

# Postgraduate Certificate

## Vibration, Noise and Balancing of Alternative Internal Combustion Engines





## Postgraduate Certificate Vibration, Noise and Balancing of 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.techtute.com/us/engineering/postgraduate-certificate/vibration-noise-balancing-alternative-internal-combustion-engines](http://www.techtute.com/us/engineering/postgraduate-certificate/vibration-noise-balancing-alternative-internal-combustion-engines)

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# 01

# Introduction

Since the Industrial Revolution, the Internal Combustion Engine has been at the heart of industry and transportation. However, in the 21st century, the need to optimize these machines is more urgent than ever. The growing demand for energy, coupled with concerns about environmental impact, creates significant problems for industry and society as a whole. In this context, TECH offers a program where professionals will update their skills in the control and reduction of faults such as vibrations, noise and balancing. A 100% online university program where graduates will be able to support their educational itinerary with the disruptive Relearning methodology in which TECH Global University is a pioneer.





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*Thanks to this Postgraduate Certificate you will comprehensively address the parameters and tools for measuring noise and vibration in MCI" First outstanding presentation"*



Throughout history, Internal Combustion Engines have been at the epicenter of industry and mobility, driving innovation and contributing to the progress of society. However, the contemporary world is facing a scenario in which it is imperative to optimize the efficiency and sustainability of these machines.

In this task, the specialized work of professionals with excellent training is essential. However, engineers face serious difficulties in keeping up-to-date and accessing the latest scientific evidence on this subject.

TECH, with respect to these demands, guarantees a definitive educational boost to its students. To this end, it offers an up-to-date and rigorous university program that covers blockages, intake and exhaust systems and other processes within the combustion system. At the same time, it delves into the modal analysis and dynamic response of motors. Also, the frequency and complexity of torsional vibrations.

In another part of the syllabus, participants in the academic pathway will learn about balancing techniques, as well as sensors and data acquisition methods. It also addresses methods to control and reduce machine noise, contributing to improvements such as minimizing noise pollution.

In addition, in order to guarantee the global management of these concepts and tools, the Postgraduate Certificate is supported by the Relearning methodology. This unique learning system facilitates the incorporation of competencies based on the practical needs of the professional environment in a fast and flexible way. Likewise, the educational itinerary will be 100% online, allowing each student to choose the right moment to access the materials, according to their personal objectives and responsibilities.

This **Postgraduate Certificate in Vibration, Noise and Balancing of 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 system provide specialized 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



*Examine international regulations applicable to industrial plants and land transportation through this TECH program"*

“

*A syllabus accessible from the portable device of your choice 24 hours a day, 7 days a week”*

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.

*You will be able to manage and plan different vibration and noise maintenance activities thanks to the skills acquired in this syllabus.*

*Don't miss the opportunity to be part of the TECH community, the best online university in the world according to Forbes.*



# 02

# Objectives

This university program provides a holistic view to understand and implement vibration and noise control in Alternative Internal Combustion Engines. For this purpose, the program includes an analysis of values such as dynamic response, frequency response and torsional vibrations. All this while addressing in parallel the impact of these failures and defects on the operation of the transportation systems. Likewise, these academic goals will be plausible thanks to TECH's innovative methodology and its 100% online and personalized study modality.







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*This syllabus will propel your career as an automotive engineer to excellence”*



## General Objectives

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- ♦ Determine the natural vibration of internal combustion engines, modally analyzing their frequency and dynamic response, the impact on engine noise in normal and abnormal operation
- ♦ Study applicable vibration and noise reduction methods, international regulations and impact on transportation and industry



*Through this program, you will master the modeling and balancing techniques to reduce vibrations in MCIA"*





## Specific Objectives

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- Determine the vibration and noise modes generated by a reciprocating internal combustion engine
- Modal analysis of internal combustion engines, their dynamic response, frequency and torsional vibrations
- Establish the different techniques for balancing motors
- Develop the techniques used in noise and vibration control and reduction
- Identify maintenance tasks required to maintain levels within tolerances
- Support the impact of vibration and noise in industry and transportation, based on applicable international standards



03

# Course Management

This educational program benefits from a teaching team made up of professionals with expertise in key areas, including aeronautical engineers and experts in alternative internal combustion engine dynamics. Their in-depth industry knowledge and experience allows them to guide students through complex issues and apply real-world approaches to practical situations from participatory forums and interactive videos. In this way, with your educational guidance, graduates will be able to build their skills in the fastest and most efficient way.



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*TECH faculty are up-to-date on the most advanced tools for testing the noise and roll generated by an MCIA"*

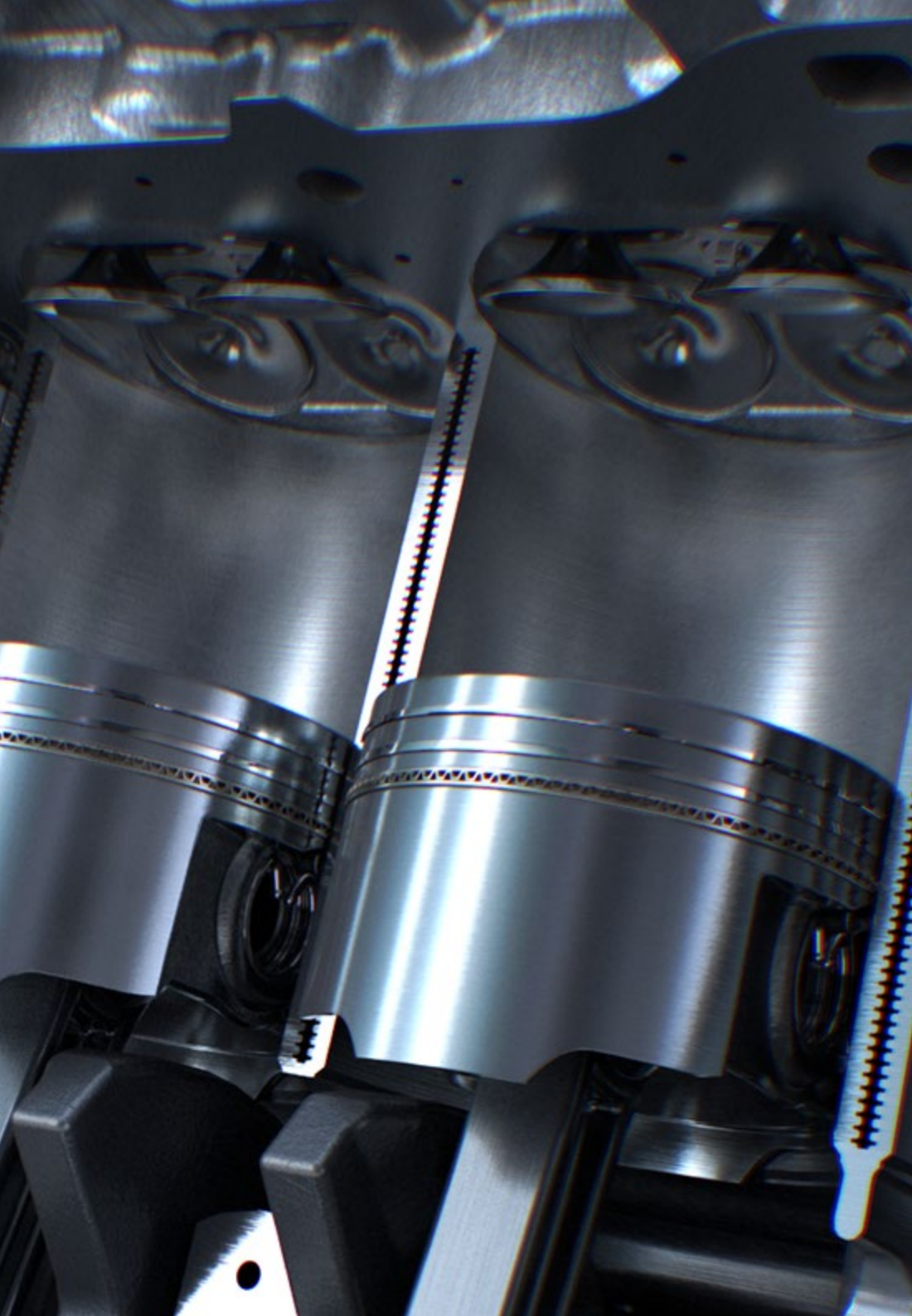


## Management



### 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

### Ms. Calatayud Sánchez, Rosa

- ◆ Type certificate Manager of the M&L fleet at Airbus DS
- ◆ Management of Certification activities with ADS areas and Authorities at Airbus DS
- ◆ Altran Innovation on behalf of Airbus DS for M&L programs Initial military version certification (FAR 25)
- ◆ Forming certification bases and type certificates for Airbus DS
- ◆ Certification and airworthiness trainer under Canadian TAA authority for Airbus DS
- ◆ Aeronautical Engineer, specializing in Aircraft and Airports, Polytechnic University of Valencia
- ◆ MBA in Tago Academy

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*Take the opportunity to learn about the latest advances in this field in order to apply it to your daily practice"*

# 04

## Structure and Content

This program is an exceptional opportunity for professionals to expand their theoretical knowledge and practical skills on the management of vibration, noise and balancing in Alternative Internal Combustion Engines. In its syllabus, the program covers aspects such as vibration analysis as well as advanced noise abatement techniques. Likewise, in order to master these contents, graduates will be supported by the Relearning methodology, which facilitates assimilation through a progressive and natural reiteration.





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*A 100% online program where you can choose the ideal time and place to study without leaving home"*

## Module 1. Vibration, Noise and Engine Balancing

- 1.1. Vibration and Noise on Internal Combustion Engines
  - 1.1.1. Evolution of Vibration and Noise Motors
  - 1.1.2. Vibration and Noise Parameters
  - 1.1.3. Data Acquisition and Interpretation
- 1.2. Sources of Vibration and Noise in Engines
  - 1.2.1. Vibration and Noise Generated by the Block
  - 1.2.2. Intake and Exhaust Generated Vibration and Noise
  - 1.2.3. Vibration and Noise Generated by Combustion
- 1.3. Modal Analysis and Dynamic Response of Motors
  - 1.3.1. Modal Analysis: Geometry, Materials and Configuration
  - 1.3.2. Modal Analysis Modeling: One Degree of Freedom/Multiple Degrees of Freedom
  - 1.3.3. Parameters: Frequency, Damping and Vibration Modes
- 1.4. Frequency and Torsional Vibration Analysis
  - 1.4.1. Amplitude and Frequency of Torsional Vibration
  - 1.4.2. Vibration Frequencies of Internal Combustion Engines
  - 1.4.3. Sensors and Data Acquisition
  - 1.4.4. Theoretical vs. Experimental Analysis
- 1.5. Engine Balancing Techniques
  - 1.5.1. In-Line Distribution Engine Balancing
  - 1.5.2. V-Distribution Engine Balancing
  - 1.5.3. Modeling and Balancing
- 1.6. Vibration Control and Reduction
  - 1.6.1. Control of Natural Vibration Frequencies
  - 1.6.2. Vibration and Shock Isolation
  - 1.6.3. Dynamic Damping
- 1.7. Noise Control and Reduction
  - 1.7.1. Noise Control and Attenuation Methods
  - 1.7.2. Exhaust Silencers
  - 1.7.3. Active Noise Cancellation Systems ANCS





- 1.8. Vibration and Noise Maintenance
  - 1.8.1. Lubrication
  - 1.8.2. Engine Block Balancing
  - 1.8.3. Useful Life of the Systems Dynamic Fatigue
- 1.9. Impact of Engine Vibration and Noise on Industry and Transportation
  - 1.9.1. International Standards in Industrial Plants
  - 1.9.2. International Regulations Applicable to Land Transportation
  - 1.9.3. International Regulations Applicable to Other Sectors
- 1.10. Practical Application of Vibration and Noise Analysis of an Internal Combustion Engine
  - 1.10.1. Theoretical Modal Analysis of an Internal Combustion Engine
  - 1.10.2. Determination of Sensors for Practical Analysis
  - 1.10.3. Establishment of Suitable Attenuation Methods and Maintenance Plan

“*Enroll now in this program and you will have at your disposal several multimedia resources to strengthen practical skills in a holistic way*”



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.



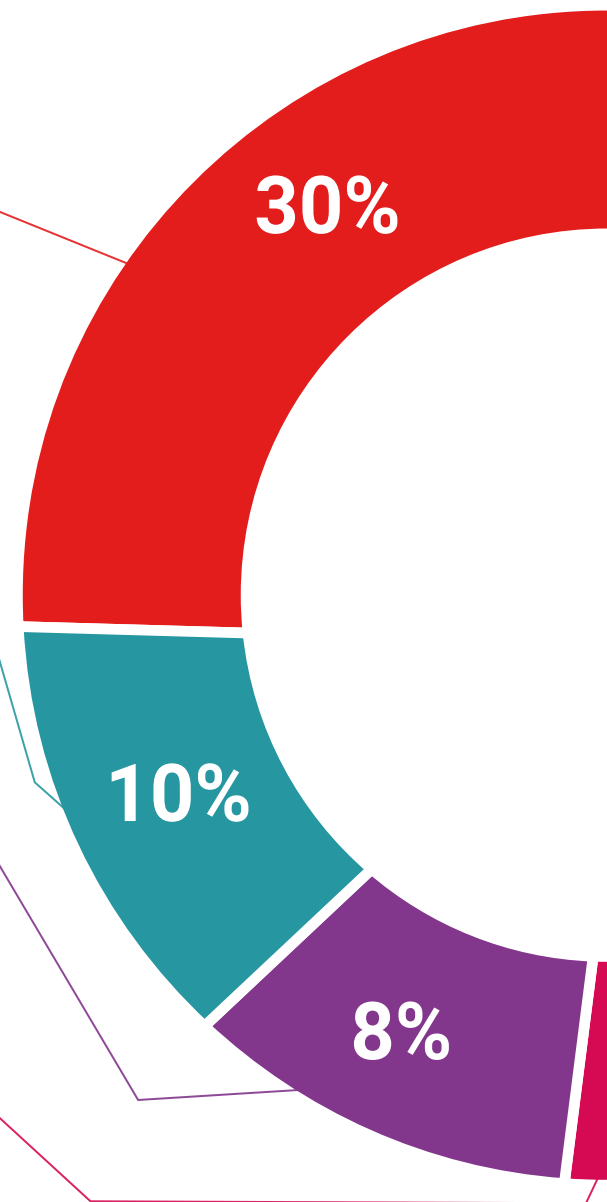
### Practising Skills and Abilities

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 Vibration, Noise and Balancing of Alternative Internal Combustion Engines guarantees students, in addition to the most rigorous and up-to-date education, access to a Postgraduate Certificate issued by TECH Global University.







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*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 Vibration, Noise and Balancing of 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 Vibration, Noise and Balancing of 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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