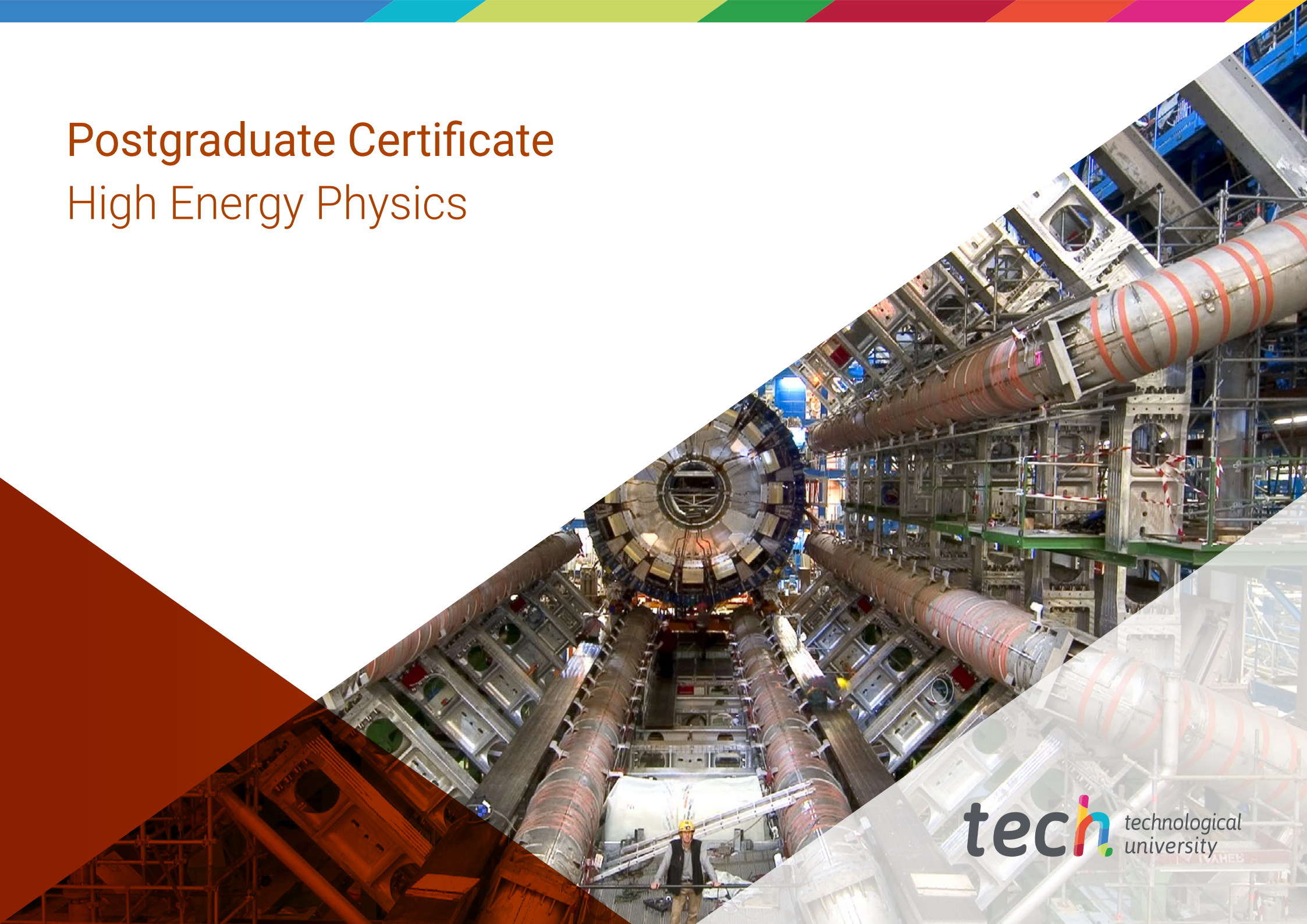


# Postgraduate Certificate High Energy Physics





## Postgraduate Certificate High Energy Physics

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

Website: [www.techtitute.com/us/engineering/postgraduate-certificate/high-energy-physics](http://www.techtitute.com/us/engineering/postgraduate-certificate/high-energy-physics)

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# 01

# Introduction

In recent years, High Energy Physics has been in development, and an example of this is the impulse given to the creation of the CERN Large Particle Collider, which seeks to explain how the universe came to be, and the particles that are closely related to it. In this theoretical scenario of physics, engineering professionals contribute significantly to the manufacturing of equipment and instruments necessary for the creation of such accelerated and conducting experiments in this field. That is why TECH provides with this 100% online program, the most advanced knowledge on group theory, symmetries or the latest developments in matter and dark energies. In addition, this will be possible thanks to multimedia teaching material that can be easily accessed at any time of the day, from a computer with an Internet connection.





“

*This Postgraduate Certificate provides you with the necessary foundation in High Energy Physics to create instruments that will allow you to learn even more about the particles of the Universe”*

Understanding dark matter, the origin of ultra-energetic cosmic rays or how violent cosmic processes occur is possible thanks to the studies that have been developed in High Energy Physics. A branch of physics that gained great social relevance in 2008 with the start-up of the LHC at CERN in Switzerland. An immense effort of scientists and technicians who seek, through different experiments, to learn more about the tiny particles of the universe.

However, these studies and experiments not only have a theoretical application and development, but have also allowed technological progress, especially with applications in medicine, which derive from the physics of accelerators. In view of this extensive field of growth, TECH has designed this Postgraduate Certificate, which provides the specialists with the most advanced knowledge in High Energy Physics.

A 100% online program, which will lead professionals to learn about groups, representations, symmetries or the application of Feynman calculus, in a comfortably way using any device with Internet connection. All this, by means of multimedia resources (video summaries, detailed videos, diagrams), essential readings or case studies, which will also allow them to dynamically deepen their knowledge of electrodynamics and chromodynamics of quarks or the Higgs boson.

In addition, professionals will reduce the long hours of study and memorization with the effective Relearning system, used by this educational institution in all its programs. Thus, the professional is offered a 100% online program, compatible with their personal and/or work responsibilities. This is a 100% online program, which is compatible with the personal and/or work responsibilities of the professionals.

This **Postgraduate Certificate in High Energy Physics** contains the most complete and up-to-date program on the market. The most important features include:

- ◆ Practical case studies are presented by experts in Physics
- ◆ 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 the self-assessment process can be carried out to improve learning
- ◆ Its special emphasis on innovative methodologies
- ◆ Theoretical lessons, questions to the expert, debate forums on controversial topics, and individual reflection work
- ◆ Contents are accessible from any fixed or portable device with an Internet connection



*Enroll now in a Program that allows you 24-hour a day access to the most advanced topics in High Energy Physics"*

“

*With this Postgraduate Certificate, you will obtain the information you need about the interactions of fundamental particles and their connection with the universe”*

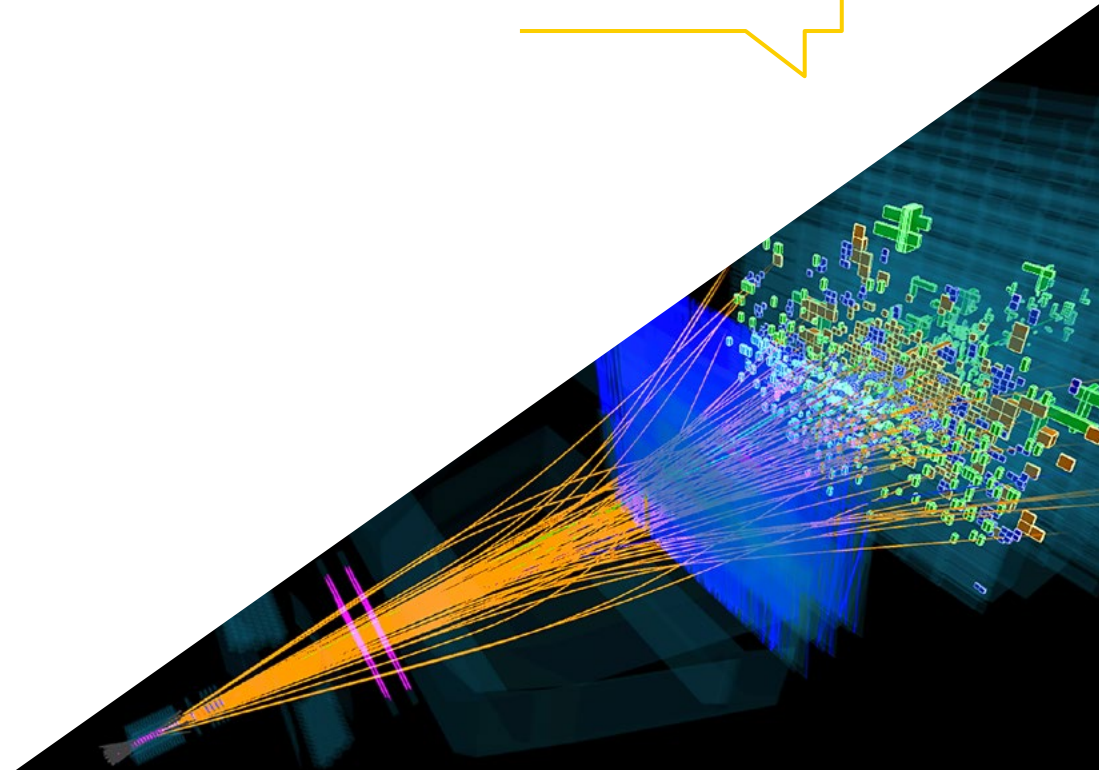
The program's teaching staff includes professionals from the sector who contribute their work experience to this educational program, as well as renowned specialists from leading societies and prestigious universities.

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 throughout the program. For this purpose, the student will be assisted by an innovative interactive video system created by renowned and experienced experts.

*In 6 weeks, you will understand the physics concepts that led to the creation of the Large Hadron Collider.*

*With this university program you will have the latest advances in supersymmetry, strings and extra dimensions.*





# 02

# Objectives

The teaching tools used by TECH in this program will allow students to easily obtain the essential notions of High Energy Physics and the understanding of concepts ranging from the microcosm to the macrocosm. Thus, at the end of the 150 teaching hours of this university course, the graduate will be able to know Feynman's rules, the Gauge or Yang-Millis theory.







“

*Would you like to know what the Gauge Theory is? This program provides you with the knowledge you need to understand this type of quantum field theory”*





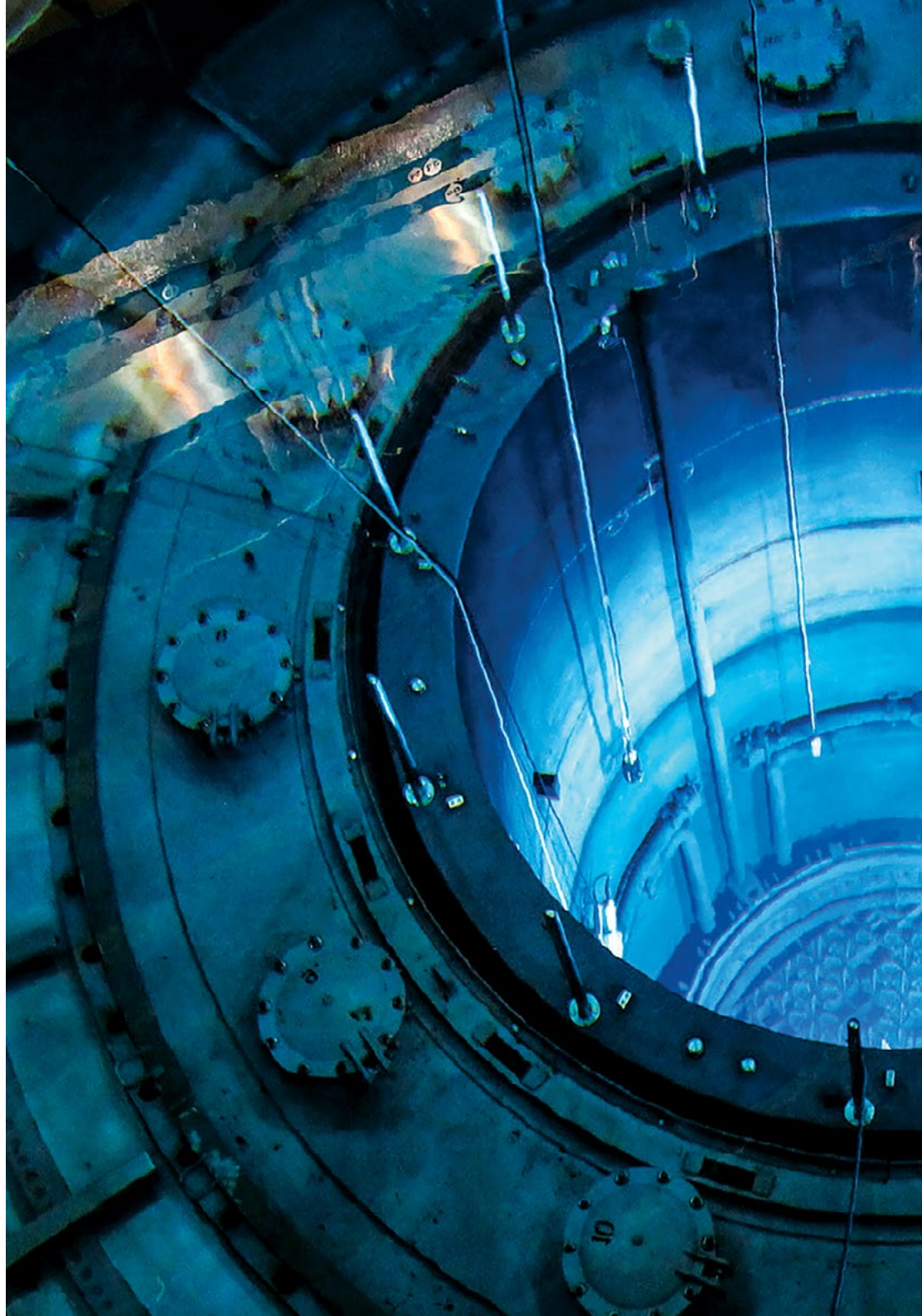
## General Objectives

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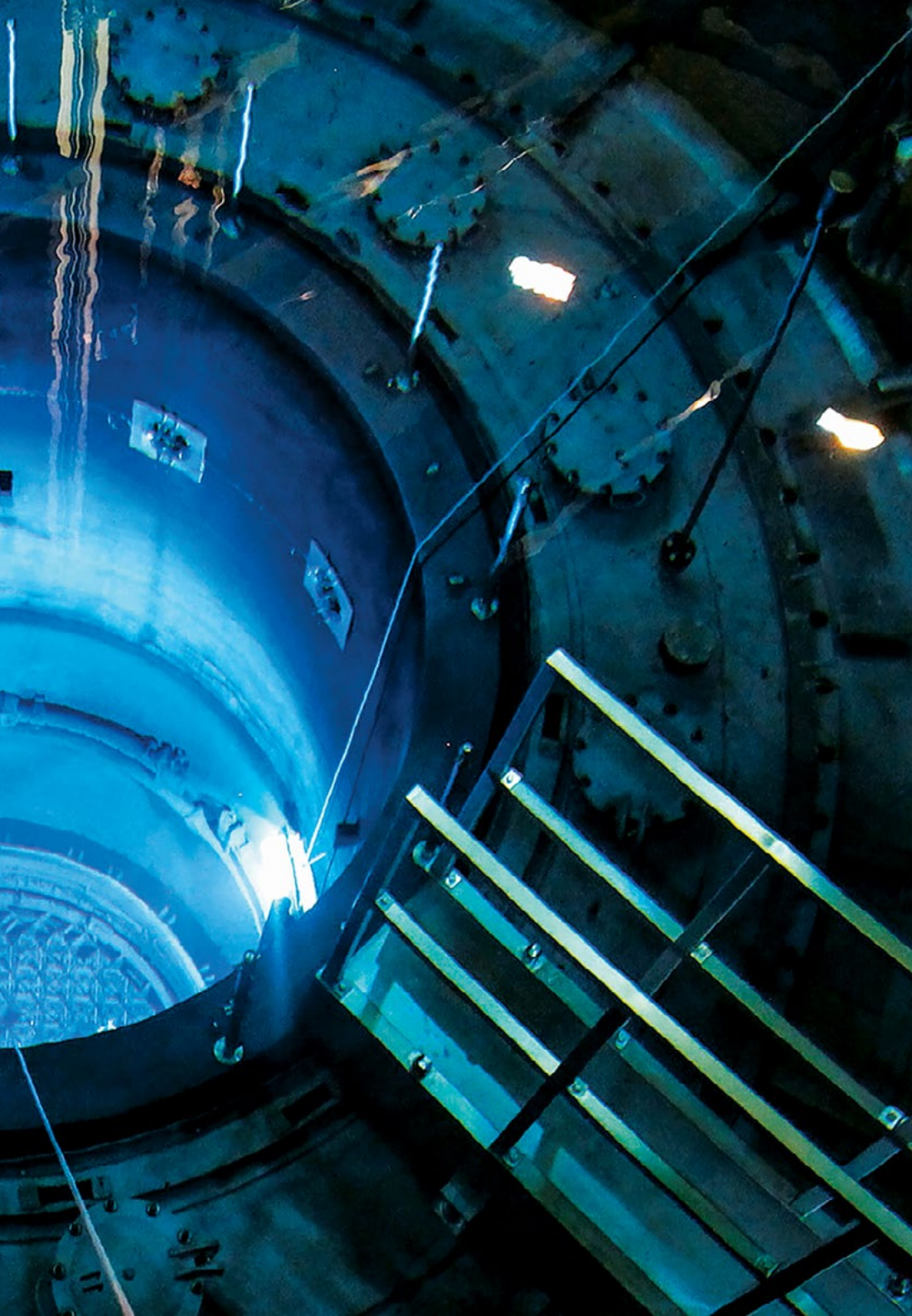
- ◆ Apply knowledge of quantum field theory and the mathematics of group and representations theory to elementary particle physics
- ◆ Have notions of neutrino physics, their masses and oscillations

“

*With this program, you will delve into the latest advances in dark matter and dark energy”*







## Specific Objectives

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- ◆ Know Feynman's rules for quantum electrodynamics, quantum chromodynamics and weak interaction
- ◆ Acquire basic notions of Yang-Mills theory



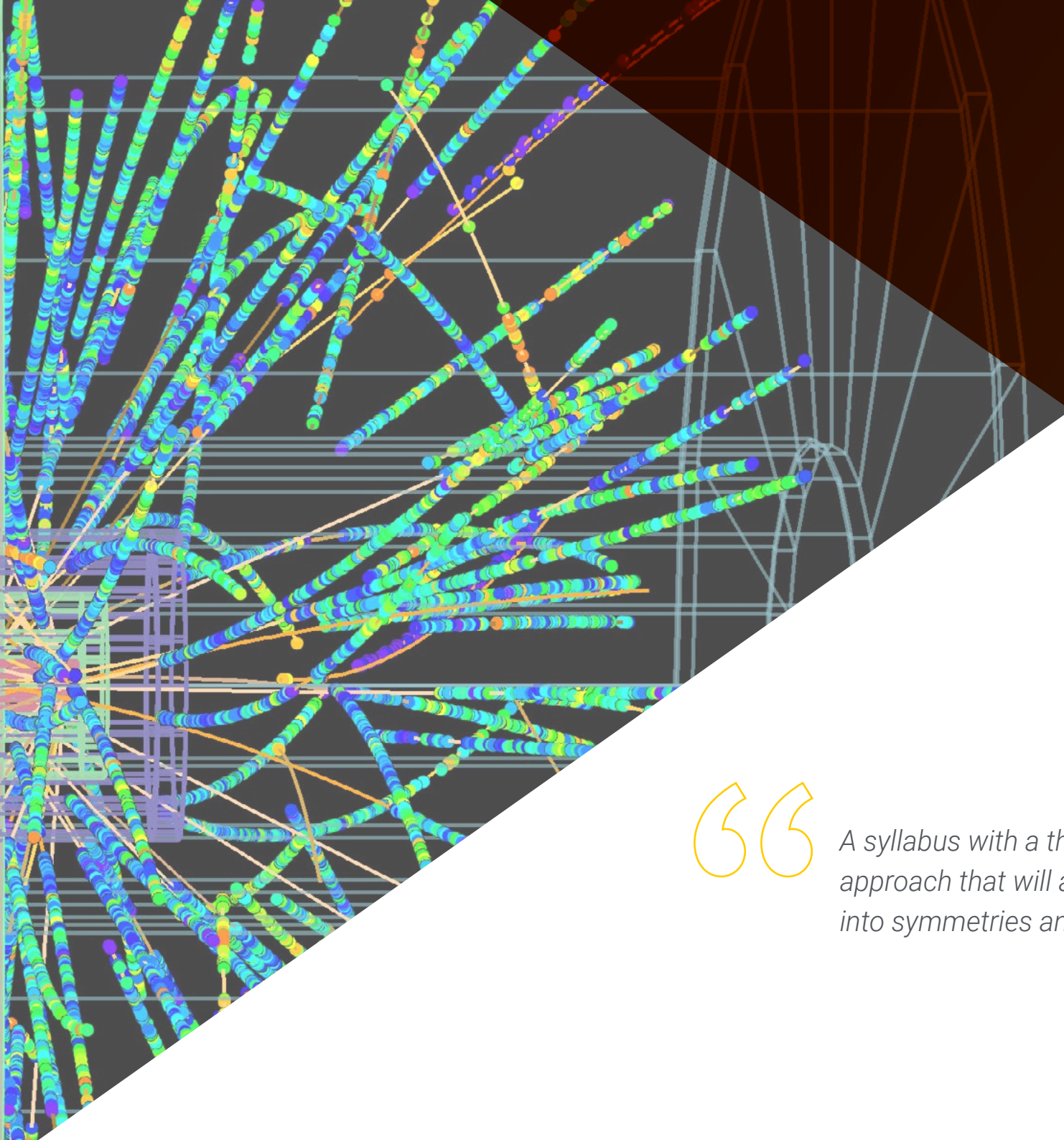
03

# Structure and Content

TECH uses the Relearning system, based on the reiteration of content, in all its programs. Its effectiveness allows a greater assimilation of concepts and the reduction of study hours. This will allow a better consolidation of knowledge by the professionals who will take this Program. In this way, they will be able to acquire an effective learning about symmetries, Feynman calculus or electrodynamics and chromodynamics of quarks. All of this, in addition to innovative multimedia content that can be accessed 24 hours a day from any electronic device with Internet connection.







“

*A syllabus with a theoretical-practical approach that will allow you to easily delve into symmetries and conservation laws”*

## Module 1. High Energy Physics

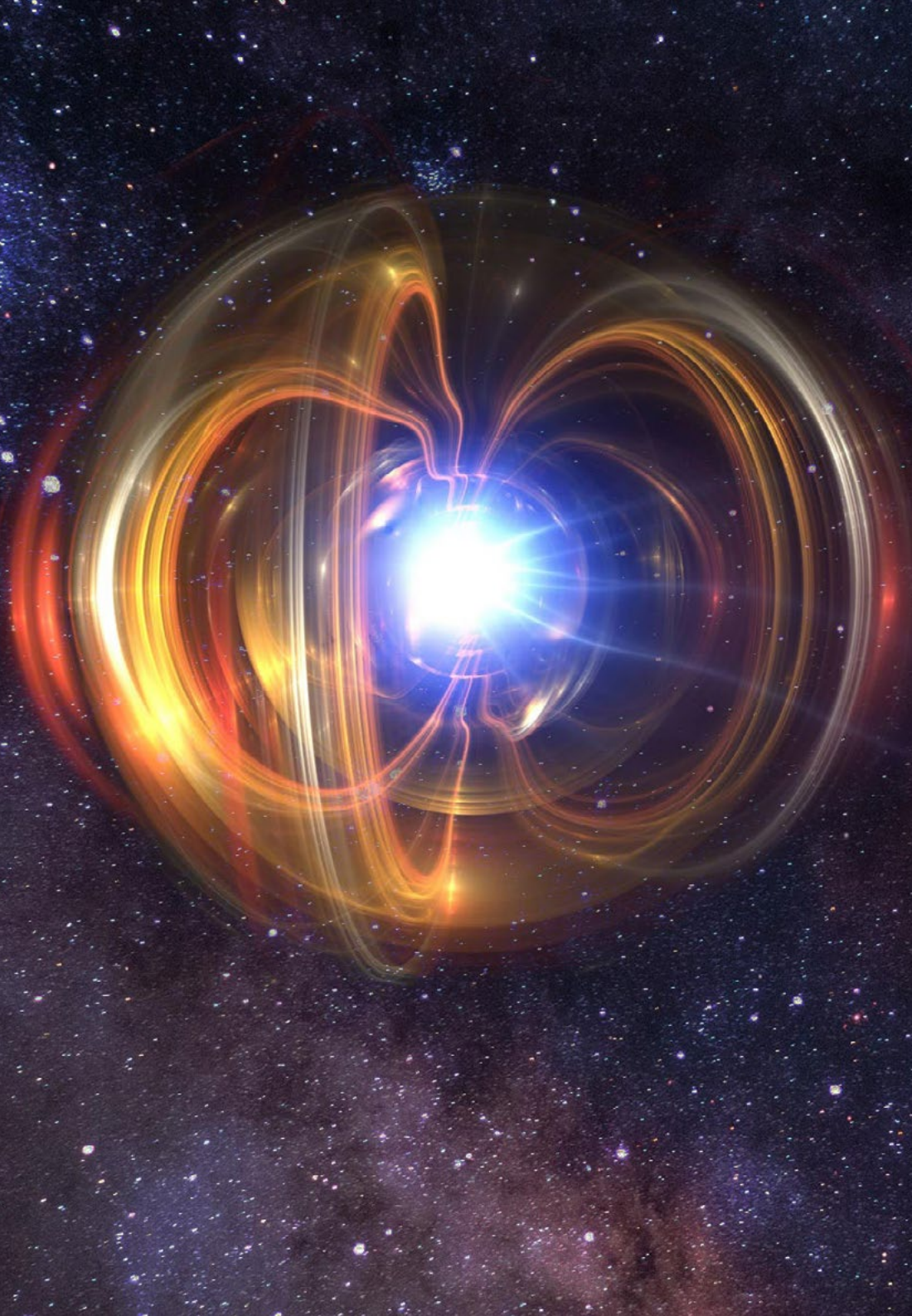
- 1.1. Mathematical Methods: Groups and Representations
  - 1.1.1. Theory of Groups
  - 1.1.2.  $SO(3)$ ,  $SU(2)$  and  $SU(3)$  and  $SU(N)$  Groups
  - 1.1.3. Lie Algebra
  - 1.1.4. Representations
  - 1.1.5. Multiplication of Representations
- 1.2. Symmetries
  - 1.2.1. Symmetries and Conservation Laws
  - 1.2.2. C, P, T Symmetries
  - 1.2.3. CPT Symmetry Violation and Conservation
  - 1.2.4. Angular Momentum
  - 1.2.5. Addition of Angular Momentum
- 1.3. Feynman Calculus: Introduction
  - 1.3.1. Average Lifetime
  - 1.3.2. Cross Section
  - 1.3.3. Fermi's Golden Rule for Decay
  - 1.3.4. Fermi's Golden Rule for Dispersion
  - 1.3.5. Dispersion of Two Bodies in the Center of Masses of Reference Systems
- 1.4. Application of Feynman Calculation: Toy Model
  - 1.4.1. Toy Model: Introduction
  - 1.4.2. Feynman Rules
  - 1.4.3. Average Lifetime
  - 1.4.4. Dispersion
  - 1.4.5. Higher Order Diagrams
- 1.5. Quantum Electrodynamics
  - 1.5.1. Dirac Equation
  - 1.5.2. Solution for Dirac Equations
  - 1.5.3. Bilinear Covariants
  - 1.5.4. The Photon
  - 1.5.5. Feynman Rules for Quantum Electrodynamics
  - 1.5.6. Casimir's Trick
  - 1.5.7. Renormalization
- 1.6. Electrodynamics and Chromodynamics of Quarks
  - 1.6.1. Feynman Rules
  - 1.6.2. Production of Hadrons in Electron-Positron Collisions
  - 1.6.3. Feynman Rules for Chromodynamics
  - 1.6.4. Color Factors
  - 1.6.5. Quark-Antiquark Interaction
  - 1.6.6. Quark-Quark Interaction
  - 1.6.7. Pair Annihilation in Quantum Chromodynamics
- 1.7. Weak Interaction
  - 1.7.1. Weak Charged Interaction
  - 1.7.2. Feynman Rules
  - 1.7.3. Muon Decay
  - 1.7.4. Neutron Decay
  - 1.7.5. Pion Decay
  - 1.7.6. Weak Interaction between Quarks
  - 1.7.7. Weak Neutral Interaction
  - 1.7.8. Electroweak Unification
- 1.8. Gauge Theories
  - 1.8.1. Local Gauge Invariance
  - 1.8.2. Yang-Mills Theory
  - 1.8.3. Quantum Chromodynamics
  - 1.8.4. Feynman Rules
  - 1.8.5. Mass Term
  - 1.8.6. Spontaneous Symmetry Breaking
  - 1.8.7. Higgs Mechanism
- 1.9. Neutrino Oscillation
  - 1.9.1. Solar Neutrino Problem
  - 1.9.2. Neutrino Oscillation
  - 1.9.3. Neutrino Masses
  - 1.9.4. Mixing Matrix



- 1.10. Advanced Topics: Brief Introduction
  - 1.10.1. Higgs Boson
  - 1.10.2. Grand Oscillation
  - 1.10.3. Matter-Antimatter Asymmetry
  - 1.10.4. Supersymmetry, Strings and Extra Dimensions
  - 1.10.5. Dark Matter and Energy

“

*With this program, you will delve into the fundamentals of quantum electrodynamics and the solutions of the Dirac equation”*



04

# 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.



05

# Certificate

This Postgraduate Certificate in High Energy Physics 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 High Energy Physics** 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 High Energy Physics**

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 language  
virtual classroom



## Postgraduate Certificate High Energy Physics

- › Modality: online
- › Duration: 6 weeks
- › Certificate: TECH Technological University
- › Dedication: 16h/week
- › Schedule: at your own pace
- › Exams: online

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