

# Postgraduate Certificate

## Advanced Alternative Internal Combustion Engines



## Postgraduate Certificate Advanced Alternative Internal Combustion Engines

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

Website: [www.techtitude.com/us/engineering/postgraduate-certificate/advanced-alternative-internal-combustion-engines](http://www.techtitude.com/us/engineering/postgraduate-certificate/advanced-alternative-internal-combustion-engines)

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Certificate

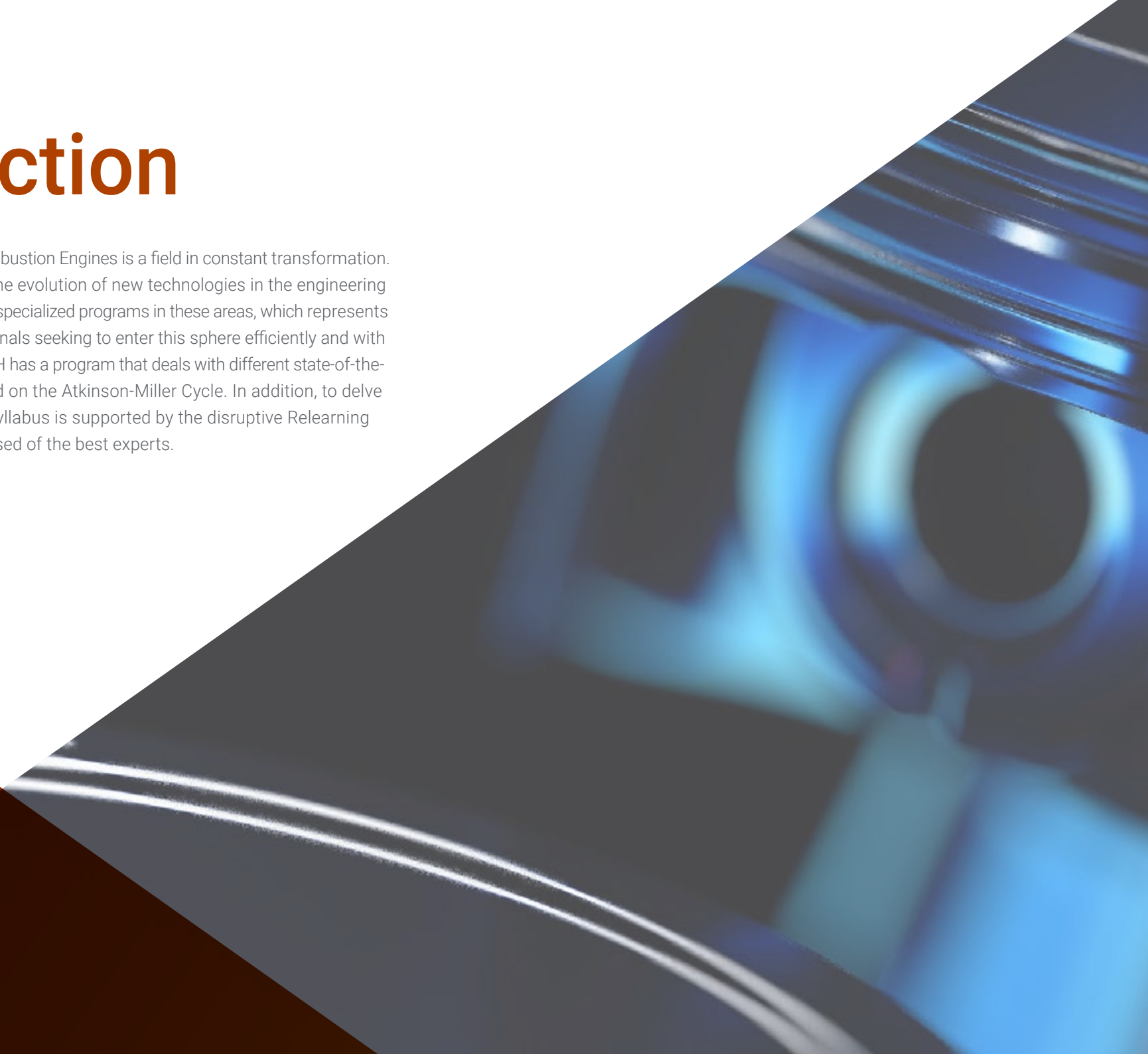
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# 01

# Introduction

The development of Alternative Combustion Engines is a field in constant transformation. Its advances are closely linked to the evolution of new technologies in the engineering area. However, there are not enough specialized programs in these areas, which represents a significant challenge for professionals seeking to enter this sphere efficiently and with up-to-date skills. In this context, TECH has a program that deals with different state-of-the-art machinery such as those based on the Atkinson-Miller Cycle. In addition, to delve into these complex subjects, the syllabus is supported by the disruptive Relearning methodology and a faculty composed of the best experts.



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*An educational itinerary in 100%  
online modality where you will update  
your competences on the design and  
development of Advanced MCIA"*

Pulsed combustion engines, or PCCIs, stand out in the automotive field for their ability to combine other systems such as spark and compression ignition. Their uses have been extended mainly to the transportation sector as they allow greater efficiency in fuel consumption and reduce polluting emissions. At the same time they extend to power generation systems that already offer improved performance over traditional engines.

This type of propellant is just one example of the constant transformations that are taking place in the field of Alternative Combustion Engine development. A very complex field that requires the most up-to-date technologies and the professional practice of duly trained experts. However, syllabuses that delve into these issues in a comprehensive way are not abundant and engineers face serious difficulties in updating their skills.

For this reason, TECH has created this Postgraduate Certificate where students will analyze the characteristics and operation of compound duty cycle engines, Atkinson-Miller cycle, among others. In turn, they will delve into the integration of modalities and the search for better applications to impact machinery efficiency and performance.

In addition, this TECH educational pathway implements the innovative Relearning teaching method. In this way, graduates will acquire practical skills in a fast and flexible manner. In addition, the university program will have a 100% online mode of study, without hermetic schedules or rigid evaluation systems. For this reason, each participant will be able to choose when and where access the contents, being able to personalize their learning. All of this with the teaching guidance of a faculty made up of the best experts.

This **Postgraduate Certificate in Advanced Alternative Internal Combustion Engines** 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 Aeronautical Engineering.
- ♦ The graphic, schematic and eminently practical contents of the book provide Specialised and practical information on those 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



*This is your opportunity to boost your professional career with rigorous specialization, developed by the best experts"*

“

*Delve into the optimization of valve openings to improve engine efficiency under different load conditions"*

*Do not miss the opportunity and master the latest lines of research in the field of internal combustion engines.*

*Address the applications of the Arkinson cycle in hybrid vehicles for partial loads through this comprehensive program.*

The program's teaching staff includes professionals from the field 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 during the educational year. For this purpose, the students will be assisted by an innovative interactive video system created by renowned and experienced experts.



# 02 Objectives

This Postgraduate Certificate has as its main goal the integral preparation of students in the design and advanced development of Alternative Internal Combustion Engines. To this end, the program is uniquely composed of the most up-to-date concepts and a disruptive educational methodology in a 100% online format. Ultimately, throughout the university program, graduates will incorporate the necessary skills to expand their practice and face the most complex challenges of the sector.







“

*This program will allow you to develop competencies through the analysis of real cases"*



## General Objectives

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- ♦ Enable students to understand, analyze and apply advanced concepts in alternative internal combustion engines
- ♦ Analyze how the latest technologies are redefining energy efficiency and reducing emissions in internal combustion vehicles
- ♦ Develop a critical mindset to evaluate and compare different approaches in order to make informed decisions in the design and development of propulsion systems



*Learn more about the features and advantages of Variable Comprehension Engines through this Postgraduate Certificate"*





## Specific Objectives

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- Explore in depth Miller cycle engines, controlled compression ignition (HCCI), compression ignition (CCI) and other emerging concepts
- Analyze the technologies that enable compression ratio adjustment and their impact on efficiency and performance
- Fundamentals of integrating multiple approaches, such as the Atkinson-Miller cycle and spark controlled ignition (SCCI), to maximize efficiency under a variety of conditions
- Assess the future prospects of alternative internal combustion engines and their relevance in the context of the evolution towards more sustainable propulsion systems

03

# Course Management

This educational program is led by a team of experts with extensive experience in the field of aeronautics. Their skills and mastery of trends in this area are related to their direct and active involvement in advanced engineering projects. Through their experiences, the faculty members have put together a syllabus that addresses the technical and environmental challenges of the motor industry. Their pedagogical advice will guide with excellence the graduates of the educational itinerary with 6 weeks of extension.



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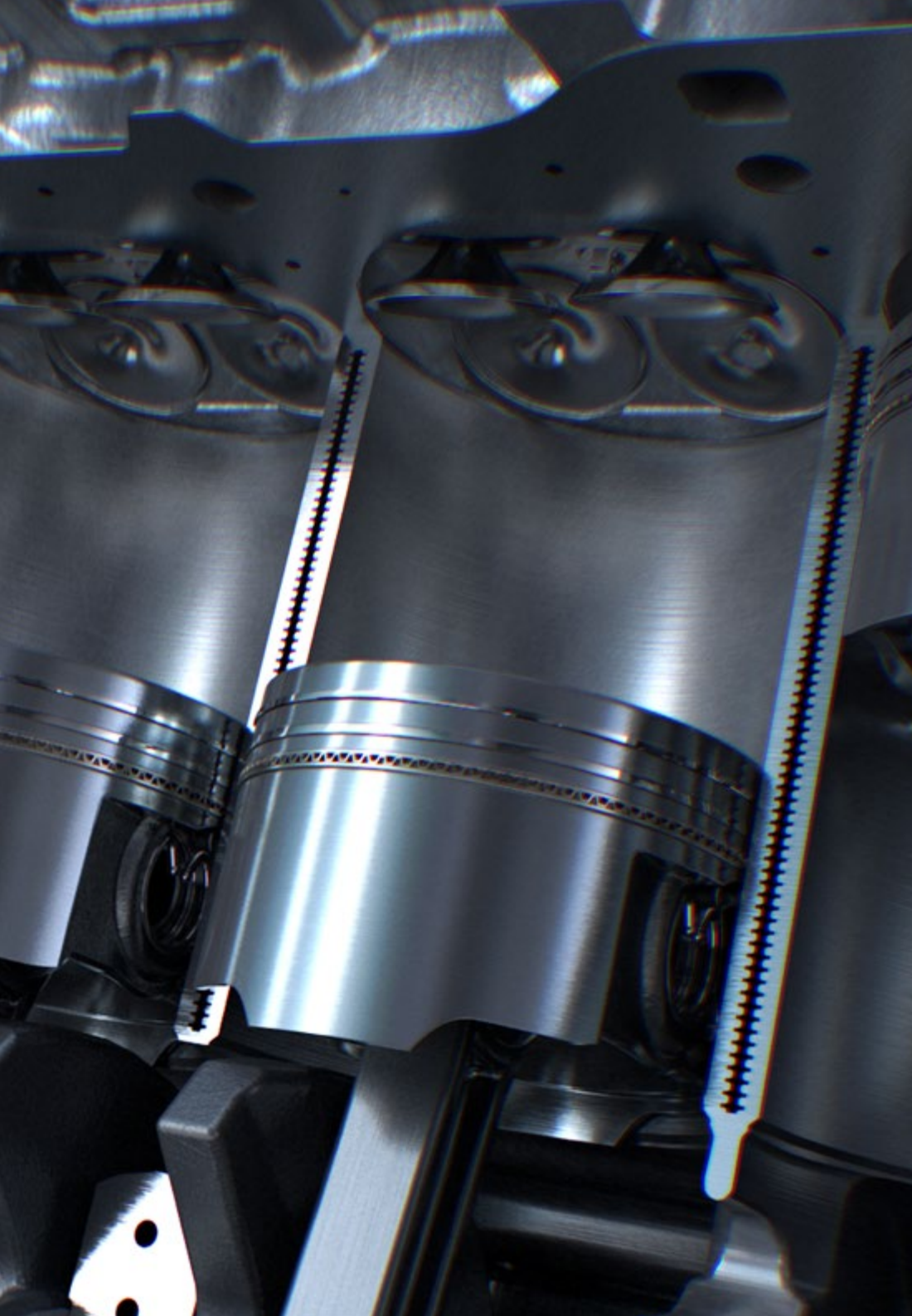
*A first-rate faculty of prestigious experts  
will be at your disposal throughout this  
educational itinerary"*

## Management



### Mr. Del Pino Luengo, Isatsi

- Airbus Defence & Space CC295 FWSAR program certification and airworthiness technical manager
- Airworthiness and certification engineer for the engine section in charge of the MTR390 program at the National Institute for Aerospace Technology (NIAT)
- Airworthiness engineer and certification for the VSTOL section by the National Institute for Aerospace Technology (NIAT)
- Aeronautical design and certification engineer for the life extension project of the Spanish Navy AB212 helicopters (PEVH AB212) at Babcock MCSE
- Design and Certification Engineer in the DOA department at Babcock MCSE
- Fleet Technical Office Engineer AS 350 B3/ BELL 212/ SA 330 J.Babcock MCSE
- Qualifying Master's Degree in Aeronautical Engineering from the University of León
- Aeronautical Technical Engineer in Aeromotors, Polytechnic University of Madrid



## Professors

### Mr. Madrid Aguado, Víctor Manuel

- ♦ Aeronautical Engineer at CAPGEMINI
- ♦ Aeronautical Engineer at INAER Helicópteros S.A.U. Spain
- ♦ Teacher at the Official College of Aeronautical Technical Engineers
- ♦ In-house trainer at Capgemini Spain in Aircraft Certification
- ♦ Teacher at CIFP Professor Raúl Vázquez
- ♦ Graduated in Aerospace Engineering from the University of León
- ♦ Degree in Aeronautical Technical Engineering, specializing in Aircraft, University School of Aeronautical Technical Engineers, Polytechnic University of Madrid
- ♦ Part 21, Part 145 & Part M Certification at ALTRAN ASD
- ♦ Part 21 Certification at INAER S.A.U



*A unique, key, and decisive educational experience to boost your professional development"*

04

# Structure and Content

The Alternative Internal Combustion Engines, with an advanced character, are characterized by the use of innovative technologies, designs and processes to optimize efficiency, reduce emissions and improve performance with respect to other conventional equipment. For this reason, TECH has grouped the latest trends in the manufacture of these machines in this very complete program. In this way, its syllabus delves into concepts such as the Miller cycle, controlled compression (HCCI), pulse combustion, among other advanced aspects. All this 100% online, in an exclusive Virtual Campus where students will have at their disposal a variety of multimedia resources.







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*A syllabus tailored to your needs:  
no tight schedules or intensive  
evaluation chronograms”*

## Module 1. Conventional and Advanced Alternative Internal Combustion Engines

- 1.1. Miller Cycle Engines
  - 1.1.1. Miller Cycle Efficiency
  - 1.1.2. Intake Valve Opening and Closing Control for Improved Thermodynamic Efficiency
  - 1.1.3. Implementation of the Miller Cycle in Internal Combustion Engines Advantages
- 1.2. Compression Controlled Compression Ignition (HCCI) Engines
  - 1.2.1. Controlled Compression Ignition
  - 1.2.2. Auto-Ignition Process of the Air-Fuel Mixture without the Need for a Spark
  - 1.2.3. Efficiency and Emissions Challenges of Controlling Autoignition
- 1.3. Compression Ignition Engines (CIE)
  - 1.3.1. Comparison between HCCI and CCI
  - 1.3.2. Compression Ignition in CIE engines
  - 1.3.3. Control of the Air-Fuel Mixture and Adjustment of the Compression Ratio for Optimum Performance
- 1.4. Atkinson Cycle Engines
  - 1.4.1. Atkinson Cycle and Its Variable Compression Ratio
  - 1.4.2. Power vs Efficiency
  - 1.4.3. Hybrid Vehicle Applications and Part-Load Efficiency
- 1.5. Pulsed Combustion Engines (PCE)
  - 1.5.1. PCE Motors Operation
  - 1.5.2. Use of Precise, Time-Controlled Fuel Injections to Achieve Ignition
  - 1.5.3. Efficiency and Emissions Control Challenges
- 1.6. Spark Ignition Engines (SIE)
  - 1.6.1. Compression Ignition and Spark Ignition Combination
  - 1.6.2. Dual Ignition Control
  - 1.6.3. Efficiency and Emissions Reduction
- 1.7. Atkinson-Miller Cycle Engines
  - 1.7.1. Atkinson and Miller Cycle
  - 1.7.2. Optimization of Valve Opening to Improve Efficiency at Different Load Conditions
  - 1.7.3. Examples of Applications in Terms of Efficiency



- 1.8. Variable Compression Engines
  - 1.8.1. Engines with Variable Compression Ratios
  - 1.8.2. Technologies for Real-Time Compression Ratio Adjustment
  - 1.8.3. Impact on Engine Efficiency and Performance
- 1.9. Advanced Internal Combustion Engines (AICE)
  - 1.9.1. Compound Duty Cycle Engines
    - 1.9.1.1. HLSI, Combined Oxidation Engines, LTC
  - 1.9.2. Technologies Applied to Advanced AICEs
  - 1.9.3. Advanced AICE applicability
- 1.10. Alternative Internal Combustion Engine Innovation and Development
  - 1.10.1. Less Conventional Alternative Engine Technologies
  - 1.10.2. Examples of Experimental or Emerging Engines
  - 1.10.3. Research Lines

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*Enroll in this program and expand your engineering skills through TECH's innovative Relearning system”*



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 Advanced Alternative Internal Combustion Engines guarantees you, in addition to the most rigorous and updated training, access to a Executive Master's Degree issued by TECH Global University.



The image features two black graduation caps (mortarboards) against a bright blue sky with light, wispy clouds. The caps are positioned diagonally, with one in the foreground and another slightly behind it. The background is split into a white triangular area at the bottom right and a dark brown area at the top right.

“

*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 **Postgraduate Certificate in Advanced Alternative Internal Combustion Engines** 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: **Postgraduate Certificate in Advanced Alternative Internal Combustion Engines**

Modality: **online**

Duration: **6 weeks**

Accreditation: **6 ECTS**



\*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.



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