

# Postgraduate Certificate Basic Thermodynamics



## Postgraduate Certificate Basic Thermodynamics

- » 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/basic-thermodynamics](http://www.techtitute.com/us/engineering/postgraduate-certificate/basic-thermodynamics)

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# 01

# Introduction

From the steam engine to the self-consumption photovoltaic installations existing today, all apply the first law of thermodynamics, where energy is neither created nor destroyed, but remains constant. This being one of the bases of thermodynamics, there is no doubt that this knowledge must be mastered by the engineers who wish to prosper in the industrial sector. A field where professional profiles capable of obtaining the maximum performance of the systems, designing complete infrastructures or with the ability to solve machinery breakdowns are sought after. That is why TECH has designed this 100% online program, which provides in just 6 weeks, the most relevant information on calorimetry, ideal gases or statistical mechanics. All of this, to innovative multimedia didactic material that can be accessed 24 hours a day from any device with an Internet connection

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*A 100% online Postgraduate Certificate that will allow you to prosper in the industrial sector thanks to the exhaustive knowledge it offers you on Basic Thermodynamics"*

The steam engine is undoubtedly the first clear and easily understandable example of the use of the laws of thermodynamics. Today, however, these principles are being used to make more efficient use of natural and renewable energy sources. This is why photovoltaic systems, improved air-conditioning systems and thermal machines have gained enormous momentum.

At the same time, there is stiff business competition, especially in the industrial and technological fields, which seek greater efficiency, innovation and the design of new machines that favor production. This is a scenario where highly qualified engineering professionals are in an unbeatable position to prosper thanks to their multidisciplinary technical capabilities. Faced with this reality, TECH has created this Postgraduate Certificate in Basic Thermodynamics, which offers students the most comprehensive knowledge in this field through multimedia resources, in which the latest technology applied to academic teaching has been used.

A program, where in just 6 weeks, the students will delve into calorimetry, Joule's law, ideal and real gases or the kinetic-molecular theory of gases. All this with a theoretical and practical approach, thanks to the case studies developed by the teaching team that is part of this program.

Also, thanks to the Relearning method, used by this academic institution in all its teachings, the person who takes this program will be able to advance in a much more natural and progressive way through the content of this instruction. In addition, this system even allows you to reduce the long hours of study.

TECH offers a 100% online and flexible education, ideal for those students who wish to access a quality university degree whenever and wherever they want. All you need is an electronic device with an Internet connection to be able to view, at any time, the courseware hosted on the Virtual Campus.

This **Postgraduate Certificate in Basic Thermodynamics** 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
- ◆ 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 self-assessment can be used 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 now in a university program that uses the latest technology in its didactic resources"*



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*An academic option that allows you to distribute the course load according to your needs"*

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

Its multimedia content, developed with the latest educational technology, will provide the professionals with situated and contextual learning, i.e., a simulated environment that will provide an immersive education programmed to learn in real situations

The design of this program focuses on Problem-Based Learning, by means of which the professionals must try to solve the different professional practice situations that are presented throughout the academic course. For this purpose, the students will be assisted by an innovative interactive video system created by renowned experts

*This university program will take you deep into the operation of real thermal machines and the Clausius theorem.*

*Enroll now in an academic option that you can access whenever you want to deepen your knowledge of the most relevant aspects of calorimetry.*



# 02

# Objectives

At the end of the 150 teaching hours of this Postgraduate Certificate, students will have obtained the knowledge they need about basic thermodynamics to be able to advance in the field of engineering. Thus, they will be able to understand the main laws and functions, which will lead them to solve any problem by applying the concepts that are part of this physics, focused on the mechanical action of heat and the other forms in which energy manifests itself. The specialized teaching team that integrate the program will support the students to successfully achieve these goals





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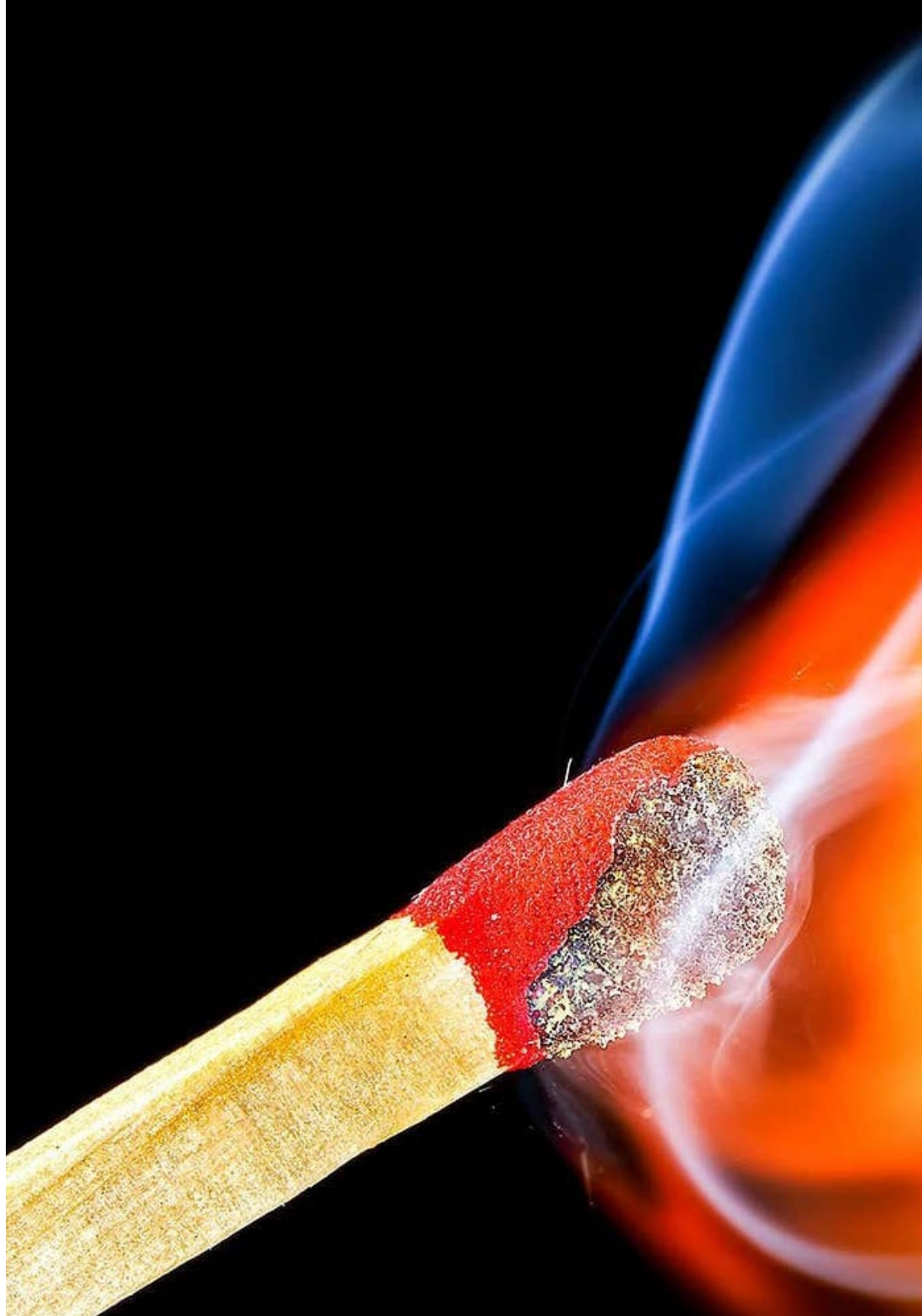
*The case studies provided by specialized professionals will allow you to approach situations and direct applications of thermodynamics”*



## General Objectives

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- ◆ Solve problems effectively in the field of thermodynamics
- ◆ Acquire basic notions of statistical mechanics
- ◆ Introduce students to the principles and laws that make up thermodynamics
- ◆ Understand the relevance of the kinetic-molecular theory of gases





## Specific Objectives

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- ◆ Be able to analyze different contexts and environments in the field of physics based on a solid mathematical foundation
- ◆ Understand and use mathematical and numerical methods commonly used in thermodynamics
- ◆ Knowing thermodynamic functions

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*Thanks to this course you will be able to solve industrial machine failures by applying the key concepts of thermodynamics”*



03

# Structure and Content

Calorimetry, thermodynamic work, statistical mechanics, real gases or entropy will be concepts that students who take this university program will end up mastering after completing this Postgraduate Certificate in Basic Thermodynamics. Achieving these goals will be much easier thanks to the use of video summaries, videos in detail, schemes or complementary readings, which are part of the library of resources that can be accessed 24 hours a day, easily from a computer, tablet or cell phone with Internet connection





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*A syllabus with a theoretical-practical vision that will lead you to advance with firm steps in the field of Thermodynamics"*



## Module 1. Thermodynamics

- 1.1. Mathematical Tools: Review
  - 1.1.1. Review of the Logarithm and Exponential Functions
  - 1.1.2. Review of Derivatives
  - 1.1.3. Integrals
  - 1.1.4. Derivative of a Function of Several Variables
- 1.2. Calorimetry. Zero Principle in Thermodynamics
  - 1.2.1. Introduction and General Concepts
  - 1.2.2. Thermodynamic Systems
  - 1.2.3. Zero Principle in Thermodynamics
  - 1.2.4. Temperature Scales. Absolute Temperature
  - 1.2.5. Reversible and Irreversible Processes
  - 1.2.6. Sign Criteria
  - 1.2.7. Specific Heat
  - 1.2.8. Molar Heat
  - 1.2.9. Phase Changes
  - 1.2.10. Thermodynamic Coefficients
- 1.3. Thermodynamic Work. First Principle of Thermodynamics
  - 1.3.1. Heat and Thermodynamic Work
  - 1.3.2. State Functions and Internal Energy
  - 1.3.3. First Principle of Thermodynamics
  - 1.3.4. Work of a Gas System
  - 1.3.5. Joule's Law
  - 1.3.6. Heat of Reaction and Enthalpy
- 1.4. Ideal Gases
  - 1.4.1. Ideal Gas Laws
    - 1.4.1.1. Boyle-Mariotte's Law
    - 1.4.1.2. Charles and Gay-Lussac's Laws
    - 1.4.1.3. Equation of State of Ideal Gases
      - 1.4.1.3.1. Dalton's Law
      - 1.4.1.3.2. Mayer's Law
  - 1.4.2. Calorimetric Equations of the Ideal Gas
  - 1.4.3. Adiabatic Processes
    - 1.4.3.1. Adiabatic Transformations of an Ideal Gas
      - 1.4.3.1.1. Relationship between Isotherms and Adiabatics
      - 1.4.3.1.2. Work in Adiabatic Processes
  - 1.4.5. Polytropic Transformations
- 1.5. Real Gases
  - 1.5.1. Motivation
  - 1.5.2. Ideal and Real Gases
  - 1.5.3. Description of Real Gases
  - 1.5.4. Equations of State of Series Development
  - 1.5.5. Van der Waals Equation and Series Development
  - 1.5.6. Andrews Isotherms
  - 1.5.7. Metastable States
  - 1.5.8. Van der Waals Equation: Consequences
- 1.6. Entropy
  - 1.6.1. Introduction and Objectives
  - 1.6.2. Entropy: Definition and Units
  - 1.6.3. Entropy of an Ideal Gas
  - 1.6.4. Entropic Diagram
  - 1.6.5. Clausius Inequality
  - 1.6.6. Fundamental Equation of Thermodynamics
  - 1.6.7. Carathéodory's Theorem
- 1.7. Second Principle of Thermodynamics
  - 1.7.1. Second Principle of Thermodynamics
  - 1.7.2. Transformations between Two Thermal Focuses
  - 1.7.3. Carnot Cycle
  - 1.7.4. Real Thermal Machines
  - 1.7.5. Clausius Theorem



- 1.8. Thermodynamic Functions. Third Principle of Thermodynamics
  - 1.8.1. Thermodynamic Functions
  - 1.8.2. Thermodynamic Equilibrium Conditions
  - 1.8.3. Maxwell's Equations
  - 1.8.4. Thermodynamic Equation of State
  - 1.8.5. Internal Energy of a Gas
  - 1.8.6. Adiabatic Transformations in a Real Gas
  - 1.8.7. Third Principle of Thermodynamics and Consequences
- 1.9. Kinetic-Molecular Theory of Gases
  - 1.9.1. Hypothesis of the Kinetic-Molecular Theory
  - 1.9.2. Kinetic Theory of the Pressure of a Gas
  - 1.9.3. Adiabatic Evolution of a Gas
  - 1.9.4. Kinetic Theory of Temperature
  - 1.9.5. Mechanical Argument for Temperature
  - 1.9.6. Principle of Equipartition of Energy
  - 1.9.7. Virial Theorem
- 1.10. Introduction to Statistical Mechanics
  - 1.10.1. Introduction and Objectives
  - 1.10.2. General Concepts
  - 1.10.3. Entropy, Probability and Boltzmann's Law
  - 1.10.4. Maxwell-Boltzmann Distribution Law
  - 1.10.5. Thermodynamic and Partition Functions

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*With this 100% online Postgraduate Certificate you will learn about statistical mechanics and the Maxwell-Boltzmann distribution law”*

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.

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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.





05

# Certificate

The Postgraduate Certificate in Basic Thermodynamics 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 Basic Thermodynamics** 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 Basic Thermodynamics**

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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