Postgraduate Diploma

Maintenance of Alternative Internal Combustion Engines

tech global university

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Postgraduate Diploma
Maintenance of Alternative Internal Combustion Engines

- Modality: **online**
- Duration: **6 months**
- Certificate: **TECH Global University**
- Credits: **18 ECTS**
- Schedule: **at your own pace**
- Exams: **online**

Website: **www.techtitute.com/us/engineering/postgraduate-diploma/postgraduate-diploma-maintenance-alternative-internal-combustion-engines**

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01

Introduction

Preventing Alternative Internal Combustion Engine failures in advance requires an intensive preventive maintenance plan. The implementation of these improvement processes requires up-to-date skills on the part of engineers. In this way, they will be able to implement electronic adjustments that optimize machine performance, economize fuel consumption or help reduce environmental pollution. This study program is available to professionals in the sector to update their knowledge and skills. A 100% online program without several rigid and restrictive evaluation schedules that delves into the main mechanisms to control vibrations, noises and engine balancing and establishes the systems for early diagnosis of different types of failures.

A Postgraduate Diploma 100% online that will allow you to implement maintenance and repairs to AICE with efficiency and low environmental impact"

The indiscriminate use of fuel is one of the problems that has historically affected the image of Internal Combustion Engines. For this reason, the search for alternative models has been prioritized in recent times, giving rise to important electronic innovations that allow greater energy efficiency, reduce polluting emissions and enhance the durability of the machinery. With constant technological advances in the industry, understanding and mastering these topics is essential to maintain and improve engine performance, reduce operating costs, comply with regulations and ensure quality operations.

Faced with this scenario, TECH offers a 6-month program where professionals will broaden their competencies in a comprehensive manner. The Postgraduate Diploma consists of 3 educational modules and, in each one of them, the students will have within their reach the keys related to the efficiency, reliability, and safety of the Alternative Internal Combustion Engines.

First, the syllabus focuses on fuel injection and engine ignition systems. In addition, it addresses the main high pressure technologies, mixture formation and the instruments for the control and calibration of competent technicians. In turn, it analyzes the sources of vibration, sway and noise, while examining ways to reduce these anomalies. Finally, the plan addresses the most advanced maintenance types and imaging tests for data extraction and long-term damage prevention.

These study materials will be available in an attractive virtual campus with multiple educational and multimedia resources, including explanatory videos, interactive summaries, and complementary readings. All this through the Relearning methodology that facilitates the assimilation of concepts in a fast and flexible way by means of their gradual and continuous repetition. Furthermore, this teaching process will be guided by a faculty of the highest prestige, with a very high level of experience in this sector of engineering.

This **Postgraduate Diploma in Maintenance 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 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

Enroll in this program and you will have at your disposal the best educational material through videos, infographics and interactive summaries"

You will have access to the contents of this Postgraduate Diploma 24 hours a day, 7 days a week, from the location of your choice"

You are one step away from enrolling in the world's top-rated university by its students according to the Trustpilot platform.

You will delve into the innovative electronic injection systems that ensure precise fuel quantity input in modern engines.

The program includes in its teaching staff professionals from the sector who bring to this training the experience of their work, as well as recognized specialists from leading companies 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

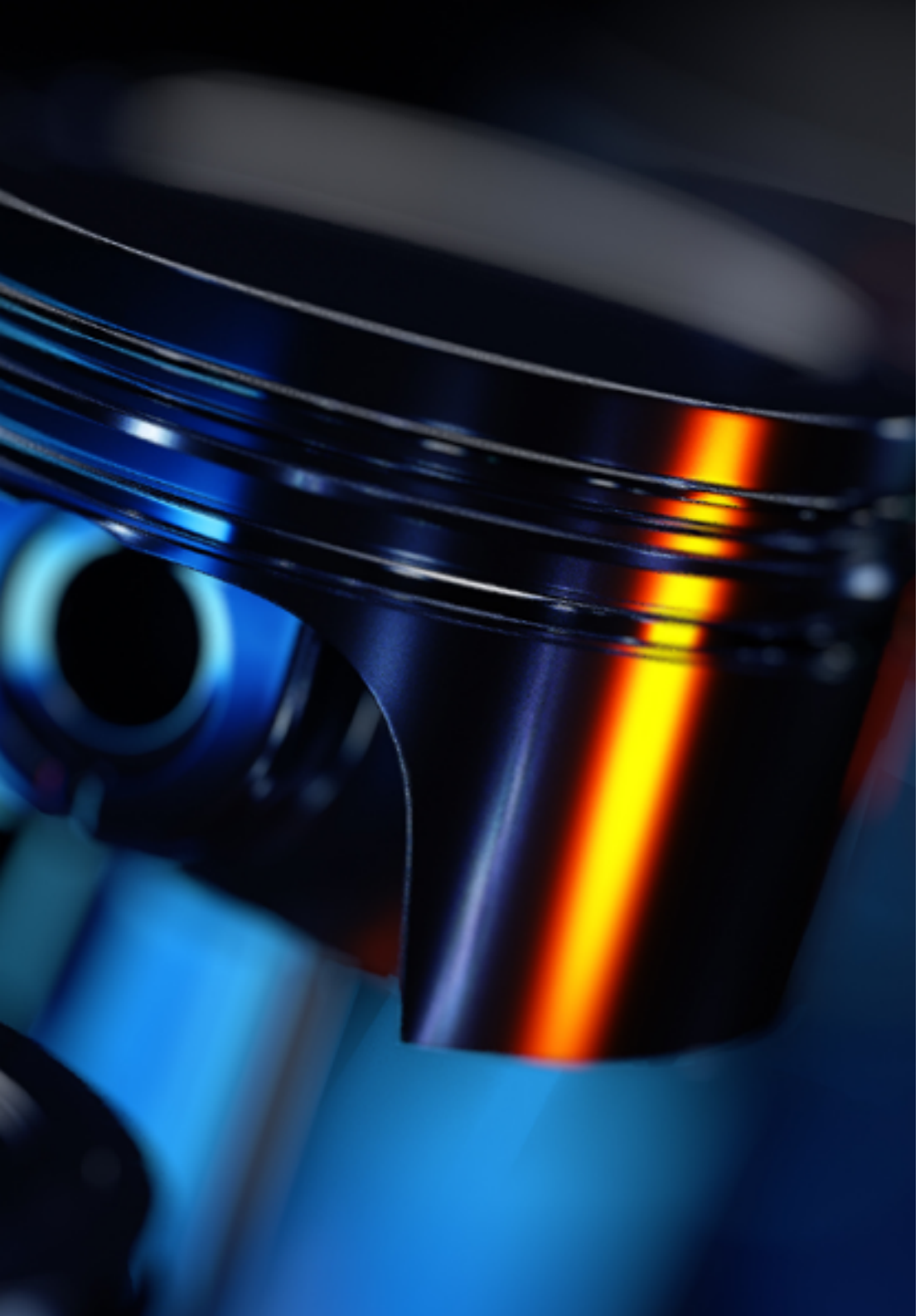
This TECH Postgraduate Diploma guarantees engineers an in-depth analysis of the most crucial and innovative topics related to Alternative Internal Combustion Engines (AICE). All graduates of the program will have specific and high quality skills to effectively maintain, optimize and diagnose such machinery. Therefore, the curriculum is supported by intensive educational objectives that delve into operational efficiency, safety, and regulatory compliance for various industrial and transportation applications.

You will implement the different methods of data extraction and analysis needed in AICE maintenance programs"

General Objectives

- Analyze the state of the art of Alternative Internal Combustion Engines (AICE)
- Identify conventional Alternative Internal Combustion Engines, (AICEs)
- Examine the different aspects to be taken into account in the life cycle of AICEas
- Compile the fundamental principles of design, manufacture and simulation of reciprocating internal combustion engines
- Fundamentals of engine testing and validation techniques, including data interpretation and iteration between design and empirical results
- Determine the theoretical and practical aspects of engine design and manufacturing, promoting the ability to make informed decisions at each stage of the process
- Analyze the different injection and ignition methods in alternative internal combustion engines, specifying the advantages and challenges of each type of injection system in different applications
- 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
- Analyze how the latest technologies are redefining energy efficiency and reducing emissions in internal combustion vehicles
- 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
- Delve into the principles of engine data analysis
- Analyze the different alternative fuels on the market, their properties and characteristics, storage, distribution, emissions and energy balance
- Analyze the different systems and components of hybrid and electric motors
- Determine the energy control and management methods, their optimization criteria and their implementation in the transportation sector
- Fundamentals of an in-depth and up-to-date understanding of the challenges, innovations and future prospects in the field of engine research and development, with a focus on alternative internal combustion engines and their integration with advanced technologies and emerging propulsion systems

You will delve into the means to reduce the vibration and noise level of AICEs over 450 intensive hours of study"



Specific Objectives

Module 1. Injection and ignition systems

- Compile the principles of fuel injection
- Determine the types of fuel injection, their uses and characteristics
- Evaluate how direct and indirect injection affects efficiency and air-fuel mixture formation
- Examine the operation of a diesel injection system: common rail system
- Fundamentals of the different injection and electronic ignition systems
- Analyze the fundamental aspects for the control and calibration of injection systems

Module 2. Vibration, noise and engine balancing

- 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

Module 3. Diagnosis and maintenance of reciprocating internal combustion engines

- Compile diagnostic methods and maintenance types
- Identify the types of existing tests and diagnostics
- Develop optimization measures for maintenance
- Demonstrate the validity of good maintenance practices

03

Course Management

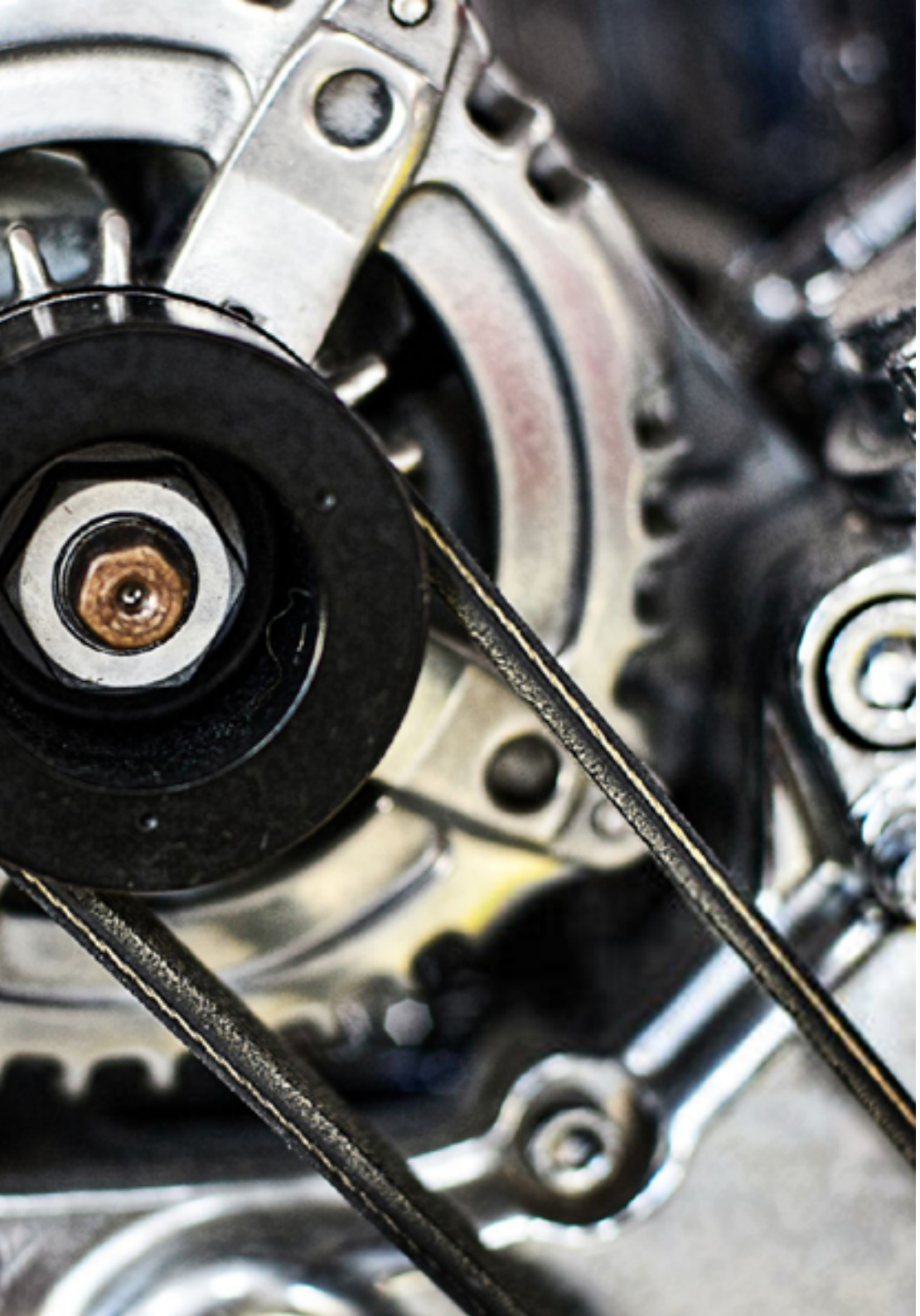
The faculty of this program has the highest prestige in the complex field of Aeronautical Engineering. These experts have participated in exhaustive design and optimization projects of Alternative Internal Combustion Engines that are implemented in state-of-the-art ships. One of the concerns of the teachers in the program has been the efficiency of their machinery and the reduction of its environmental impact. These aspects are evident in their professional trajectory and have been reflected with excellence in this syllabus.

All the teachers in this faculty are fully proficient in the injection and ignition technologies that enhance the quality of AICEs"

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. Mariner Bonet, Iñaki

- Head of Flight Test Office at Avincis Aviation Technics
- Design, Certification and Test Engineer at Avincis Aviation Technics
- Calculation and materials engineer at the Aragon Institute of Technology
- Calculus Engineer at the Polytechnic University of Valencia
- Master in Flight Test and Aircraft Certification (EASA cat 2) by the Polytechnic University of Madrid
- Aeronautical Engineer from the Polytechnic University of Valencia

04

Structure and Content

In this study plan, the students will delve into essential elements for the preventive maintenance and recovery of parts and components of reciprocating Internal Combustion Engines. In particular, the syllabus covers, first of all, the types of injection systems, high-pressure technologies, ignition, diagnostics, control, calibration and optimization. Next, the means of inspection and steps for monitoring these machines are discussed. These contents are taught 100% online, accompanied by multimedia resources such as explanatory videos and interactive summaries.

Do you need a methodology that allows you to assimilate complex concepts with flexibility? Achieve your goals with the unique Relearning system"

Module 1. Injection and ignition systems

1.1. Fuel Injection
- 1.1.1. Mixing Formation
- 1.1.2. Combustion Chamber Types
- 1.1.3. Mixture Distribution
- 1.1.4. Injection Parameters

1.2. Direct and Indirect Injection Systems
- 1.2.1. Direct and Indirect Injection in Diesel Engines
- 1.2.2. Injector Pump System
- 1.2.3. Operation of a Diesel Injection System: Common Rail System

1.3. High Pressure Injection Technologies
- 1.3.1. In-Line Injection Pump Systems
- 1.3.2. Rotary Injection Pump Systems
- 1.3.3. Systems with Single Injection Pumps
- 1.3.4. Common-Rail Injection Systems

1.4. Mixture Formation
- 1.4.1. Internal Flow in Diesel Injection Nozzles
- 1.4.2. Jet Description
- 1.4.3. Atomization Process
- 1.4.4. Diesel Jet under Evaporative Conditions

1.5. Control and Calibration of Injection Systems
- 1.5.1. Components and Sensors in Injection Systems
- 1.5.2. Engine Maps
- 1.5.3. Motor Calibration

1.6. Spark Ignition Technologies
- 1.6.1. Conventional Ignition (Spark Plugs)
- 1.6.2. Electronic Ignition
- 1.6.3. Adaptive Ignition

1.7. Electronic Ignition Systems
- 1.7.1. Operation
- 1.7.2. Ignition Systems
- 1.7.3. Spark Plugs

1.8. Diagnosis and Troubleshooting of Injection and Ignition Systems
- 1.8.1. Motor-Installation Parameters
- 1.8.2. Thermodynamic Models
- 1.8.3. Sensitivity of Combustion Diagnostics

1.9. Optimization of Injection and Ignition systems
- 1.9.1. Engine Map Design
- 1.9.2. Engine Modeling
- 1.9.3. Engine Map Optimization

1.10. Engine Map Analysis
- 1.10.1. Torque and Power Map
- 1.10.2. Engine Efficiency
- 1.10.3. Fuel Consumption

Module 2. Vibration, Noise and Engine Balancing

2.1. Vibration and Noise on Internal Combustion Engines
- 2.1.1. Evolution of Vibration and Noise Motors
- 2.1.2. Vibration and Noise Parameters
- 2.1.3. Data Acquisition and Interpretation

2.2. Sources of Vibration and Noise in Engines
- 2.2.1. Vibration and Noise Generated by the Block
- 2.2.2. Intake and Exhaust Generated Vibration and Noise
- 2.2.3. Vibration and Noise Generated by Combustion

2.3. Modal Analysis and Dynamic Response of Motors
- 2.3.1. Modal Analysis: Geometry, Materials and Configuration
- 2.3.2. Modal Analysis Modeling: One Degree of Freedom/Multiple Degrees of Freedom
- 2.3.3. Parameters: Frequency, Damping and Vibration Modes

2.4. Frequency and Torsional Vibration Analysis
- 2.4.1. Amplitude and Frequency of Torsional Vibration
- 2.4.2. Vibration Frequencies of Internal Combustion Engines
- 2.4.3. Sensors and Data Acquisition
- 2.4.4. Theoretical vs. Experimental Analysis

2.5. Engine Balancing Techniques
- 2.5.1. In-Line Distribution Engine Balancing
- 2.5.2. V-Distribution Engine Balancing
- 2.5.3. Modeling and Balancing

2.6. Vibration Control and Reduction
- 2.6.1. Control of Natural Vibration Frequencies
- 2.6.2. Vibration and Shock Isolation
- 2.6.3. Dynamic Damping

2.7. Noise Control and Reduction
- 2.7.1. Noise Control and Attenuation Methods
- 2.7.2. Exhaust Silencers
- 2.7.3. Active Noise Cancellation Systems ANCS

2.8. Vibration and Noise Maintenance
- 2.8.1. Lubrication
- 2.8.2. Engine Block Balancing
- 2.8.3. Useful Life of the Systems Dynamic Fatigue

2.9. Impact of Engine Vibration and Noise on Industry and Transportation
- 2.9.1. International Standards in Industrial Plants
- 2.9.2. International Regulations Applicable to Land Transportation
- 2.9.3. International Regulations Applicable to Other Sectors

2.10. Practical Application of Vibration and Noise Analysis of an Internal Combustion Engine
- 2.10.1. Theoretical Modal Analysis of an Internal Combustion Engine
- 2.10.2. Determination of Sensors for Practical Analysis
- 2.10.3. Establishment of Suitable Attenuation Methods and Maintenance Plan

Module 3. Diagnosis and Maintenance of Alternate Internal Combustion Engines

3.1. Diagnostic Methods and Failure Analysis
- 3.1.1. Identification and Use of Different Diagnostic Methods
- 3.1.2. Failure Code Analysis and OBD Diagnostics Systems
- 3.1.3. Use of Advanced Diagnostic Tools
  - 3.1.3.1. Scanners and Oscilloscopes
- 3.1.4. Interpretation of Data to Identify Problems and Improve Performance

3.2. Maintenance Types
- 3.2.1. Differentiation between Preventive, Predictive and Corrective Maintenance
- 3.2.2. Selecting the Appropriate Maintenance Strategy According to the Context
- 3.2.3. Planned Maintenance to Minimize Costs and Downtime
- 3.2.4. Focus on Extended Engine Life and Optimal Engine Performance

3.3. Repair and Adjustment of Components
- 3.3.1. Repair and Adjustment Techniques for Key Components
  - 3.3.1.1. Injectors, Spark Plugs and Timing Systems
- 3.3.2. Identification and Troubleshooting of Ignition and Combustion Related Problems
- 3.3.3. Fine-Tuning to Optimize Performance and Efficiency

3.4. Performance and Fuel Economy Optimization
- 3.4.1. Strategies for Improving Fuel Efficiency and Engine Performance
- 3.4.2. Adjustment of Injection and Ignition Parameters to Maximize Fuel Economy
- 3.4.3. Evaluation of the Relationship between Performance and Emissions to Comply with International Environmental Regulations

3.5. Failure Analysis and Troubleshooting
- 3.5.1. Systematic Processes for Identifying and Resolving Engine Failures
- 3.5.2. Use of Flowcharts and Diagnostic Checklists
- 3.5.3. Testing and Analysis to Isolate Specific Problems in Components

3.6. Data Management and Engine Performance Logging
- 3.6.1. Engine Performance Data Collection and Analysis
- 3.6.2. Use of Logs to Monitor Trends and Anticipate Problems
- 3.6.3. Implementation of Recording Systems to Improve Traceability and Preventive Maintenance

3.7. Motor Inspection and Monitoring Techniques
- 3.7.1. Visual and Auditory Inspection of Components for Wear and Damage
- 3.7.2. Vibration and Abnormal Noise Monitoring as Indicators of Problems
- 3.7.3. Use of Sensors and Real-Time Monitoring Systems for Detecting Subtle Changes

3.8. Diagnostic Imaging and Non-Destructive Testing
- 3.8.1. Application of Imaging Techniques to Tetect Problems
  - 3.8.1.1. Thermography, Ultrasound
- 3.8.2. Non-Destructive Testing for Early Defect Detection
- 3.8.3. Interpretation of Imaging Test Results for Maintenance Decisions

3.9. Planning and Execution of Maintenance Programs
- 3.9.1. Design of Customized Maintenance Programs for Different Engines Applications
- 3.9.2. Scheduling of Maintenance Intervals and Activities
- 3.9.3. Coordination of Resources and Teams for Efficient Program Execution

3.10. Best Practices in Engine Maintenance
- 3.10.1. Integration of Techniques and Approaches to Achieve Optimal Results
- 3.10.2. International Safety and Regulatory Compliance During Maintenance
- 3.10.3. Encouraging a Culture of Continuous Improvement in Engine Maintenance

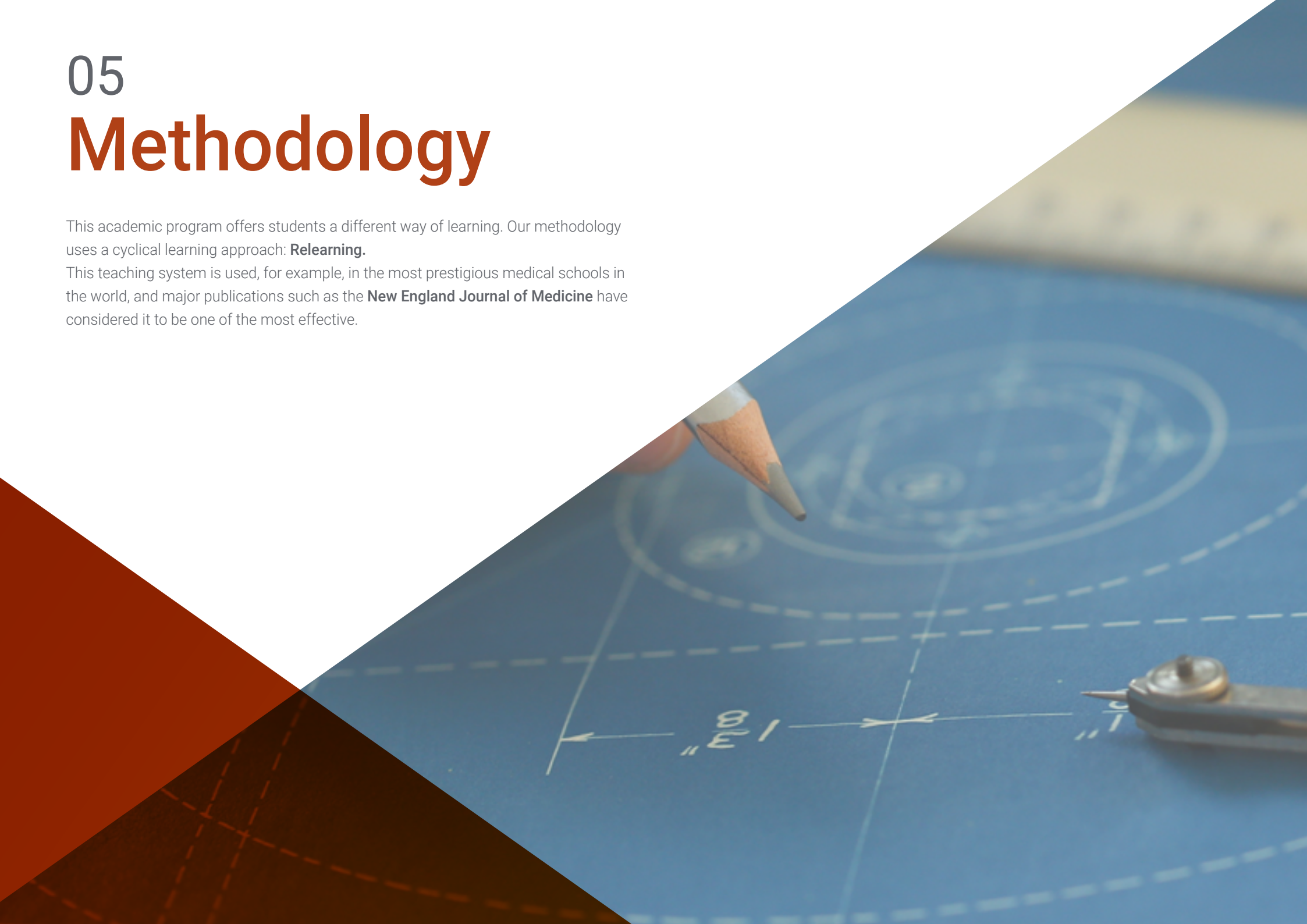
TECH is the best digital university in the world according to Forbes magazine. Don't miss the opportunity to be part of their academic community"

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.



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

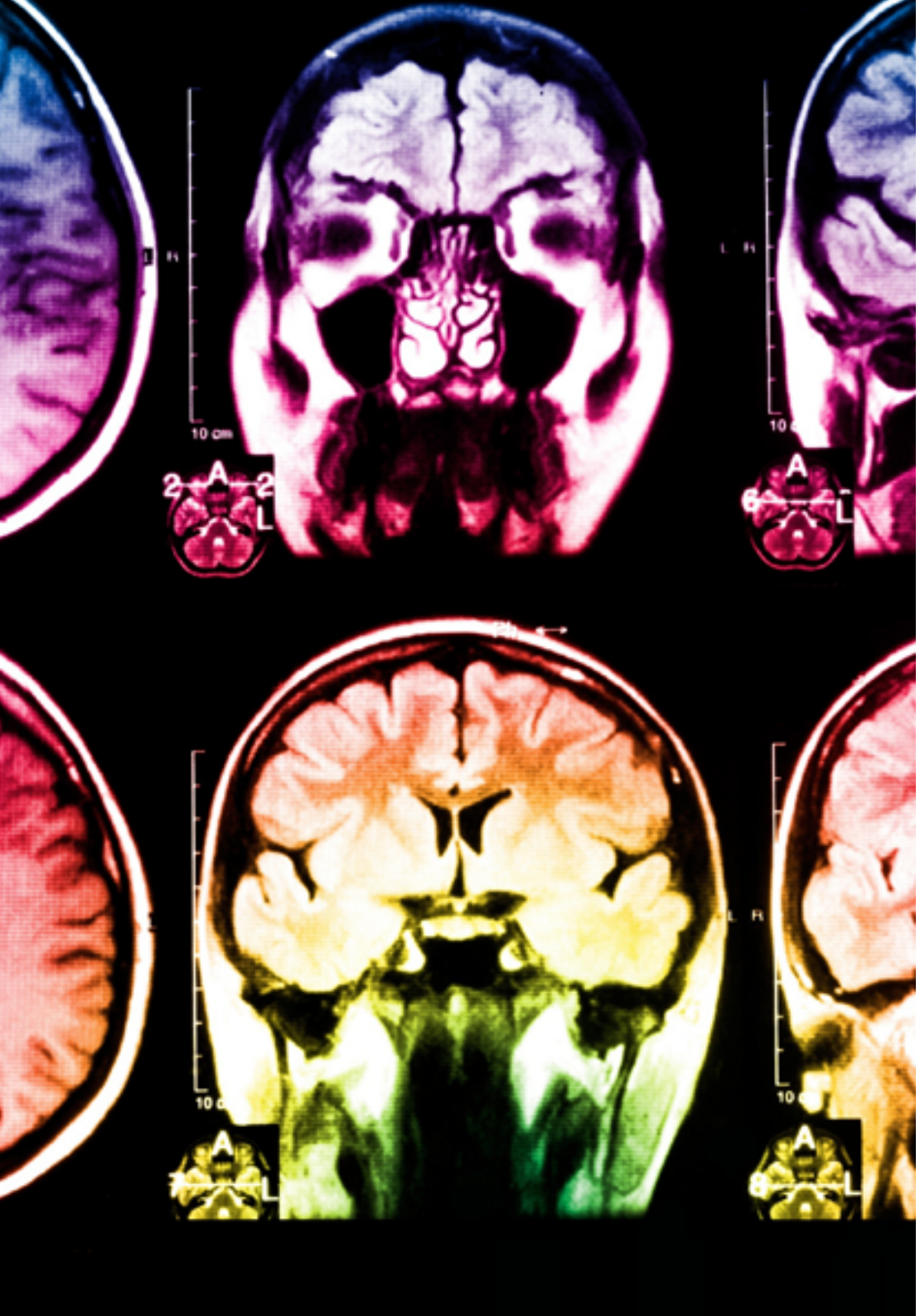
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

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.

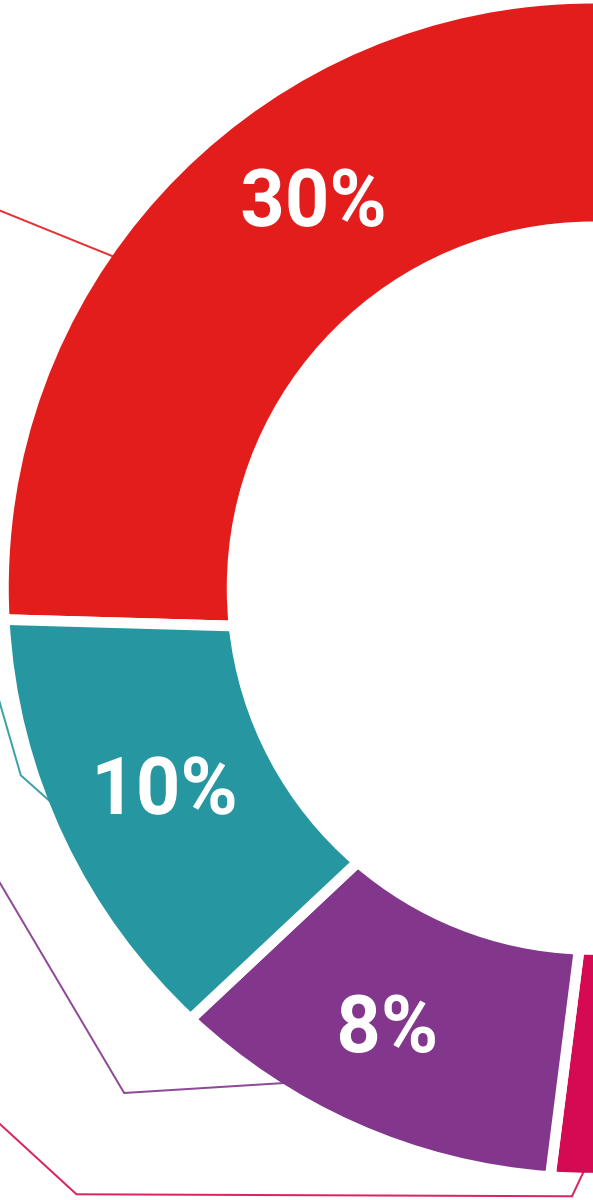
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

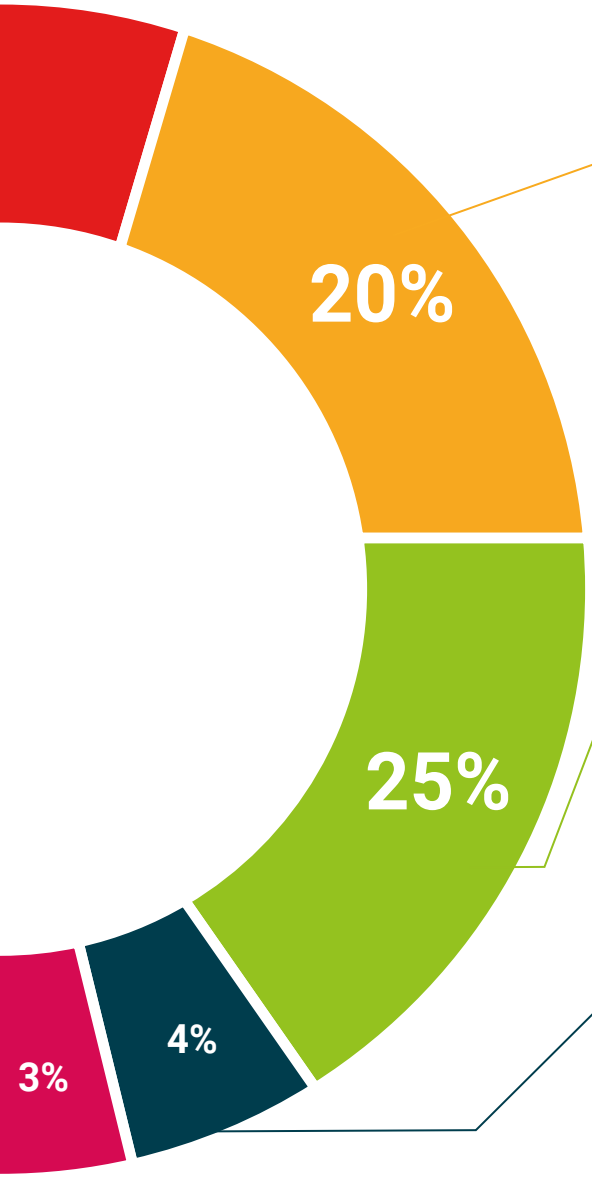
Practising Skills and Abilities

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.

06

Certificate

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

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 Diploma in Maintenance 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 Diploma in Maintenance of Alternative Internal Combustion Engines**

Modality: **online**

Duration: **6 months**

Accreditation: **18 ECTS**


tech global university

Mr./Ms. _____, with identification document _____
has successfully passed and obtained the title of:

Postgraduate Diploma in Maintenance of Alternative Internal Combustion Engines

This is a program of 450 hours of duration equivalent to 18 ECTS, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

TECH Global University is a university officially recognized by the Government of Andorra on the 31st of January of 2024, which belongs to the European Higher Education Area (EHEA).

In Andorra la Vella, on the 28th of February of 2024

Dr. Pedro Navarro Illana
Rector

This qualification must always be accompanied by the university degree issued by the competent authority to practice professionally in each country. Unique TECH Code: AFWORD23S techtitute.com/certificates

*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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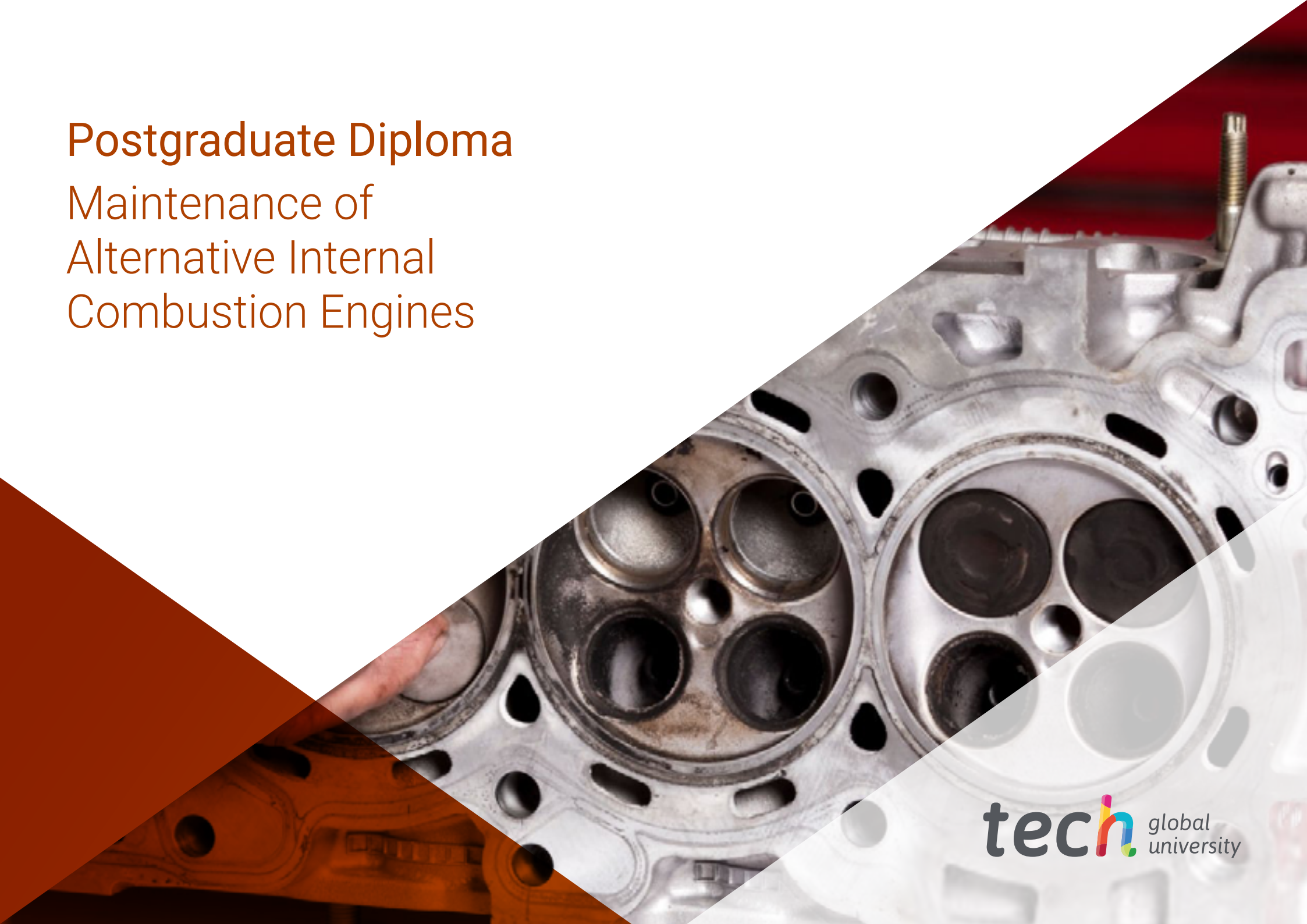

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