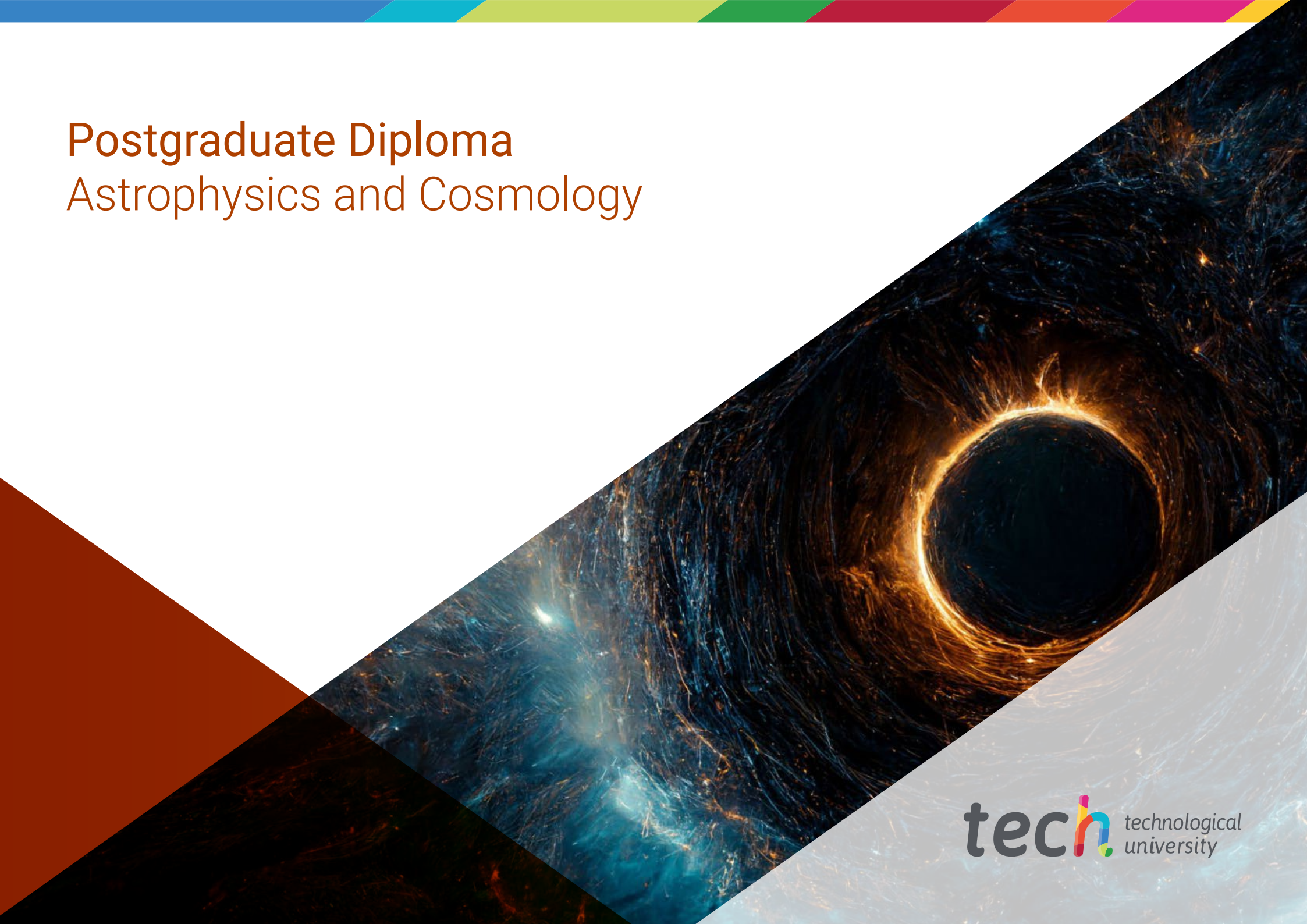
Postgraduate Diploma
Astrophysics and Cosmology



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Postgraduate Diploma
Astrophysics and Cosmology

- 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-astrophysics-cosmology**

Index

01
Introduction
p. 4

02
Objectives
p. 8

03
Structure and Content
p. 12

04
Methodology
p. 18

05
Certificate
p. 26

01

Introduction

Technological advances in recent years have considerably boosted astrophysics, allowing a much better understanding of the planets and exoplanets farthest from Earth: a progress that will undoubtedly lead to the manufacture of more sophisticated and precise equipment, showing results and images that are key to understanding the creation of the universe. For this reason, TECH contributes to this professional growth through a 100% online program, which will allow engineering professionals to delve into modern physics, new developments and advances in the field of theoretical and experimental physics and the key concepts of general relativity. All this, in a 100% online teaching format that can be accessed comfortably at any time from a device with Internet connection.

With this Postgraduate Diploma, you will be able to merge your engineering knowledge with Astrophysics and Cosmology"

Thanks to technology, it was possible to detect the gravitational wave of Einstein's theory, and to make telescopes such as the Hubbel, James Webb or robotic vehicles such as Perseverance, which explores Mars. In this context, a promising future for Astrophysics and Cosmology can be deduced, mainly due to the creation of more powerful instruments. All this with the aim of better understanding the universe, the cosmos and each of the physical elements that make it up.

A scenario that requires large investments and highly qualified personnel from the field of engineering in order to become a reality, In this way the concepts of physics can be transferred to new technologies and further boost this field. That is why TECH has created this Postgraduate Diploma in Astrophysics and Cosmology, which offers students the most relevant and advanced scientific information in this field.

To do this, students have innovative teaching material that will allow them to easily delve into the progress that was achieved thanks to modern physics, with contributions to medical physics, geophysics, quantum computing or the creation of particle accelerators. With this solid base of knowledge, professionals will delve into the most relevant aspects of astrophysics, general relativity and the early universe.

The program will also enable them to advance through the content of the syllabus in a more agile way, thanks to the use of the Relearning system, which in turn helps to reduce the hours of study.

A 100% online Postgraduate Diploma which means for engineering professionals advancing in their careers thanks to a program that they can access whenever and wherever they wish. All you need is an electronic device with Internet connection to access the syllabus on the virtual campus. Moreover, students can distribute the teaching load according to their needs. Thus, professionals have a state-of-the-art higher education that is compatible with the most demanding responsibilities.

This **Postgraduate Diploma in Astrophysics and Cosmology** 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 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

Do you pursue a high-quality and flexible Postgraduate Diploma? TECH has thought about it and thus, offers this 100% online Postgraduate Diploma"

Click now and take a step further in your career as an Engineer and be part of the great companies creating robotic vehicles. and planetary exploration"

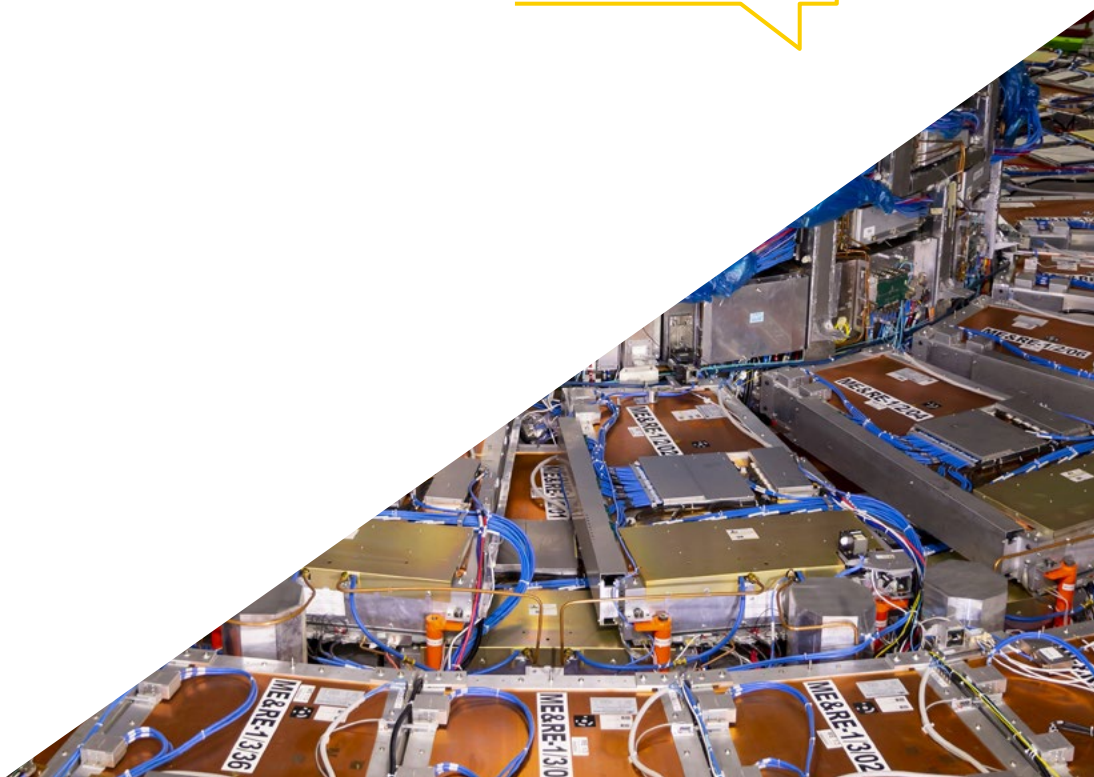
Delve into this program in the cosmological distances and the Hubble's Law.

Enroll now in a Postgraduate Diploma that will launch your professional path into Astrophysics and Cosmology.

The program's teaching staff includes professionals in the sector who contribute their work experience to this training program, as well as renowned specialists from leading societies and prestigious universities.

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

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



02

Objectives

This Postgraduate Diploma was created to boost the career of Engineers who wish to delve into the field of Astrophysics and Cosmology For this purpose, TECH offers an intensive and advanced learning, which will provide in only six months the necessary knowledge to master the most common physical processes in planetary and solar physics, to know how to apply knowledge of calculus and algebra to the study of gravity or to know the latest discoveries about dark energy.

Thanks to the multimedia and advanced content of this Syllabus you can delve into the effects of gravitational waves on matter"

General Objectives

- Acquire basic concepts of astrophysics
- Obtain basic notions about Feynman diagrams, how they are drawn and their utilities
- Learn and apply approximate methods to study quantum systems
- Master the Klein-Gordon, Dirac and electromagnetic fields

Click now and enroll in a 100% online program that you can access whenever you wish, from your computer or tablet, to the latest scientific evidence on dark matter"

Specific Objectives

Module 1. Introduction to Modern Physics

- Identify and assess the presence of physical processes in daily life and in both specific (medical applications, fluid behavior, optics or radiation protection) and common scenarios (electromagnetism, thermodynamics or classical mechanics)
- Be able to use computer tools to solve and model physical problems
- Be familiar with new developments and advances in the field of physics, both theoretical and experimental
- Develop communication skills, write reports and documents, or make effective presentations of these

Module 2. Astrophysics

- Understand and use mathematical and numerical methods commonly used in Astrophysics
- Be familiar with new developments and advances in the field of Astrophysics, both theoretical and experimental
- Understand the most common physical processes in cosmology
- Know the most common physical processes in only Physics

Module 3. General Relativity and Cosmology

- Acquire basic notions of general relativity
- Apply knowledge of calculus and algebra to the study of gravity using the theory of general relativity
- Know the Einstein's equations in tensor format
- Acquire basic knowledge of cosmology and the primitive universe

03

Structure and Content

This Postgraduate Diploma consists of 450 teaching hours of advanced and exhaustive knowledge of Astrophysics and Cosmology. This learning will serve as a basis for the engineering professional who decides to advance in this field. For this purpose, TECH offers innovative teaching tools: video summaries of each topic, detailed videos, diagrams or specialized readings, which will contribute the acquisition of knowledge. In addition, case studies provided by the specialists of this program will provide the practical approach necessary for this program.

In just six months you will gain a solid foundation of knowledge about modern physics and the advances in Astrophysics and Cosmology"

Module 1. Introduction to Modern Physics

1.1. Introduction to Medical Physics
- 1.1.1. How to Apply Physics to Medicine
- 1.1.2. Energy of Charged Particles in Tissues
- 1.1.3. Photons through Tissues
- 1.1.4. Applications

1.2. Introduction to Particle Physics
- 1.2.1. Introduction and Objectives
- 1.2.2. Quantified Particles
- 1.2.3. Fundamental Forces and Charges
- 1.2.4. Particle Detection
- 1.2.5. Classification of Fundamental Particles and Standard Model
- 1.2.6. Beyond the Standard Model
- 1.2.7. Current Generalization Theories
- 1.2.8. High-Energy Experiments

1.3. Particle Accelerators
- 1.3.1. Particle Acceleration Processes
- 1.3.2. Linear Accelerators
- 1.3.3. Cyclotrons
- 1.3.4. Synchrotrons

1.4. Introduction to Nuclear Physics
- 1.4.1. Nuclear Stability
- 1.4.2. New Methods in Nuclear Fission
- 1.4.3. Nuclear Fusion
- 1.4.4. Synthesis of Superheavy Elements

1.5. Introduction to Astrophysics
- 1.5.1. The Solar System
- 1.5.2. Birth and Death of a Star
- 1.5.3. Space Exploration
- 1.5.4. Exoplanets

1.6. Introduction to Cosmology
- 1.6.1. Distance Calculation in Astronomy
- 1.6.2. Velocity Calculations in Astronomy
- 1.6.3. Dark Matter and Energy
- 1.6.4. The Expansion of the Universe
- 1.6.5. Gravitational Waves

1.7. Geophysics and Atmospheric Physics
- 1.7.1. Geophysics
- 1.7.2. Atmospheric Physics
- 1.7.3. Meteorology
- 1.7.4. Climate Change

1.8. Introduction to Condensed Matter Physics
- 1.8.1. Aggregate States of Matter
- 1.8.2. Matter Allotropes
- 1.8.3. Crystalline Solids
- 1.8.4. Soft Matter

1.9. Introduction to Quantum Computing
- 1.9.1. Introduction to the Quantum World
- 1.9.2. Qubits
- 1.9.3. Multiple Qubits
- 1.9.4. Logic Gates
- 1.9.5. Quantum Programs
- 1.9.6. Quantum Computers

1.10. Introduction to Quantum Cryptography
- 1.10.1. Classic Information
- 1.10.2. Quantum Information
- 1.10.3. Quantum Encryption
- 1.10.4. Protocols in Quantum Cryptography

Module 2. Astrophysics

2.1. Introduction
- 2.1.1. Brief History of Astrophysics
- 2.1.2. Instruments
- 2.1.3. Observational Magnitude Scale
- 2.1.4. Calculation of Astronomical Distances
- 2.1.5. Color Index

2.2. Spectral Lines
- 2.2.1. Historical Introduction
- 2.2.2. Kirchoff's Laws
- 2.2.3. Relationship between Spectrum and Temperature
- 2.2.4. Doppler Effect
- 2.2.5. Spectrograph

2.3. Radiation Field Study
- 2.3.1. Prior Definitions
- 2.3.2. Lens opacity
- 2.3.3. Optical Depth
- 2.3.4. Microscopic Opacity Sources
- 2.3.5. Total Opacity
- 2.3.6. Extinction
- 2.3.7. Structure of Spectral Lines

2.4. Stars
- 2.4.1. Classification of Stars
- 2.4.2. Methods for Determining the Mass of a Star
- 2.4.3. Binary Stars
- 2.4.4. Classification of Binary Stars
- 2.4.5. Determining the Masses of a Binary System

2.5. Life of Stars
- 2.5.1. Characteristics of a Star
- 2.5.2. Birth of a Star
- 2.5.3. Life of a Star. Hertzprung-Russell Diagrams
- 2.5.4. Death of a Star

2.6. Death of Stars
- 2.6.1. White Dwarf
- 2.6.2. Supernovas
- 2.6.3. Neutron Stars
- 2.6.4. Black Holes

2.7. Study of the Milky Way
- 2.7.1. Shape and Dimensions of the Milky Way
- 2.7.2. Dark Matter
- 2.7.3. Phenomenon of Gravitational Lensing
- 2.7.4. Massive Particles of Weak Interaction
- 2.7.5. Shape and halo of the Milky Way
- 2.7.6. Spiral Structure of the Milky Way

2.8. Galaxy Clusters
- 2.8.1. Introduction
- 2.8.2. Classification of Galaxies
- 2.8.3. Photometry of Galaxies
- 2.8.4. Local Group: Introduction

2.9. Distribution of Large-Scale Galaxies
- 2.9.1. Shape and Age of the Universe
- 2.9.2. Standard Cosmological Model
- 2.9.3. Formation of Cosmological Structures
- 2.9.4. Observational Methods in Cosmology

2.10. Dark Matter and Energies
- 2.10.1. Discovery and Characteristics
- 2.10.2. Consequences on the Distribution of Ordinary Matter
- 2.10.3. Dark Matter Problems
- 2.10.4. Candidate Particles for Dark Matter
- 2.10.5. Dark Energy and its Consequences

Module 3. General Relativity and Cosmology

3.1. Special Relativity
- 3.1.1. Postulates
- 3.1.2. Lorentz Transformations in Standard Configuration
- 3.1.3. Impulses (Boosts)
- 3.1.4. Tensors
- 3.1.5. Relativistic Kinematics
- 3.1.6. Relativistic Linear Momentum and Energy
- 3.1.7. Lorentz Covariance
- 3.1.8. Energy-Momentum Tensor

3.2. Principle of Equivalence
- 3.2.1. Principle of Weak Equivalence
- 3.2.2. Experiments on the Weak Equivalence Principle
- 3.2.3. Locally Inertial Reference Systems
- 3.2.4. Principle of Equivalence
- 3.2.5. Consequences on the Equivalence Principle

3.3. Particle Motion in the Gravitational Field
- 3.3.1. Path of Particles under Gravity
- 3.3.2. Newtonian Limit
- 3.3.3. Gravitational Redshift and Tests
- 3.3.4. Temporary Dilatation
- 3.3.5. Geodesic Equation

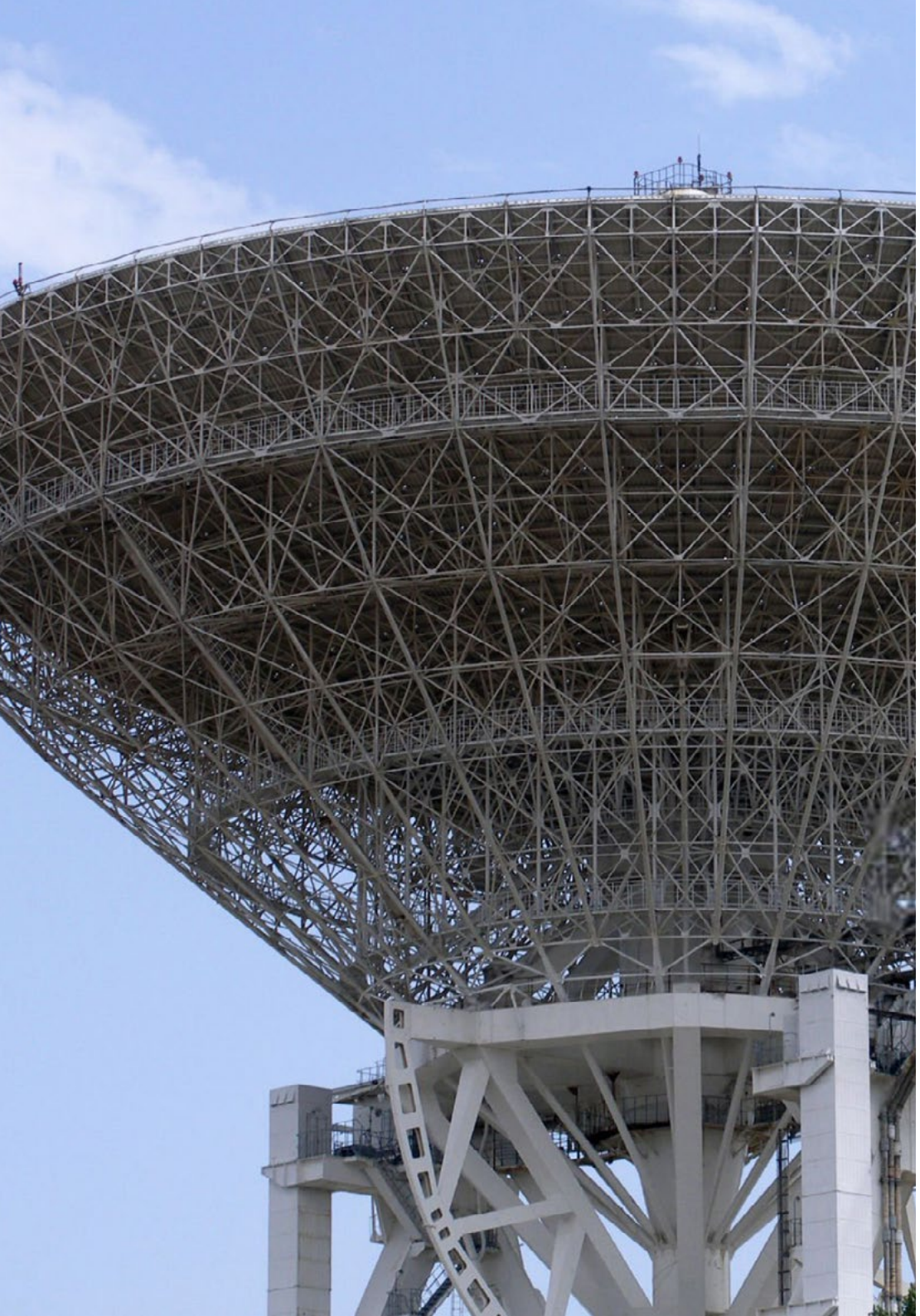
3.4. Geometry: Necessary Concepts
- 3.4.1. Two-Dimensional Spaces
- 3.4.2. Scalar, Vector and Tensor Fields
- 3.4.3. Metric Tensor: Concept and Theory
- 3.4.4. Partial Derivative
- 3.4.5. Covariant Derivative
- 3.4.6. Christoffel Symbols
- 3.4.7. Covariant Derivatives of Tensors
- 3.4.8. Directional Covariant Derivatives
- 3.4.9. Divergence and Lapacian

3.5. Curved Space-Time
- 3.5.1. Covariant Derivative and Parallel Transport: Definition
- 3.5.2. Geodesics from Parallel Transport
- 3.5.3. Riemann Curvature Tensor
- 3.5.4. Riemann Tensor: Definition and Properties
- 3.5.5. Ricci Tensor: Definition and Properties

3.6. Einstein Equations: Derivation
- 3.6.1. Reformulation of the Equivalence Principle
- 3.6.2. Applications of the Equivalence Principle
- 3.6.3. Conservation and Symmetries
- 3.6.4. Derivation of Einstein's Equations from the Equivalence Principle

3.7. Schwarzschild Solution
- 3.7.1. Schwartzschild Metrics
- 3.7.2. Length and Time Elements
- 3.7.3. Conserved Quantities
- 3.7.4. Equation of Motion
- 3.7.5. Light Deflection. Study of Schwartzschild Metrics
- 3.7.6. Schwartzschild Radius
- 3.7.7. Eddington-Finkelstein Coordinates
- 3.7.8. Black Holes

3.8. Linear Gravity Limits Consequences
- 3.8.1. Linear Gravity: Introduction
- 3.8.2. Coordinate Transformation
- 3.8.3. Linearized Einstein Equations
- 3.8.4. General Solution of Linearized Einstein Equations
- 3.8.5. Gravitational Waves
- 3.8.6. Effects of Gravitational Waves on Matter
- 3.8.7. Generation of Gravitational Waves



3.9. Cosmology: Introduction
- 3.9.1. Observation of the Universe: Introduction
- 3.9.2. Cosmological Principle
- 3.9.3. System of Coordinates
- 3.9.4. Cosmological Distances
- 3.9.5. The Hubble's Law
- 3.9.6. Inflation

3.10. Cosmology: Mathematical Study
- 3.10.1. Friedmann's First Equation
- 3.10.2. Friedmann's Second Equation
- 3.10.3. Densities and Scale Factor
- 3.10.4. Consequences of Friedmann's Equations Curvature of the Universe
- 3.10.5. Primitive Universe Thermodynamics

A 100% online program that will allow you to delve into the curvature of the universe and the consequences derived from the Friedmann equations"

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

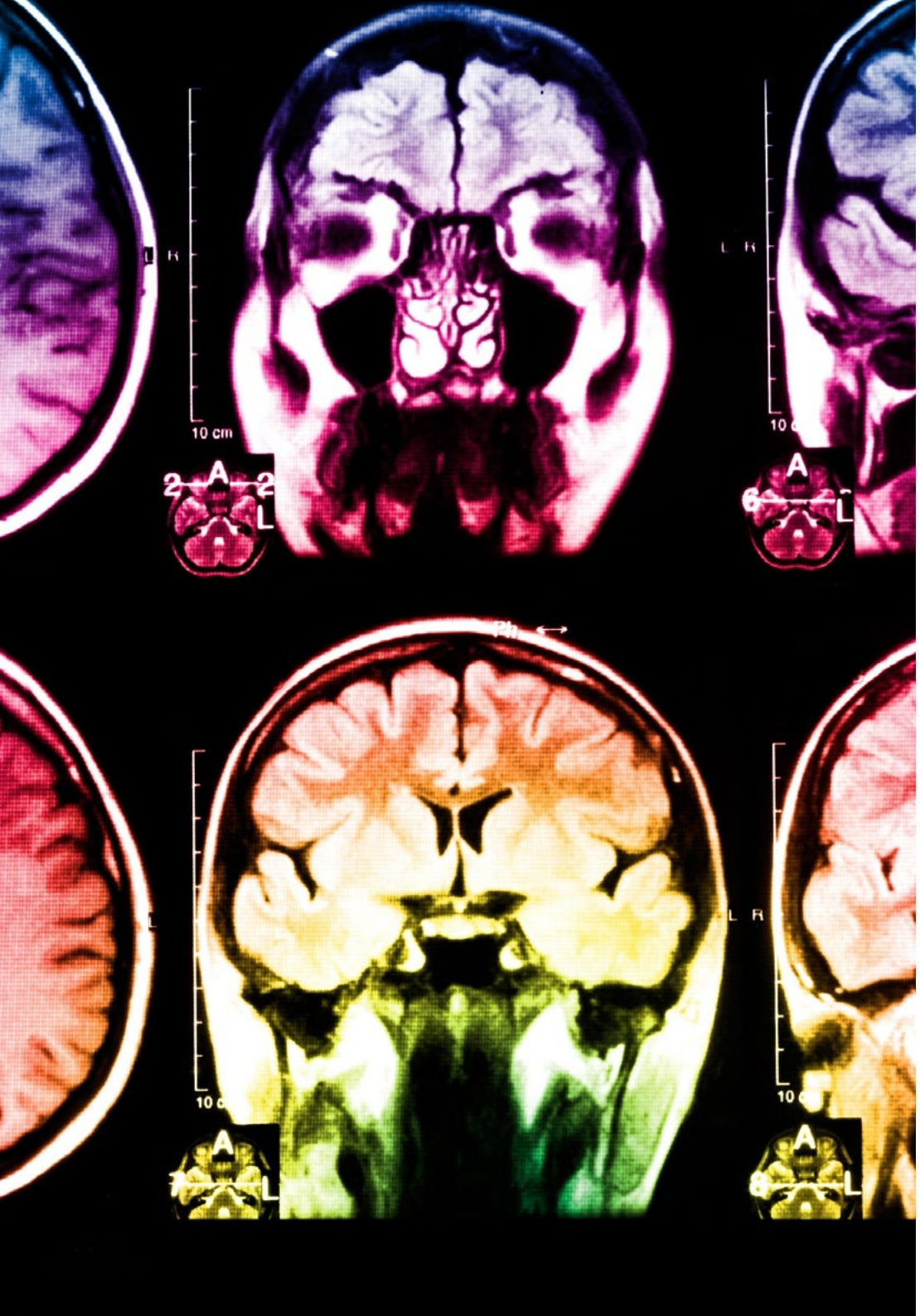
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

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.

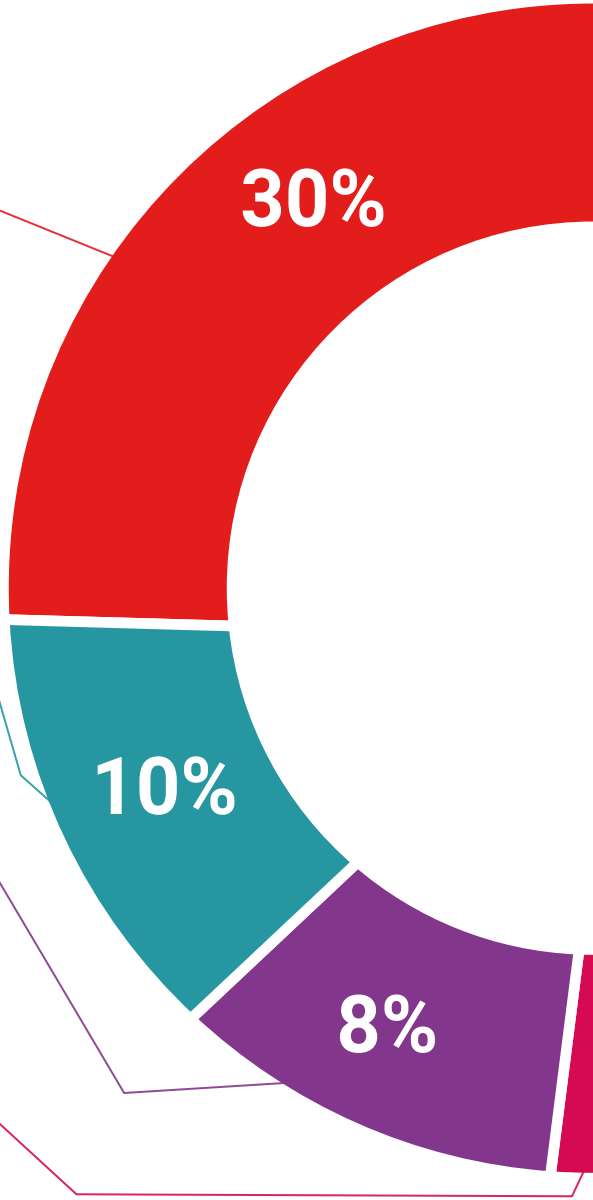
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

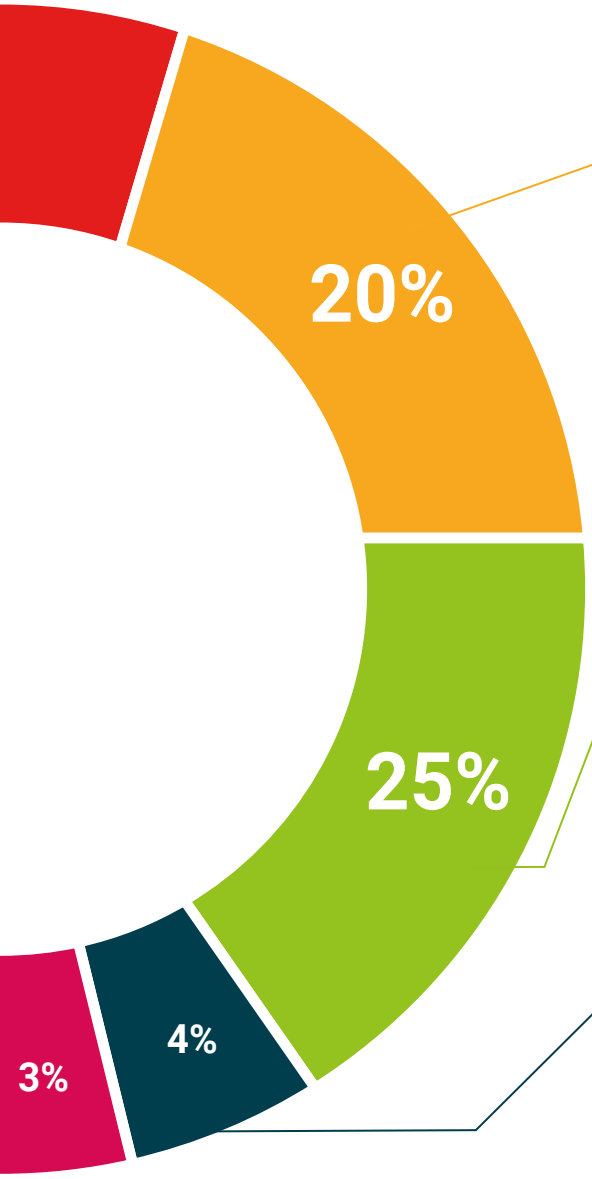
Practising Skills and Abilities

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

The Postgraduate Diploma in Astrophysics and Cosmology 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 Astrophysics and Cosmology** 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 Astrophysics and Cosmology**

Official Nº of hours: **450 h.**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Awards the following

DIPLOMA

to

Mr./Ms. _____, with identification number _____.

For having passed and accredited the following program

POSTGRADUATE DIPLOMA

in

Astrophysics and Cosmology

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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