Postgraduate Diploma

Radiophysics Applied to Diagnostic Imaging

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Postgraduate Diploma
Radiophysics Applied to Diagnostic Imaging

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

Website: **www.techtitute.com/us/engineering/postgraduate-diploma/postgraduate-diploma-radiophysics-applied-diagnostic-imaging**

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01

Introduction

Radiophysics Applied to Diagnostic Imaging is a revolutionary field that amalgamates medical precision with engineering innovation to optimize the diagnosis of diseases. The application of advanced physical principles in the acquisition, processing and visualization of medical images allows earlier, more accurate and detailed detection of pathologies. In addition, improved image quality provides vital information for healthcare professionals, enabling more accurate diagnoses and personalized treatment plans. Faced with the growing demand for highly trained experts in this field, TECH has created a program that offers engineers the opportunity to access the latest innovations in advanced Diagnostic Imaging techniques.

With this program, you will perfect the quality of diagnostic images through the use of advanced technologies such as X-Rays, Computed Tomography (CT) and Magnetic Resonance Imaging (MRI)"

In the fast-paced advancement of medical engineering, there is a growing need for advanced specialization in diagnostic imaging. In this dynamic context, where technology is constantly redefining the limits of diagnostic accuracy, engineering professionals face the challenge of updating and acquiring specialized knowledge beyond traditional training boundaries. It is in this scenario that the present university program emerges as a unique opportunity. Designed for engineers seeking to excel in a constantly evolving field, the syllabus is positioned as a direct response to the demand for experts trained in the intricate aspects of medical engineering.

The syllabus of the Postgraduate Diploma in Radiophysics Applied to Diagnostic Imaging has been carefully designed to address fundamental aspects that will enhance the competence and expertise of graduates. To this end, students will delve into key aspects such as a thorough understanding of the Bragg-Gray theory and the dose measured in air, or the practical ability to carry out quality control of an ionization chamber. In this sense, the academic pathway will cover critical areas that are essential for the success of the medical engineer. Throughout their training, students will explore in detail the complex operation of an X-ray tube, analyze international quality control protocols and thoroughly evaluate the radiological risks inherent in hospital facilities.

In terms of methodology, the program adapts to the changing demands of today's professional by offering a 100% *online*modality. Through a flexible educational platform and diverse multimedia content, the *Relearning*method is implemented, a pedagogical strategy that promotes retention and deep understanding through the repetition of key concepts. This approach ensures that engineers, immersed in an interactive and dynamic learning environment, consolidate their specialization in diagnostic imaging effectively and efficiently.

This **Postgraduate Diploma in Radiophysics Applied to Diagnostic Imaging** contains the most complete and up-to-date program on the market. The most important features include:

- The development of practical cases presented by experts in Radiophysics Applied to Diagnostic Imaging
- 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

Thanks to this Postgraduate Diploma in Radiophysics Applied to Diagnostic Imaging, you will improve the accuracy of physicians' diagnoses and ensure the safety of patient care"

You will learn more about radiological protection, regulations and safe practices in medical environments, through the use of cutting-edge multimedia resources"

You will explore in depth the most avant-garde and innovative techniques for the measurement of ionizing radiation, with TECH's quality guarantee.

Immerse yourself in the fundamentals of Diagnostic Imaging, exploring the various techniques and dosimetry applied to radiodiagnosis.

The program's teaching staff includes professionals from the field who contribute their work experience to this educational 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 students will be assisted by an innovative interactive video system created by renowned and experienced experts.

02

Objectives

This program focuses on understanding the complex interactions between radiation and matter, addressing dosimetry and quality control in diagnostic practice. More than transmitting knowledge, it seeks to cultivate critical skills to improve the quality of medical imaging. Its objective is to train professionals committed to diagnostic excellence and radiological safety, preparing them to face technological advances and the growing demands of an accurate, ethical and safe practice.

At TECH, you will not only acquire theoretical knowledge, but also practical skills fundamental to face the current challenges in the use of radiation in Diagnostic Imaging"

General Objectives

- Develop the physical basis of radiation dosimetry
- Distinguish between dosimetric and radiation protection measurements
- Determine the ionizing radiation detectors in a hospital
- Fundamentals of measurement quality control
- Delve into the physical elements of X-Ray beam collection
- Evaluate the technical characteristics of the equipment that can be used in a radiodiagnostic installation
- Examine the role of quality assurance and quality control systems in the achievement of optimal diagnostic images
- Analyze the importance of radiological protection, both for the professionals and for the patients themselves
- Investigate the risks derived from the use of ionizing radiation
- Develop the international regulations applicable to hospital radiation protection
- Specify the main safety actions in the use of ionizing radiation
- Design and manage structural shielding against radiation

Apply state-of-the-art technologies, assuring and evaluating the quality of the equipment and procedures used in Radiodiagnosis"

Specific Objectives

Module 1. Interaction of Ionizing Radiation with Matter

- Internalize the Bragg-Gray theory and the dose measured in air
- Develop the limits of the different dosimetric quantities
- Analyze the calibration of a dosimeter
- Performing quality control of an ionization chamber

Module 2. Advanced Diagnostic Imaging

- Investigate the functioning of an X-ray tube and a digital image detector
- Identify the different types of radiological images (static and dynamic)
- Analyze international quality control protocols for radiology equipment
- Delve into the fundamental aspects of dosimetry in patients undergoing radiological

Module 3. Radiation Protection in Hospital Radioactive Facilities

- Determine the radiological risks present in hospital radioactive facilities
- Identify the main international laws governing radiological protection
- Develop the actions carried out at the radiation protection level
- Establish the concepts applicable to the design of a radioactive facility

03

Course Management

The teaching team behind this Postgraduate Diploma is composed of highly qualified professionals who are passionate about their area of expertise. Their excellence is not only evident in their vast academic and scientific knowledge, but also in their dedication to train future experts in this crucial field of Engineering. These educators do not limit themselves to transmitting advanced theoretical knowledge, but share practical experiences and real cases to enrich learning. Their educational work is fundamental to prepare graduates for excellence in Diagnostic Imaging and Radiation Safety.

The teaching staff will focus on the students, enabling them to integrate their teachings with the latest technological innovations"

Management

Dr. De Luis Pérez, Francisco Javier

- Specialist in Hospital Radiophysics
- Head of the Radiophysics and Radiological Protection Service at Quirónsalud Hospitals in Alicante, Torrevieja and Murcia
- Research Group in Personalized Multidisciplinary Oncology, Catholic University San Antonio of Murcia
- PhD in Applied Physics and Renewable Energies, University of Almeria
- Degree in Physical Sciences, specializing in Theoretical Physics, University of Granada
- Member of: Spanish Society of Medical Physics (SEFM), Royal Spanish Society of Physics (RSEF), Illustrious Official College of Physicists and Consulting and Contact Committee, Proton Therapy Center (Quirónsalud)

Professors

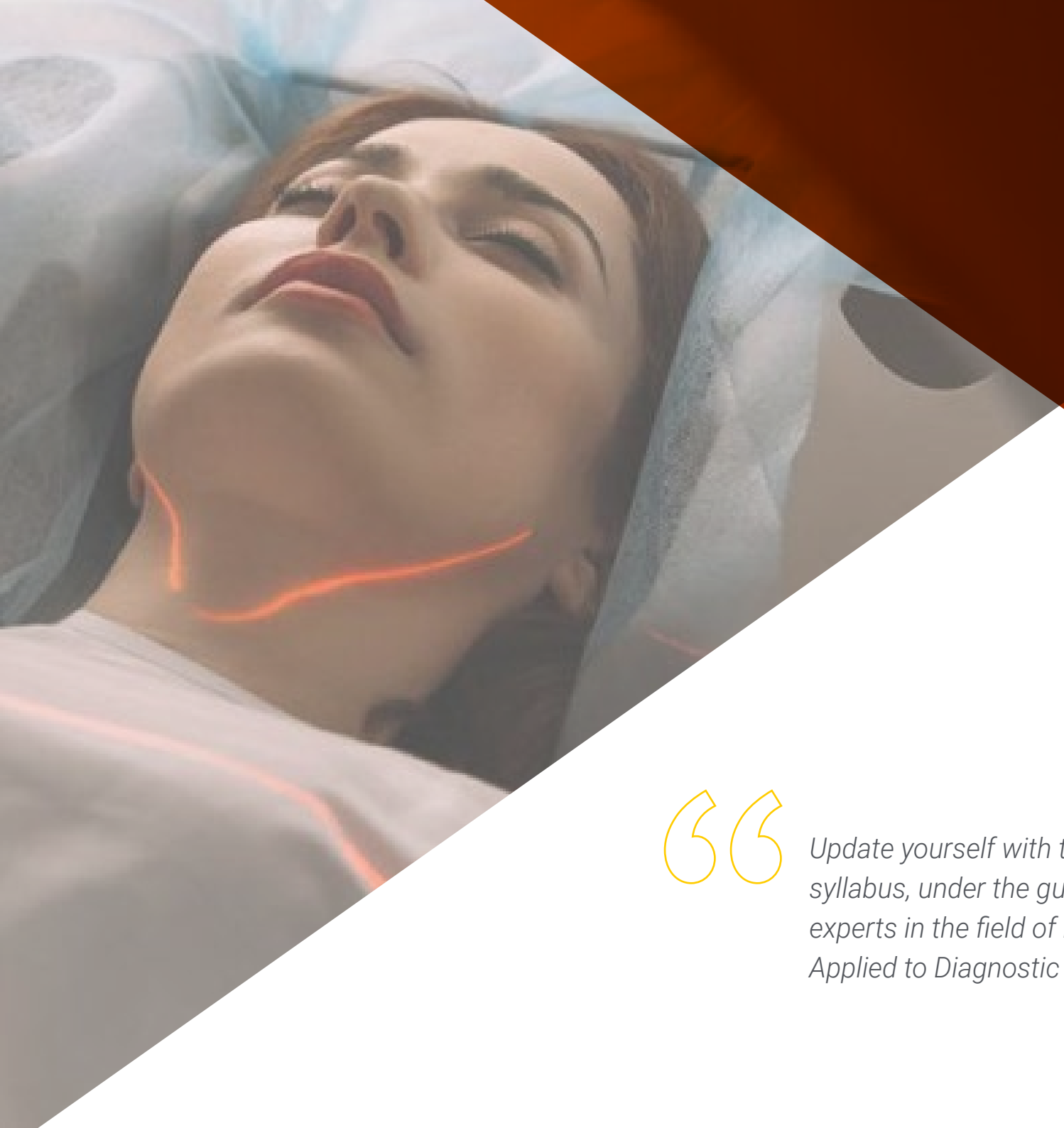
Dr. Rodríguez, Carlos Andrés

- Specialist in Hospital Radiophysics
- Physician in Hospital Radiophysics at the University Clinical Hospital of Valladolid, responsible for the Nuclear Medicine section
- Principal Tutor of residents of the Department of Radiophysics and Radiological Protection of the University Clinical Hospital of Valladolid
- Degree in Hospital Radiophysics
- Degree in Physics at the University of Salamanca

04

Structure and Content

This academic program is distinguished by its comprehensive structure and dynamic content. It is composed of modules ranging from radiation interactions with matter to dosimetry and radiation protection, covering all aspects necessary to obtain high quality medical images. This updated approach will provide theoretical knowledge supported by the latest technology used in real radiodiagnostic environments. In addition, a thorough analysis of radiological protection will be performed, a crucial aspect to ensure the safety of both medical staff and patients.



Update yourself with this complete syllabus, under the guidance of leading experts in the field of Radiophysics Applied to Diagnostic Imaging"

Module 1. Interaction of Ionizing Radiation with Matter

1.1. Ionizing Radiation-Matter Interaction
- 1.1.1. Ionizing Radiation
- 1.1.2. Collisions
- 1.1.3. Braking Power and Range

1.2. Charged Particle-Matter Interaction
- 1.2.1. Fluorescent Radiation
  - 1.2.1.1. Characteristic Radiation or X-rays
  - 1.2.1.2. Auger Electrons
- 1.2.2. Braking Radiation
- 1.2.3. Spectrum Upon Collision of Electrons with a High Z Material
- 1.2.4. Electron-Positron Annihilation

1.3. Photon-Matter Interaction
- 1.3.1. Attenuation
- 1.3.2. Hemireductive Layer
- 1.3.3. Photoelectric Effect
- 1.3.4. Compton Effect
- 1.3.5. Pair Creation
- 1.3.6. Predominant Effect According to Energy
- 1.3.7. Imaging in Radiology

1.4. Radiation Dosimetry
- 1.4.1. Equilibrium of Charged Particles
- 1.4.2. Bragg-Gray Cavity Theory
- 1.4.3. Spencer-Attix Theory
- 1.4.4. Absorbed Dose in Air

1.5. Radiation Dosimetry Quantities
- 1.5.1. Dosimetric Quantities
- 1.5.2. Radiation Protection Quantities
- 1.5.3. Radiation Weighting Factors
- 1.5.4. Weighting Factors of the Organs According to Radiosensitivity

1.6. Detectors for the Measurement of Ionizing Radiation
- 1.6.1. Ionization of Gases
- 1.6.2. Excitation of Luminescence in Solids
- 1.6.3. Dissociation of Matter
- 1.6.4. Detectors in the Hospital Environment

1.7. Ionizing Radiation Dosimetry
- 1.7.1. Environmental Dosimetry
- 1.7.2. Area Dosimetry
- 1.7.3. Personal Dosimetry

1.8. Thermoluminescence Dosimeters
- 1.8.1. Thermoluminescence Dosimeters
- 1.8.2. Dosimeter Calibration
- 1.8.3. Calibration at the National Dosimetry Center

1.9. Physics of Radiation Measurement
- 1.9.1. Value of a Quantity
- 1.9.2. Accuracy
- 1.9.3. Precision
- 1.9.4. Repeatability
- 1.9.5. Reproducibility
- 1.9.6. Traceability
- 1.9.7. Quality in Measurement
- 1.9.8. Quality Control of an Ionization Chamber

1.10. Uncertainty in Radiation Measurement
- 1.10.1. Measurement Uncertainty
- 1.10.2. Tolerance and Action Level
- 1.10.3. Type A Uncertainty
- 1.10.4. Type B Uncertainty

Module 2. Advanced Diagnostic Imaging

2.1. Advanced Physics in X-Ray Generation
- 2.1.1. X-Ray Tube
- 2.1.2. Radiation Spectra Used in Radiodiagnosis
- 2.1.3. Radiological Technique

2.2. Radiological Imaging
- 2.2.1. Digital Image Recording Systems
- 2.2.2. Dynamic Imaging
- 2.2.3. Radiodiagnostic Equipment

2.3. Quality Control in Diagnostic Radiology
- 2.3.1. Quality Assurance Program in Diagnostic Radiology
- 2.3.2. Quality Protocols in Radiodiagnostics
- 2.3.3. General Quality Control Checks

2.4. Patient Dose Estimation in X-Ray Installations
- 2.4.1. Patient Dose Estimation in X-Ray Facilities
- 2.4.2. Patient Dosimetry
- 2.4.3. Diagnostic Dose Reference Levels

2.5. General Radiology Equipment
- 2.5.1. General Radiology Equipment
- 2.5.2. Specific Quality Control Tests
- 2.5.3. Doses to Patients in General Radiology

2.6. Mammography Equipment
- 2.6.1. Mammography Equipment
- 2.6.2. Specific Quality Control Tests
- 2.6.3. Mammography Patient Dose

2.7. Fluoroscopy Equipment. Vascular and Interventional Radiology
- 2.7.1. Fluoroscopy Equipment
- 2.7.2. Specific Quality Control Tests
- 2.7.3. Doses to Interventional Patients

2.8. Computed Tomography Equipment
- 2.8.1. Computed Tomography Equipment
- 2.8.2. Specific Quality Control Tests
- 2.8.3. Dose to CT Patients

2.9. Other Radiodiagnostic Equipment
- 2.9.1. Other Radiodiagnostic Equipment
- 2.9.2. Specific Quality Control Tests
- 2.9.3. Non-Ionizing Radiation Equipment

2.10. Radiological Image Visualization Systems
- 2.10.1. Digital Image Processing
- 2.10.2. Calibration of Display Systems
- 2.10.3. Quality Control of Display Systems

Module 3. Radiation Protection in Hospital Radioactive Facilities

3.1. Hospital Radiation Protection
- 3.1.1. Hospital Radiation Protection
- 3.1.2. Radiation Protection Magnitudes and Specialized Radiation Protection Units
- 3.1.3. Risks Specific to the Hospital Area

3.2. International Regulations on Radiation Protection
- 3.2.1. International Legal Framework and Authorizations
- 3.2.2. International Regulations on Health Protection against Ionizing Radiations
- 3.2.3. International Regulations on Radiological Protection of the Patient
- 3.2.4. International Regulations on the Specialty of Hospital Radiophysics
- 3.2.5. Other International Regulations

3.3. Radiation Protection in Hospital Radioactive Facilities
- 3.3.1. Nuclear Medicine
- 3.3.2. Radiodiagnostics
- 3.3.3. Radiotherapy Oncology

3.4. Dosimetric Control of Exposed Professionals
- 3.4.1. Dosimetric Control
- 3.4.2. Dose Limits
- 3.4.3. Personal Dosimetry Management

3.5. Calibration and Verification of Radiation Protection Instrumentation
- 3.5.1. Calibration and Verification of Radiation Protection Instrumentation
- 3.5.2. Verification of Environmental Radiation Detectors
- 3.5.3. Verification of Surface Contamination Detectors

3.6. Control of the Airtightness of Encapsulated Radioactive Sources
- 3.6.1. Control of the Airtightness of Encapsulated Radioactive Sources
- 3.6.2. Methodology
- 3.6.3. International Limits and Certificates

3.7. Design of Structural Shielding in Medical Radioactive Facilities
- 3.7.1. Design of Structural Shielding in Medical Radioactive Facilities
- 3.7.2. Important Parameters
- 3.7.3. Thickness Calculation

3.8. Structural Shielding Design in Nuclear Medicine
- 3.8.1. Structural Shielding Design in Nuclear Medicine
- 3.8.2. Nuclear Medicine Installations
- 3.8.3. Workload Calculation

3.9. Design of Structural Shielding in Radiotherapy
- 3.9.1. Design of Structural Shielding in Radiotherapy
- 3.9.2. Radiotherapy Facilities
- 3.9.3. Workload Calculation

3.10. Structural Shielding Design in Radiodiagnostics
- 3.10.1. Structural Shielding Design in Radiodiagnostics
- 3.10.2. Radiodiagnostic Installations
- 3.10.3. Workload Calculation

You will address emerging challenges in Applied Diagnostic Imaging Radiophysics, continuously improving diagnostic processes and radiation safety"

05

Methodology

This academic program offers students a different way of learning. Our methodology uses a cyclical learning approach: **Relearning.**

This teaching system is used, for example, in the most prestigious medical schools in the world, and major publications such as the **New England Journal of Medicine** have considered it to be one of the most effective.

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

Case Study to contextualize all content

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

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

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

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

A learning method that is different and innovative

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

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

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

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

Relearning Methodology

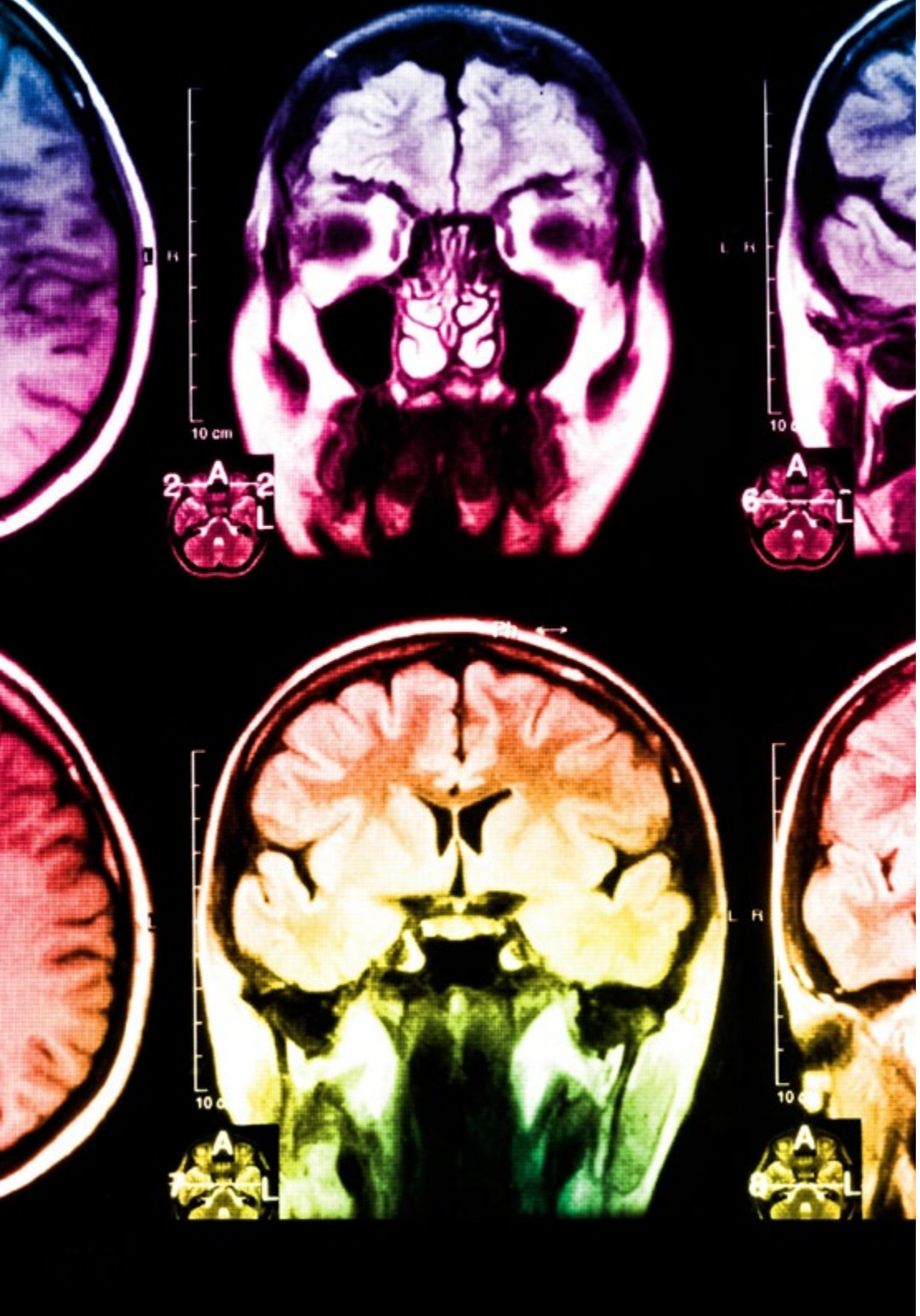
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

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

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

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

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



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

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

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

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

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

Study Material

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

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

Classes

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

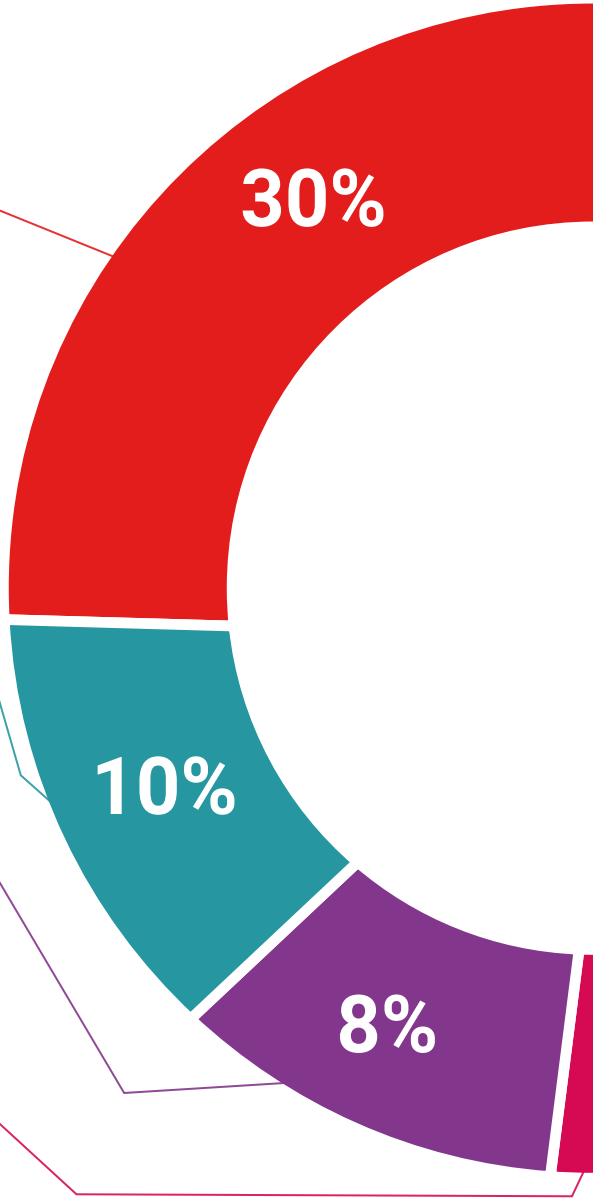
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

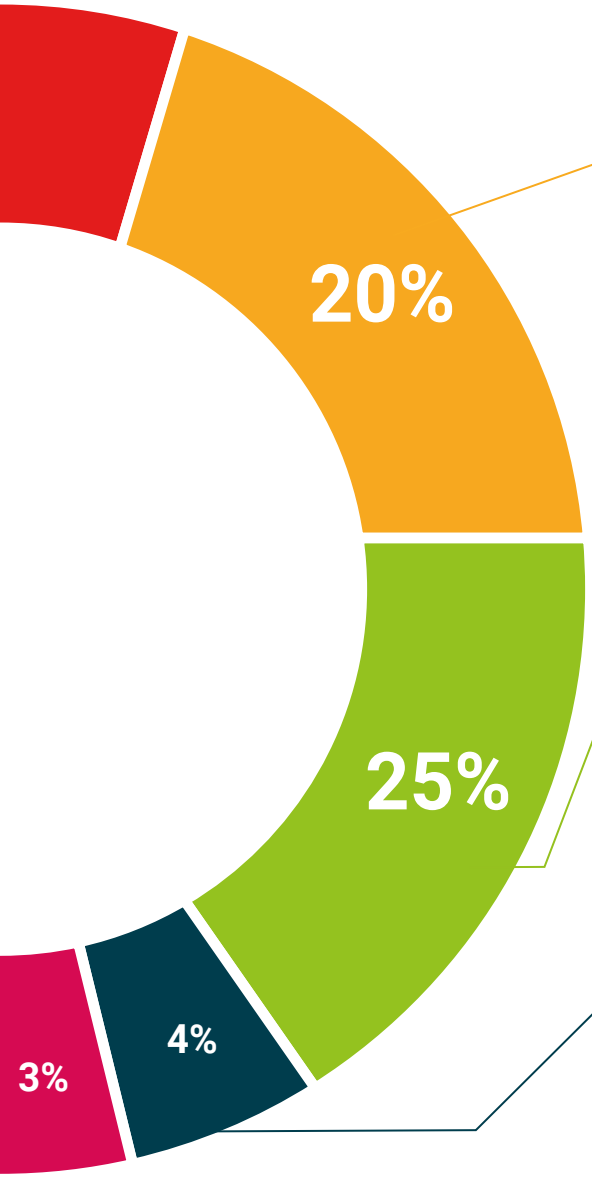
Practising Skills and Abilities

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

Additional Reading

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





Case Studies

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

Interactive Summaries

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

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

Testing & Retesting

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

06

Certificate

The Postgraduate Diploma in Radiophysics Applied to Diagnostic Imaging guarantees, in addition to the most rigorous and training, access to a Postgraduate Diploma issued by TECH Global University.

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

This program will allow you to obtain your **Postgraduate Diploma in Radiophysics Applied to Diagnostic Imaging**endorsed by **TECH Global University**, the world's largest online university.

TECH Global University is an official European University publicly recognized by the Government of Andorra (***official bulletin***). Andorra is part of the European Higher Education Area (EHEA) since 2003. The EHEA is an initiative promoted by the European Union that aims to organize the international training framework and harmonize the higher education systems of the member countries of this space. The project promotes common values, the implementation of collaborative tools and strengthening its quality assurance mechanisms to enhance collaboration and mobility among students, researchers and academics.

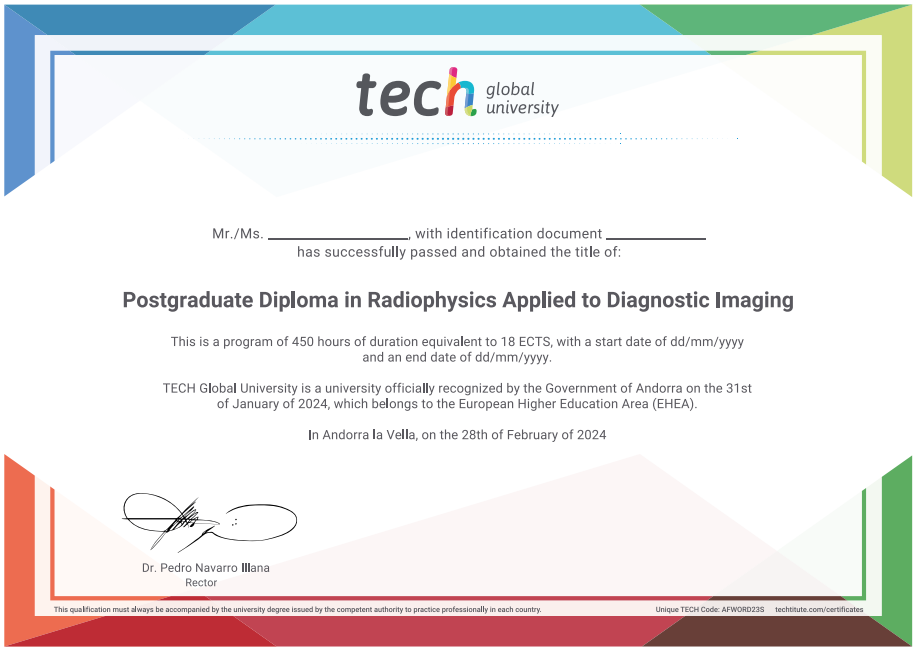
This **TECH Global University** title is a European program of continuing education and professional updating that guarantees the acquisition of competencies in its area of knowledge, providing a high curricular value to the student who completes the program.

Title: **Postgraduate Diploma in Radiophysics Applied to Diagnostic Imaging**

Modality: **online**

Duration: **6 months**

Accreditation: **18 ECTS**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Mr./Ms. _____, with identification document _____
has successfully passed and obtained the title of:

Postgraduate Diploma in Radiophysics Applied to Diagnostic Imaging

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

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

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

Dr. Pedro Navarro Illana
Rector

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

*Apostille Convention. In the event that the student wishes to have their paper diploma issued with an apostille, TECH Global University will make the necessary arrangements to obtain it, at an additional cost.

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