Postgraduate Diploma
Climate Physics

technological university

Postgraduate Diploma
Climate Physics

» Modality: **online**
» Duration: **6 months**
» Certificate: **TECH Technological University**
» Dedication: **16h/week**
» Schedule: **at your own pace**
» Exams: **online**

Website: **www.techtitute.com/us/engineering/postgraduate-diploma/postgraduate-diploma-climate-physics**

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01
Introduction

Climate change has become one of the main current problems of human beings. Therefore, the scientific community is working to find solutions and adopt measures to reduce its consequences. The contribution from the field of Engineering can be decisive, so more and more specialized professionals with advanced knowledge in Physics of Climate are in demand. For this reason, TECH has designed this 100% online program that offers graduates the most relevant and essential information on thermodynamics of the atmosphere or meteorology. For that purpose, the students have access to innovative multimedia resources developed by specialists and which can be easily accessed 24 hours a day, from any device with Internet connection.

With this Postgraduate Diploma in Climate Physics, you will obtain a solid learning on Climate Physics, which will allow you to advance in your professional career"

Scientific studies carried out in recent decades explain the phenomenon of climate change and its causes, from the point of view of physics. The consequences derived from this phenomenon have led international organizations to adopt measures to alleviate them and also to promote actions and projects that act in line with them.

The engineer professional is fundamental in this scenario given his technical expertise and skills However, in order to contribute in a more effective way with their projects, the specialist must have very solid notions about Climate Physics. That is why TECH has designed this Postgraduate Diploma, where in only 6 months, the graduate will be able to obtain the latest information and scientific evidence in this field.

Thus, through multimedia resources based on video summaries of each topic, videos in detail, diagrams or essential readings, the professional will deepen knowledge in advanced thermodynamics, climatology and understanding of the thermodynamic properties of the atmosphere and its most frequent meteorological evolutions. The case studies provided by the specialized teaching team of this program will allow the student to analyze real situations, whose methodologies can be applied in their professional practice.

Thus, TECH offers an excellent opportunity for students who wish to prosper in their professional career through a 100% online Postgraduate Diploma with a flexible mode. Students only need a device with an Internet connection to be able to visualize, at any time, the contents hosted on the virtual platform. It also offers the freedom of being able to distribute the teaching load according to their needs. An ideal educational option for people who wish to combine their work and/or personal responsibilities with an education that is at the forefront of the academic world.

Thus, the engineering professional can obtain a qualification that is at the academic vanguard, and which can be accessed easily, whenever and wherever he/she wishes. The students only require a computer, tablet or cell phone with an Internet connection to be able to access, at any time, the syllabus hosted on the virtual platform. Also, the Relearning methodology, will allow you to progress through this Postgraduate Diploma in a much more agile way and reduce the long hours of study.

This **Postgraduate Diploma in Climate Physics** contains the most complete and up-to-date program on the market. The most important features include:

- Practical case studies are presented by experts in Physics
- The graphic, schematic, and practical contents with which they are created, provide scientific and practical information on the disciplines that are essential for professional practice
- Practical exercises where the self-assessment process can be carried out to improve learning
- Its special emphasis on innovative methodologies
- Theoretical lessons, questions to the expert, debate forums on controversial topics, and individual reflection assignments
- Content that is accessible from any fixed or portable device with an Internet connection

This is an ideal academic option for professionals who wish to easily delve into atmospheric thermodynamics developments"

With this program, you can delve into the main concepts of atmosphere dynamics and the synoptic meteorology"

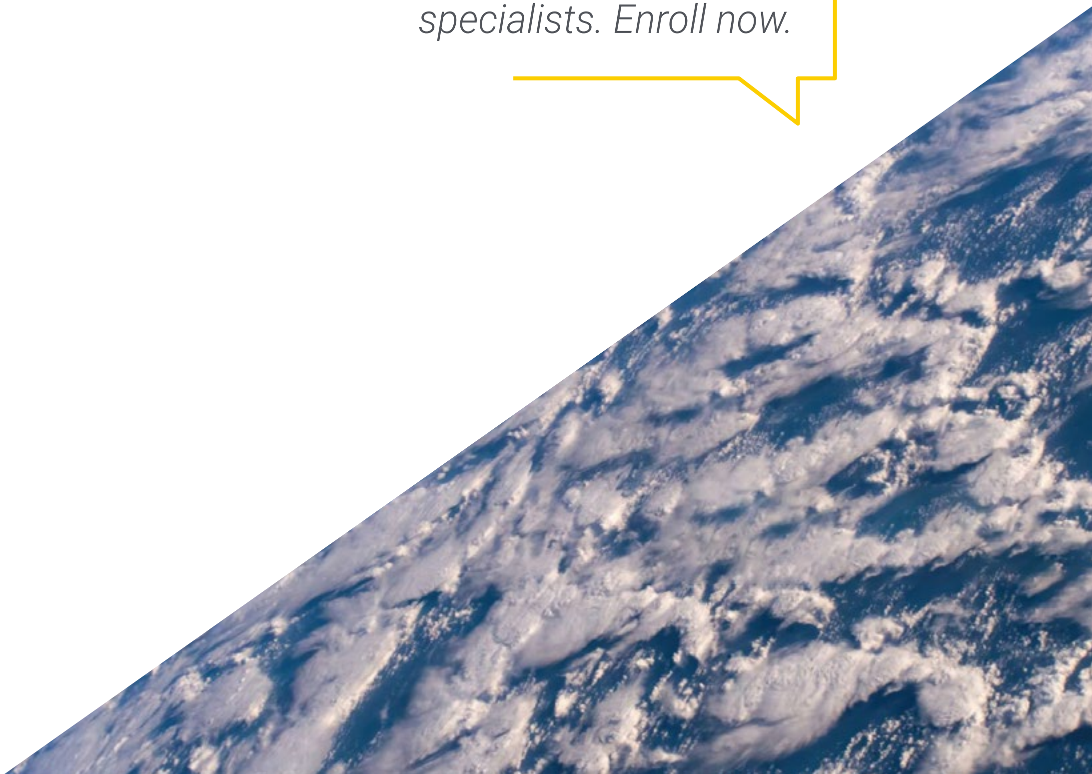
Obtain the knowledge you need about climate change and apply it in your next engineering projects.

A syllabus with a theoretical-practical approach developed by Climate Physics specialists. Enroll now.

The program's teaching staff includes professionals from the sector who contribute their work experience to this training 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 academic year For this purpose, the student will be assisted by an innovative interactive video system created by renowned and experienced experts.



02

Objectives

Upon completing this 6-month university degree, students will obtain the most advanced knowledge about advanced thermodynamics, climatology and meteorology In this way, you will gain a more comprehensive understanding of climate change and current atmospheric processes. For this purpose, it has pedagogical tools and specialized teachers who will guide you in achieving these goals.

A 100% online program with video summaries of each topic, which will allow you to consolidate your knowledge of advanced thermodynamics, climatology or meteorology"

General Objectives

- Know how to distinguish which collectivity will be more useful to the study of a given system depending on the type of thermodynamic system
- Know the fundamentals and general scope of atmospheric sciences
- Identify the factors influencing climate change
- Obtain basic knowledge about current global warming

This program will allow you to keep up to date with the knowledge on physics and the current global warming"

Specific Objectives

Module 1. Advanced Thermodynamics

- Advance in the principles of thermodynamics
- Understand the concepts of collectivity and be able to differentiate between the different types
- Know how to distinguish which collectivity will be more useful to the study of a given system depending on the type of thermodynamic system
- Know the basics of the *Ising* model
- Gain knowledge of the difference between boson and baryon statistics

Module 2. Meteorology and Climatology

- Know the general characteristics and properties of the atmosphere from the meteorological point of view
- Achieve basic knowledge of the radioactive properties of the Earth-atmosphere system
- Recognize the thermodynamic properties of the atmosphere and its most frequent meteorological evolutions
- Identify the processes that lead to cloud formation and precipitation and the fundamental forces involved in air motion

Module 3. Thermodynamics of the Atmosphere

- Recognize thermodynamic phenomena
- Identify the determinant role of water vapor in the atmosphere
- Be able to characterize atmospheric stability
- Obtain basic knowledge about current global warming

03

Structure and Content

The effectiveness of the Relearning System, based on the reiteration of content, has led TECH to include it in all its programs This will allow students to progress in a much more natural way through the 3 modules that make up this degree. In addition, among the advantages of this method is the reduction of long hours of study which is in other teaching methods. Thus, it will be much easier to acquire intensive learning about the Climate Physics.

No attendance, no classes with fixed schedules. Enroll now in a Postgraduate Diploma which is compatible with your professional responsibilities"

Module 1. Advanced Thermodynamics

1.1. Formalism of Thermodynamics
- 1.1.1. Laws of Thermodynamics
- 1.1.2. The Fundamental Equation
- 1.1.3. Internal Energy: Euler's Form
- 1.1.4. Gibbs-Duhem Equation
- 1.1.5. Legendre Transformations
- 1.1.6. Thermodynamic Potentials
- 1.1.7. Maxwell's Relations for a Fluid
- 1.1.8. Stability Conditions

1.2. Microscopic Description of Macroscopic Systems I
- 1.2.1. Microstates and Macrostates: Introduction
- 1.2.2. Phase Space
- 1.2.3. Collectivities
- 1.2.4. Microcanonical Collectivity
- 1.2.5. Thermal Equilibrium

1.3. Microscopic Description of Macroscopic Systems II
- 1.3.1. Discrete Systems
- 1.3.2. Statistical Entropy
- 1.3.3. Maxwell-Boltzmann Distribution
- 1.3.4. Pressure
- 1.3.5. Effusion

1.4. Canonical Collectivity
- 1.4.1. Partition Function
- 1.4.2. Ideal Systems
- 1.4.3. Energy Degeneration
- 1.4.4. Behavior of the Monoatomic Ideal Gas at a Potential
- 1.4.5. Energy Equipartition Theorem
- 1.4.6. Discrete Systems

1.5. Magnetic Systems
- 1.5.1. Thermodynamics of Magnetic Systems
- 1.5.2. Classical Paramagnetism
- 1.5.3. ½ Spin Paramagnetism
- 1.5.4. Adiabatic Demagnetization

1.6. Phase Transitions
- 1.6.1. Classification of Phase Transitions
- 1.6.2. Phase Diagrams
- 1.6.3. Clapeyron Equation
- 1.6.4. Vapor-Condensed Phase Equilibrium
- 1.6.5. The Critical Point
- 1.6.6. Ehrenfest's Classification of Phase Transitions
- 1.6.7. Landau's Theory

1.7. Ising's Model
- 1.7.1. Introduction
- 1.7.2. One-Dimensional Chain
- 1.7.3. Open One-Dimensional Chain
- 1.7.4. Mean Field Approximation

1.8. Real Gases
- 1.8.1. Comprehensibility Factor. Virial Development
- 1.8.2. Interaction Potential and Configurational Partition Function
- 1.8.3. Second Virial Coefficient
- 1.8.4. Van der Waals Equation
- 1.8.5. Lattice Gas
- 1.8.6. Corresponding States Law
- 1.8.7. Joule and Joule-Kelvin Expansions

1.9. Photon Gas
- 1.9.1. Boson Statistics Vs. Fermion Statistics
- 1.9.2. Energy Density and Degeneracy of States
- 1.9.3. Planck Distribution
- 1.9.4. Equations of State of a Photon Gas

1.10. Macrocanonical Collectivity
- 1.10.1. Partition Function
- 1.10.2. Discrete Systems
- 1.10.3. Fluctuations
- 1.10.4. Ideal Systems
- 1.10.5. The Monoatomic Gas
- 1.10.6. Vapor-Solid Equilibrium

Module 2. Meteorology and Climatology

2.1. General Structure of the Atmosphere
- 2.1.1. Weather and Climate
- 2.1.2. General Characteristics of the Earth's Atmosphere
- 2.1.3. Atmospheric Composition
- 2.1.4. Horizontal and Vertical Structure of the Atmosphere
- 2.1.5. Atmospheric Variables
- 2.1.6. Observing Systems
- 2.1.7. Meteorological Scales
- 2.1.8. Equation of State
- 2.1.9. Hydrostatic Equation

2.2. Atmospheric Motion
- 2.2.1. Air Masses
- 2.2.2. Extratropical Cyclones and Fronts
- 2.2.3. Mesoscale and Microscale Phenomena
- 2.2.4. Fundamentals of Atmospheric Dynamics
- 2.2.5. Air Motion: Apparent and Real Forces
- 2.2.6. Equations of Horizontal Motion
- 2.2.7. Geostrophic Wind, Friction Force and Gradient Wind
- 2.2.8. Atmospheric General Circulation

2.3. Radioactive Energy Exchange in the Atmosphere
- 2.3.1. Solar and Terrestrial Radiation
- 2.3.2. Absorption, Emission and Reflection of Radiation
- 2.3.3. Earth-Atmosphere Radioactive Exchanges
- 2.3.4. Greenhouse Effect
- 2.3.5. Radiative Balance at the Top of the Atmosphere
- 2.3.6. Radiative Forcing of the Climate
  - 2.3.6.1. Natural and Anthropogenic Climate Forcing
  - 2.3.6.2. Climate Sensitivity

2.4. Thermodynamics of the Atmosphere
- 2.4.1. Adiabatic Processes: Potential Temperature
- 2.4.2. Stability and Instability of Dry Air
- 2.4.3. Saturation and Condensation of Water Vapor in the Atmosphere
- 2.4.4. Rise of Moist Air: Saturated and Pseudoadiabatic Adiabatic Evolution
- 2.4.5. Condensation Levels
- 2.4.6. Stability and Instability of Humid Air

2.5. Cloud Physics and Precipitation
- 2.5.1. General Cloud Formation Processes
- 2.5.2. Cloud Morphology and Classification
- 2.5.3. Cloud Microphysics: Condensation Nuclei and Ice Nuclei
- 2.5.4. Precipitation Processes: Rain, Snow and Hail Formation
- 2.5.5. Artificial Modification of Clouds and Precipitation

2.6. Atmospheric Dynamics
- 2.6.1. Inertial and Non-Inertial Forces
- 2.6.2. Coriolis Force
- 2.6.3. Equation of Motion
- 2.6.4. Horizontal Pressure Field
- 2.6.5. Pressure Reduction at Sea Level
- 2.6.6. Horizontal Pressure Gradient
- 2.6.7. Pressure-Density
- 2.6.8. Isohipsas
- 2.6.9. Equation of Motion in the Intrinsic Coordinate System
- 2.6.10. Horizontal Frictionless Flow: Geostrophic Wind, Gradient Wind
- 2.6.11. Friction Effect
- 2.6.12. Wind at Height
- 2.6.13. Local and Small-Scale Wind Regimes
- 2.6.14. Pressure and Wind Measurements

2.7. Synoptic Meteorology
- 2.7.1. Baric Systems
- 2.7.2. Anticyclones
- 2.7.3. Air Masses
- 2.7.4. Frontal Surfaces
- 2.7.5. Warm Fronts
- 2.7.6. Cold Front
- 2.7.7. Frontal Depressions. Occlusion Occluded Front

2.8. General Circulation
- 2.8.1. General Characteristics of the General Circulation
- 2.8.2. Surface and Overhead Observations
- 2.8.3. Single-Cell Model
- 2.8.4. Tricellular Model
- 2.8.5. Jet Streams
- 2.8.6. Ocean Currents
- 2.8.7. Ekman Transport
- 2.8.8. Global Distribution of Precipitation
- 2.8.9. Teleconnections. El Niño Southern Oscillation. The North Atlantic Oscillation

2.9. Climate System
- 2.9.1. Climate Classifications
- 2.9.2. Köppen Classification
- 2.9.3. Components of the Climate System
- 2.9.4. Coupling Mechanisms
- 2.9.5. Hydrological Cycle
- 2.9.6. Carbon Cycle
- 2.9.7. Response Times
- 2.9.8. Feedback
- 2.9.9. Climate Models

2.10. Climate Change
- 2.10.1. Concept of Climate Change
- 2.10.2. Data Collection. Paleoclimatic Techniques
- 2.10.3. Evidence of Climate Change. Paleoclimate
- 2.10.4. Current Global Warming
- 2.10.5. Energy Balance Model
- 2.10.6. Radiative Forcing
- 2.10.7. Causal Mechanisms of Climate Change
- 2.10.8. General Circulation Models and Projections

Module 3. Thermodynamics of the Atmosphere

3.1. Introduction
- 3.1.1. Thermodynamics of the Ideal Gas
- 3.1.2. Laws of Conservation of Energy
- 3.1.3. Laws of Thermodynamics
- 3.1.4. Pressure, Temperature and Altitude
- 3.1.5. Maxwell-Boltzmann Distribution of Velocities

3.2. The Atmosphere
- 3.2.1. The Physics of the Atmosphere
- 3.2.2. Air Composition
- 3.2.3. Origin of the Earth's Atmosphere
- 3.2.4. Atmospheric mass Distribution and Temperature

3.3. Fundamentals of Atmospheric Thermodynamics
- 3.3.1. Equation of State of Air
- 3.3.2. Humidity Indices
- 3.3.3. Hydrostatic Equation: Meteorological Applications
- 3.3.4. Adiabatic and Diabatic Processes
- 3.3.5. Entropy in Meteorology

3.4. Thermodynamic Diagrams
- 3.4.1. Relevant Thermodynamic Diagrams
- 3.4.2. Properties of Thermodynamic Diagrams
- 3.4.3. Emagrams
- 3.4.4. Oblique Diagram: Applications

3.5. Study of Water and its Transformations
- 3.5.1. Thermodynamic Properties of Water
- 3.5.2. Phase Transformation in Equilibrium
- 3.5.3. Clausius-Clapeyron Equation
- 3.5.4. Approximations and Consequences of the Clausius-Clapeyron Equation

3.6. Condensation of Water Vapor in the Atmosphere
- 3.6.1. Phase Transitions of Water
- 3.6.2. Thermodynamic Equations of Saturated Air
- 3.6.3. Equilibrium of Water Vapor with Water Droplets: Kelvin and Köhler Curves
- 3.6.4. Atmospheric Processes that Give Rise to Water Vapor Condensation

3.7. Atmospheric Condensation by Isobaric Processes
  3.7.1. Dew and Frost Formation
  3.7.2. Formation of Radiative and Advection Fogs
  3.7.3. Isoenthalpic Processes
  3.7.4. Equivalent Temperature and Wet Thermometer Temperature
  3.7.5. Isoenthalpic Mixtures of Air Masses
  3.7.6. Mixing Mists
3.8. Atmospheric Condensation by Adiabatic Ascent
  3.8.1. Saturation of Air by Adiabatic Rise
  3.8.2. Reversible Adiabatic Saturation Processes
  3.8.3. Pseudo-Adiabatic Processes
  3.8.4. Equivalent Pseudo-Potential and Wet-Thermometer Temperature
  3.8.5. Föhn Effect
3.9. Atmospheric Stability
  3.9.1. Stability Criteria in Unsaturated Air
  3.9.2. Stability Criteria in Saturated Air
  3.9.3. Conditional Instability
  3.9.4. Convective Instability
  3.9.5. Analysis of Stabilities by Means of the Oblique Diagram
3.10. Thermodynamic Diagrams
  3.10.1. Conditions for Equivalent Area Transformations
  3.10.2. Examples of Thermodynamic Diagrams
  3.10.3. Graphical Representation of Thermodynamic Variables in a T-ln(p) Diagram
  3.10.4. Use of Thermodynamic Diagrams in Meteorology

The library of multimedia resources, to which you will have 24/7 access from your computer, will allow you to comfortably delve into the atmospheric thermodynamics"

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.

Discover Relearning, a system that abandons conventional linear learning, to take you through cyclical teaching systems: a way of learning that has proven to be extremely effective, especially in subjects that require memorization"

Case Study to contextualize all content

Our program offers a revolutionary approach to developing skills and knowledge. Our goal is to strengthen skills in a changing, competitive, and highly demanding environment.

At TECH, you will experience a learning methodology that is shaking the foundations of traditional universities around the world"

You will have access to a learning system based on repetition, with natural and progressive teaching throughout the entire syllabus.

The student will learn to solve complex situations in real business environments through collaborative activities and real cases.

A learning method that is different and innovative

This TECH program is an intensive educational program, created from scratch, which presents the most demanding challenges and decisions in this field, both nationally and internationally. This methodology promotes personal and professional growth, representing a significant step towards success. The case method, a technique that lays the foundation for this content, ensures that the most current economic, social and professional reality is taken into account.

Our program prepares you to face new challenges in uncertain environments and achieve success in your career"

The case method is the most widely used learning system in the best faculties in the world. The case method was developed in 1912 so that law students would not only learn the law based on theoretical content. It consisted of presenting students with real-life, complex situations for them to make informed decisions and value judgments on how to resolve them. In 1924, Harvard adopted it as a standard teaching method.

What should a professional do in a given situation? This is the question that you are presented with in the case method, an action-oriented learning method. Throughout the program, the studies will be presented with multiple real cases. They will have to combine all their knowledge and research, and argue and defend their ideas and decisions.

Relearning Methodology

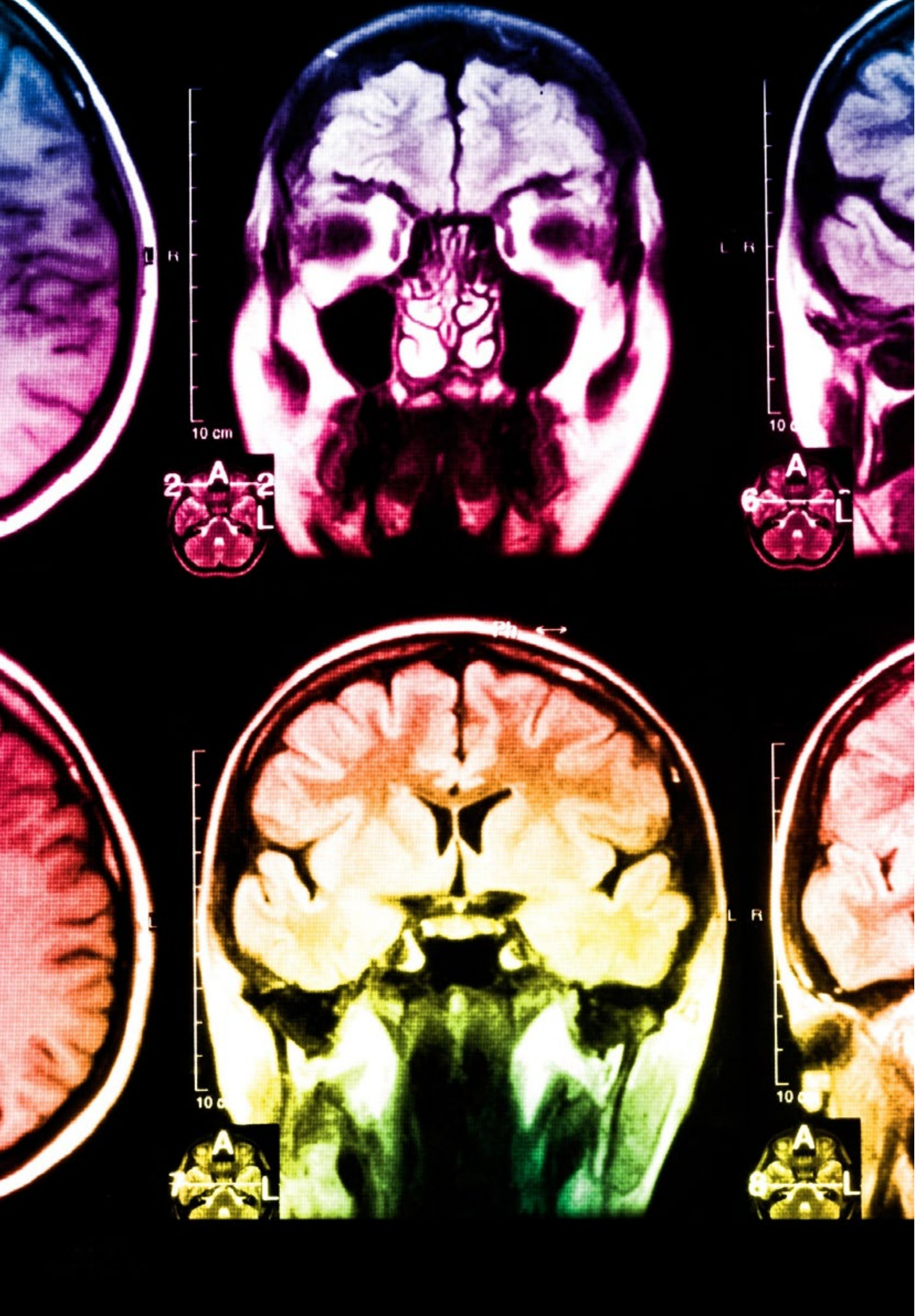
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

We enhance the Case Study with the best 100% online teaching method: Relearning.

In 2019, we obtained the best learning results of all online universities in the world.

At TECH, you will learn using a cutting-edge methodology designed to train the executives of the future. This method, at the forefront of international teaching, is called Relearning.

Our university is the only one in the world authorized to employ this successful method. In 2019, we managed to improve our students' overall satisfaction levels (teaching quality, quality of materials, course structure, objectives...) based on the best online university indicators.



In our program, learning is not a linear process, but rather a spiral (learn, unlearn, forget, and re-learn). Therefore, we combine each of these elements concentrically. This methodology has trained more than 650,000 university graduates with unprecedented success in fields as diverse as biochemistry, genetics, surgery, international law, management skills, sports science, philosophy, law, engineering, journalism, history, and financial markets and instruments. All this in a highly demanding environment, where the students have a strong socio-economic profile and an average age of 43.5 years.

Relearning will allow you to learn with less effort and better performance, involving you more in your training, developing a critical mindset, defending arguments, and contrasting opinions: a direct equation for success.

From the latest scientific evidence in the field of neuroscience, not only do we know how to organize information, ideas, images and memories, but we know that the place and context where we have learned something is fundamental for us to be able to remember it and store it in the hippocampus, to retain it in our long-term memory.

In this way, and in what is called neurocognitive context-dependent e-learning, the different elements in our program are connected to the context where the individual carries out their professional activity.

This program offers the best educational material, prepared with professionals in mind:

Study Material

All teaching material is produced by the specialists who teach the course, specifically for the course, so that the teaching content is highly specific and precise.

These contents are then applied to the audiovisual format, to create the TECH online working method. All this, with the latest techniques that offer high quality pieces in each and every one of the materials that are made available to the student.

Classes

There is scientific evidence suggesting that observing third-party experts can be useful.

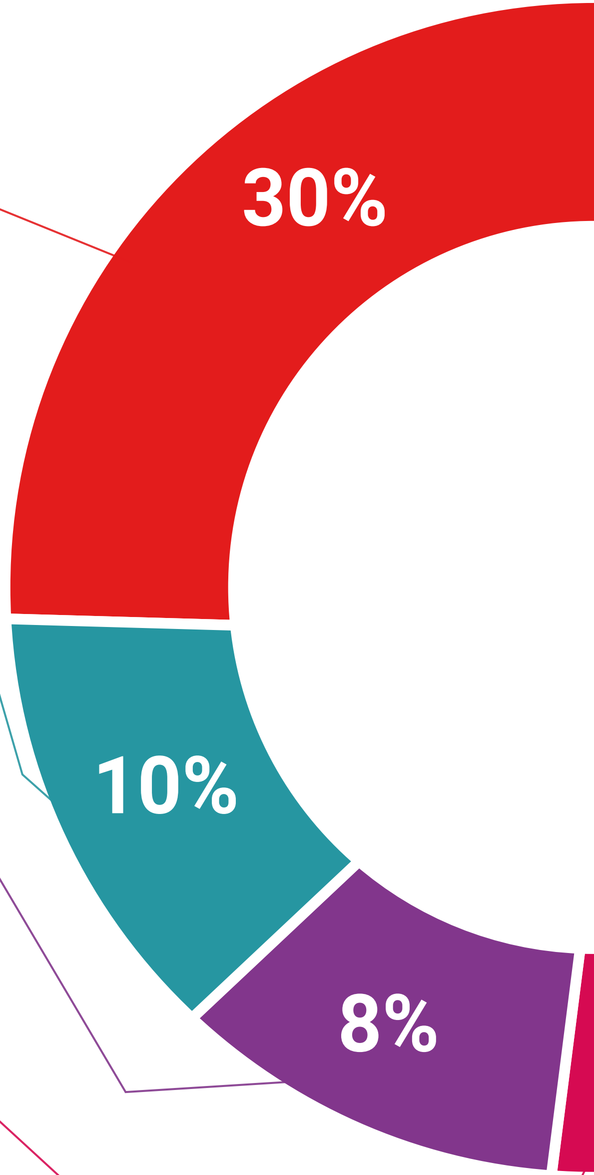
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

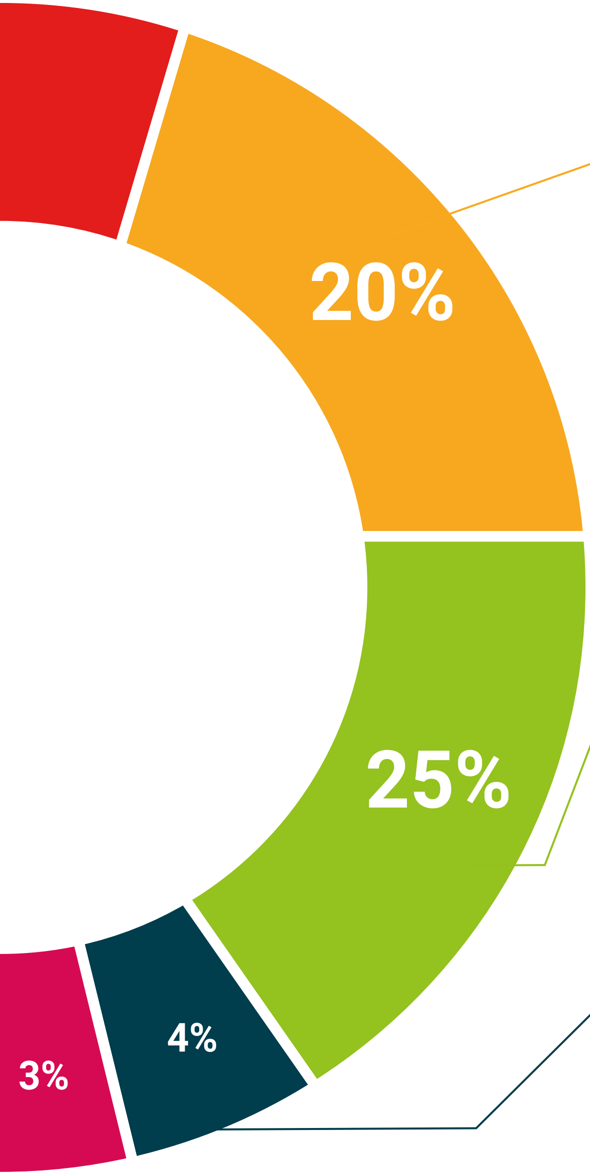
Practising Skills and Abilities

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

Additional Reading

Recent articles, consensus documents and international guidelines, among others. In TECH's virtual library, students will have access to everything they need to complete their course.





Case Studies

Students will complete a selection of the best case studies chosen specifically for this program. Cases that are presented, analyzed, and supervised by the best specialists in the world.

Interactive Summaries

The TECH team presents the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

This exclusive educational system for presenting multimedia content was awarded by Microsoft as a "European Success Story".

Testing & Retesting

We periodically evaluate and re-evaluate students' knowledge throughout the program, through assessment and self-assessment activities and exercises, so that they can see how they are achieving their goals.

05

Certificate

This Postgraduate Diploma in Climate Physics guarantees students, in addition to the most rigorous and up-to-date education, access to a Postgraduate Diploma issued by TECH Technological University.

Successfully complete this program and receive your university qualification without having to travel or fill out laborious paperwork"

This **Postgraduate Diploma in Climate Physics** contains the most complete and up-to-date program on the market.

After the student has passed the assessments, they will receive their corresponding **Postgraduate Diploma** issued by **TECH Technological University** via tracked delivery*.

The diploma issued by **TECH Technological University** will reflect the qualification obtained in the Postgraduate Diploma, and meets the requirements commonly demanded by labor exchanges, competitive examinations, and professional career evaluation committees.

Title: **Postgraduate Diploma in Climate Physics**

Official N° of hours: **450 h.**


tech technological university

Awards the following

DIPLOMA

to

Mr./Ms. _______________, with identification number ___________.

For having passed and accredited the following program

POSTGRADUATE DIPLOMA

in

Climate Physics

This is a qualification awarded by this University, equivalent to 450 hours, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

TECH is a Private Institution of Higher Education recognized by the Ministry of Public Education as of June 28, 2018.

June 17, 2020

Tere Guevara Navarro

Dean

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 EDUCATION will make the necessary arrangements to obtain it, at an additional cost.

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