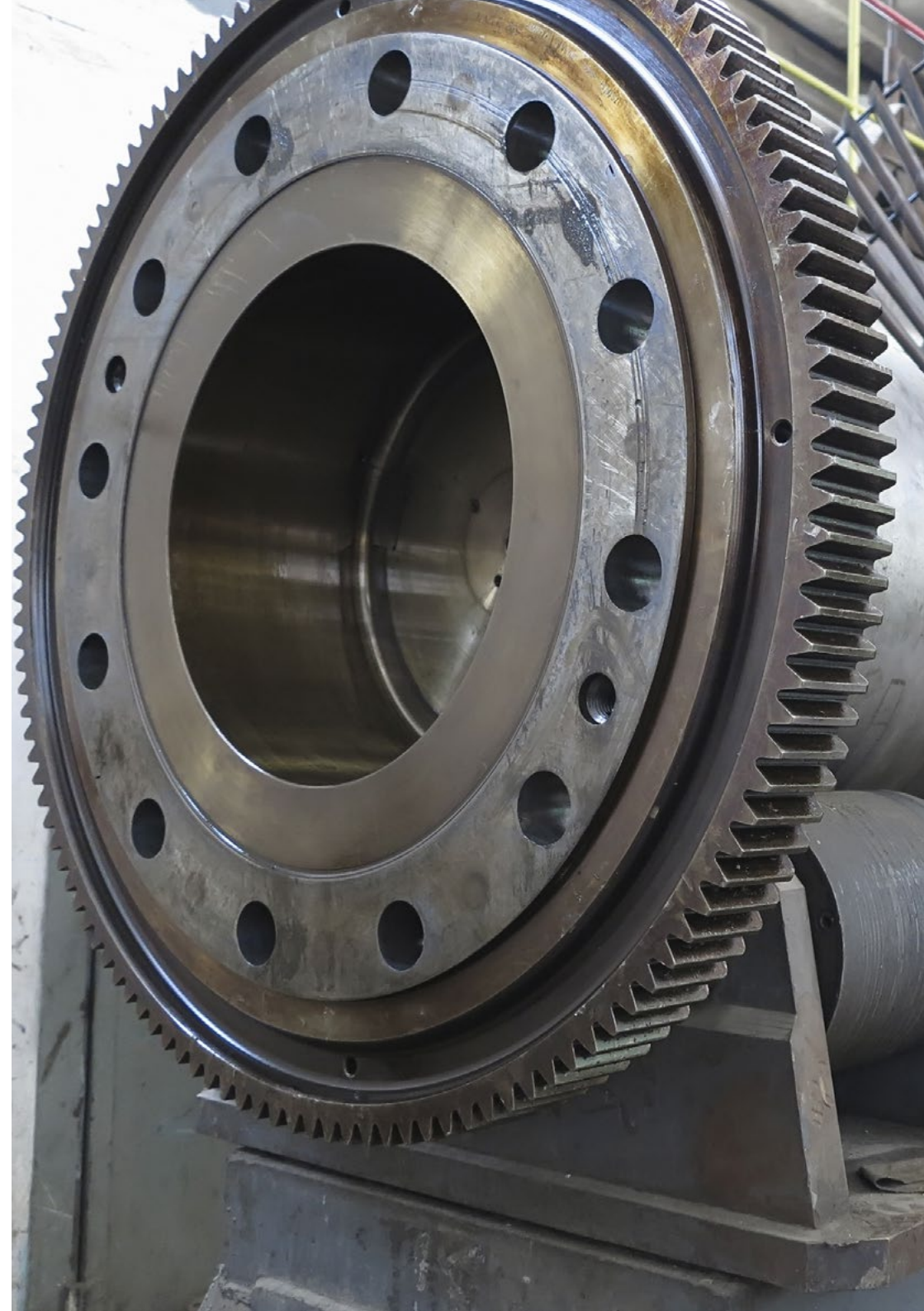
“

Delve into all the essential aspects of the Symmetry Condition or the Boundary Conditions, from the comfort of your home or work office"



General Objectives

- ◆ 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 multi-physics and thermal analysis
- ◆ Interpret the results obtained by correct post-processing





Specific Objectives

- ◆ Analyze the FEM or MVE environment
- ◆ Specify what, where and how the boundary conditions can be defined
- ◆ Determine possible time steps
- ◆ Concretizing and designing Upwind schemes
- ◆ Develop high order schemes
- ◆ Examine convergence loops and in which cases to use each one
- ◆ Expose the imperfections of CFD results



Exceed your highest expectations, thanks to a unique program with the most complete theoretical and practical materials on the academic market"

03

Course Management

In order to provide a postgraduate of the highest quality and usefulness, TECH Technological University has selected professionals specialized in Advanced CFD Techniques as part of this teaching staff, who have been in charge of the design of the most advanced contents. Thus, you will learn from the best the keys to your professional development in a field that adapts to new technologies and the latest market advances.



“

The most experienced and expert teaching staff will support you throughout the learning process, preparing you to meet the current challenges in this promising area"

Management



Dr. García Galache, José Pedro

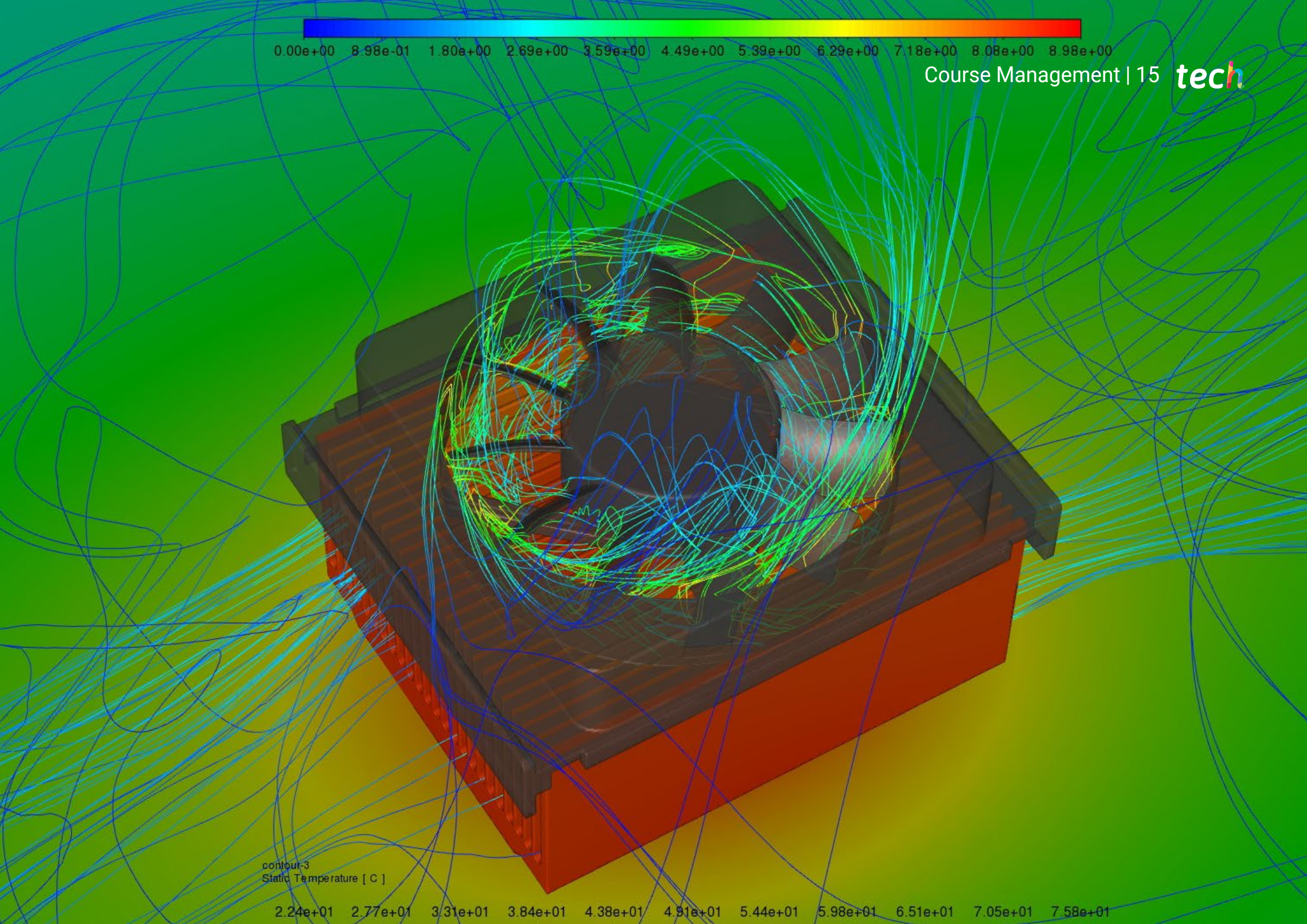
- ◆ Doctor in Aeronautical Engineering from the Polytechnic University of Valencia
- ◆ Degree in Aeronautical Engineering from the Polytechnic University of Valencia
- ◆ Research Master's Degree in Fluid Mechanics by the Von Kármán Institute for Fluid Dynamics
- ◆ Programa de formación breve en el Instituto Von Kármán de Dinámica de Fluidos

Professors

Ms. Pérez Tainta, Maider

- ◆ Process Engineer at J.M. Jauregui
- ◆ Researcher in hydrogen combustion at Ikerlan
- ◆ Mechanical engineer at Idom
- ◆ Graduate in Mechanical Engineering from the University of the Basque Country (UPV)
- ◆ Master's Degree in Mechanical Engineering
- ◆ Interuniversity Master's Degree in Fluid Mechanics
- ◆ Python programming course

0.00e+00 8.98e-01 1.80e+00 2.69e+00 3.59e+00 4.49e+00 5.39e+00 6.29e+00 7.18e+00 8.08e+00 8.98e+00



contour-3
Static Temperature [C]

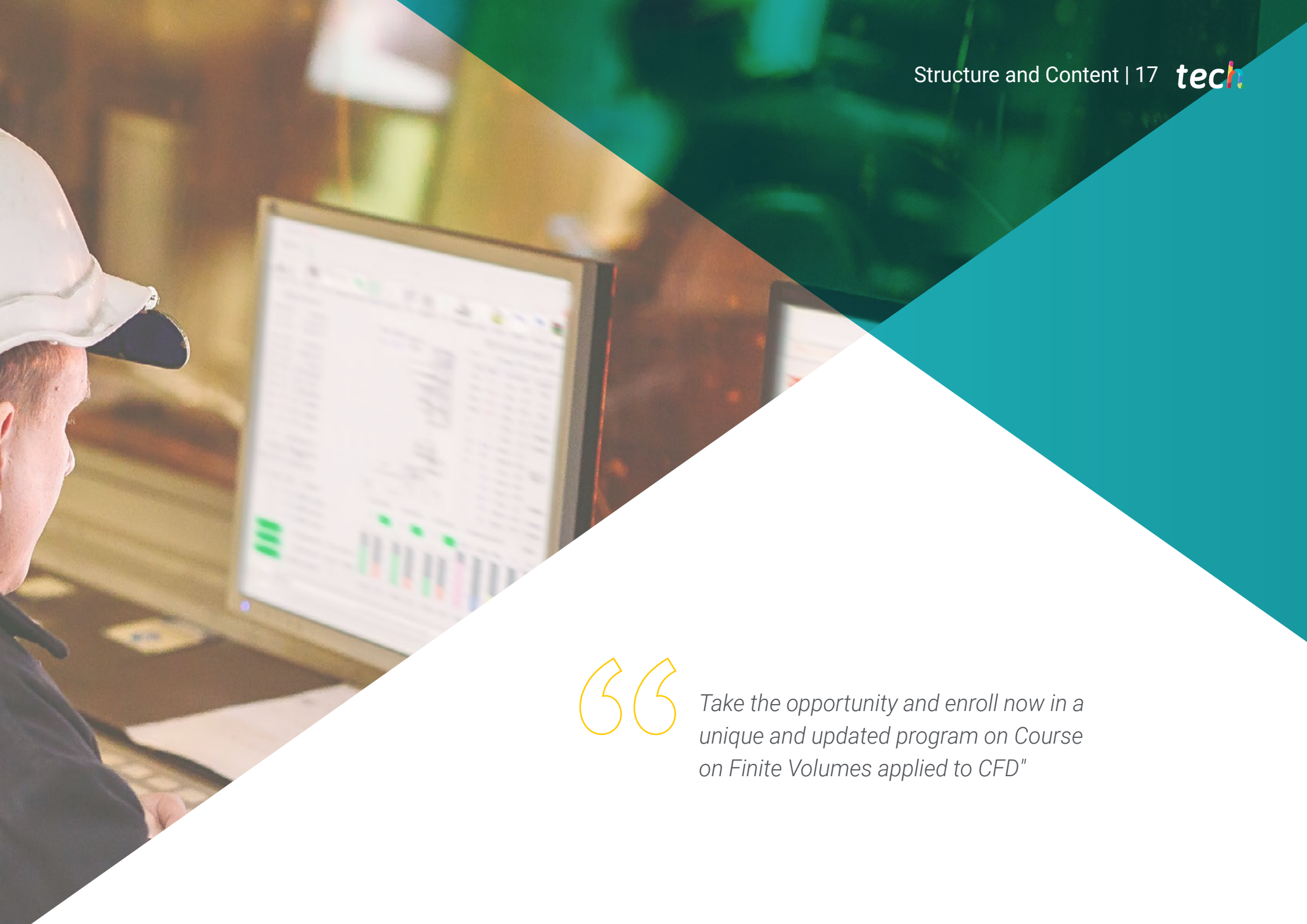
2.24e+01 2.77e+01 3.31e+01 3.84e+01 4.38e+01 4.91e+01 5.44e+01 5.98e+01 6.51e+01 7.05e+01 7.58e+01

04

Structure and Content

The structure and the contents of this curriculum have been designed by the renowned professionals that make up TECH Technological University team of experts in the area of Computer Science. These specialists have used their extensive experience and state-of-the-art knowledge to create practical and completely innovative content. All of this, based on the most efficient pedagogical methodology, TECH Technological University Relearning.



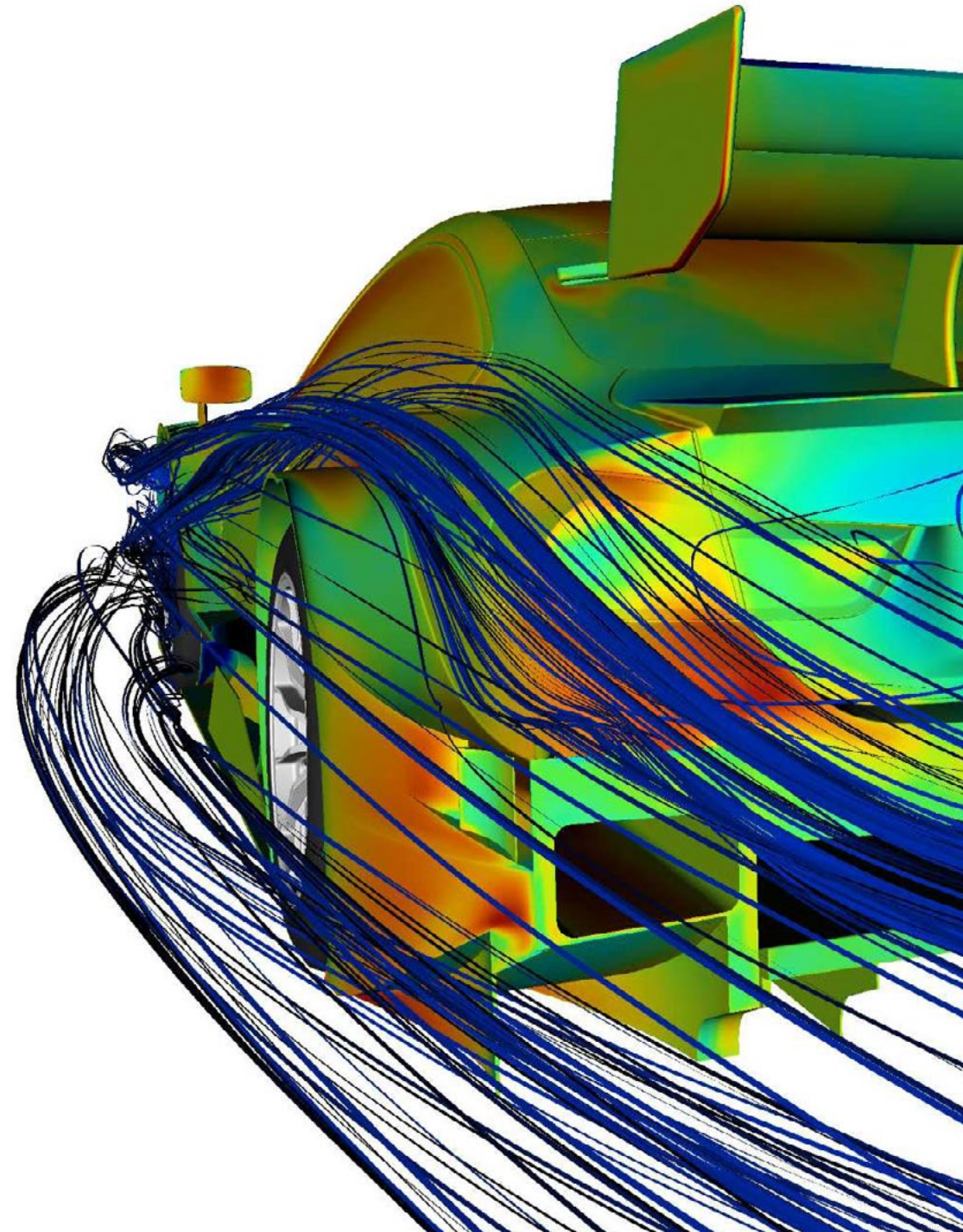


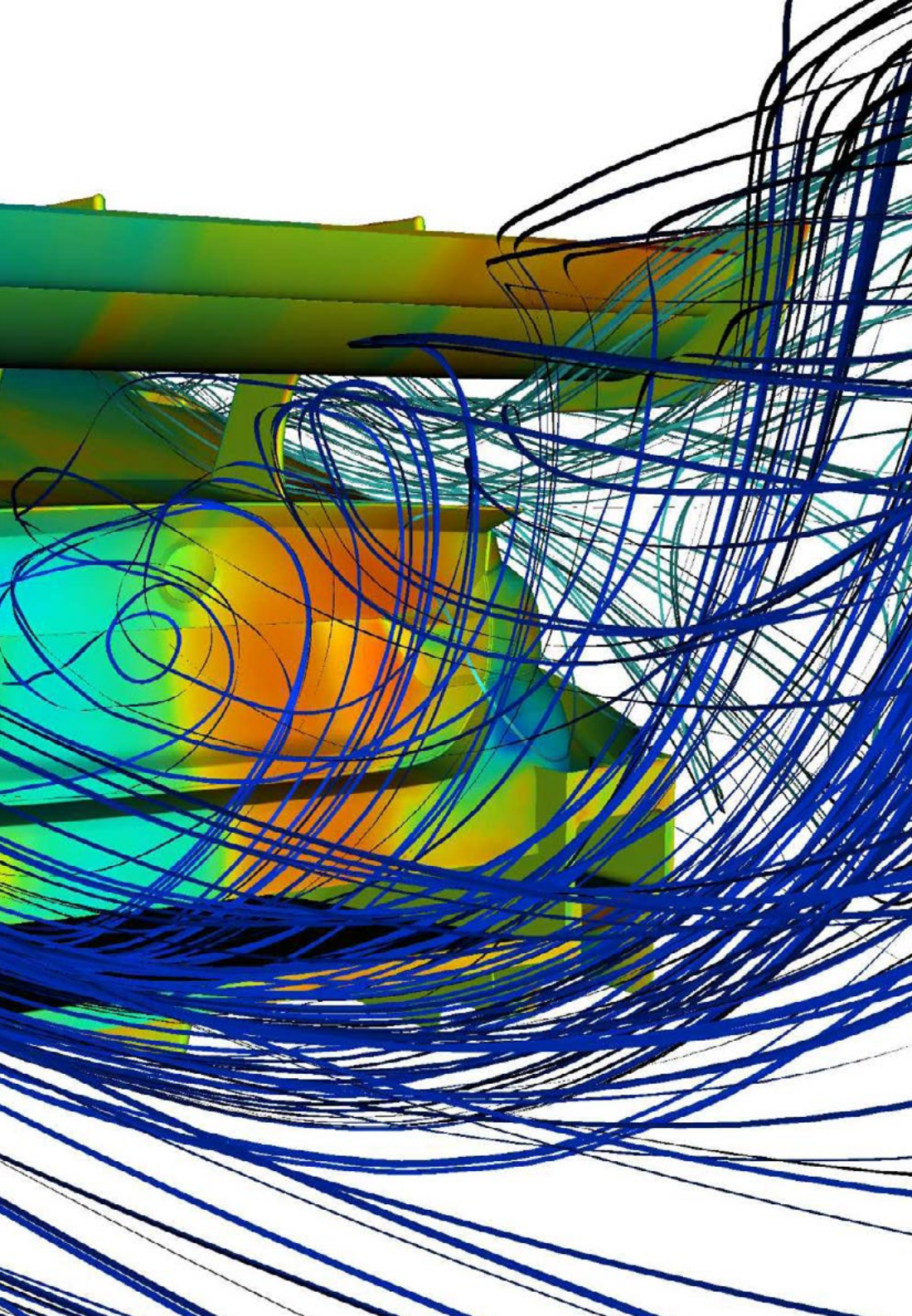
“

Take the opportunity and enroll now in a unique and updated program on Course on Finite Volumes applied to CFD”

Module 1. CFD in Application Environments: Finite Volume Methods

- 1.1. Finite Volume Methods
 - 1.1.1. Definitions in FVM
 - 1.1.2. MVF in Structures
- 1.2. Source Terms
 - 1.2.1. External volumetric forces
 - 1.2.1.1. Gravity, centrifugal force
 - 1.2.2. Volumetric (mass) and pressure source term (evaporation, cavitation, chemical)
 - 1.2.3. Scalar source term
 - 1.2.3.1. Temperature, species
- 1.3. Applications of boundary conditions
 - 1.3.1. Input and Output
 - 1.3.2. Symmetry condition
 - 1.3.3. Wall condition
 - 1.3.3.1. Tax values
 - 1.3.3.2. Values to be solved by parallel calculation
 - 1.3.3.3. Wall models
- 1.4. Boundary Conditions
 - 1.4.1. Lateral boundary conditions. Dirichlet
 - 1.4.1.1. Scalars
 - 1.4.1.2. Diseases
 - 1.4.2. Boundary conditions with known derivative: Neumann
 - 1.4.2.1. Zero gradient
 - 1.4.2.2. Finite gradient
 - 1.4.3. Cyclic boundary conditions: Born-von Karman
 - 1.4.4. Other boundary conditions: Robin
- 1.5. Temporary integration
 - 1.5.1. Explicit and implicit Euler
 - 1.5.2. Lax-Wendroff time step and variants (Richtmyer and MacCormack)
 - 1.5.3. Runge-Kutta multi-stage time step



- 
- 1.6. Upwind Schematics
 - 1.6.1. Riemman's Problem
 - 1.6.2. Main upwind schemes: MUSCL, Van Leer, Roe, AUSM
 - 1.6.3. Design of an upwind spatial scheme
 - 1.7. High order schemes
 - 1.7.1. High-order discontinuous Galerkin
 - 1.7.2. ENO and WENO
 - 1.7.3. High Order Schemes. Advantages and Disadvantages
 - 1.8. Pressure-velocity convergence loop
 - 1.8.1. PISA
 - 1.8.2. SIMPLE, SIMPLER and SIMPLEC
 - 1.8.3. PIMPLE
 - 1.8.4. Transient loops
 - 1.9. Moving contours
 - 1.9.1. Overlocking techniques
 - 1.9.2. Mapping: mobile reference system
 - 1.9.3. Immersed boundary method
 - 1.9.4. Overlapping meshes
 - 1.10. Errors and uncertainties in CFD modeling
 - 1.10.1. Precision and accuracy
 - 1.10.2. Numerical errors
 - 1.10.3. Input and physical model uncertainties

“

Thanks to the most efficient teaching methodology, you will be able to acquire new knowledge in a precise way and in only few weeks"

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.



A close-up photograph of a person's hands typing on a laptop keyboard. The image is partially obscured by a large teal diagonal graphic that covers the top right and bottom right portions of the page. The lighting is soft, highlighting the texture of the skin and the keys.

“

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 has been the most widely used learning system among the world's leading Information Technology schools for as long as they have existed. 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 course, students 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 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.



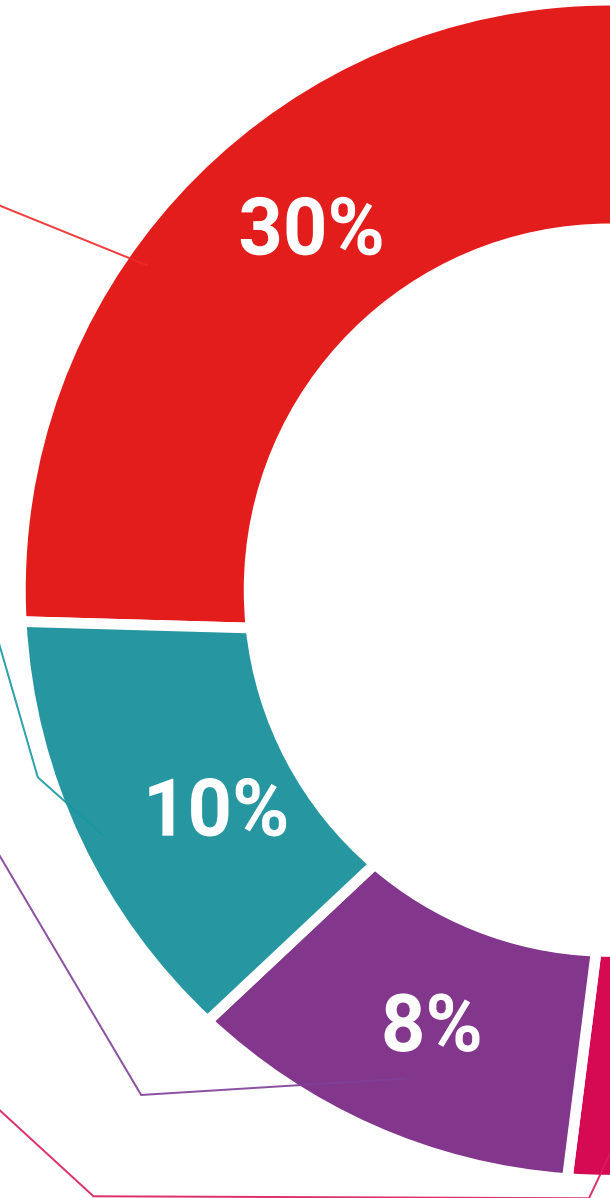
Practising Skills and Abilities

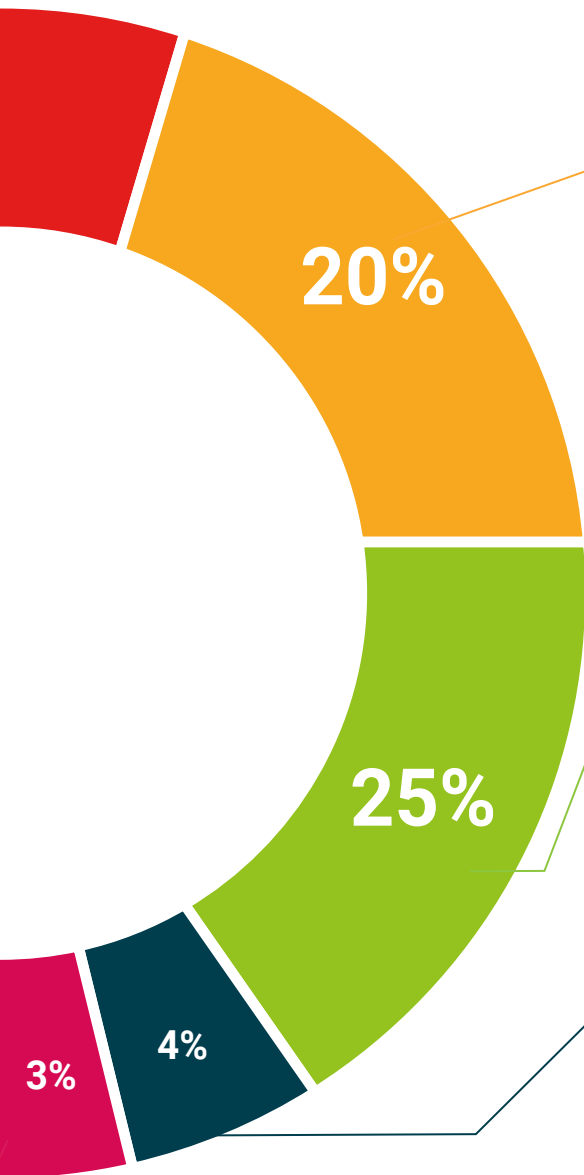
They will carry out activities to develop specific skills and abilities in each subject area. Exercises and activities to acquire and develop the skills and abilities that a specialist needs to develop in the context of the globalization that we are experiencing.



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 Course on Finite Volumes applied to CFD guarantees students, in addition to the most rigorous and up-to-date education, access to a Postgraduate Certificate issued by TECH Technological University.





“

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

This **Postgraduate Certificate in Course on Finite Volumes applied to CFD** 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 certificate 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 Course on Finite Volumes applied to CFD**

Official N° of Hours: **150 h.**



*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.



Postgraduate Certificate Course on Finite Volumes applied to CFD

- » Modality: online
- » Duration: 6 weeks
- » Certificate: TECH Technological University
- » Accreditation: 6 ECTS
- » Dedicated 16h/week
- » Schedule: at your own pace
- » Exams: online

Postgraduate Certificate Course on Finite Volumes applied to CFD