

# Postgraduate Certificate Nuclear and Particle Physics



## Postgraduate Certificate Nuclear and Particle 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/nuclear-particle-physics](http://www.techtitute.com/us/engineering/postgraduate-certificate/nuclear-particle-physics)

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# 01

# Introduction

The boost of nuclear physics has allowed us to better understand atoms and to transfer this knowledge in order to improve the techniques and methods applied in disciplines such as medicine and engineering. This has allowed the development of devices and equipment that improve the diagnosis and therapy of certain diseases or favor the generation of energy. A range of possibilities is opening up to specialists who wish to delve into the smallest particles studied by humans. In this context, TECH offers students a 100% online program, which will help you, in just 6 weeks, to delve into the properties, structure and nuclear interaction or symmetry. For this purpose, it provides the most innovative and current teaching tools that can be accessed comfortably from any device with Internet connection.





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*A 100% online program, without fixed schedules, which was designed for combining your personal responsibilities with quality teaching”*

Semiconductor technology, energy generation or gammagraphy devices have been possible thanks to the development of nuclear and particle physics. Without it, it would not be possible to achieve more sustainable and efficient energy alternatives or the diagnosis and treatment of serious diseases of humans. A theoretical framework was achieved, thanks to comprehensive knowledge and hard scientific work, and the engineering professionals can complement them with their technical expertise.

Given the relevance and the field of development of this discipline of physics at present, this educational institution has decided to design a 100% online postgraduate certificate, which offers students the most innovative content on Nuclear and Particle Physics.

A university program, consisting of 150 teaching hours of comprehensive and advanced knowledge about atomic models, nuclear properties, the standard model of elementary particles, Quarks or relativistic kinematics. All this focusing on a theoretical approach, thanks to the case studies elaborated by the teaching professionals of the program.

Also, through the Relearning method, the specialist taking this program will be able to advance through the syllabus in a much more natural way and even reduce the long hours of study that are so frequent in other teaching systems.

Thus, the engineering professional has an excellent opportunity to take a program that is at the academic forefront, whenever and wherever they wish. They only need an electronic device with Internet connection to access at any time, the contents hosted on the virtual platform. This 100% online program is, therefore, ideal for those who wish to combine the most demanding responsibilities with a quality program.

This **Postgraduate Certificate in Nuclear and Particle 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 assignments
- ◆ Content that is accessible from any fixed or portable device with an Internet connection



*Delve into Nuclear and Particle Physics easily thanks to the multimedia material you will find in this university program"*

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*Get the knowledge you need on Nuclear and Particle Physics from the best specialists, and put them into practice from the field of Engineering”*

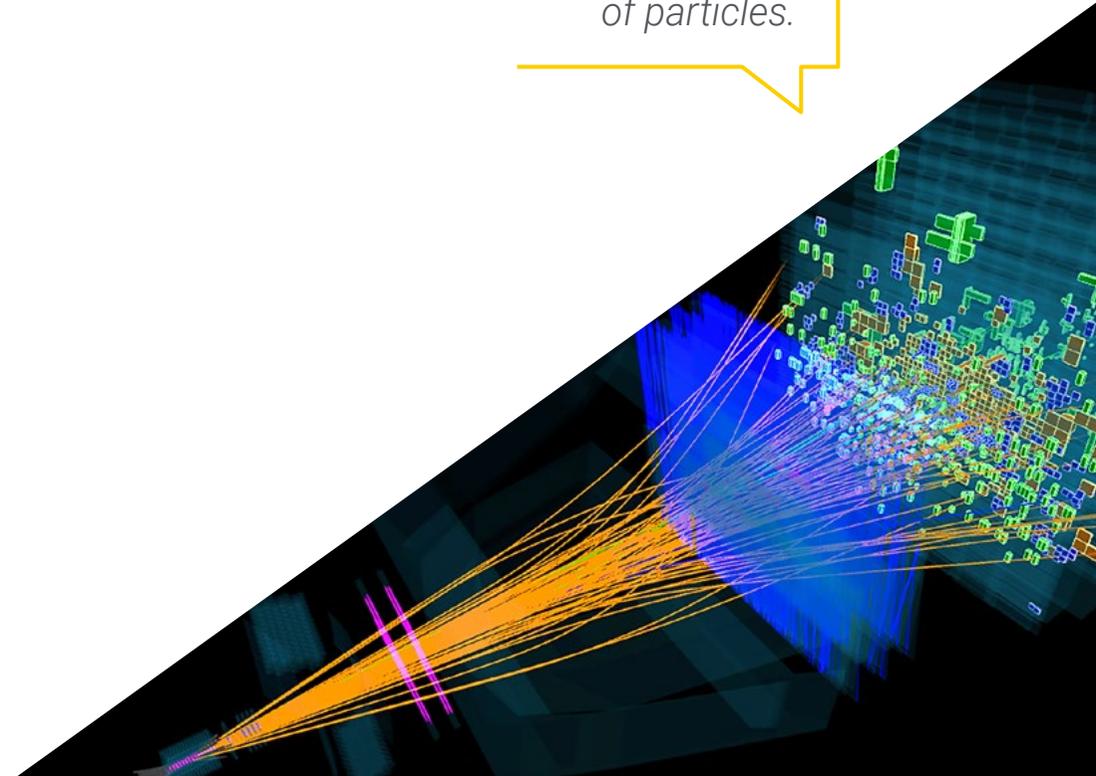
The program's teaching staff includes professionals from the sector who contribute their work experience to this educational program, as well as renowned specialists from leading societies and prestigious universities.

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 only 6 weeks, you will achieve intensive education about nuclear structure, kinematics and conservation laws.*

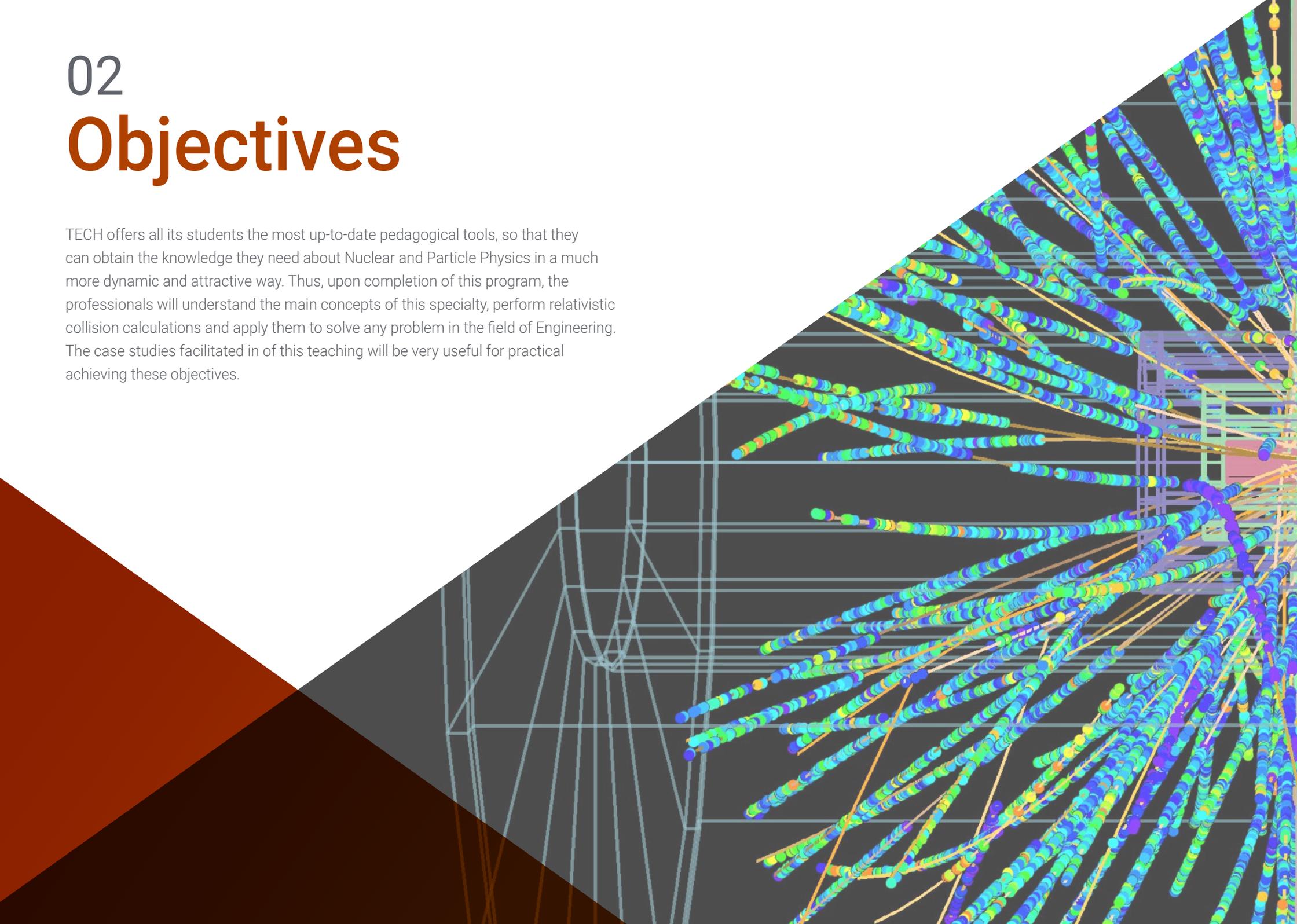
*With this certificate, you will gain a better understanding of the properties and structures of particles.*

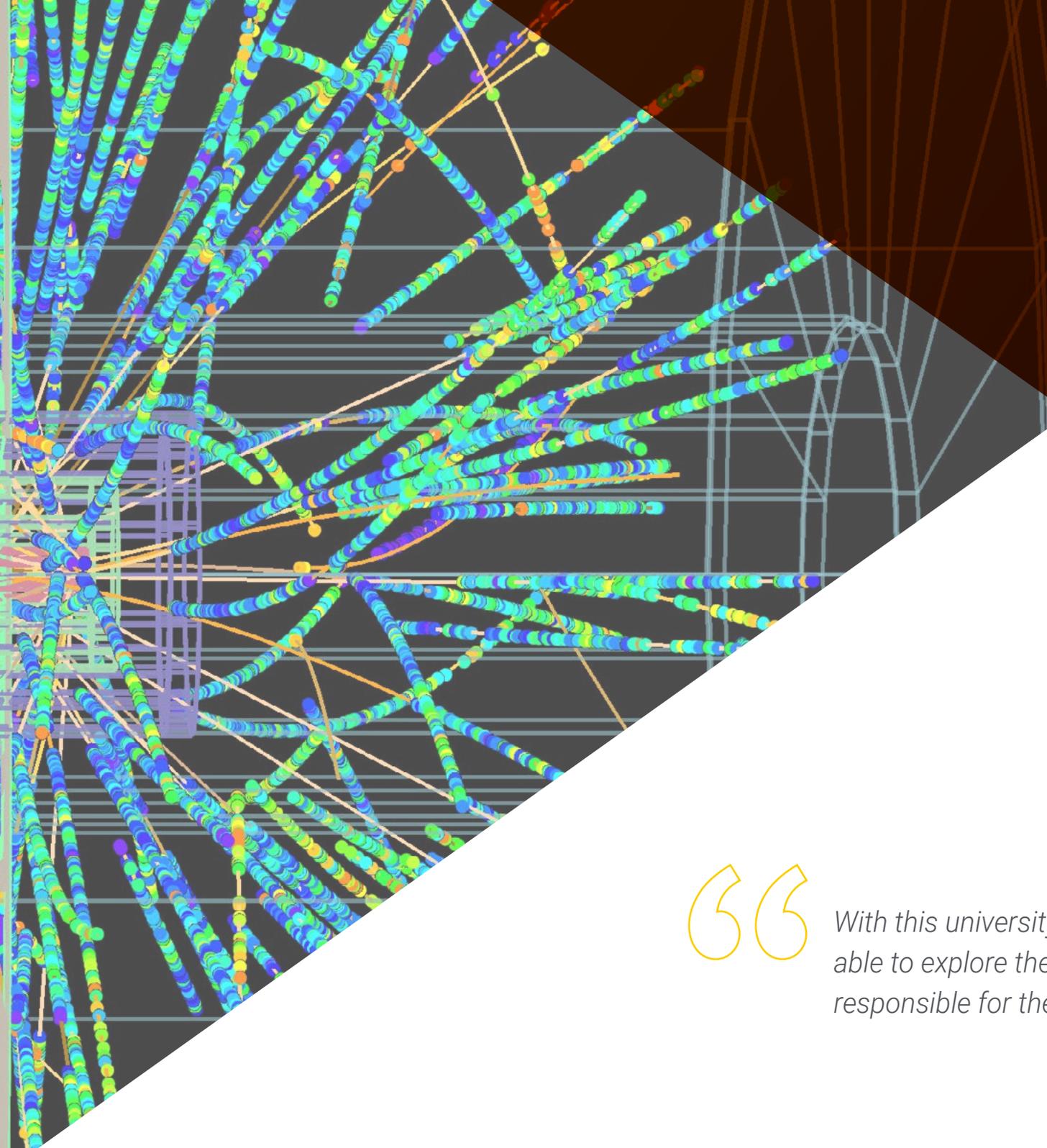


# 02

# Objectives

TECH offers all its students the most up-to-date pedagogical tools, so that they can obtain the knowledge they need about Nuclear and Particle Physics in a much more dynamic and attractive way. Thus, upon completion of this program, the professionals will understand the main concepts of this specialty, perform relativistic collision calculations and apply them to solve any problem in the field of Engineering. The case studies facilitated in of this teaching will be very useful for practical achieving these objectives.





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*With this university program, you will be able to explore the fundamental interactions responsible for the behavior of atoms”*



## General Objectives

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- ◆ Obtain basic knowledge of nuclear and particle physics
- ◆ Know how to distinguish the different nuclear decay processes
- ◆ To know the most important discoveries made in nuclear and particle physics





## Specific Objectives

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- ◆ Know the Feynman diagrams, their use and how to draw them
- ◆ Know how to calculate relativistic collisions
- ◆ Schrödinger's Equation for Central Potentials

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*Would you like to be able to master Feynman diagrams and know how to apply them? Enroll now and acquire the learning you need through this university program"*

03

# Structure and Content

In its maxim to offer all its students a quality education, TECH has created this Postgraduate Certificate using the latest technology applied to its teaching resources. Thanks to this, the professionals will delve into Nuclear and Particle Physics in a much more agile way. Thus, in 6 weeks, you will obtain all the knowledge you need to progress in this field and master such fundamental concepts as nuclear structure and scattering, bound states or relativistic kinematics.

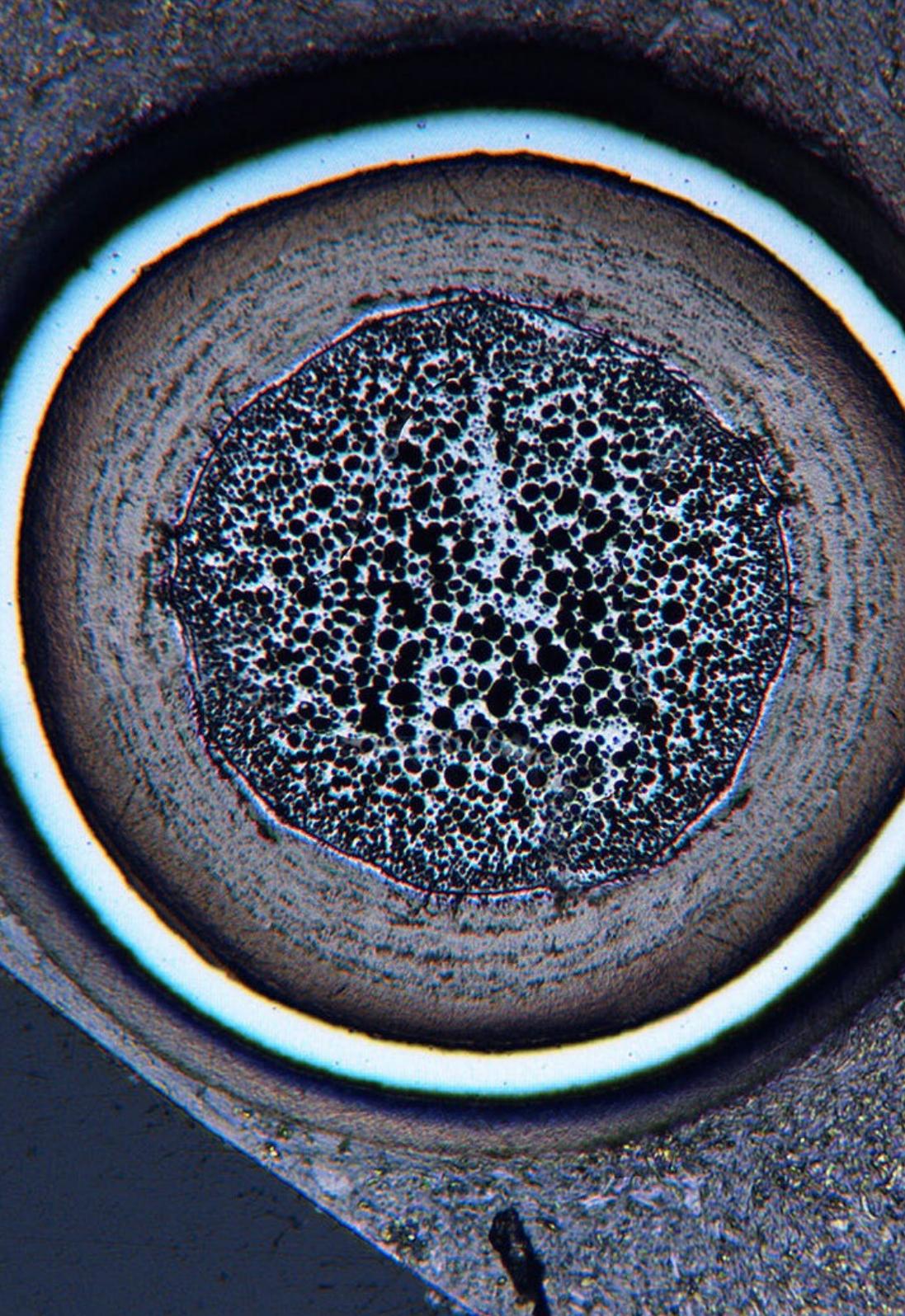


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*You have a library of multimedia resources that you can easily access whenever you wish”*

## Module 1. Nuclear and Particle Physics

- 1.1. Introduction to Nuclear Physics
  - 1.1.1. Periodic Table of the Elements
  - 1.1.2. Important Discoveries
  - 1.1.3. Atomic Models
  - 1.1.4. Important Definitions Scales and Units in Nuclear Physics
  - 1.1.5. Segré's Diagram
- 1.2. Nuclear Properties
  - 1.2.1. Binding Energy
  - 1.2.2. Semiempirical Mass Formula
  - 1.2.3. Fermi Gas Model
  - 1.2.4. Nuclear Stability
    - 1.2.4.1. Alpha Decay
    - 1.2.4.2. Beta Decay
    - 1.2.4.3. Nuclear Fusion
  - 1.2.5. Nuclear Deexcitation
  - 1.2.6. Double Beta Decay
- 1.3. Nuclear Scattering
  - 1.3.1. Internal Structure: Dispersion Study
  - 1.3.2. Effective Section
  - 1.3.3. Rutherford's Experiment: Rutherford's Effective Section
  - 1.3.4. Mott's Effective Section
  - 1.3.5. Momentum Transfer and Shape Factors
  - 1.3.6. Nuclear Charge Distribution
  - 1.3.7. Neutron Scattering
- 1.4. Nuclear Structure and Strong Interaction
  - 1.4.1. Nucleon Scattering
  - 1.4.2. Bound States Deuterium
  - 1.4.3. Strong Nuclear Interaction
  - 1.4.4. Magic Numbers
  - 1.4.5. The Layered Model of the Nucleus
  - 1.4.6. Nuclear Spin and Parity
  - 1.4.7. Electromagnetic Moments of the Nucleus
  - 1.4.8. Collective Nuclear Excitations: Dipole Oscillations, Vibrational States and Rotational States
- 1.5. Nuclear Structure and Strong Interaction II
  - 1.5.1. Classification of Nuclear Reactions
  - 1.5.2. Reaction Kinematics
  - 1.5.3. Conservation Laws
  - 1.5.4. Nuclear Spectroscopy
  - 1.5.5. The Compound Nucleus Model
  - 1.5.6. Direct Reactions
  - 1.5.7. Elastic Dispersion
- 1.6. Introduction to Particle Physics
  - 1.6.1. Particles and Antiparticles
  - 1.6.2. Fermions and Baryons
  - 1.6.3. The Standard Model of Elementary Particles: Leptons and Quarks
  - 1.6.4. The Quark Model
  - 1.6.5. Intermediate Vector Bosons
- 1.7. Dynamics of Elementary Particles
  - 1.7.1. The Four Fundamental Interactions
  - 1.7.2. Quantum Electrodynamics
  - 1.7.3. Quantum Chromodynamics
  - 1.7.4. Weak Interaction
  - 1.7.5. Disintegrations and Conservation Laws



- 1.8. Relativistic Kinematics
  - 1.8.1. Lorentz Transformations
  - 1.8.2. Quatrivectors
  - 1.8.3. Energy and Linear Momentum
  - 1.8.4. Collisions
  - 1.8.5. Introduction to Feynman Diagrams
- 1.9. Symmetries
  - 1.9.1. Groups, Symmetries and Conservation Laws
  - 1.9.2. Spin and Angular Momentum
  - 1.9.3. Addition of Angular Momentum
  - 1.9.4. Flavor Symmetries
  - 1.9.5. Parity
  - 1.9.6. Load Conjugation
  - 1.9.7. CP Violation
  - 1.9.8. Time Reversal
  - 1.9.9. CPT Conservation
- 1.10. Linked States
  - 1.10.1. Schrödinger's Equation for Central Potentials
  - 1.10.2. Hydrogen Atom
  - 1.10.3. Fine Structure
  - 1.10.4. Hyperfine Structure
  - 1.10.5. Positronium
  - 1.10.6. Quarkonium
  - 1.10.7. Lightweight Mesons
  - 1.10.8. Baryons

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.





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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.

“

*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.



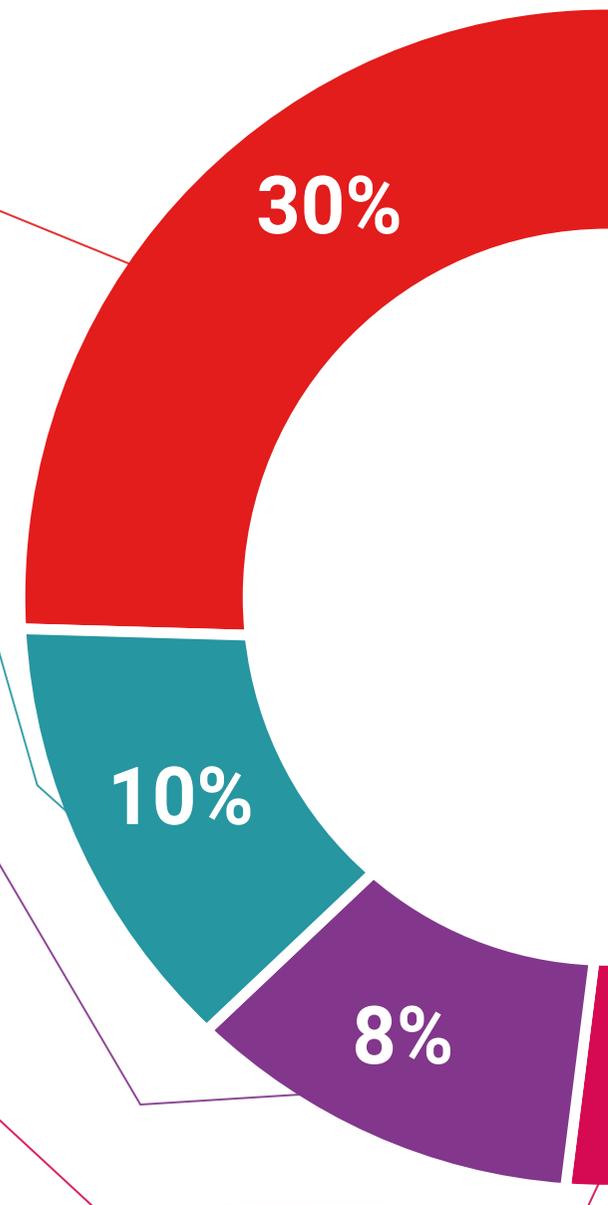
### Practising Skills and Abilities

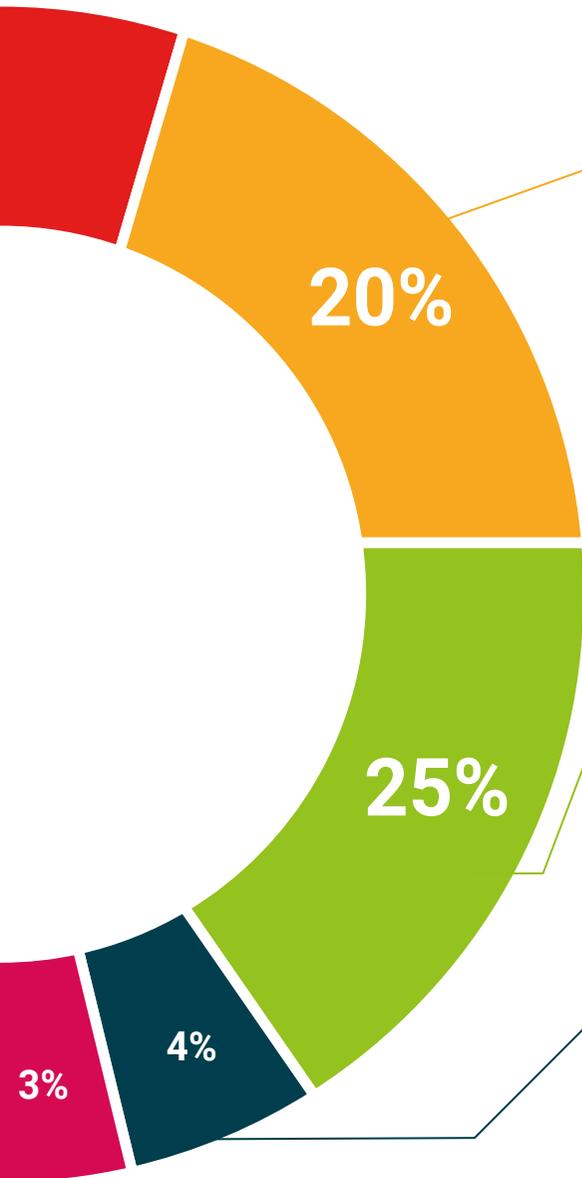
They will carry out activities to develop specific skills and abilities in each subject area. Exercises and activities to acquire and develop the skills and abilities that a specialist needs to develop in the context of the globalization that we are experiencing.



### 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 Nuclear and Particle 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 Nuclear and Particle 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 Nuclear and Particle 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  
development language  
virtual classroom



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