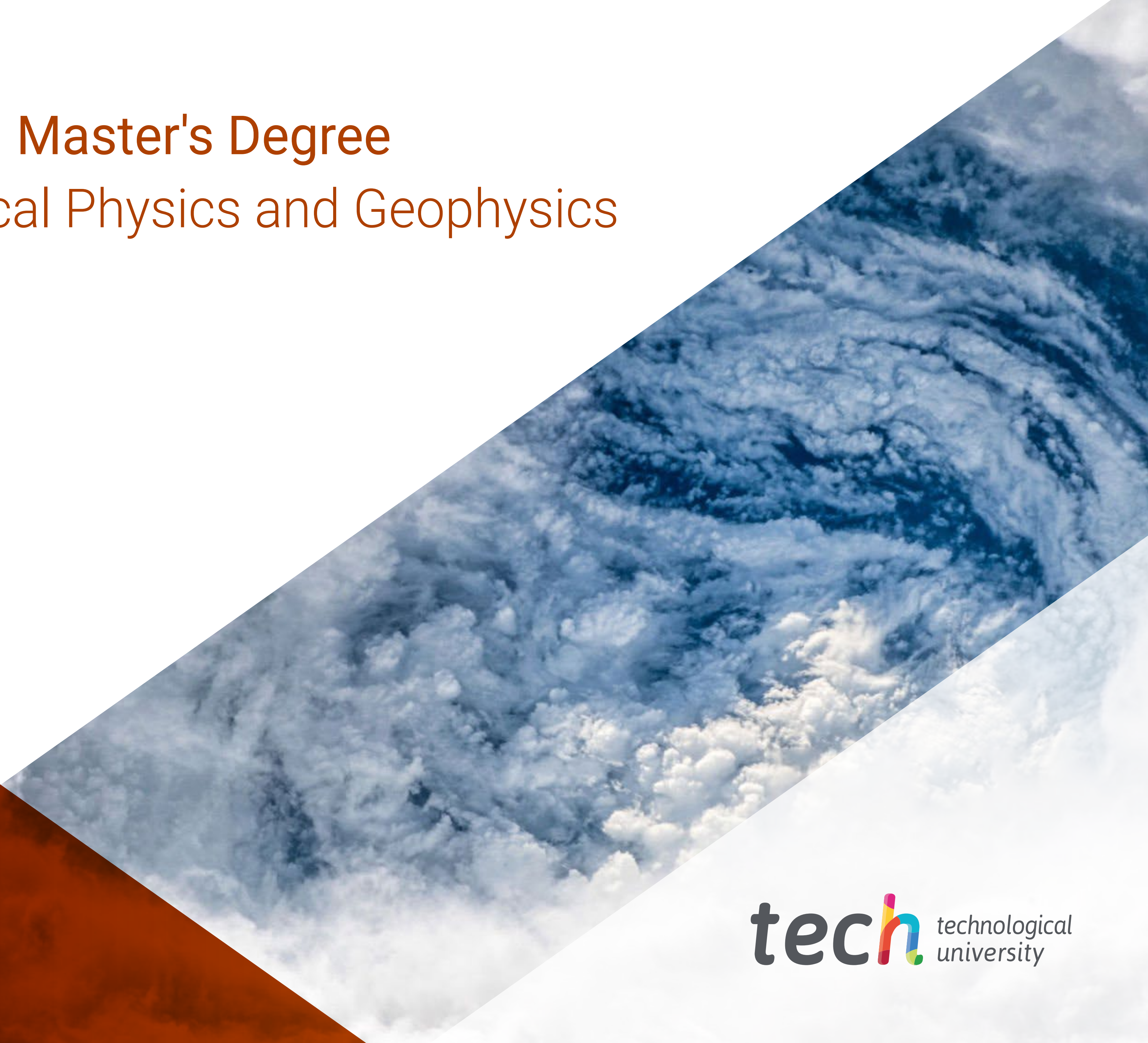
Professional Master's Degree
Meteorological Physics and Geophysics



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Professional Master's Degree

Meteorological Physics and Geophysics

- Modality: **online**
- Duration: **12 months**
- Certificate: **TECH Technological University**
- Dedication: **16h/week**
- Schedule: **at your own pace**
- Exams: **online**

Website: **www.techtitute.com/us/engineering/professional-master-degree/master-meteorological-physics-geophysics**

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01
Introduction

Materials are behind many of the advances made throughout human history. These range from the stones used for hunting, to the vehicles we use to move around, to today's digital screens. However, the problem of climate change has prompted the search for alternative resources to generate energy or the creation of more sustainable products. In this scenario, the engineering professional with extensive knowledge in geophysics and meteorology is in demand from the public and private sector, which needs to find solutions to prevent natural hazards, improve weather forecasting techniques or find new components. For this reason, TECH has designed this 100% online program where you can access 24 hours a day to the most advanced content in physics of materials, Machine Learning or climatology.

A 100% online Professional Master's Degree that will allow you to be up to date with the most relevant experimental techniques in materials physics"

The current scientific community is working tirelessly to find more sustainable natural resources or techniques, such as low-temperature manufacturing, to reduce energy consumption. All this, as a consequence of a change in mentality derived from the existing environmental problems, which have caused a shortage of raw materials and natural catastrophes that directly affect human beings in their daily lives.

In this scenario, it is essential to optimize the processes of exploration and extraction of resources such as minerals, water or the generation of increasingly "cleaner" energy. For this, it is necessary to have engineering professionals with a more open mind towards the care of the environment and the use of their knowledge in the search for scientific-technical solutions. For this reason, TECH has designed this Professional Master's Degree in Meteorological Physics and Geophysics, which will provide the graduate with the most advanced and up-to-date information in this field.

To this end, this academic institution provides students with the most attractive multimedia teaching resources, allowing them to delve dynamically into the key concepts of advanced thermodynamics, the physics of materials, analog and digital electronics, fluid mechanics and climatology. An educational program with a theoretical as well as practical approach thanks to the case studies provided by the specialists who are part of this program.

In addition, the engineering professional will be able to advance through the content of this course quickly thanks to the Relearning methodology, based on the repetition of concepts, which even reduces the long hours of study that are so frequent with other teaching systems.

The professional is, therefore, before a Professional Master's Degree that is in line with current academic times and which can be accessed comfortably, whenever and wherever you want. All you need is an electronic device with an Internet connection to view the syllabus hosted on the Virtual Campus. In addition, students have the freedom to distribute the teaching load according to their needs. An excellent opportunity to study an education that facilitates the professional progression of students in the field of Meteorological Physics and Geophysics.

This **Professional Master's Degree in Meteorological Physics and Geophysics** 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 education will boost your career path thanks to the advanced knowledge you will acquire about geophysics and the most sophisticated methods for searching for natural resources"

The multimedia resource library will allow you to delve into analog and digital electronics whenever you want, from any device with an internet connection"

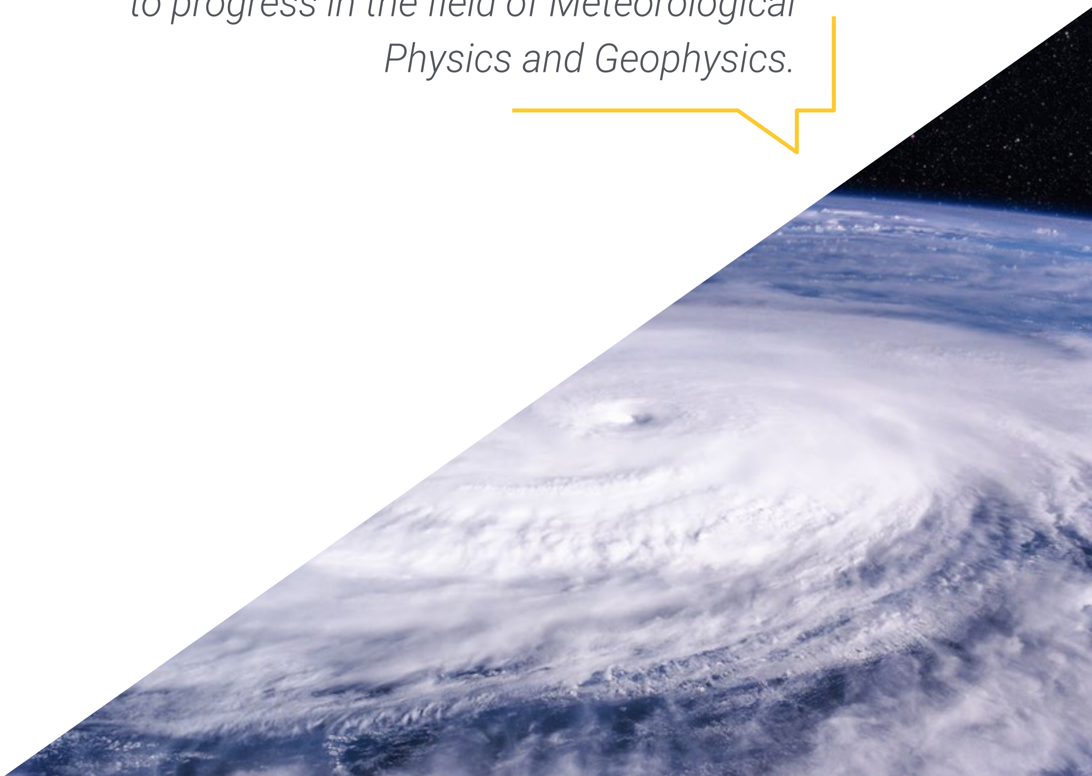
This program is fully compatible with the most demanding responsibilities, since you have neither classroom attendance, nor classes with fixed schedules. Enroll now.

This is a program that will provide you with the necessary techniques and tools to progress in the field of Meteorological Physics and Geophysics.

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

This Professional Master's Degree has been developed by specialists in the field of Meteorological Physics and Geophysics, to offer students the most comprehensive knowledge on thermodynamics, methods of resource search and assessment and mitigation of natural hazards or factors influencing climate change. Video summaries of each topic, videos in detail or specialized readings will facilitate learning.

"You will be able to progress in your professional career and gain access to companies that increasingly demand engineers with extensive knowledge in Meteorological Physics"

General Objectives

- Know the general properties of the climate system and the factors that influence changes in the climate
- Understand the four principles of thermodynamics and apply them to the study of thermodynamic systems
- Be able to explain these behaviors using the basic equations of fluid dynamics of fluid dynamics
- Apply processes of analysis, synthesis and critical reasoning

Specific Objectives

Module 1. Thermodynamics
- Solve problems effectively in the field of thermodynamics
- Acquire basic notions of statistical mechanics
- Be able to analyze different contexts and environments in the field of physics based on a solid mathematical basis
- Understand and use mathematical and numerical methods commonly used in thermodynamics

Module 2. 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 3. Geophysics
- Apply the principles of physics to the study of the Earth
- Understand the fundamental physical processes of the Earth
- Understand the basic techniques for studying the physical properties, structure, and dynamics of the Earth
- Identify methods of searching for resources and assessing and mitigating natural hazards

Module 4. Physics of Materials
- Know the relationship between Material Science and Physics, and the applicability of this science in today's technology
- Understanding the connection between the microscopic structure (atomic, nanometric or micrometric) and the macroscopic properties of materials, as well as their interpretation in physical terms
- Know the most relevant experimental techniques and be able to discern their use to solve a problem in Materials Science
- Master the multiple properties of materials

Module 5. Analog and Digital Electronics
- Understand the operation of linear, nonlinear and digital electronic circuits
- Know the different forms of specification and implementation of digital systems
- Identify the different electronic devices and their operation
- Master the MOS digital circuits

Module 6. Remote Sensing and Image Processing
- Achieve basic knowledge of medical and atmospheric image processing and its applications in the corresponding fields of medical and atmospheric physics respectively
- Acquire skills in image optimization, registration and fusion
- Obtain basic knowledge of machine learning and data analysis

Module 7. Statistical Physics

- Understand the theory of collectivities and be able to apply it to the study of ideal and interacting systems, including phase transitions and critical phenomena
- Know the theory of stochastic processes and be able to apply it to simple cases
- Be familiar with the elementary kinetic theory of transport processes and be able to apply it to dilute gases and quantum gases

Module 8. Fluid Mechanics

- Understand the general concepts of Fluid Physics and solve related problems
- Know the basic characteristics of fluids and their behaviors under various conditions
- Know the constitutive equations
- Acquire confidence in the handling of the Navier-Stokes equations

Module 9. 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 10. 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

With this Professional Master's Degree, you will be up to date on Machine Learning, its applications and current limitations in the field of meteorology and geophysics"

03

Skills

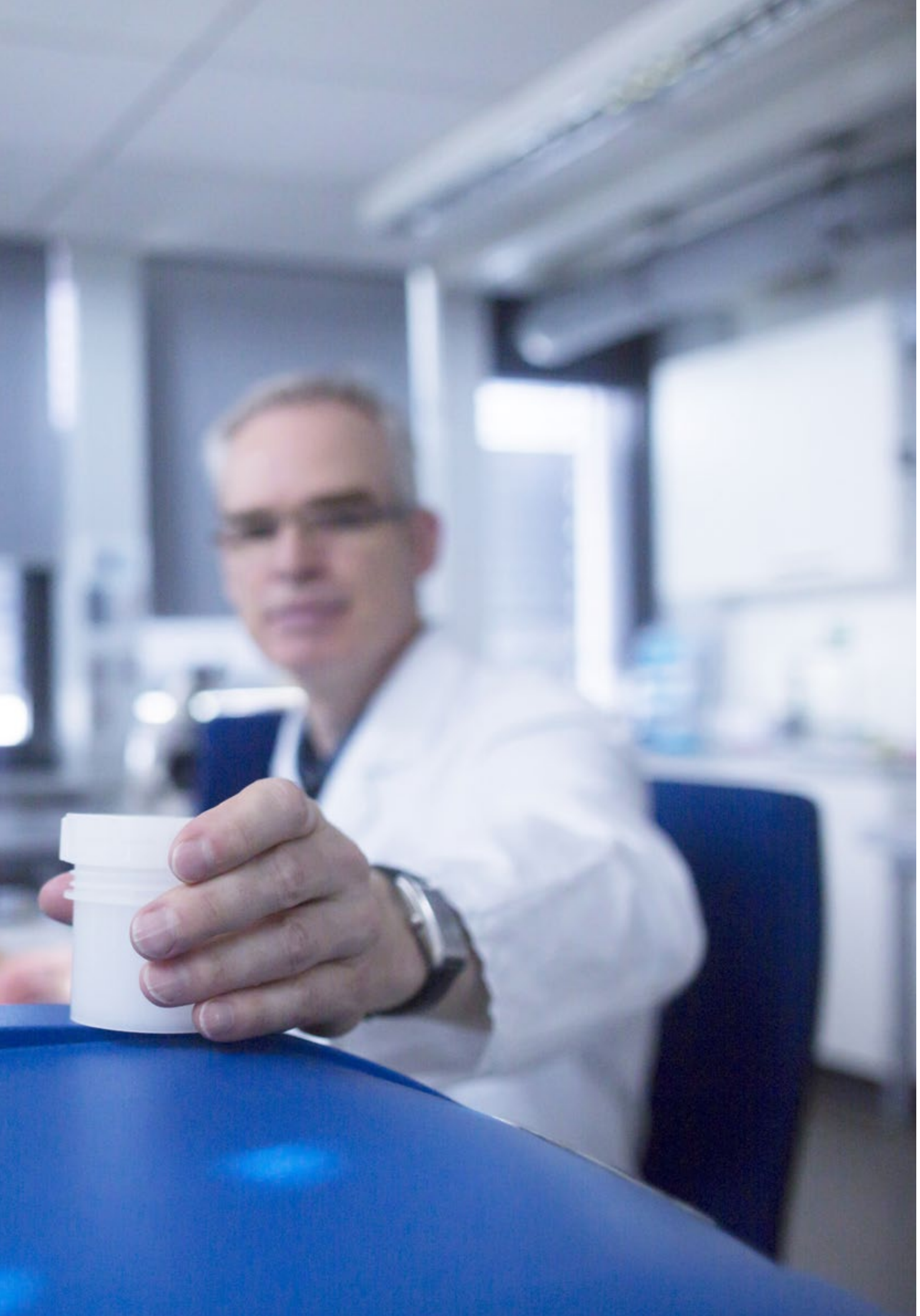
TECH seeks in all its educational program to enhance the competencies of the students who study their programs. On this occasion, the engineering professional will acquire the technical skills necessary to master the computer programs used in remote sensing, as well as their ability to analyze and understand key concepts in Geophysics and Meteorological Physics. All of this, with the objective that, at the end of this program, they will be able to prosper in their work environment.

This 100% online program will take you deeper into the advances in atmospheric sciences through multimedia resources"

General Skills

- Know the fundamentals and general scope of atmospheric sciences
- Know how to apply mathematical methods for the understanding and analysis of the Earth
- Interpret active remote sensing with lidar and radar
- Understand atmospheric dynamics

Upon completion of the 12 months of this Professional Master's Degree program you will have mastered 3D and 4D segmentation and processing techniques Enroll now"



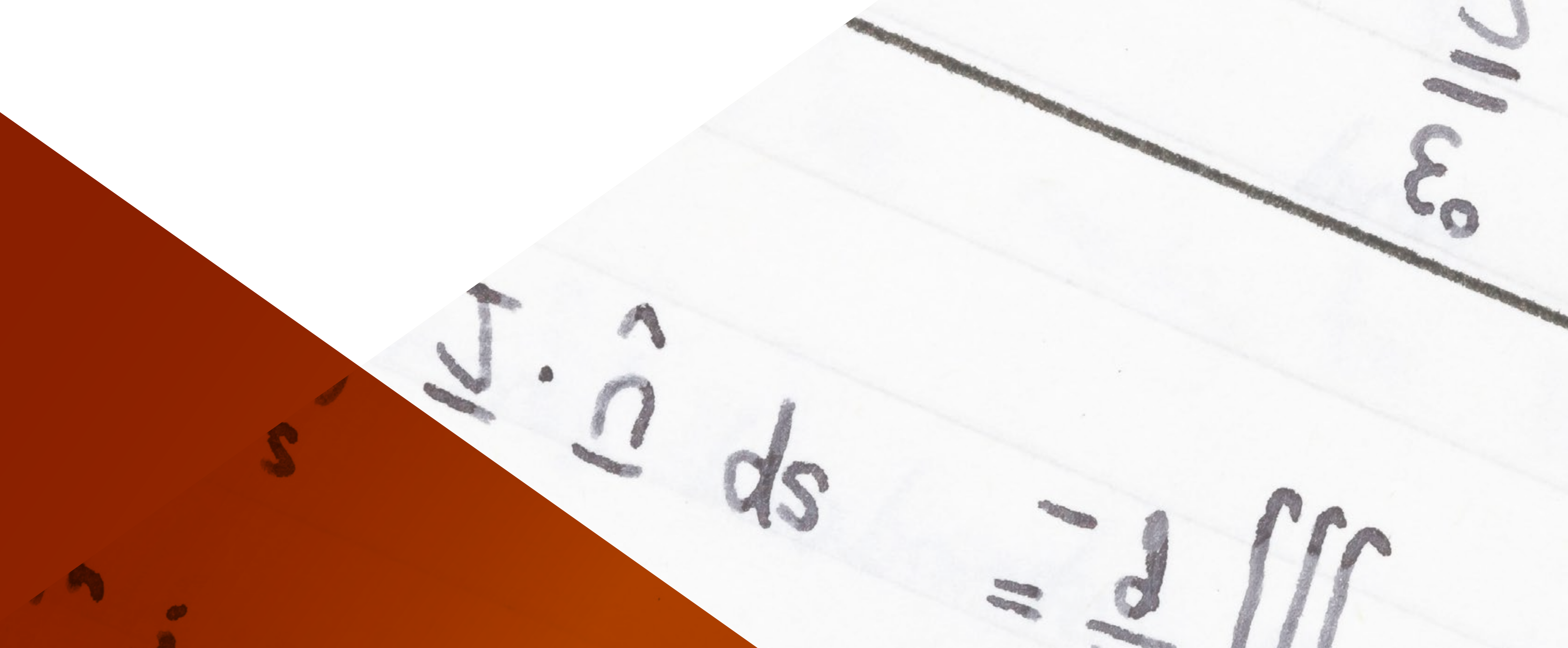
Specific Skills

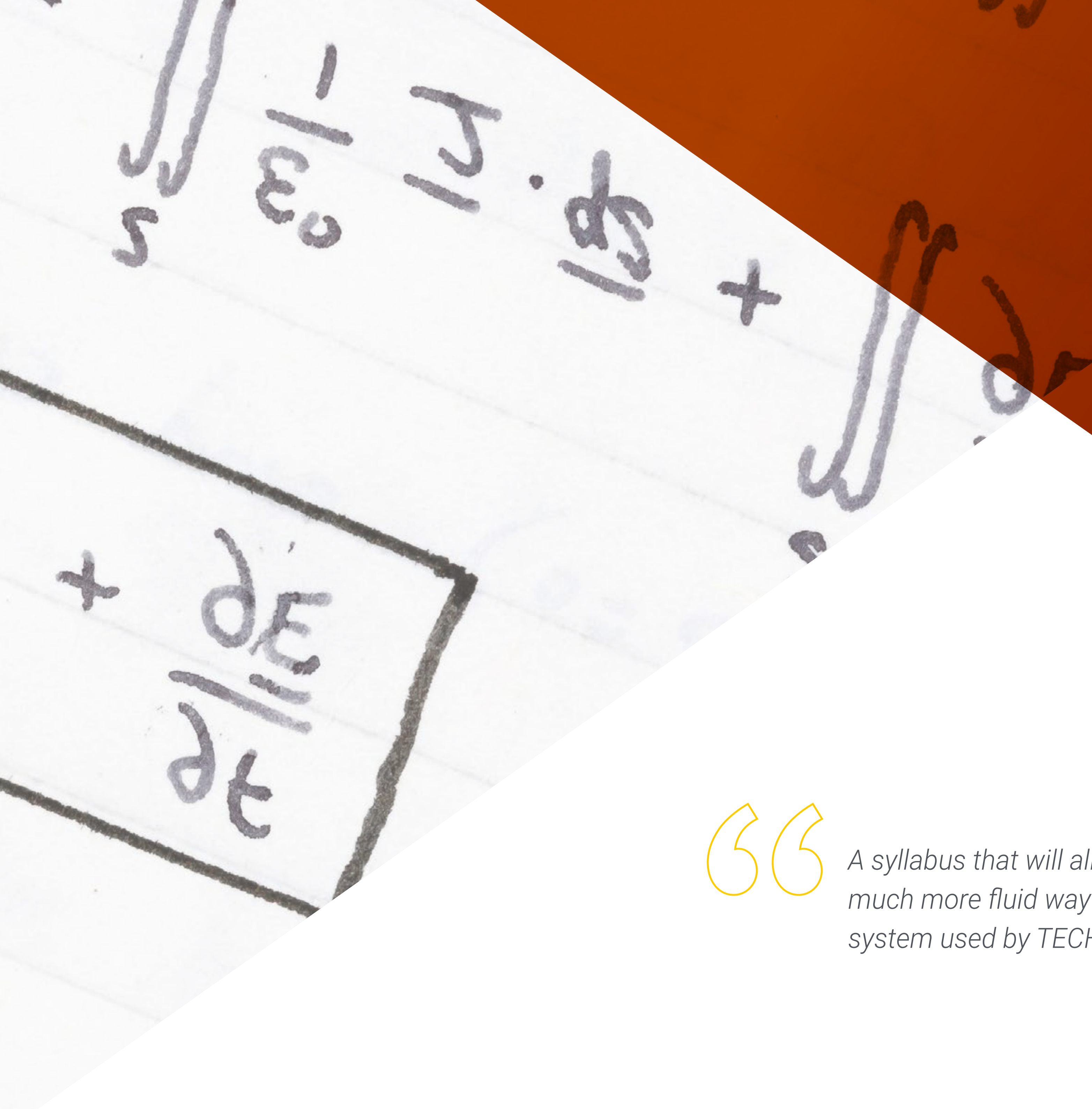
- Know how to use various computer programs that simulate physical systems in the field of Materials Science
- Master the analysis of stabilities by means of the oblique diagram
- Be able to apply bipolar and advanced technology digital circuits
- Proper use of Remote Sensing software with Python

04

Structure and Content

The syllabus of this Professional Master's Degree has been designed to provide the Engineering professional with the maximum knowledge on Meteorological Physics and Geophysics. To this end, the syllabus has been divided into 10 modules in which you can delve into the key concepts of thermodynamics, statistical physics, remote sensing and image processing, fluid mechanics or meteorology and climatology. All this, through a theoretical-practical approach that will allow you to advance in your professional career at a time when climate change and the search for solutions are the main goal.





A syllabus that will allow you to progress in a much more fluid way thanks to the Relearning system used by TECH"

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
  1.4.4. 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

Module 2. Advanced Thermodynamics

2.1. Formalism of Thermodynamics
- 2.1.1. Laws of Thermodynamics
- 2.1.2. The Fundamental Equation
- 2.1.3. Internal Energy: Euler's Form
- 2.1.4. Gibbs-Duhem Equation
- 2.1.5. Legendre Transformations
- 2.1.6. Thermodynamic Potentials
- 2.1.7. Maxwell's Relations for a Fluid
- 2.1.8. Stability Conditions

2.2. Microscopic Description of Macroscopic Systems I
- 2.2.1. Microstates and Macrostates: Introduction
- 2.2.2. Phase Space
- 2.2.3. Collectivities
- 2.2.4. Microcanonical Collectivity
- 2.2.5. Thermal Equilibrium

2.3. Microscopic Description of Macroscopic Systems II
- 2.3.1. Discrete Systems
- 2.3.2. Statistical Entropy
- 2.3.3. Maxwell-Boltzmann Distribution
- 2.3.4. Pressure
- 2.3.5. Effusion

2.4. Canonical Collectivity
- 2.4.1. Partition Function
- 2.4.2. Ideal Systems
- 2.4.3. Energy Degeneration
- 2.4.4. Behavior of the Monoatomic Ideal Gas at a Potential
- 2.4.5. Energy Equipartition Theorem
- 2.4.6. Discrete Systems

2.5. Magnetic Systems
- 2.5.1. Thermodynamics of Magnetic Systems
- 2.5.2. Classical Paramagnetism
- 2.5.3. ½ Spin Paramagnetism
- 2.5.4. Adiabatic Demagnetization

2.6. Phase Transitions
- 2.6.1. Classification of Phase Transitions
- 2.6.2. Phase Diagrams
- 2.6.3. Clapeyron Equation
- 2.6.4. Vapor-Condensed Phase Equilibrium
- 2.6.5. The Critical Point
- 2.6.6. Ehrenfest's Classification of Phase Transitions
- 2.6.7. Landau's Theory

2.7. Ising's Model
- 2.7.1. Introduction
- 2.7.2. One-Dimensional Chain
- 2.7.3. Open One-Dimensional Chain
- 2.7.4. Mean Field Approximation

2.8. Real Gases
- 2.8.1. Comprehensibility Factor. Virial Development
- 2.8.2. Interaction Potential and Configurational Partition Function
- 2.8.3. Second Virial Coefficient
- 2.8.4. Van der Waals Equation
- 2.8.5. Lattice Gas
- 2.8.6. Corresponding States Law
- 2.8.7. Joule and Joule-Kelvin Expansions

2.9. Photon Gas
- 2.9.1. Boson Statistics Vs. Fermion Statistics
- 2.9.2. Energy Density and Degeneracy of States
- 2.9.3. Planck Distribution
- 2.9.4. Equations of State of a Photon Gas

2.10. Macrocanonical Collectivity
- 2.10.1. Partition Function
- 2.10.2. Discrete Systems
- 2.10.3. Fluctuations
- 2.10.4. Ideal Systems
- 2.10.5. The Monoatomic Gas
- 2.10.6. Vapor-Solid Equilibrium

Module 3. Geophysics

3.1. Introduction
- 3.1.1. Physics of the Earth
- 3.1.2. Concept and Development of Geophysics
- 3.1.3. Characteristics of Geophysics
- 3.1.4. Disciplines and Fields of Study
- 3.1.5. Coordinate Systems

3.2. Gravity and Shape of the Earth
- 3.2.1. Size and Shape of the Earth
- 3.2.2. Earth's Rotation
- 3.2.3. Laplace's Equation
- 3.2.4. Figure of the Earth
- 3.2.5. The Geoid and the Normal Gravity Ellipsoid

3.3. Gravity Measurements and Anomagnetic Gravity
- 3.3.1. Air-Free Anomaly
- 3.3.2. Bouguer Anomaly
- 3.3.3. Isostasy
- 3.3.4. Interpretation of Local and Regional Anomalies

3.4. Geomagnetism
- 3.4.1. Sources of the Earth's Magnetic Field
- 3.4.2. Fields Produced by Dipoles
- 3.4.3. Components of the Terrestrial Magnetic Field
- 3.4.4. Harmonic Analysis: Separation of Fields of Internal and External Origin

3.5. Earth's Internal Magnetic Field
- 3.5.1. Dipole Field
- 3.5.2. Geomagnetic Poles and Geomagnetic Coordinates
- 3.5.3. Non-Dipole Field
- 3.5.4. International Reference Geomagnetic Field
- 3.5.5. Temporal Variation of the Internal Field
- 3.5.6. Origin of the Internal Field

3.6. Paleomagnetism
- 3.6.1. Magnetic Properties of Rocks
- 3.6.2. Remnant Magnetization
- 3.6.3. Geomagnetic Virtual Poles
- 3.6.4. Paleomagnetic Poles
- 3.6.5. Apparent Polar Drift Curves
- 3.6.6. Paleomagnetism and Continental Drift
- 3.6.7. Geomagnetic Field Inversions
- 3.6.8. Marine Magnetic Anomalies

3.7. External Magnetic Field
- 3.7.1. Origin of the External Magnetic Field
- 3.7.2. Structure of the Magnetosphere
- 3.7.3. Ionosphere
- 3.7.4. Variations of the External Field: Diurnal Variation, Magnetic Storms
- 3.7.5. Polar Auroras

3.8. Seismic Wave Generation and Propagation
- 3.8.1. Mechanics of an Elastic Medium: Elastic Parameters of the Earth
- 3.8.2. Seismic Waves: Internal and Surface Waves
- 3.8.3. Reflection and Refraction of Internal Waves
- 3.8.4. Trajectories and Travel Times: Dromochrons

3.9. Internal Structure of Earth
- 3.9.1. Radial Variation of the Seismic Wave Velocity
- 3.9.2. Reference Earth Models
- 3.9.3. Physical and Compositional Stratification of the Earth
- 3.9.4. Density, Gravity, and Pressure within the Earth
- 3.9.5. Seismic Tomography

3.10. Landslides
- 3.10.1. Location and Time of Origin
- 3.10.2. Global Seismicity in Relation to Plate Tectonics
- 3.10.3. Size of an Earthquake: Intensity, Magnitude, Energy
- 3.10.4. Gutenberg-Richter Law

Module 4. Physics of Materials

4.9. Thermal Properties
- 4.9.1. Introduction
- 4.9.2. Heat Capacity
- 4.9.3. Thermal Conduction
- 4.9.4. Expansion and Contraction
- 4.9.5. Thermoelectric Phenomena
- 4.9.6. Magnetocaloric Effect
- 4.9.7. Characterization of Thermal Properties

4.10. Optical Properties: Light and Matter
- 4.10.1. Absorption and Re-Emission
- 4.10.2. Light Sources
- 4.10.3. Energy Conversion
- 4.10.4. Optical Characterization
- 4.10.5. Microscopy Techniques
- 4.10.6. Nanostructures

Module 5. Analog and Digital Electronics

5.1. Circuit Analysis
- 5.1.1. Element Constraints
- 5.1.2. Connection Constraints
- 5.1.3. Combined Constraints
- 5.1.4. Equivalent Circuits
- 5.1.5. Voltage and Current Division
- 5.1.6. Circuit Reduction

5.2. Analog Systems
- 5.2.1. Kirchoff's Laws
- 5.2.2. Thévenin's Theorem
- 5.2.3. Norton's Theorem
- 5.2.4. Introduction to Semiconductor Physics

5.3. Devices and Characteristic Equations
- 5.3.1. Diode
- 5.3.2. Bipolar Transistors (BJTs) and MOSFETs
- 5.3.3. Pspice Model
- 5.3.4. Characteristic Curves
- 5.3.5. Regions of Operation

5.4. Amplifiers
- 5.4.1. Amplifier Operation
- 5.4.2. Equivalent Circuits of Amplifiers
- 5.4.3. Feedback
- 5.4.4. Frequency Domain Analysis

5.5. Amplification Stages
- 5.5.1. BJT and MOSFET Amplifier Function
- 5.5.2. Polarization
- 5.5.3. Equivalent Small-Signal Model
- 5.5.4. Single-Stage Amplifiers
- 5.5.5. Frequency Response
- 5.5.6. Connection of Amplifier Stages in Cascade
- 5.5.7. Differential Torque
- 5.5.8. Current Mirrors and Application as Active Loads

5.6. Operational Amplifier and Applications
- 5.6.1. Ideal Operational Amplifier
- 5.6.2. Deviations from Ideality
- 5.6.3. Sinusoidal Oscillators
- 5.6.4. Comparators and Relaxation Oscillators

5.7. Logic Functions and Combinational Circuits
- 5.7.1. Information Representation in Digital Electronics
- 5.7.2. Boolean Algebra
- 5.7.3. Simplification of Logic Functions
- 5.7.4. Two-Level Combinational Structures
- 5.7.5. Combinational Functional Modules

5.8. Sequential Systems
- 5.8.1. Concept of Sequential System
- 5.8.2. Latches, Flip-Flops and Registers
- 5.8.3. State Tables and State Diagrams: Moore and Mealy Models
- 5.8.4. Synchronous Sequential Systems Implementation
- 5.8.5. General Structure of a Computer

- 5.9. MOS Digital Circuits
    - 5.9.1 Inverters
    - 5.9.2. Static and Dynamic Parameters
    - 5.9.3. Combinational MOS Circuits
        - 5.9.3.1. Step Transistor Logic
        - 5.9.3.2. Implementing Latches and Flip-Flops
- 5.10. Bipolar and Advanced Technology Digital Circuits
    - 5.10.1. BJT Switch. BTJ Digital Circuits
    - 5.10.2. TTL Transistor-Transistor Logic Circuits
    - 5.10.3. Characteristic Curves of a Standard TTL
    - 5.10.4. Emitter-Coupled Logic Circuits ECL
    - 5.10.5. Digital Circuits with BiCMOS

Module 6. Remote Sensing and Image Processing

- 6.1. Introduction to Image Processing
    - 6.1.1. Motivation
    - 6.1.2. Digital Medical and Atmospheric Imaging
    - 6.1.3. Modalities of Medical and Atmospheric Imaging
    - 6.1.4. Quality Parameters
    - 6.1.5. Storage and Display
    - 6.1.6. Processing Platforms
    - 6.1.7. Image Processing Applications
- 6.2. Image Optimization, Registration and Fusion
    - 6.2.1. Introduction and Objectives
    - 6.2.2. Intensity Transformations
    - 6.2.3. Noise Correction
    - 6.2.4. Filters in the Spatial Domain
    - 6.2.5. Frequency Domain Filters
    - 6.2.6. Introduction and Objectives
    - 6.2.7. Geometric Transformations
    - 6.2.8. Records
    - 6.2.9. Multimodal Merging
    - 6.2.10. Applications of Multimodal Fusion
- 6.3. 3D and 4D Segmentation and Processing Techniques
    - 6.3.1. Introduction and Objectives
    - 6.3.2. Segmentation Techniques
    - 6.3.3. Morphological Operations
    - 6.3.4. Introduction and Objectives
    - 6.3.5. Morphological and Functional Imaging
    - 6.3.6. 3D Analysis
    - 6.3.7. 4D Analysis
- 6.4. Feature Extraction
    - 6.4.1. Introduction and Objectives
    - 6.4.2. Texture Analysis
    - 6.4.3. Morphometric Analysis
    - 6.4.4. Statistics and Classification
    - 6.4.5. Presentation of Results
- 6.5. Machine Learning
    - 6.5.1. Introduction and Objectives
    - 6.5.2. Big Data
    - 6.5.3. Deep Learning
    - 6.5.4. Software Tools
    - 6.5.5. Applications
    - 6.5.6. Limitations
- 6.6. Introduction to Remote Sensing
    - 6.6.1. Introduction and Objectives
    - 6.6.2. Definition of Remote Sensing
    - 6.6.3. Exchange Particles in Remote Sensing
    - 6.6.4. Active and Passive Remote Sensing
    - 6.6.5. Remote Sensing Software with Python

6.7. Passive Photon Remote Sensing
- 6.7.1. Introduction and Objectives
- 6.7.2. Light
- 6.7.3. Interaction of Light with Matter
- 6.7.4. Black Bodies
- 6.7.5. Other Effects
- 6.7.6. Point Cloud Diagram

6.8. Passive Remote Sensing in Ultraviolet, Visible, Infrared, Infrared, Microwave and Radio
- 6.8.1. Introduction and Objectives
- 6.8.2. Passive Remote Sensing: Photon Detectors
- 6.8.3. Visible Observation with Telescopes
- 6.8.4. Types of Telescopes
- 6.8.5. Mounts
- 6.8.6. Optics
- 6.8.7. Ultraviolet
- 6.8.8. Infrared
- 6.8.9. Microwaves and Radio Waves
- 6.8.10. netCDF4 Files

6.9. Active Remote Sensing with Lidar and Radar
- 6.9.1. Introduction and Objectives
- 6.9.2. Active Remote Sensing
- 6.9.3. Atmospheric Radar
- 6.9.4. Weather Radar
- 6.9.5. Comparison of Lidar with Radar
- 6.9.6. HDF4 Files

6.10. Passive Remote Sensing of Gamma and X-Rays
- 6.10.1. Introduction and Objectives
- 6.10.2. Introduction to X-ray Observation
- 6.10.3. Gamma Ray Observation
- 6.10.4. Remote Sensing Software

Module 7. Statistical Physics

7.1. Stochastic Processes
- 7.1.1. Introduction
- 7.1.2. BrownianMotion
- 7.1.3. Random Walk
- 7.1.4. Langevin Equation
- 7.1.5. Fokker-Planck Equation
- 7.1.6. Brownian Engines

7.2. Review of Statistical Mechanics
- 7.2.1. Collectivities and Postulates
- 7.2.2. Microcanonical Collectivity
- 7.2.3. Canonical Collectivity
- 7.2.4. Discrete and Continuous Energy Spectra
- 7.2.5. Classical and Quantum Limits. Thermal Wavelength
- 7.2.6. Maxwell-Boltzmann Statistics
- 7.2.7. Energy Equipartition Theorem

7.3. Ideal Gas of Diatomic Molecules
- 7.3.1. The Problem of Specific Heats in Gases
- 7.3.2. Internal Degrees of Freedom
- 7.3.3. Contribution of Each Degree of Freedom to the Heat Capacity
- 7.3.4. Polyatomic Molecules

7.4. Magnetic Systems
- 7.4.1. ½ Spin Systems
- 7.4.2. Quantum Paramagnetism
- 7.4.3. Classical Paramagnetism
- 7.4.4. Superparamagnetism

7.5. Biological Systems
- 7.5.1. Biophysics
- 7.5.2. DNA Denaturation
- 7.5.3. Biological Membranes
- 7.5.4. Myoglobin Saturation Curve. Langmuir Isotherm

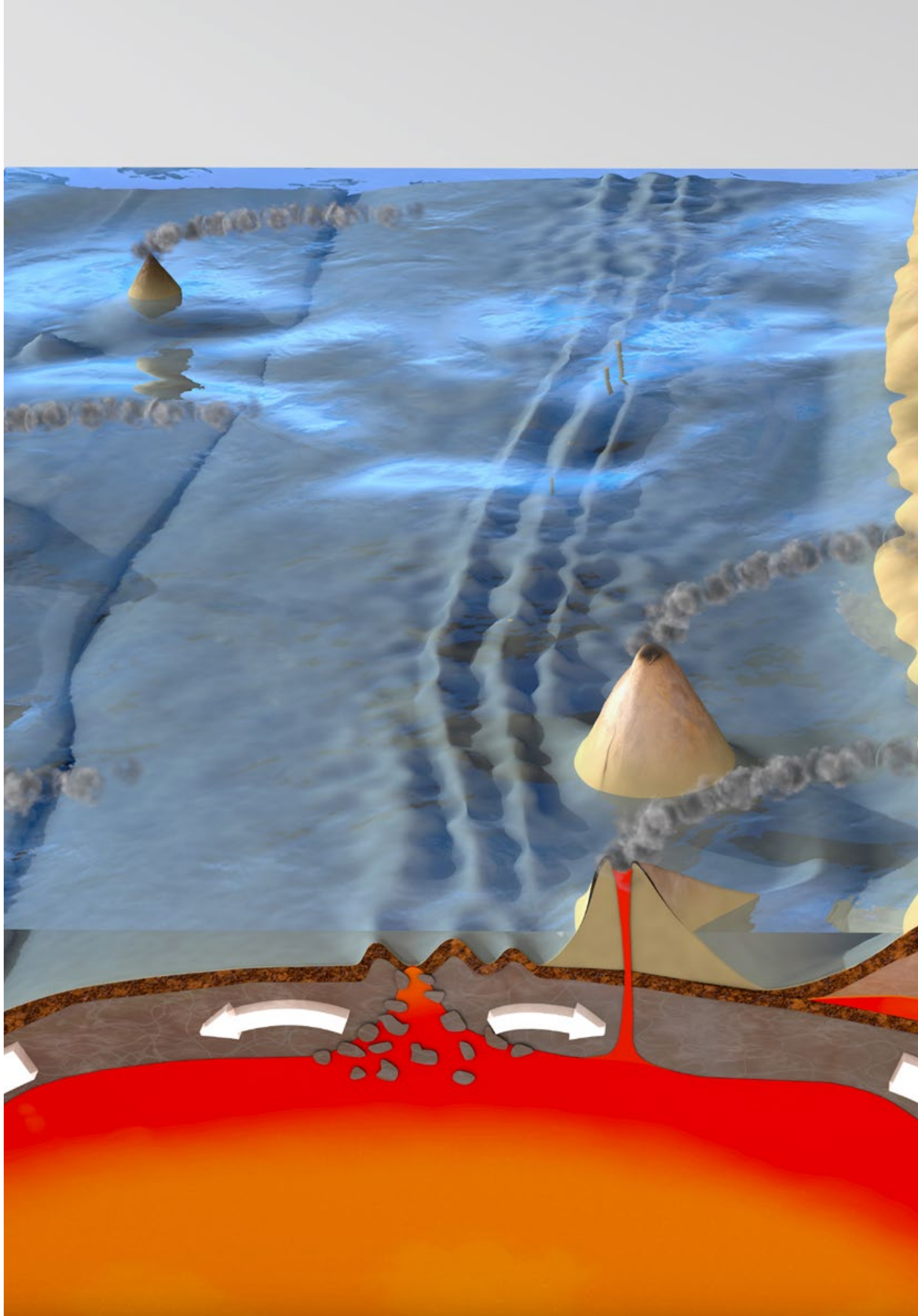
7.6. Systems with Interaction
- 7.6.1. Solids, Liquids, Gases
- 7.6.2. Magnetic Systems. Ferro-Paramagnetic Transition
- 7.6.3. Weiss Model
- 7.6.4. Landau Model
- 7.6.5. Ising's Model
- 7.6.6. Critical Points and Universality
- 7.6.7. Monte Carlo Method. Metropolis Algorithm

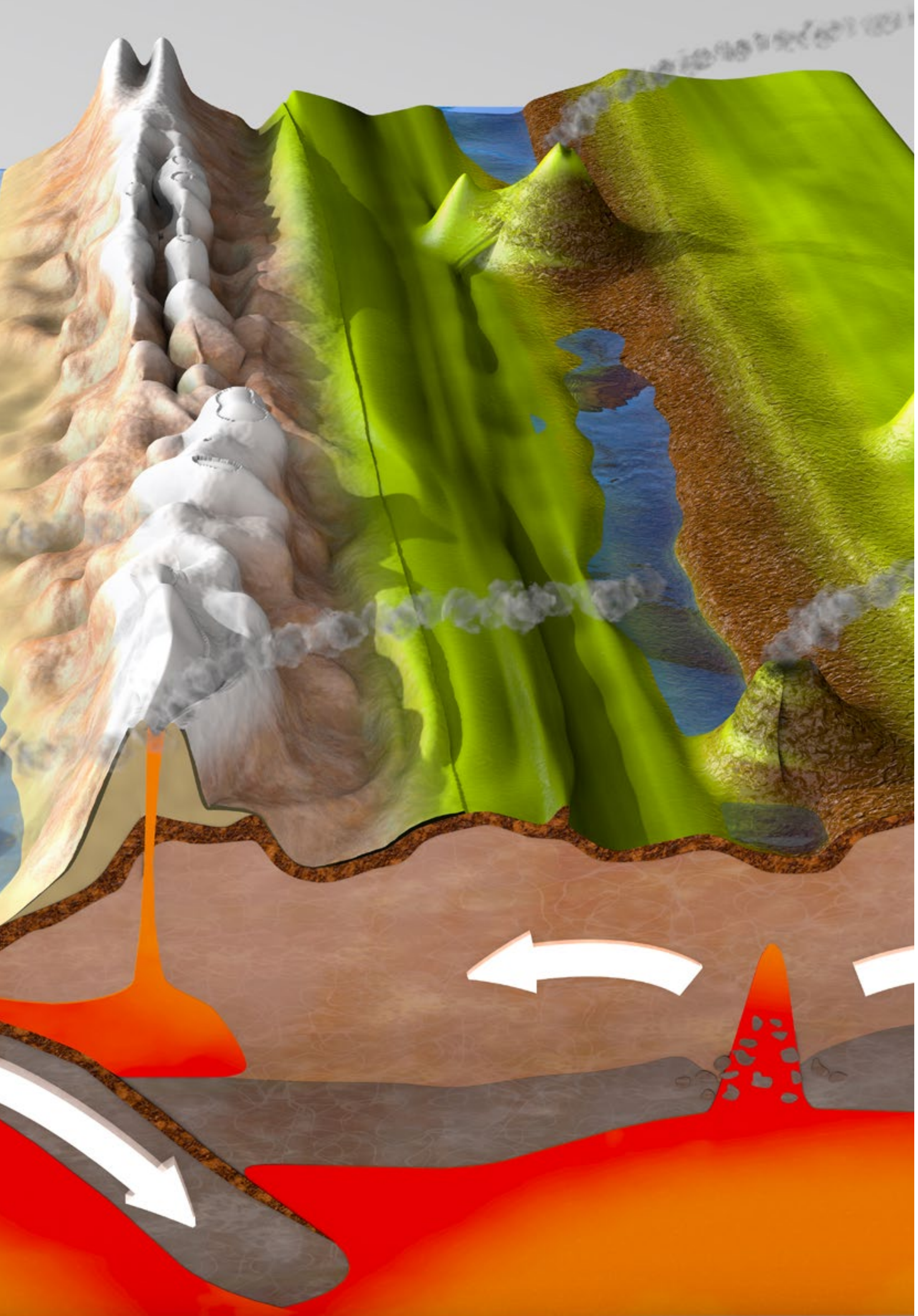
7.7. Quantum Ideal Gas
- 7.7.1. Distinguishable and Indistinguishable Particles
- 7.7.2. Microstates in Quantum Statistical Mechanics
- 7.7.3. Calculation of the Macrocanonical Partition Function in an Ideal Gas
- 7.7.4. Quantum Statistics: Bose-Einstein and Fermi-Dirac Statistics
- 7.7.5. Ideal Gases of Bosons and Fermions

7.8. Ideal Boson Gas
- 7.8.1. Photons. Black Body Radiation
- 7.8.2. Phonons. Heat Capacity of the Crystal Lattice
- 7.8.3. Bose-Einstein Condensation
- 7.8.4. Thermodynamic Properties of Bose-Einstein Gas
- 7.8.5. Critical Temperature and Density

7.9. Ideal Gas for Fermions
- 7.9.1. Fermi-Dirac Statistics
- 7.9.2. Electron Heat Capacity
- 7.9.3. Fermion Degeneracy Pressure
- 7.9.4. Fermi Function and Temperature

7.10. Elementary Kinetic Theory of Gases
- 7.10.1. Dilute Gas in Equilibrium
- 7.10.2. Transport Coefficients
- 7.10.3. Thermal Conductivity of the Crystalline Lattice and Electrons
- 7.10.4. Gaseous Systems Composed of Moving Molecules





Module 8. Fluid Mechanics

8.1. Introduction to Fluid Physics
- 8.1.1. No-Slip Condition
- 8.1.2. Classification of Flows
- 8.1.3. Control System and Volume
- 8.1.4. Fluid Properties
  - 8.1.4.1. Density
  - 8.1.4.2. Specific Gravity
  - 8.1.4.3. Vapor Pressure
  - 8.1.4.4. Cavitation
  - 8.1.4.5. Specific Heat
  - 8.1.4.6. Compressibility
  - 8.1.4.7. Speed of Sound
  - 8.1.4.8. Viscosity
  - 8.1.4.9. Surface Tension

8.2. Fluid Statics and Kinematics
- 8.2.1. Pressure
- 8.2.2. Pressure Measuring Devices
- 8.2.3. Hydrostatic Forces on Submerged Surfaces
- 8.2.4. Buoyancy, Stability and Motion of Rigid Solids
- 8.2.5. Lagrangian and Eulerian Description
- 8.2.6. Flow Patterns
- 8.2.7. Kinematic Tensors
- 8.2.8. Vorticity
- 8.2.9. Rotationality
- 8.2.10. Reynolds Transport Theorem

8.3. Bernoulli and Energy Equations
- 8.3.1. Conservation of Mass
- 8.3.2. Mechanical Energy and Efficiency
- 8.3.3. Bernoulli's Equation
- 8.3.4. General Energy Equation
- 8.3.5. Stationary Flow Energy Analysis

8.4. Fluid Analysis
- 8.4.1. Conservation of Linear Momentum Equations
- 8.4.2. Conservation of Angular Momentum Equations
- 8.4.3. Dimensional Homogeneity
- 8.4.4. Variable Repetition Method
- 8.4.5. Buckingham's Pi Theorem

8.5. Flow in Pipes
- 8.5.1. Laminar and Turbulent Flow
- 8.5.2. Inlet Region
- 8.5.3. Minor Losses
- 8.5.4. Networks

8.6. Differential Analysis and Navier-Stokes Equations
- 8.6.1. Conservation of Mass
- 8.6.2. Current Function
- 8.6.3. Cauchy Equation
- 8.6.4. Navier-Stokes Equation
- 8.6.5. Dimensionless Navier-Stokes Equations of Motion
- 8.6.6. Stokes Flow
- 8.6.7. Inviscid Flow
- 8.6.8. Irrotational Flow
- 8.6.9. Boundary Layer Theory. Clausius Equation

8.7. External Flow
- 8.7.1. Drag and Lift
- 8.7.2. Friction and Pressure
- 8.7.3. Coefficients
- 8.7.4. Cylinders and Spheres
- 8.7.5. Aerodynamic Profiles

8.8. Compressible Flow
- 8.8.1. Stagnation Properties
- 8.8.2. One-Dimensional Isentropic Flow
- 8.8.3. Nozzles
- 8.8.4. Shock Waves
- 8.8.5. Expansion Waves
- 8.8.6. Rayleigh Flow
- 8.8.7. Fanno Flow

8.9. Open Channel Flow
- 8.9.1. Classification
- 8.9.2. Froude Number
- 8.9.3. Wave Speed
- 8.9.4. Uniform Flow
- 8.9.5. Gradually Varying Flow
- 8.9.6. Rapidly Varying Flow
- 8.9.7. Hydraulic Jump

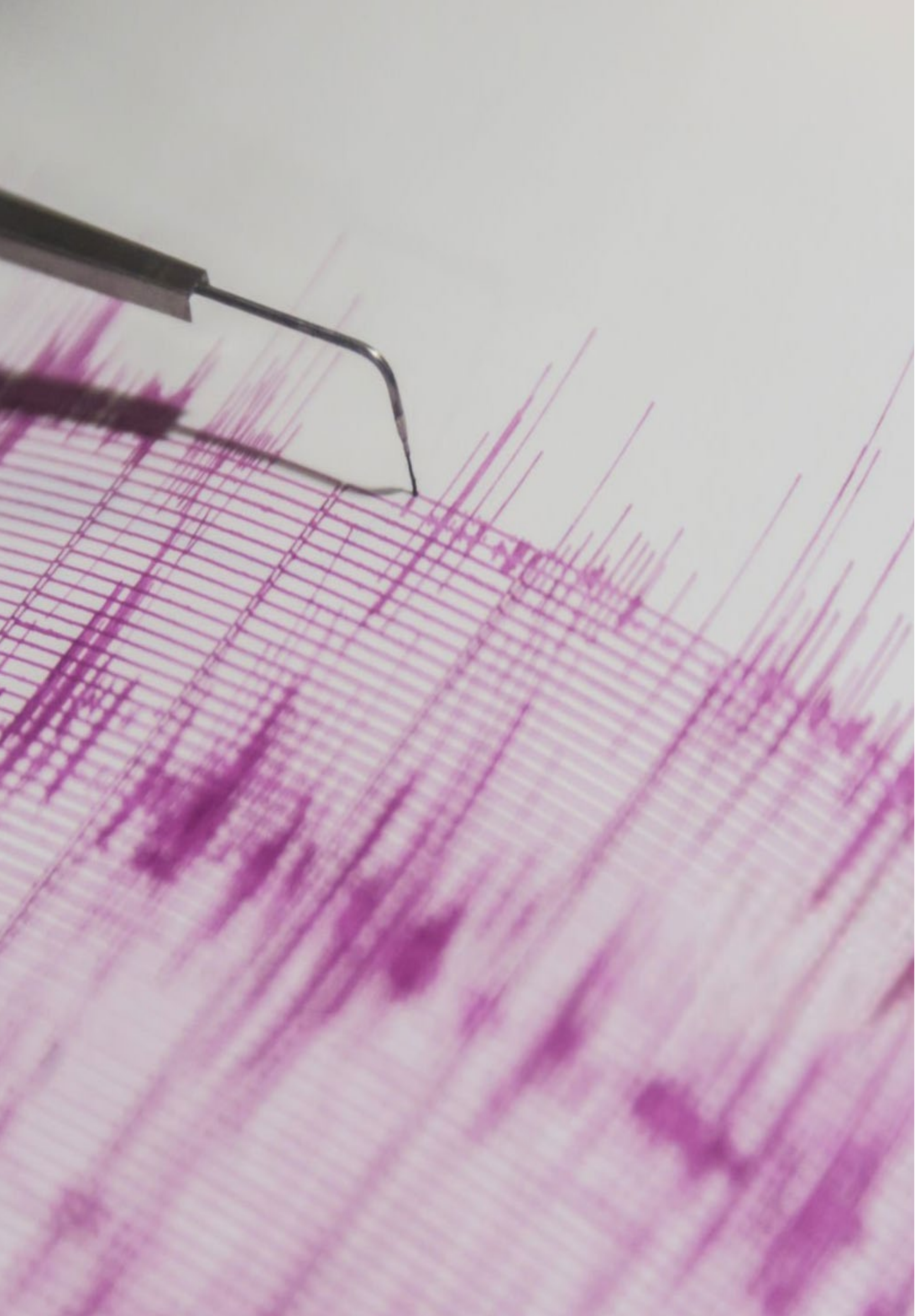
8.10. Non-Newtonian Fluids
- 8.10.1. Standard Flows
- 8.10.2. Material Functions
- 8.10.3. Experiments
- 8.10.4. Generalized Newtonian Fluid Model
- 8.10.5. Generalized Linear Viscoelastic Fluid Model
- 8.10.6. Advanced Constitutive Equations and Geometry

Module 9. Meteorology and Climatology

9.1. General Structure of the Atmosphere
- 9.1.1. Weather and Climate
- 9.1.2. General Characteristics of the Earth's Atmosphere
- 9.1.3. Atmospheric Composition
- 9.1.4. Horizontal and Vertical Structure of the Atmosphere
- 9.1.5. Atmospheric Variables
- 9.1.6. Observing Systems
- 9.1.7. Meteorological Scales
- 9.1.8. Equation of State
- 9.1.9. Hydrostatic Equation

- 9.2. Atmospheric Motion
    - 9.2.1. Air Masses
    - 9.2.2. Extratropical Cyclones and Fronts
    - 9.2.3. Mesoscale and Microscale Phenomena
    - 9.2.4. Fundamentals of Atmospheric Dynamics
    - 9.2.5. Air Motion: Apparent and Real Forces
    - 9.2.6. Equations of Horizontal Motion
    - 9.2.7. Geostrophic Wind, Friction Force and Gradient Wind
    - 9.2.8. Atmospheric General Circulation
- 9.3. Radioactive Energy Exchange in the Atmosphere
    - 9.3.1. Solar and Terrestrial Radiation
    - 9.3.2. Absorption, Emission and Reflection of Radiation
    - 9.3.3. Earth-Atmosphere Radioactive Exchanges
    - 9.3.4. Greenhouse Effect
    - 9.3.5. Radiative Balance at the Top of the Atmosphere
    - 9.3.6. Radiative Forcing of the Climate
        - 9.3.6.1. Natural and Anthropogenic Climate Forcing
        - 9.3.6.2. Climate Sensitivity
- 9.4. Thermodynamics of the Atmosphere
    - 9.4.1. Adiabatic Processes: Potential Temperature
    - 9.4.2. Stability and Instability of Dry Air
    - 9.4.3. Saturation and Condensation of Water Vapor in the Atmosphere
    - 9.4.4. Rise of Moist Air: Saturated and Pseudoadiabatic Adiabatic Evolution
    - 9.4.5. Condensation Levels
    - 9.4.6. Stability and Instability of Humid Air
- 9.5. Cloud Physics and Precipitation
    - 9.5.1. General Cloud Formation Processes
    - 9.5.2. Cloud Morphology and Classification
    - 9.5.3. Cloud Microphysics: Condensation Nuclei and Ice Nuclei
    - 9.5.4. Precipitation Processes: Rain, Snow and Hail Formation
    - 9.5.5. Artificial Modification of Clouds and Precipitation
- 9.6. Atmospheric Dynamics
    - 9.6.1. Inertial and Non-Inertial Forces
    - 9.6.2. Coriolis Force
    - 9.6.3. Equation of Motion
    - 9.6.4. Horizontal Pressure Field
    - 9.6.5. Pressure Reduction at Sea Level
    - 9.6.6. Horizontal Pressure Gradient
    - 9.6.7. Pressure-Density
    - 9.6.8. Isohipsas
    - 9.6.9. Equation of Motion in the Intrinsic Coordinate System
    - 9.6.10. Frictionless Horizontal Flow: Geostrophic Wind, Gradient Wind
    - 9.6.11. Friction Effect
    - 9.6.12. Wind at Height
    - 9.6.13. Local and Small-Scale Wind Regimes
    - 9.6.14. Pressure and Wind Measurements
- 9.7. Synoptic Meteorology
    - 9.7.1. Baric Systems
    - 9.7.2. Anticyclones
    - 9.7.3. Air Masses
    - 9.7.4. Frontal Surfaces
    - 9.7.5. Warm Fronts
    - 9.7.6. Cold Front
    - 9.7.7. Frontal Depressions. Occlusion Occluded Front
- 9.8. General Circulation
    - 9.8.1. General Characteristics of the General Circulation
    - 9.8.2. Surface and Overhead Observations
    - 9.8.3. Single-Cell Model
    - 9.8.4. Tricellular Model
    - 9.8.5. Jet Streams
    - 9.8.6. Ocean Currents
    - 9.8.7. Ekman Transport
    - 9.8.8. Global Distribution of Precipitation
    - 9.8.9. Teleconnections. El Niño Southern Oscillation. The North Atlantic Oscillation

Module 10. Thermodynamics of the Atmosphere



10.8. Atmospheric Condensation by Adiabatic Ascent
- 10.8.1. Saturation of Air by Adiabatic Rise
- 10.8.2. Reversible Adiabatic Saturation Processes
- 10.8.3. Pseudo-Adiabatic Processes
- 10.8.4. Equivalent Pseudo-Potential and Wet-Thermometer Temperature
- 10.8.5. Föhn Effect

10.9. Atmospheric Stability
- 10.9.1. Stability Criteria in Unsaturated Air
- 10.9.2. Stability Criteria in Saturated Air
- 10.9.3. Conditional Instability
- 10.9.4. Convective Instability
- 10.9.5. Analysis of Stabilities by Means of the Oblique Diagram

10.10. Thermodynamic Diagrams
- 10.10.1. Conditions for Equivalent Area Transformations
- 10.10.2. Examples of Thermodynamic Diagrams
- 10.10.3. Graphical Representation of Thermodynamic Variables in a T-ln(p) Diagram
- 10.10.4. Use of Thermodynamic Diagrams in Meteorology

An academic option that will allow you to learn about the physical properties of materials and their multiple uses and applications"

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

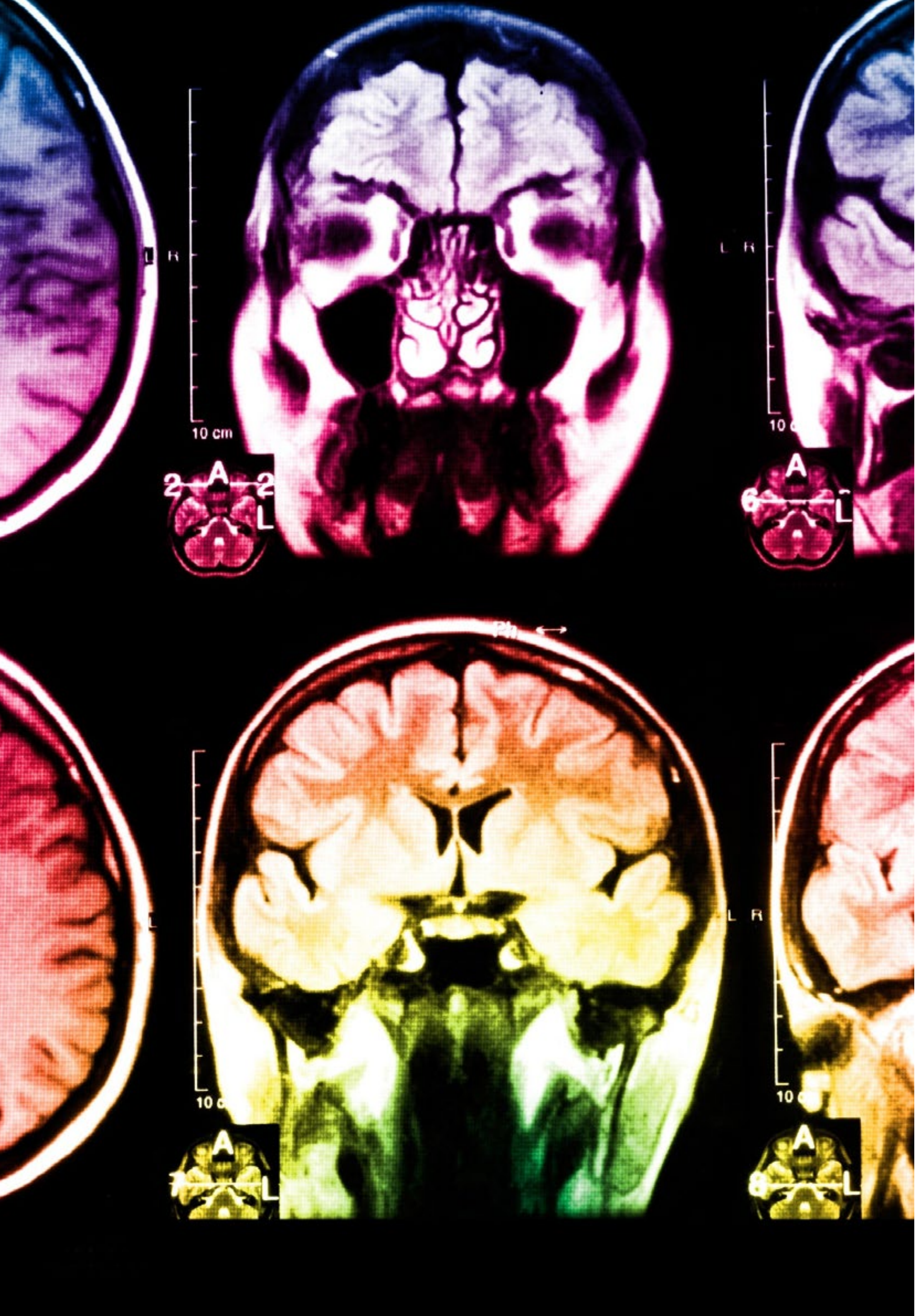
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

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.

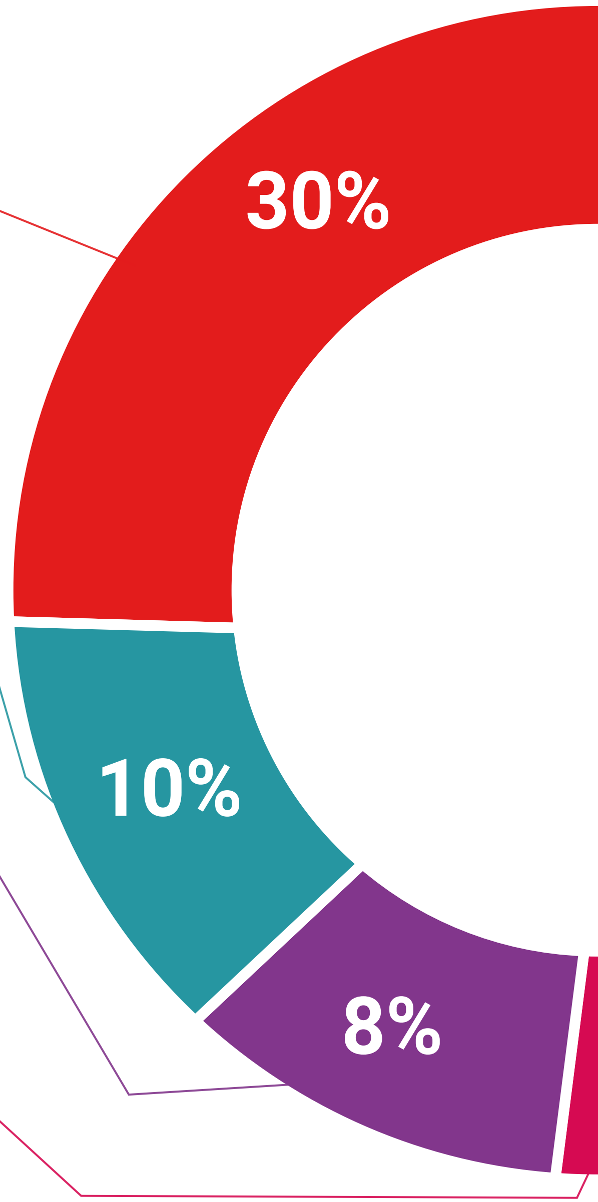
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

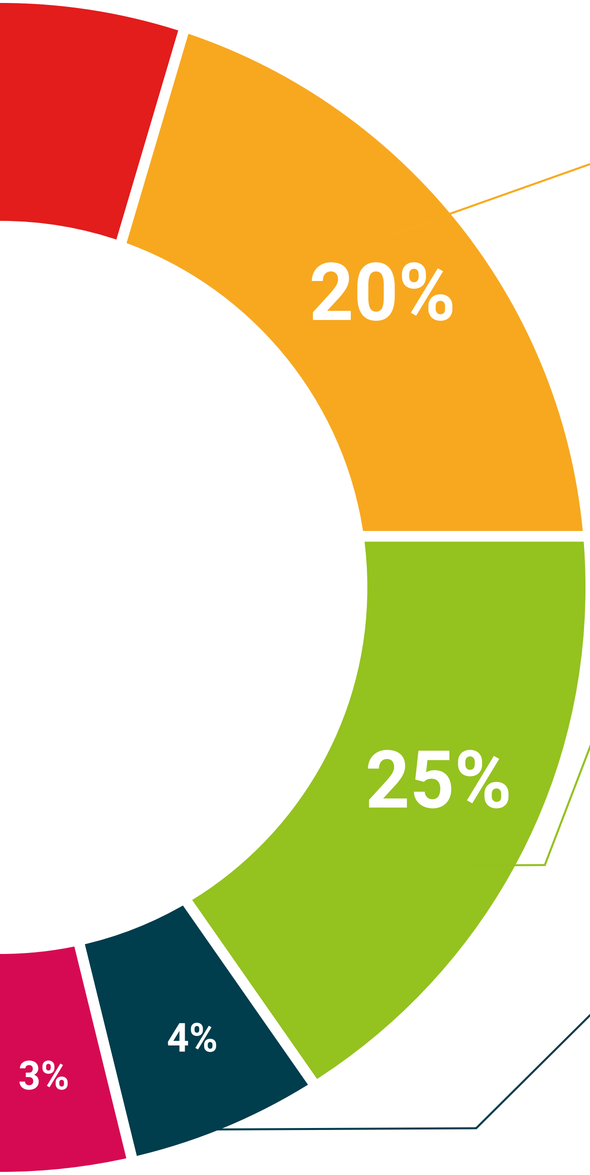
Practising Skills and Abilities

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".

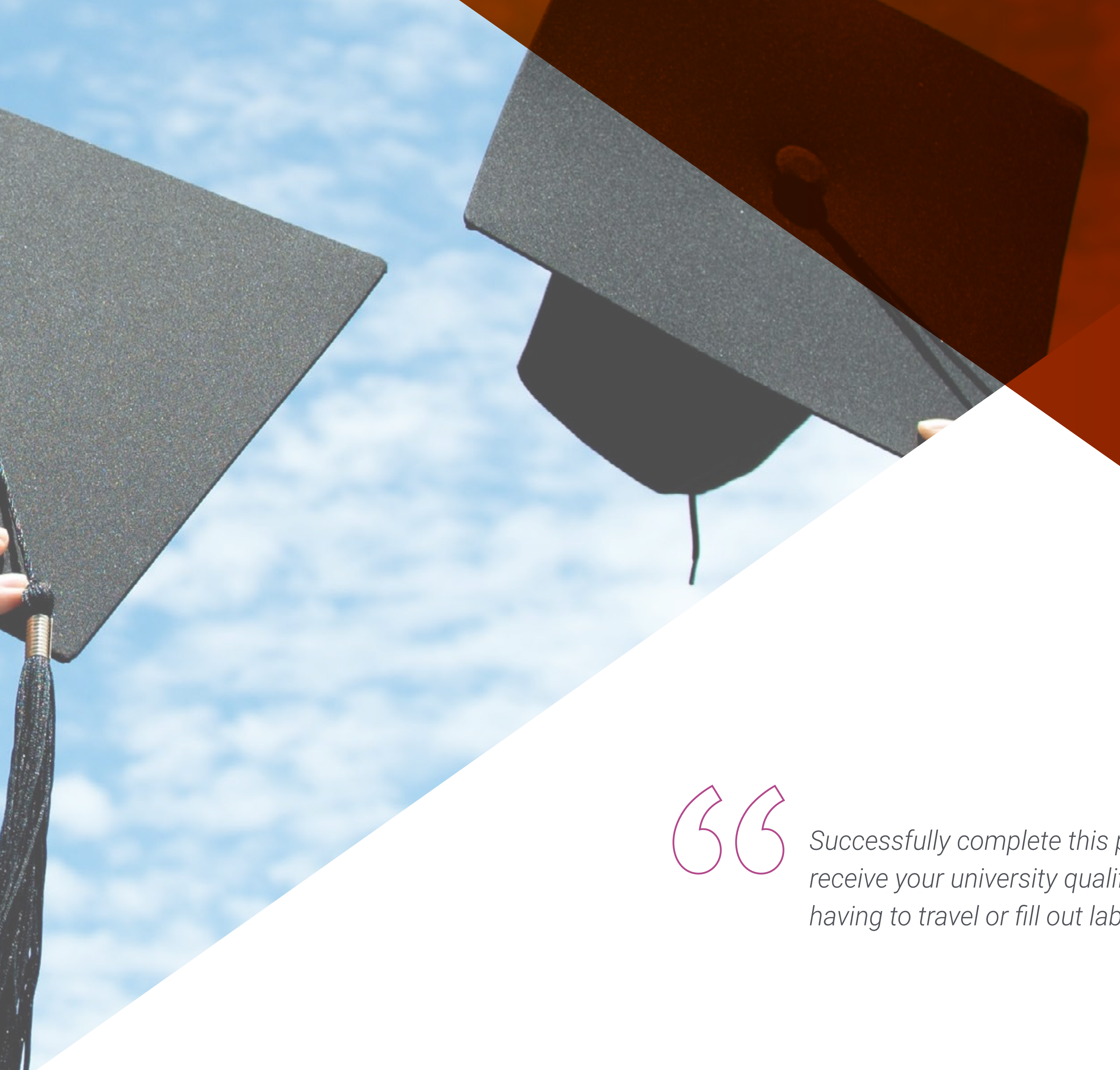
Testing & Retesting

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 Professional Master's Degree in Meteorological Physics and Geophysics guarantees students, in addition to the most rigorous and up-to-date education, access to a Professional Master's Degree issued by TECH Technological University.



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

This **Professional Master's Degree in Meteorological Physics and Geophysic** contains the most complete and up-to-date program on the market.

After the student has passed the assessments, they will receive their corresponding **Professional Master's Degree** issued by **TECH Technological University** via tracked delivery*.

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

Title: **Professional Master's Degree in Meteorological Physics and Geophysics**

Official Nº of hours: **1,500 h.**

tech technological university

Awards the following

DIPLOMA

to

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

For having successfully passed and accredited the following program

PROFESSIONAL MASTER'S DEGREE

in

Meteorological Physics and Geophysics

This is a qualification awarded by this University, equivalent to 1,500 hours, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

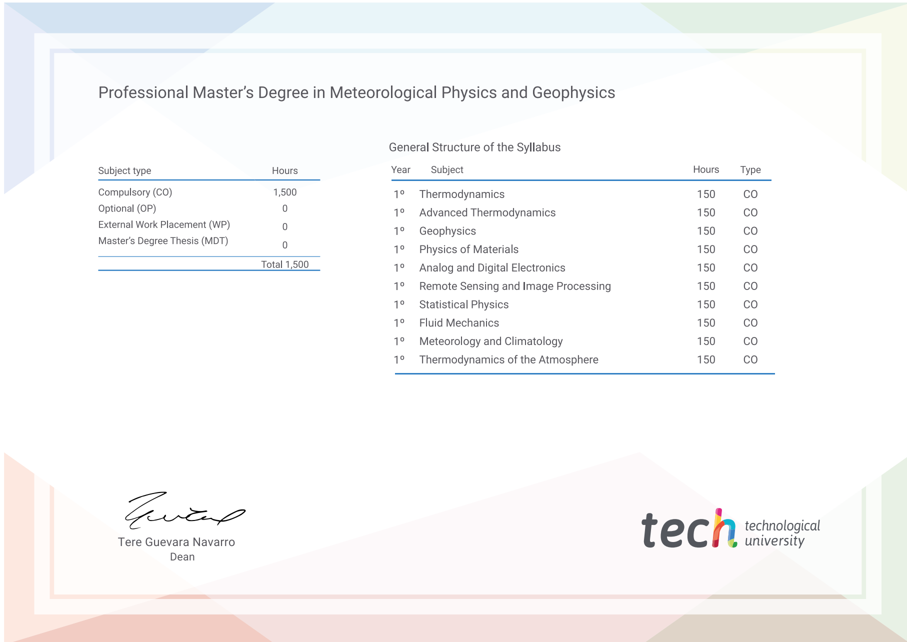
TECH is a Private Institution of Higher Education recognized by the Ministry of Public Education as of June 28, 2018.

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



Professional Master's Degree in Meteorological Physics and Geophysics

Subject type	Hours
Compulsory (CO)	1,500
Optional (OP)	0
External Work Placement (WP)	0
Master's Degree Thesis (MDT)	0
	Total 1,500

General Structure of the Syllabus

Year	Subject	Hours	Type
1º	Thermodynamics	150	CO
1º	Advanced Thermodynamics	150	CO
1º	Geophysics	150	CO
1º	Physics of Materials	150	CO
1º	Analog and Digital Electronics	150	CO
1º	Remote Sensing and Image Processing	150	CO
1º	Statistical Physics	150	CO
1º	Fluid Mechanics	150	CO
1º	Meteorology and Climatology	150	CO
1º	Thermodynamics of the Atmosphere	150	CO

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Dean

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*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.

Professional Master's Degree

Meteorological Physics and Geophysics

- » Modality: **online**
- » Duration: **12 months**
- » Certificate: **TECH Technological University**
- » Dedication: **16h/week**
- » Schedule: **at your own pace**
- » Exams: **online**

Professional Master's Degree
Meteorological Physics
and Geophysics

technological university